

Competence and Responsibility

The Third European Conference of
The European Council for High Ability
held in Munich (Germany), October 11-14, 1992

Volume 2

Proceedings of the Conference

Edited by

Kurt A. Heller und Ernst A. Hany



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Foreword

Volume 2 of "Competence and Responsibility" contains the Proceedings of the 3rd European Conference conducted by the European Council for High Ability (ECHA), which was held in Munich, Germany, in October 1992. This conference was intended to provide a state-of-the-art overview of the European research on giftedness and creativity and of attempts to provide differential education to the highly able. The organization of the symposia and workshops allowed a substantial exchange of ideas and practical approaches from both sides of the former "iron curtain", and encouraged discussions and mutual stimulation of European scholars and practitioners and individuals of other continents who shared their valuable experiences with the other participants of the conference.

At the time when we chose "Competence and Responsibility" for being the motto of this conference, we were not aware that the same words were used by a company of chemical industries in their newspaper advertisements. This is not the place to discuss any subconscious effects of advertisement campaigns; instead, we would like to point to the fact that education, politics, and industry are more and more taking a systems view on global issues. If one speaks of competence, this first assumes a set of tasks which requires the competence focused, and second makes a comparison between subjects of different levels of competence. The concept of responsibility expands this perspective of interactive relationships by referring to global values which are accepted by all partners who interact in a system of competences and demands. Based on these premises, first the education of the gifted is conceptualized as a task every society has to fulfill in order to secure both the individual's right of appropriate education and its own progress and second, this education has to aim at developing the gifted's attitude of being responsible for their nurturing society's well-being, i. e. of being obliged to attempting to solve the urgent problems of their decade. The Munich conference looked at this system of mutual responsibility from a psychological and educational perspective. The development of young people's talents and adults' skills by means of education provided by family and school, of psychological treatment, or of the careful design of the work environment, and by means of selecting individuals who fit best to the learning and working settings available were the topics dealt with in most contributions.

More than 400 scholars and practitioners from 31 different countries throughout the world (90% from Europe, 5% from North America/Canada, 5% from the Asia-Pacific area) participated in this conference. Approximately 25% of the over 200 contributions are incorporated into this book. The abstracts of all 200 contributions are included in volume 1 which was edited by E. A. Hany and K. A. Heller in 1992, and published by Hogrefe & Huber, Seattle (ISBN 3-8017-0684-2/ISBN 0-88937-111-3).

Unfortunately, we were not able to include here many other interesting papers due to lack of space and for financial reasons. In addition to volume 2, a German report on the workshop "Behinderung und Begabungsentfaltung" (Handicap and Development of Giftedness) has been published under the same title by the "Stiftung zur Förderung körperbehinderter Hochbegabter", Vaduz/Liechtenstein (1993) - ISBN 3-908-506-07-7; see the last contribution to the section 6 (Special Groups) in this volume.

The main criteria in realizing the necessary selection for volume 2 were a truly European and international representation of recent research topics in the field of gifted education and - of course - the quality of the contributions. Finally, we intended to focus not only research problems and outcomes but also their applicability to practice and policy. The editors thank all contributors for their confidence in us and for (generally) submitting the manuscripts on time.

The content ranges from opening speeches to keynote addresses (including commentaries), symposia, workshops, audiovisual and poster presentations. The selected papers are classified into the following categories or subject areas:

- (1) *Opening Speeches*, comprising of an official declaration of the Federal Government of Germany concerning their politics of nurturing the gifted, and of the introductory position paper of the chairman of the conference.
- (2) *Ability and Achievement*, focusing mainly on intraindividual differences of talents and skills which provide the basis of differential education.
- (3) *Creativity and Innovation*, with contributions mostly issuing recent theoretical developments either of cognitive or of organizational processes which constitute creative innovation.
- (4) *Development of Giftedness and Talent*, particularly from a life-long perspective, with contributions using methodological approaches as different as case studies and long-term longitudinal studies on representative samples.
- (5) *Gender Issues*, emphasizing empirically proven relationships between attitudinal and motivational sex differences and thematically corresponding differences in achievement.
- (6) *Special Groups*, the contributions of which demonstrate the regrettable fact that many talents are wasted by internal or external handicapping conditions.
- (7) *Identification and Psychological Measurement Problems*, comprising of contributions which reach from basic overviews to recent developments of new tests and procedures for identification.
- (8) *Gifted Education and Program Evaluation*, focusing primarily on comprehensive reviews of educational models or on special methodological procedures of evaluation.
- (9) *Teachers of the Gifted*, describing characteristics of more versus less experienced teachers which are of substantial influence to the education of the gifted.
- (10) *Policy and Advocacy in Gifted Education*, joining both contributions which represent the opinions held by political institutions of Germany and papers which add a broader national or international perspective on efforts of systematically nurturing the gifted.

In order to complete the proof-reading and because some papers from contributors who are not native English speakers had to be rewritten, we had to cope with standardizing the English as well as with time and budgetary problems. Hence we are now pleased to present the Proceedings of the 3rd ECHA Conference, 1992, for a greater audience. We want to express our thanks to all colleagues and co-workers who assisted us in the editing work. Heidi Röder, Edeltraud Schauer, and Monika Wersing typed several manuscripts, Catrin Herter and Kerstin Osterrieder checked the file transfers on the computers. Colleen S. Browder assisted in the translation into English, and Beate Karbaumer re-drew most of the figures and gave most manuscripts their final layout.

Finally, our thanks go to The Federal Ministry of Education and Science in Bonn, and the Donor Association for the Promotion of Science in Germany (Stifterverband für die Deutsche Wissenschaft) through "Bildung und Begabung e. V." (Private Association "Education and Talent") in Bonn for their grants. This support enabled us to publish volume 1 (Abstracts) and volume 2 (Proceedings). And we are grateful that the Hogrefe & Huber Publishers made it possible to publish this book in the tried and tested way. Our hope is that the Proceedings will contribute to the progress of gifted education in Europe and around the world.

Munich, January, 1994

Kurt A. Heller

Ernst A. Hany

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I. OPENING SPEECHES

Introduction

The Third European Conference of the European Council for High Ability was opened by a triplet of lectures two of which are given on the following pages. Rainer Ortleb, the German Federal Minister of Education and Science, took the occasion of the conference for giving an official statement of the Federal Government's principles of support for gifted and talented young people in Germany. In addition, he described current initiatives and programs of support of the gifted which added to the educational measures taken by the governments of the German federal states (Laender). Michael Vorbeck from the Council of Europe, Section of Educational Research, illuminated the situation of the gifted by introducing a general European perspective. He described measures taken by the Council of Europe to promote research and education of the gifted, and described his profile of the "homo europaeus" which should guide the educational goals pursued by the schools of this continent. Vorbeck's contribution was not included in this volume as Volume 1 of Competence and Responsibility contained a long draft of his speech. Kurt Heller, chairman of the ECHA conference, then presented his observations of the European and international state of research on giftedness, and described the major trends and results of research and its practical applications. He also pointed out that current efforts of designing educational services for the gifted are in need of further basic research and of cross-cultural studies.

Federal support programs for gifted and talented young people in Germany: Concepts and initiatives

Rainer Ortleb

The Federal Minister of Education and Science, Bonn/Berlin, Germany

Madam President, Ladies and Gentlemen,

I.

I am delighted to be able to talk to you, the participants in the Third European Conference for High Ability, here today. The aim of the conference - that is to say to intensify and deepen the discussion between giftedness researchers and experts on education policy from the countries of Europe - is very close to my heart. In this context, I also hope to see a particularly lively and fruitful exchange of ideas with the numerous conference participants from Eastern Europe. As the countries of Europe come closer together, we are going to be faced by major tasks - something that we Germans are already very much noticing in our special situation. Against a background of freedom, scientific communication at the national and international level will increasingly contribute towards eliminating prejudices and obstacles, while providing new food for thought at the same time.

Today, promotion of the gifted, promotion of top scientific achievements and the creation of educational elites rank among the central questions in the socio-political debate in the Federal Republic of Germany, and particularly in the debate on education policy.

Initiatives aimed at increased promotion of particularly gifted children, young people, trainees and students are meeting with growing approval among politicians and the general public. The Federal Government sees this as an encouragement to continue its commitment to the promotion of special talents and gifts in the non-school sector, in vocational training and in higher education institutions.

II.

The policy of the Federal Government is geared to greater differentiation between the forms of education and the supplementary promotion measures available because it is convinced that this is the only way of giving the necessary consideration to the major differences in talents and inclinations and the wide variety of levels of performance. This basic standpoint automatically results in a positive attitude towards promotion not only of the disadvantaged, but also of the gifted. A differentiated range of education and training measures should be available, together with supplementary promotion schemes, so that every individual can develop his or her range of talents to the full.

Particularly gifted people should primarily be promoted for their own sake. The full development of their capabilities and performance potential is a prerequisite for development of their personality as a whole. In addition, there is a growing consensus of opinion that the Federal Republic of Germany, like the other countries in Europe, cannot afford only to accept and promote special talents in sports and individual artistic fields. We need scientists and practitioners

who develop new ideas, and managers who can successfully "sell" them on the world market. The promotion of special gifts is necessary to provide science, the economy, political and cultural life with new stimuli resulting from outstanding achievements of young talents.

III.

The Federal Republic of Germany is a federal state. Its constitution is geared to preserving and advancing the cultural independence and wealth of traditions which have developed in the course of the centuries in the German Länder and the city states, such as Bavaria, Saxony and Hamburg. With this in mind, dealing with cultural affairs and the school system is the responsibility and duty of the Länder.

Within the scope of its legislative powers, the Federal Government also has to work towards the equality of the situation in the education sector. In this way, it contributes towards a high standard of education and training across the nation and safeguards occupational mobility. This is particularly important with a view to the process of European unification. The Federal Government exercises these competences in the field of higher education institutions, vocational training, further education and individual fields of non-school promotion. The responsibility for the promotion of gifted young people outside the school sector is derived from its responsibility for the promotion of junior scientists.

Even those who advocate the power-dividing function of our federal system and see our opportunities as lying in the variety of initiatives inherent in this system, must permit the question of how the responsibility of the Federal Government for the education policy of the nation as a whole can be strengthened and further consolidated.

I would particularly like to stress this point against the background of the current debate on amending the Basic Law. The restriction of the competences of the Federal Government in the education sector would lead to a situation where it would no longer be possible to guarantee the measure of quality and equality in the education sector which all democratic parties have demanded in the past. The way in which the promotion of the gifted has developed seems to me to be a particularly good example.

IV.

The promotion of the gifted by the Federal Government covers all fields of education:

There can be no doubt as to the fact that it is the task of the *school* to impart fundamental qualifications. However, despite all their commendable efforts to provide differentiated instruction, they are often not in a position to give especially gifted pupils the attention they need. Moreover, school is not the only place where particularly gifted young persons can be promoted. Only an approach towards promotion of the gifted which is geared to every element of their personality holds the promise of lasting success. In recent times, more and more emphasis has been placed on this aspect by giftedness researchers, for instance by Professor Harry Passow, the Nestor of education for the highly gifted from the USA.

The out-of-school promotion schemes of the Federal Government for gifted young people of school age essentially consist of three elements:

1. In numerous research schemes and *pilot projects*, we are promoting basic research and the development of theories for the identification of special gifts and talents, partly with the aim of building up a soundly-based advisory system for pupils parents and teachers. Research on giftedness has in the meantime become one of the principles of practical teaching, educational advice, careers advice and, above all, identification. A number of important projects which were completed only recently will be discussed in detail as contributions to the Conference in the next few days.

2. Another key field of the promotional measures of the Federal Government in the non-school sector is national *competitions*. They have proved particularly successful as an instrument for promoting the gifted. Special mention should be made of the national competitions in the fields of mathematics, chemistry, physics, information technology, modern languages and history. These competitions place special demands on analytical talent and creativity. They are an invitation to young, highly gifted people to develop their special skills and try them out in fair competition. There has been a very satisfying response to this offer among school pupils in the new Länder. The young people take part in almost all the competitions in numbers corresponding to their proportion of their contemporaries. There has even been an above-average response to some of the most important competitions, such as that in mathematics or the "Young Researchers" (Jugend Forscht) competition.

The national winners are sent to the International Scientific Olympics in mathematics, chemistry, physics, information technology and biology where, I am pleased to say, the German teams regularly achieve impressive successes. Cultural and artistic competitions supplement the range of opportunities offered to young people.

However, the goal of promoting special talents and gifts by way of competitions would not be achieved if this promotion ended with the award of the prizes.

3. For this purpose, the Federal Ministry of Education and Science has, since 1988, tested extracurricular Summer courses in the form of a *pupils' academy* as another element of promotion of the highly gifted. Selected on the basis of very stringent criteria, young people between the ages of 16 and 18 live together for several weeks in selected, somewhat out-of-the-way places, such as boarding schools, and are instructed - in special fields chosen by themselves - by university professors, recognised artists and leading economic experts. These pilot projects have been very successful. Therefore, there are plans to establish academies of this kind for about 1,500 young people per year on a permanent basis.

V.

While the promotion of special talents in the higher education sector already has a long-standing tradition, and the promotion of gifted pupils in and out of school has become increasingly important in recent years, the promotion of special gifts and talents in *vocational training* was not a central element of education policy up to the early Nineties. Today, some two-thirds of all young people in Germany are prepared for working life in a system of vocational training in companies. Up to now, they had no access to promotion schemes for the gifted. I considered it a challenge to change the situation.

We have succeeded in matching the promotion of the gifted in schools and higher education institutions with a corresponding system of promotion in vocational training because there, too, there are young people who are willing and able to reach above-average achievements in their occupation.

A craftsman who does top-class work in his field belongs just as much to a small elite as a university professor. Although particular gifts of young specialists in companies, practices and administrative authorities manifest themselves in a different way than in scientific or artistic work, for example, this does not mean that they are any less deserving of promotion. That is why I launched the programme entitled "Promotion of the Gifted in Vocational Training" in the Summer of 1991. The opportunities for promotion which it provides are designed to help young people to develop their practical, intellectual, social and creative capacities to the full in their work.

At the same time, the "Promotion of the Gifted in Vocational Training" is an indication of the Federal Government's will gradually to put vocational training on an equal footing with schooling and higher education. Perhaps this will fulfil the hope that, more than has previously been the

case, a greater number of gifted young people with a will to work will see vocational training and staying in their occupation as a worthwhile alternative to studying. Particularly against the backdrop of European unification and the efforts to harmonise economic and social standards in the unified Germany, we need a strong economy in both the old and the new German Länder. In this context, we are reliant not only on the abilities of entrepreneurs and managers, but also and in particular on the performance of highly qualified specialists in companies.

The participants in the programme "Promotion of the Gifted in Vocational Training" can receive grants for up to four years to finance further education activities running parallel to their work. These grants can be used, for example, for learning foreign languages, for periods abroad or for the acquisition of knowledge and skills in related fields of training.

The scheme for promotional vocational training will be fully established by the end of 1993, after which time some 9,000 young employees per year will be able to enjoy the benefits of special promotion.

VI.

The situation in the *higher education sector* is different to that in school education and vocational training. There, the promotion of the gifted is traditionally a task of the lecturers, in particular. They can recognise special scientific talents at an early stage and have the opportunity to giving them specific scientific promotion.

The promotion of the gifted in higher education institutions is also a task laid down in the statutes of various private foundations and associations. At the moment, there are nine independent foundations dedicated to the promotion of the talented in the higher education sector. In addition, the Land of Bavaria has its own scheme for promotion of the gifted, although it is limited to Bavaria, and there are also numerous other foundations. All the schemes and foundations for the promotion of the gifted expect outstanding achievements in studies and scientific work. Above and beyond these intellectual requirements, these institutions lay varying degrees of emphasis on other aspects, such as development of personality, readiness to accept responsibility and commitment to the state and society, as well as artistic and practical skills. They offer intensive scientific and individual support, as well as material assistance in the form of scholarships.

Among the numerous forms of promotion opportunities after completing a course of higher education, special mention should be made of the promotion of doctoral candidates by the institutions for the promotion of the gifted and the promotion of graduates by the Länder, as well as the post-graduate colleges which are currently being set up.

VII.

Ladies and Gentlemen, the Third European Conference on High Ability in Munich will trigger initiatives, continue the exchange of ideas and experience in this field and constitute an important basis for work in the coming years. In addition, I hope that the intensive discussion of ways of promoting special gifts and talents will meet with a great response not only among the young people involved, their parents and their teachers, but also in the public and the media.

I wish your Conference every success.

Responsibility in research on high ability

Kurt A. Heller

Institute of Educational Psychology, University of Munich, Munich, Germany

The title of this keynote can be interpreted in several ways. I can only emphasize a few here.

(1) Contributions from research on giftedness to the improvement of practical requisites in the identification and nurturance of gifted children and adolescents.

From an educational psychological point of view, the role of nurturance of the gifted is primarily *individual development support*. This implies at least the following: a) "Giftedness" as a multifactorial concept, b) personality development is an interactive process, c) nurturance of the gifted as a function of optimizing individual (personality) and social developmental aspects. This is tangential to the social and educational policy of equal opportunity.

On a): Independent of whether "giftedness" is considered psychometrically as a predisposition toward outstanding achievements in various areas or cognitively as more or less domain-specific expertise, new theories favor multidimensional models of giftedness (cf. Gardner, 1985; Heller, 1986; Hany & Heller, 1991; Mönks, 1992). Theory-guided diagnostic and nurturance concepts thus call for differentiated approaches which are not represented by one-sided IQ-fixings or so-called cut-off models (Mönks & Heller, 1994). The practical identification of gifted children and adolescents frequently limps behind the state of the art recognitions from research on the gifted.

On b): Giftedness first manifests itself as a relatively non-specific individual achievement potential whose development interacts with the social learning environment from the very beginning. This indicates interaction with educational and socialization variables. This interaction process should be viewed as a mutual influencing of children's behaviors and parental upbringing practices. The hereditary background is then important in the development of giftedness mostly for the individual selection and employment of the learning opportunities presented by the social environment (cf. Scarr & McCartney, 1983; Weinert, 1992). Early indicators of giftedness even suggest that during the first few month and years of life particular activities develop which are expressed in curiosity and exploratory behaviors. These can be interpreted as influencing the socialization agents. Attempts to provoke socialization conditions adequate for giftedness and thus to actively influence the learning environment to satisfy basic cognitive and social-emotional needs are apparently characteristic of the behavior of very gifted children (cf. Friedrich & Lehwald, 1992). An important educational task for parents and teachers or other relevant socialization agents stems from this. The demand for early identification and nurturance of gifted children and adolescents is thus founded on the responsibility for providing appropriate learning environments.

On c): The constitution of the Federal Republic of Germany and that of most the individual states guarantees the individual's right to equal opportunity. This is frequently - knowingly or unintentionally - incorrectly interpreted and used as an argument against educational programs for the gifted by its critics.

"With a view to the demand for equality of educational opportunity a ... dual nuancing of the equality term is necessary. On the one hand, equality in the sense of Article 3 of the constitution, means that every young person must have all educational paths open. There is no objective

reason (e. g. race, religion, social status, sex) for excepting someone from a particular educational path. On the other hand, the social state clause of the constitution (Art. 20, paragraph 1 in connection with Art. 2, paragraph 1 and Art. 3) states that a dynamic component is contained in the term of equality, such that each individual's own situation should be considered" (cited according to Gauger, 1992, p. 25).

The individual's right to equal education opportunities thus stands face to face with the social responsibility for offering an adequate spectrum of specific programs. The degree to which the individual youth takes advantage of these offerings cannot be determined by the state, but is determined by individual interests, abilities, educational goals, etc. This is not to say that the state should not insist on an obligatory basic education for everyone. Therefore, the decision for making use of educational opportunities lies with the individual him-/herself. In addition, there are many instances where personality development is interfered with through less adequate socialization conditions, deficient learning environments or individual handicaps. The school's task here and possible educational psychological counseling is to maximize the educational equality. This obligation results from the equality rights principle whereby the social components of equal opportunity should be discussed. This includes all youth, the gifted and not only those with learning and physical disabilities.

The realization of the constitutional right to equal opportunity, i. e. the transformation of needs into educational activities, includes questions central to applied research in giftedness. In addition to learning and ability psychological aspects, giftedness, instructional psychological, educational and social psychological or support-didactical problems are relevant.

(2) Research on giftedness includes not only technological or practical questions, but also necessities basis scientific research approaches.

Scientific history has often shown the efficiency of applied research is greatly influenced by basic theoretical and experimental research. This basis rule also holds true for research on giftedness and for the practice of nurturing the gifted, including diagnosis, counseling, and intervention. One could name, for example, innovative approaches from more recent cognitive psychology or expertise research in the expert-novice paradigm (for current information, see also Gruber & Mandl, 1992; Schneider, 1992, 1993; Shore & Kanewski, 1993; Perleth *et al.*, 1993 or contributions from Cho, Freeman, and/or Sękowski, in this volume). This produced important drives within applied research on problem solving as well as in instructional questions, such as we find in research on learning and thought processes specific to the gifted, memory strategies, metacognitive competencies, coping styles, etc.

Additional topics, more related to basic scientific questions are based on longitudinal analyses (e. g. description and explanation) of development processes in the gifted. This includes social-cultural contexts which promote or inhibit development (cf. Mönks & Spiel, this volume). In addition, (semi-)experimental studies with the function of causal analyses, for example, for explaining of sex differences in various dimensions of giftedness (competence) and/or achievement areas (performance), especially in math, sciences, and technology (cf. Brody and Goldstein & Stocking, this volume). Scientific recognitions contribute not only to answering general or differential psychological questions. The explanatory knowledge acquired leads to the development of the knowledge for changes necessary in practical nurturance of the gifted, e. g. in counseling and intervention, in education and instruction.

(3) Important advances in knowledge about developmental conditions of gifted children and adolescents can also be expected from cross-cultural socialization research. This has thus far been somewhat neglected in the research of the gifted, despite its methodological advantages.

The reason for relatively few cross-cultural studies that can be referred to as more than international cooperations but meet scientific methodology requirements is the enormous cost

but also specific methodological problems which frequently confound the work and financial load. I will report more on this later. One expects *cross-cultural* research approaches within giftedness to bring about an increase in knowledge with regard to various cultural influences on individual developmental and educational processes (cf. Eckensberger & Krewer, 1990). This goal should be met by a specific research strategy. This means that cross-cultural psychology should be defined by research methods and not by the object research (Petzold, 1992). Three types of comparison are relevant: a) cross-national, b) cross-cultural, and c) cross-societal. In the context of our research problem, the second, cross-cultural studies are of interest; with regard to the cross-national view cf. Wilgosh (this volume). Culturally caused behavioral differences in individual development should be identified through the systematic comparison of psychology variables or results obtained in different cultural conditions. Equivalent or non-cultural measurement instruments must be employed. This is a major problem of cross-cultural research. On the basis of such research designs, universality assumptions can be examined in relevant development, educational, learning or instructional areas. This is a function of cross-cultural psychology which was already emphasized by Wilhelm Wundt in his psychology of different cultures at the turn of the century. Thus, the so-called *etic* (from phonetic) approach starts with a universality hypothesis of human behavior. In contrast, the so-called *emic* (from phonemic) approach looks at cultural socialization influences within certain cultures (cultural-relativity hypothesis). Accordingly cultural-specific and valid measurement which must also be culture free instruments make it difficult to actually make cultural comparisons. Therefore, newer ecopsychological models (e. g. Berry, 1980) attempt to integrate concepts from "emic" and "etic" (cf. Petzold, 1992, p. 311f.).

Cross-cultural studies can provide new recognitions about social-cultural development and nurturance conditions of the gifted solely from their change perspective. This could lead to greater variety in the support program ideas. Not only a practical use but also tolerance toward foreign cultures is increased (cf. Butler-Por, this volume). The meeting of international ideas and cultures can also be supported by international conferences such as this ECHA conference. Although the exchange of information and ideas is central here, the informal contacts should not be dismissed in their peace making role. If the participants of ECHA feel reached by this statement, then an important goal of ECHA has been achieved.

Before I go on to a comparative overview of the contents of the program, one last research policy responsibility should be mentioned.

(4) *As long as research is supported by state or private/public foundations and is directly or indirectly a public service, a mutual responsibility grows between the society and the research community.*

Without wanting to question the freedom of research - i. e. the responsible selection of topics and methods by the researchers themselves - the simultaneous responsibility of the society toward society by the direct or indirect funding of research must be emphasized. This stipulation also holds true for the research of giftedness, which otherwise is in danger of isolation (and not only from the mainstream of the scientific community). On the other hand, qualified researchers in this field have the same rights as other scientists, to demand appropriate work conditions where one can consider scientifically desirable questions from the field of basic research and also from the practice of giftedness nurturance. It can be taken as a positive sign that the scientific and public opinion about the uses and rights of research on giftedness is playing an increasing role - albeit small in comparison with other topics - in the consciousness of those responsible. Perhaps this international conference in Europe can increase the initiative here and elsewhere - for the good of the coming generation and to improve the future of all mankind.

(5) *A content analysis of the topics here at the third ECHA conference in comparison with the previous nine WCGT world conference proceedings and the most important*

journals in the field of giftedness research points to important trends in the international research scene. This could be important for the continual development of research on the gifted at the European level.

First, here are analysis results from the conference proceedings of the previous nine world conferences of the World Conference for Gifted and Talented Children (WCGT). A total of 408 conference presentations have been published from 1975 to 1992. This corresponds to a publication percentage of about 15%. Approximately 40% were from practice, 20% each in the areas of theoretical and empirical reports (on applied research), 15% on gifted programs and support of the gifted. Only 5% (in the last three years) discussed the topic of basis research (Heller & Menacher, 1992). This picture reflects the analyses of relevant journals (Pyryt, 1988; Rogers, 1989; Carter & Swanson, 1990). Here, too, the majority of the practice-oriented applied research is employing generally simple statistical methods. Only about 25% of the studies reported can be considered as hypothesis oriented. More demanding statistical methods such as path analyses or cluster analyses are rarely found here and are probably published in journals (cf. Pyryt, 1988).

The need to catch up in theoretically guided experimental and quasi-experimental research on giftedness is emphasized indirectly in the classification of psychological subdisciplines taking part. The percentage of general psychologists taking part is negligible (median of about 5%), whereas educational psychologists make up about 70% and clearly dominate.

A more recent content analysis (Heller, 1993) of (English-language) journals with the majority of publications on the gifted from the last 10 years (Gifted Child Quarterly, Roeper Review, Journal for the Education of the Gifted, and Gifted Education International) provided the following picture: The topics "Gifted Education" and "Programs and Nurturing" are most strongly represented in all four journals analyzed with percentages between 30 and 60. Topics such as "Characteristics of the Gifted and Talented" are more frequently found in the Journal for the Education of the Gifted (39%) and in the Gifted Child Quarterly (28%) versus the Roeper Review (21.5%) and Gifted Education International (19%). "Social Context" has its strongest representation in the Gifted Child Quarterly with 13%, "Identification" with 7.5% each in the Gifted Child Quarterly and the Journal for the Education of the Gifted. The rates of "Learning and Perception" and "Development" are astonishingly low in all four journals. Solely the category "Definitions and Concepts of Giftedness and Talent" had higher percentages in the Gifted Child Quarterly (27%) and the Journal for the Education of the Gifted (16%). These results generally confirm those reported by Rogers (1989) and Carter and Swanson (1990) who, in part, included different journals.

What picture is presented by the contributions to the Third ECHA conference? Ninety percent of the 400 conference participants come from Europe and 10% from overseas. Of the non-Europeans, 5% are from North America and Canada and 5% from Asia. Africa, Australia and New Zealand are not represented. The German participants are, as expected, the leading group with 35%. A considerable number of visitors come from the former communist states of Europe. Together they make up nearly a third. Following Germany (35%), Hungary, Poland and the CSFR are represented with 9%. The former states of the USSR follow with 7%. With that the Third ECHA Conference contributes significantly to the European Unification. The changes which were already becoming apparent two years ago at the Second ECHA Conference (1990) in Budapest seem to continue in a positive manner despite current conflicts within Europe. Concerning this our conference has already passed the first hurdle. The main topics of this conference and those of the preceding world congresses on high ability are relatively similar. The question of identification, however, with 14%, is dealt with twice as frequently as at the other nine world congresses (with an average of 7%).

There is a lack of support and practical experience concerning the education of the gifted including information about giftedness in former communist states of Europe. With regard to definition problems and theoretical bases of support for the gifted there is a growing interest. In contrast to this, in Western Europe there is a dominant tendency to establish private and political initiatives for support programs for the gifted. This might be a positive sign. Or does a low percentage (2%) of future oriented topics at this conference mean that it is necessary to be sceptical concerning the planning concepts? I hope not. With regard to actual analysis results, we know that scientific disciplines and subdisciplines of psychology and education are confirmed. The vast area of research into high ability seems to be dominated by educational psychology and related subjects. As an educational psychologist, I do not regret this although a higher scale of interdisciplinary work could exert a positive influence. This demand also concerns the relationship between practical and basis research. "Pragmatic nature and education of the gifted on an unsure scientific basis" - to employ Franz Weinert's sober description (Waldmann & Weinert, 1990, p. 184) - will provoke further discussions.

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II. ABILITY AND ACHIEVEMENT

Introduction

In contrast to average or below average performances, exceptional performances at school or work are usually contributed to interindividual (cognitive and motivational) differences. This overlooks, however, an important moderator function in social learning conditions. Hansgeorg Bartenwerfer first discusses in more detail such *interindividual* differences which have been proven to be *individual* prerequisites for eminent performance in many studies. Not taking them into consideration, especially at school, causes great problems for the individuals concerned, for example, boredom due to lack of stimulation and social isolation from non-gifted peers. These are exemplified by a number of case studies.

Finally, problems in identifying interindividual talent differences as well as related questions of equality are discussed. In his commentary, Edward Nęcka supplements the interindividual approach with an *intraindividual* approach which is especially important from the developmental point of view. Furthermore, the discussant emphasizes the necessity of not only taking quantitative but also *qualitative* differences into consideration, pointing out as one example metacognitive factors (see also the contribution from Christoph Perleth, below). Necka recommends using characteristics of temperament to study "preconditions of talent", whereby a "general energy" - apparently in the sense of Russian research on giftedness - is assumed.

In the contribution which follows by Andrzej Sękowski, a review of the symposium "Structures and processes in intellectual achievements" is presented. This deals not only with cognitive skills but also cognitive styles and strategies in solving complex tasks in various achievement settings and with various age groups. In his second contribution, Sękowski reports about his own empirical studies for predicting various achievement contents. According to this, predictors vary according to domain-specific achievement criteria, e. g. in math or humanities. Then, studies

are presented by Katya Stoycheva which are concerned with the relationship between creativity and intelligence. Based on test theoretical data, influences of creative motivation and the need for achievement on this relationship are analyzed using correlational methods. The results are presented for discussion.

Finally, Christoph Perleth reports about three studies which investigated central metacognitive competencies, especially metamemory in kindergarten and grade school children. Whereas the first two studies provide more information about the early development of metacognitive competences, the main result of the third (training) study is probably more interesting from an educational and nurturing point of view. Training effects could be shown in various talent levels especially for near transfer tasks; the superiority of *gifted students* first became apparent with increasing transfer distance. In conclusion, some consequences for the classroom - for both normal children and the learning disabled - are discussed.

Individual differences in talent

Hansgeorg Bartenwerfer

German Institute for International Educational Research, Frankfurt/Main, Germany

Definition

The topic of this presentation is "Individual Differences in Talent". First we have to take a look at the concept "talent". What does it mean to say "A is musically talented" or "B is a talented speaker", etc.? Such statements mean that someone possesses good preconditions for performing well in the corresponding area - e. g. in music. These prerequisites for high performances are generally considered to be connected with one particular person. We will not be speaking about talents in groups - e. g. for particular races - since the topic here is individual differences in talent. We can thus define "talent" in the following way:

Talent is the sum of all individual conditions which can enable one to perform outstandingly in mental, artistic or physical areas.

Such individual conditions are, for example: intelligence, creativity, social ability, knowledge, interests and motivation, perseverance, concentration, stress resistance, vitality, emotional stability, physical and mental health, physical stature.

I want to add a definition from Professor Rainer Ortleb, the present Federal Minister for Education and Science, who stresses even more the individuality of talent. Ortleb (1992, p. 6), in his preface to Kurt A. Heller's book "Giftedness in Childhood and Adolescence" (*Hochbegabung im Kindes- und Jugendalter*), wrote that giftedness is a concept for the fact "that there are individuals who are capable of unusual achievements in intellectual, creative, psychomotor, or social areas, that others are incapable of, even with better educational opportunities or greater personal exertions".

Types of talent

The number of types of talents has probably never been counted: Thus, one can say, there are uncounted types of talents. Everything we do in life, within and outside of our professions, can be carried out in a more or less talented manner. In our society, however, talent in professional lives are honored more than, for example, talents in hobbies. Therefore, we will begin with talent in professions. Individuals who achieve outstandingly in their field soon notice it in cash or other non-monetary rewards, such as recognition or prestige. Almost everyone is pleased to receive prestige or lots of money, or both.

Each day shows us that there really are different types of talent. The successful conductor certainly needs other talents than a great mathematician. The same holds true for a highly ranked tennis player versus an entrepreneur who makes a large profit by producing wooden matches. Different types of talent are needed, for example, by a famous portrait painter and a chess champion, the successful politician compared with a novelist.

Those who think about various types of talent should not be misled into thinking there are only special types of talent. This kind of assumption does not do justice to some types of great talent. Certainly there are very special talents such as those of excellent mathematicians who are incapable of dealing with other areas of life. But there are also talented individuals who

excel in many areas. Classical examples of this are Leonardo da Vinci or Goethe. But this is not only true of the past; the *Studienstiftung des deutschen Volkes* has demonstrated since the twenties that there are not only special talents but also that the support and challenge of broader talents is essential.

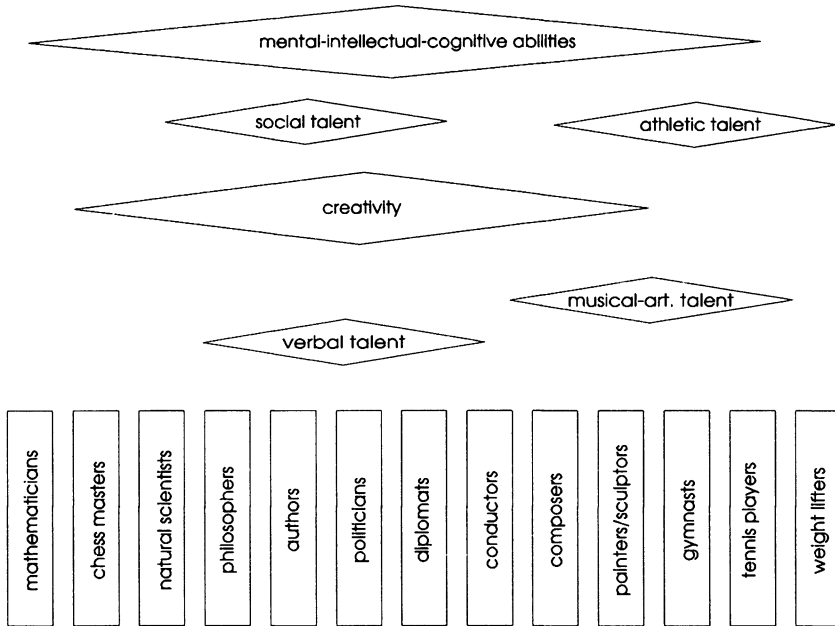


Figure 1: Different types of giftedness (talent)

Causes of individual talent differences

In order to understand various types of talent as well as special versus general talents, it is useful to view the causes of talents. We know today that many causes have to come together to really be able to speak about talents. The following figure may be useful for understanding this: The most important factors are presented broadly where it is known that they are meaningful for the development of particularly high achievements.

The meaning of various causes of talent

The boxes in the top row of figure 2 and those on the left are not of equal importance. Of the three top boxes, the one on the left is no doubt of the greatest importance. Much of the groundwork for later development is laid during the first years of life. A review by Christopher Jencks *et al.* (1972) explained up to 50% of the variance of educational achievement using family background.

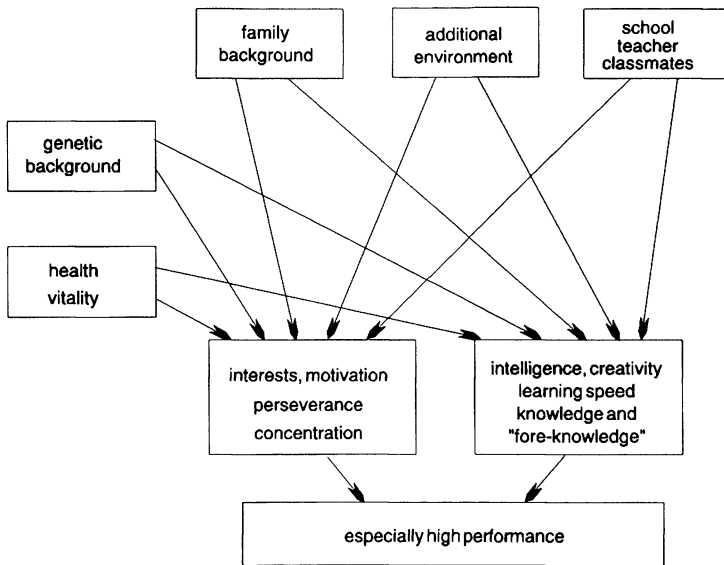


Figure 2: Causes of high mental performances

The second most important factor, according to most researchers, is a child's genetic background. We do not know much yet about how genes influence mental abilities. This probably takes place more or less indirectly. An example: Verbal talent in adults is often linked to the frequency with which the mothers speak to the young child. If the child speaks little for genetic reasons, i.e. hardly opens its mouth, then the mother will tend to speak less to the child. When there is a response, meaning it is pleasant and interesting to speak with the child, the mother will speak more frequently with it and thus nurture its later verbal abilities. In this example, the mother's behavior with the child is partially determined by the child's genes. A direct genetic effect would be when the number of nerve cells in the central nervous system and their interconnections were genetically determined. Thus, the genetic background effects a child both directly and indirectly.

Educators may find it dissatisfactory that the factor "school" plays less of a role than the factor family background. This does not mean, however, that school is of no importance. The importance of the school can be very great in many individual instances. The statement that the genetic equipment has a greater effect on talent development than the school environment is only a statistical finding. This does not tell how the development of talent will proceed in an individual child.

In order to make it clearer that a great deal of importance is to be placed on various causes of talent development with regard to cognitive inequality, I quote Christopher Jencks and colleagues (1972, p. 180), who in my opinion, carried out the largest and most neutral international study (retranslation from German into English):

"(1) If we could make everybody have the same genes, then the inequality of test results would probably drop by 33 to 50 percent.

(2) If we could provide everyone with the same total environment, then the inequality of test results would probably drop 25 to 40 percent.

(3) If we only equalized the economic status of every person, the inequality of test results would only drop by 6 percent or less.

(4) If we provided everyone with the same amount of schooling, the cognitive inequality in adults could be decreased by 5 to 15% percent which is, however, a very generous estimate.

(5) If we could equalize the quality of all grade schools, the cognitive inequality would be reduced by 3 percent or less.

(6) If we could make the quality of high schools equal, then the cognitive inequality would be reduced by 1 percent or less."

Most of the differences in the adults' test results are due to factors which the school does not control. This does not mean that schools could not equalize the test scores if they attempted to do so. Probably they could. If we wanted everyone to read at the present national average, then we could provide very gifted children with only one or two years of schooling, children who are somewhat above average with six years, those who are somewhat below average 12 years, and the very slow ones, 18 years or more. "We assume that such measures will greatly reduce the inequality of reading results. We still do not vote for such solutions. 'Equal opportunity' means to us that every individual has a chance at as much education as he/she wants. (However) such a comprehension of equal opportunity guarantees unequal results." (Jencks *et al.* 1972, p. 161f., retranslation from German).

The degree of individual talent differences

Individual talent differences can be incredibly large. This is suppressed or ignored again and again by teachers. Let us examine some examples of particularly high degrees of mental-intellectual-cognitive ability. This ignores all cases of special musical or sport talents. They generally do not cause any difficulties, because particular musical or sport talents in our society are generally accepted - in contrast to outstanding mental-intellectual-cognitive talents. In many places, early musical or sporting talents are scouted for in order to nurture them from an early age. I also neglect examples of famous personalities because they are already well known. I will only present a few examples of early observable talents that have occurred in our lifetimes and could cross any of our paths.

I will first quote the news agency, Reuter from December 1981, "The best of 530 candidates in the entrance examination for mathematics at the University of Oxford was ten-year-old Ruth Lawrence. Ruth will be able to begin studying in October 1983 as a twelve-year-old." This means that this ten-year-old was better in these exams than applicants approximately twice her age, and that in competition with 530 of them.

In August 1982, one could read the following report from the Deutsche Presse Agentur (dpa). "A Soviet 12-year-old was given special permission from health authorities to begin studying medicine. He learned his ABC's in a few days and completed his schooling in half the normal time - with top grades." In the Soviet Union, one was normally not allowed to study medicine until at least the age of 18. The application for special permission to begin earlier and the considerations that had to be made, brought this item to the attention of the press.

Another dpa report from September 1985: "A thirteen-year-old boy from Simferopol on the Crimean sea has begun studying at the Moscow Physical-Technical University. As the East German news service ADN reported on Monday, the boy learned to read and write while still at kindergarten. He started school with the third grade and finished 11 grades in six years."

In August 1985, there was an article by Axel Hacke in the *Süddeutsche Zeitung*. I quote from this article: "The Fu-Fable was not appreciated by Peter. This is a little strange because this book is greatly enjoyed by Hamburg grade schoolers. Fu is a friendly yellow being. He teaches the little ones to read so that they are soon having no problem with 'Fu calls Fara'. Peter, however, did have one problem with this, in that, at the age when all his classmates were fighting their way through Fu sentences, Peter had already read all of Jules Verne's books in the adult versions. This usually took place in the following manner: In the morning he picked up a novel and in the evening he put it down completed. One year later, he could still retell the story with all the action details." This corresponds to an achievement that one usually expects from high school students.

We add to this a case from the USA, reported in a weekly magazine from the Spanish Ministry for Education and Science in January 1986: "Stephen Baccus, 16-year-old American teenager is completing his bar exams at the Department of Jurisprudence at the University of Miami. After completing school at 14, he enrolled at the University of Miami where he completed his degree in record time (two years). Nevertheless, his lightning career will not enable him to practice law before his 18th birthday since the Florida State Laws state 18 as the minimum age for practicing a profession."

In the *Wiesbadener Kurier*, November 1984, the following report stems from Peking: "A five-year-old Chinese boy has, according to official reports, passed the entrance examinations and will be admitted to the Chinese University of Science and Technology". The government press agency *Zhongguo Xinwenshe* reported that the boy, Liu Xiaobin comes from a state collective *Gangbu* in the province *Jiangsu*. His parents are both grade school teachers. When he was two, they began to teach him and within three months he had learned 3600 characters. "Nine months later he could read books", the report continued. Now he has the educational level of an adult. - The University of Anhui constructed a special instruction program for him.

In the *Frankfurter Rundschau*, another AP report from Peking in February 1985 was even more unusual. "The University of Wuhau has admitted a four-year-old boy who not only speaks Chinese but also English, memorizes long poems and calculates without difficulty. This was reported in the weekend edition by the Peking news agency *Xinhua*. According to the report, the little boy, whose name is given as *Jinjin*, is participating in a preparatory course for a business-technical course of study. As early as one-and-a-half years, *Jinjin*, according to *Xinhua*, understood English and Chinese. At two he spoke both languages, knew the one times table and could recognize twenty different characters and name them. At three-and-a-half, the 'Wonder Child' supposedly knew how to add, subtract, multiply and divide, and was capable of reading classic English and Chinese poetry. Now the son of a worker and a genetic researcher has memorized a number of Chinese poems and has the mathematical knowledge of a high school student."

As a last example, I mention a case out of my own counseling practice. This summer, a fifteen-year-old boy finished his high school degree with honors. He is now beginning a mathematics degree at a university in Rhineland Palatinate (Rheinland Pfalz).

Results of not considering individual talent differences

One has to assume large differences in the world of schools. Unfortunately, this is frequently overlooked. Perhaps it is too strenuous to adapt to various students. One also uses a hypothesis to avoid having to do so. One says: "Highly talented children make their own way, even if you don't do anything for them". But this hypothesis which dates back to Heinrich Roth only holds true for about half to three-quarters of all highly talented children. The rest can have massive difficulties.

The things that lead to most of the difficulties can be subsumed under two ideas, lack of challenge and isolation.

The lack of challenge results from the quick recognition abilities and the quick learning of intellectually highly talented children. When material has to be repeated for slow learners, then quick learners are not challenged. Depending on their temperament, the children become bored, start daydreaming or disturbing their classmates. What is also negative is that the quick learners do not need to concentrate. They never learn to concentrate. They also never learn to exert themselves because things came so naturally to them. Later they lack the basic important skills of concentration and exertion. In order to avoid these deficits, the school needs to provide quick learners with additional challenging tasks.

In a very different way, highly talented children become isolated. This isolation frequently has three components: (1) The parents are unable to cope adequately with their child who questions them to "death". They suppress their child literally, give inadequate or no answers. The child instinctively feels the wall between him/her and his/her parents. (2) The second component exists with regard to the child's classmates. They notice that these children are different and label them as "brains" or "know-it-alls". (3) The third component in the isolation exists in the teacher-student relationship. The highly talented child is frequently viewed as uncomfortable and disturbing. The teacher wants the entire class to move on as a whole; the child that is very advanced and always putting his/her hand up is a disturbance. The child feels pushed aside again and somewhat isolated from its teacher.

A certain isolation from his/her parents, classmates and teachers is difficult for any child to bear. A loss of a sense of security is often the cause of conduct disorders, sometimes neurotic behavior. Here are a few examples.

The first two cases are taken from an essay by Wolfram Bortfeldt (1985): "Jörg began school early, after a few months he had lost interest in learning. The answer to his curious questions was all too frequently 'Wait, that comes later!'. Jörg, an introverted child soon stopped asking question and just did not say anything more at school."

"Patrick..., a 14-year-old Hamburg boy had such bad grades at gymnasium that he was in danger of failing in several subjects: In biology he had a D, in Latin he was getting F's and in math he was between a C and a D. But his mother did not want to believe that he was not suited to the college-preparatory track. At two he had suddenly begun to say entire sentences after not speaking at all previously. At three, he wanted to know why water turns to steam and was fascinated by examining of blood under a microscope. When he was four, Patrick read his first chemistry books and at eleven he played chess so well that he was almost unable to find any partners his own age. At age 14, he was able to checkmate the chess computer. An intelligence test showed that Patrick had an IQ of 140 and was mathematically gifted. His problems in school were apparently due to the fact that he had an easy time of it in the early grades and needed to work hard at gymnasium. He had never learned to study hard. In addition, he never tried to be called upon, was considered a daydreamer and an outsider. A psychologist advised him to change schools. He feels more accepted at the new school. There's a gifted girl who challenges him. Now his grades have improved, except for in Latin, a typical study subject, where he needs tutoring now and then. - Patrick becomes somewhat embarrassed when his mother explains that he does not like pop music but likes to listen to classical music and read challenging literature. Patrick would rather keep it to himself that he read Goethe's 'Iphigenia' because he does not want to be considered something unusual. 'I don't want to be made fun of.'"

The third case comes from my own counseling practice. Thomas, at that time 18, achieved such high scores on an intelligence test that he can be considered highly gifted. After a good grade school career, he gradually went downhill. Finally in the 9th grade at gymnasium, it was

all over after failing twice. Although he was highly intelligent, he was barely able to pass in the next lower type of school "Realschule". He has almost completely lost motivation, and describes his situation as desolate. Without exertion, without concentration, he was always able to work on things only for short periods. He sometimes worked for a few hours at a time as a stockboy "... so that my father doesn't throw me out ...". He does not like to read books because it is too strenuous. The only television that can be considered are programs that do not require him to think. This comment stems from someone who can think better than most people. From what we were able to find out, his original curiosity was rejected. His parents, both with grade school educations, stopped answering his questions during early childhood. He never really made friends with classmates because of his differences, especially his individuality. The school's reproach that he never pays attention is justified, he says, because he has already learned everything before it is taught, and is bored and daydreams in class.

Hypotheses about the development of damages by not considering individual talent differences

Based on my review of the literature and my counseling experience, I have formed the following hypotheses:

The greater the lack of challenge is and the longer it lasts, the worse the prognosis for the healthy mental development of talented children will be. In addition: The more complete the isolation (from parents, teachers, and classmates) is and the longer it lasts, the worse the prognosis will be for a healthy mental development in talented children.

Thus, parents and teachers should make sure that talented children do not lack of challenge over longer periods and that they do not remain isolated for longer periods of time.

Recognition (diagnosis) of individual talent differences

One can conclude from the preceding information that it is important to recognize special talents if problems in the mental development of talented children are to be avoided.

Most of the recognitions about especially talented children stem from parents and teachers. Teachers are practiced in passing judgements on their students. When they are familiar with the topic of giftedness, then teachers are an important source of information for identifying the highly gifted. However, teachers can be mistaken. We know of such mistakes in the instances of Thomas Alva Edison, Albert Einstein, Justus Liebig, and Thomas Mann.

Aids for parents and teachers for recognizing talent are so-called checklists containing typical characteristics of talented children. A few examples from a list by the Federal Ministry for Education and Science, 1985 (pp. 32-53) and 1991 (p. 27):

- The vocabulary of gifted individuals is unusual for their age.
- They are able to memorize facts quickly.
- They read a lot on their own and prefer books above their age level.
- They are easily bored doing routine tasks.
- They are interested in "adult" topics such as religion, philosophy, politics,... justice in the world...
- They are very individualistic.
- They tend to quickly decide situations.
- They can empathize with others and are thus open to political and social problems.

When indications for a special ability are found based on checklists, a diagnosis should be made by a psychologist trained in the field. An aid in this is the three-factor model by Renzulli in the expanded Mönks form (1992), see figure 3. This model says that not only intelligence

should be included, but also variables such as creativity, task motivation and environment should be considered. Figure 4 represents a presentation I worked out of the Renzulli/Mönks model.

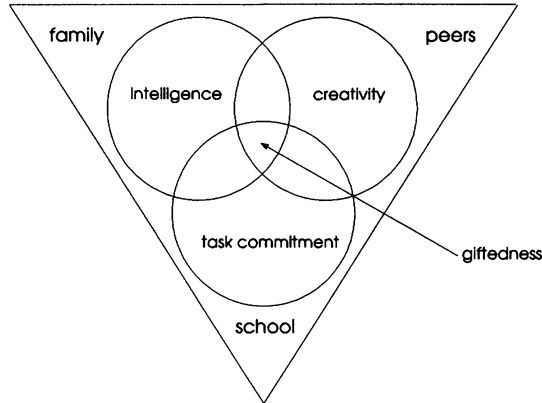


Figure 3: Renzulli's three-ring model as expanded by Mönks (1992)

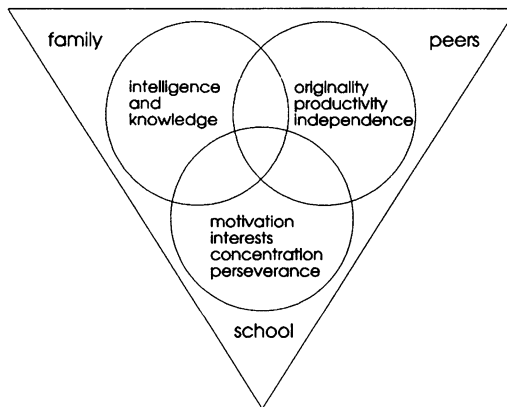


Figure 4: Diagnostic categories related to the three-ring model

This figure can be read as follows: If high degrees of all three areas are present, then one reaches the overlapping area in the middle. The occurrence of special talents is probable here. The psychologist then views the environment of the subject, that is the (outer round) family, school and peers. This environment is of great importance for the development of talented achievements, since they are the point where nurturance or blockage occurs.

Individual talent differences and equal opportunity

Certainly this is not the place to discuss equal opportunity and the inequality of educational results in detail. But the overview character of this article calls for a short review of the question.

The point of begin is the generally accepted postulate whereby all citizens have the same social chances in education, career and personal advance. In the section "The degree of individual talent differences", we said that the degree of individual talent differences is enormous, these differences can hardly be overestimated. On the one hand, there are individuals who never get beyond a meager existence because their talent is inadequate for having a job that lifts them out of the welfare level. What can equal opportunity mean in this case? Not much. Equal opportunity is only of importance for an intermediate range of young people, who are both normally educable and do not grow up in such luxury that degrees are of no importance. One possibility to equalize opportunity would be when all citizens have the same income and the same education independent of whether they contribute a great deal or very little to society. This possibility has met with so little enthusiasm that it does not need to be discussed here. But even if such a model with equal income for all parents who raise children and the same education for all children could be realized, there would still be huge talent differences due solely to genetic inequality (which cannot be equalized).

But let us abandon such utopian idealizations and look for possibilities of achieving a relative equality of mental-cognitive ability under genetic inequality. There are two possible paths here, a radical and a moderate. The radical method requires the children with the less fortunate genetic equipment to be placed in more favorable environmental conditions. For example, teachers would have to help those students who have the most difficulties, and ignore the quicker learners. The more moderate method is to simply treat all students equally, with everyone receiving the same amount of attention.

In the radical method, there really is a tendency toward reduction in talent differences even if they are not eliminated. In the traditional method, the talent differences remain clearly visible.

The reality of our schools shows us both methods and these side by side. In the radical method, the weaker students are helped and the quick learners are (sometimes quite brutally) held back. Then we have the difficulties mentioned on pages 16-21. The teachers who hold back the quick learners, ignoring and rejecting them, are frequently unaware of the problems in their behavior. A teacher who was requested to allow a child, who was bored because it always finished its work ahead of time, to read a book on the subject being taught, stated she could not justify this nurturing of an already privileged child. This would lead to elitism. This teacher is not aware that his or her rule is working against the principle of optimal talent nurturance where every child is nurtured to the maximum of its abilities (cf. Philip J. Idenburg, 1967).

It can be suspected that a paper on individual talent nurturance is likely to land in the middle between two fronts. Such confrontations are very obvious currently as was seen at the 5th World Conference on Gifted and Talented Children in Hamburg in 1985.

The state constitutions and the state education laws based on these still include a lot of inequalities with regard to individual talent differences. The Baden-Württemberg constitution, for example, states in Article 11 that "every young person has a right, independent of race or economic situation, to an education suited to his/her talents". In the Bremen state constitution in Article 27 it says: "Every individual has an equal right to education according to his/her ability". - This emphasizes the individual possibilities of each student. The school laws correspond quite exactly to the constitution. "... Instruction takes into consideration ... the interests and learning abilities of individual students through increasing differentiation ..."

According to this, there can be no doubt that the individual students' teachers and his/her talents (or interests, learning abilities) must be taken into consideration. In contrast, however,

there is no mention of such individual rights to be found in the Hessen constitution. This is also true of the Hessen school law. The question of considering individual talent differences is left open. And the comments of Hessen's school teachers reflect this. The variety of comments ranges from an understanding of quick learning children who could be less bored if they were given additional tasks or given tutoring jobs to do. One also hears that internal differentiation is impossible within the classroom because that would create so much preparatory work which would be too much to ask of overworked teachers. Other arguments against internal differentiation are that it destroys equal opportunity, and the teachers were not taught how to do so. One also has to ask oneself, why the quick learner should not learn to accept that patience and waiting are sometimes necessary. This overlooks, however, the fact that patience and waiting can become a habit and then have dire consequences (see section "Results of not considering individual talent differences").

Individual talent differences can thus bring up a number of problems in an era of equality. This need not be this way. Education practices and the literature show many ways of enabling highly talented and less capable students to grow up and be educated with the same dignity next to one another.

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Commentary on "Individual differences in talent"

A commentary to Professor Bartenwerfer's keynote speech

Edward Nęcka

Institute of Psychology, Jagiellonian University, Cracow, Poland

Individual differences constitute the primary fact of nature, so they should not be neglected particularly in the field of gifted education. However, the topic is sometimes dealt with in a stereotypical and one-sided way. I would like, therefore, to stress these points of Professor Bartenwerfer's speech that seem to go beyond these stereotypes.

The first point I would to stress concerns the problem of intra-individual differences. This problem is clearly underestimated both in research and education, since majority of research and special programs refers to inter-individual differences. In other words, the question of how an individual differs from others is overestimated, whereas the problem of how the same individual differs from him/herself is underestimated. Let us try a kind of mental experiment and imagine what would happen if people did not differ from one another in terms of their abilities and "gifts". For many of us such a situation would be horrible, and many psychologists and educators would feel useless. I am not going to discuss the question of whether such a situation would be pleasant or not (probably not), I am only trying to stress the importance of intra-individual differences, that is, the differences which go beyond the well-established differential paradigm based on the Gauss curve.

The intra-individual perspective seems to be particularly important from the developmental point of view. As we know, the general mental ability, or fluid intelligence, slightly decreases with age, although the crystallized one increases at the same time. It is therefore not suitable to look at the age-related changes solely in the pessimistic way. Apart from crystallized intelligence, there are other important aspects of the human intellect which changes *positively* with age. These aspects are associated with the more and more popular notion of wisdom, defined as the level of competence in solving complex and unclear real-life problems. It is customary to think that people get wiser and wiser as they age. But can we be sure that wisdom is a category that is not applicable to young people, even young children? Perhaps we do not pay enough attention to this facet of intellectual giftedness, that is, we do not expect gifted children to be wise, although we do expect them to be "bright", knowledgeable, and intelligent. We also probably do not pay enough attention to wisdom while organizing special enrichment programs for gifted children, although we pay a lot of attention to the process of learning, skill acquisition, and problem solving. Clearly, wisdom looks like a neglected category, as far as gifted education is concerned, but the stress put on intra-individual differences is likely to appreciate it.

Another problem worth mentioning here is the question of qualitative aspects of intelligence, as opposed to quantitative ones. Clearly, gifted and talented individuals differ from less able ones not only because they know *more*, they think *quicker*, and they obtain *higher* test scores. They also differ from the average people because their knowledge is organized in a specific, or even unique, way, because they know how to solve problems without sheer speed of thinking, and because they possess efficient strategies of problem solving, which enable them to obtain high test scores in a way that is not accessible to other people. In other words, highly talented individuals, no matter adult or not, differ qualitatively from less talented ones.

It is an important task for researchers to establish the comprehensive list of such qualitative differences. As far as we know at present, the so-called "metacognitive" factors play an important role in this respect. These factors are connected with planning and monitoring of every mental activity. Talented individuals probably plan and monitor their activities more thoroughly, thus being able to avoid mistakes, traps, and false assumptions, or at least being able to recover from such lapses due to increased sensitivity to external feedback. Better planning and monitoring is hardly a quantitative aspect: even though one can plan and monitor *more*, it is important if he/she can plan and monitor *better*, that is, in the way that is more suitable to the situation or problem at hand, or which is more suitable in general. For instance, many basic experiments on problem solving show that giftedness is connected with more time and attention paid to the preparatory stages of the problem solving process, at the expense of the final executive stages. It is typical of less able individuals to choose the reverse strategy. Anyway, many problems may be solved, and many goals may be achieved, in qualitatively different ways, that is, with the use of various strategies. However, some of these strategies are more "intelligent" than others, not only because they are typical of highly intelligent people but also because they are more efficient.

My third remark and refers to the problem of the "preconditions" of talent. Professor Bartenwerfer mentioned such preconditions, and noticed that they are probably related to the genetic endowment of an individual. It is worth realizing, I believe, which psychological traits are mostly rooted in genetics. It seems that the answer is: temperament. So what is the relation of temperament traits to high abilities? First, let me stress the importance of the general energy level. It is well-known from biographies of outstanding individuals that they were (and are!) able to work hard for the prolonged periods of time without any symptoms of fatigue. Does it mean they were not susceptible to fatigue? Or perhaps they knew how to allocate efficiently their energy resources? Or perhaps they were able to decide what was important in their work and what was less important, so that they were able to spend their resources without visible signs of fatigue? Whatever the answer, the effect was all the same: the ability to work hard for the long periods of time. It is therefore customary to regard highly able individuals as showing high energy level; but this is a purely temperamental trait, with no direct relation to intellect.

Another temperamental trait which seems very important in this respect is sensation seeking, that is, the willing to know more and more, and the wish to experience novel things. As far as we know, this trait is biologically rooted, and should be regarded as one of the basic human personality traits. It is also the trait typically found in the case of gifted individuals. Why it is so? Probably sensation seekers expose themselves to the increased number of new experiences, and they do that from their early childhood. Therefore, they have more chances to acquire new knowledge and to try out their newly acquired skills. In other words, they are more intellectually stimulated - not necessarily because of their parents' deliberate efforts but because of their own (albeit inherited to the great extent) temperamental traits. Sensation seekers are also less afraid of novelty, including the novelty connected with the problem solving situations. They are therefore more able to solve problems smoothly, efficiently, and without tension.

As we can see, temperament and cognition probably interact with each other, thus increasing the likelihood that the final "product", that is, a mature human being, will show exceptional cognitive abilities. But this line of theorizing demonstrates that the problem of preconditions of the talent should not be reduced to the classical nature/nurture question.

I introduced three remarks in my short speech, with which I tried to stress the importance of intra-individual differences, the problem of qualitative aspects of talent, and the question of the intellect/temperament interaction. I think that professor Bartenwerfer's in-depth analyses of the nature of individual differences in talent were properly completed with this short commentary.

Report from the symposium "Structures and processes in intellectual achievement"

Andrzej Sękowski

Department of Psychology, Catholic University of Lublin, Lublin, Poland

One of the central issues approached by specialists in the psychology of giftedness, training and education of gifted people is "achievements" as both the predictor and criterion of giftedness. It would seem that achievements should fall into the sphere of interest of educators, sociologists or even politicians; however, they capture the attention of psychologists, too. This is because the level of achievements, both outstanding and those lower than expected, is often surprising to psychologists, teachers and parents.

The presentations at the symposium focused upon outstanding achievements of gifted people but also upon the so called lowered achievements which did not come up to the expectations expressed by psychologists, educators, or teachers.

The following six papers were presented at the symposium:

- Undheim, J.O. (Norway), "High academic achievement in an egalitarian society",
- Beltran Llera and Gonzales Roman (Spain), "Study of cognitive skills in university students",
- Sękowski, A. (Poland), "The role of preferences of cognitive styles and intelligence in different kinds of achievements",
- Farkasova, E. (CSFR), "Special abilities at learning a foreign language by young pupils",
- De Tombe, D. J. (Netherlands), "A method of defining complex problems",
- Scheblanova, H. J. (Russia), "Moscow-Munich longitudinal study of giftedness: Goals, methods, and results of a two-wave investigation".

Peter Span was debater at the symposium. He rose to speak after each presentation; he also made an attempt to recapitulate the results presented in all the papers.

In his paper, J.O. Undheim presented a number of highly interesting results of research into high achievement in an egalitarian society. The author demonstrated the results of research carried out in Norway. J.O. Undheim summarised his presentation in the following way:

Norway is, along with the other Scandinavian countries, a very egalitarian country. The Norwegian education for grades 1 through 9 (elementary and middle school) is characterized by mainstreaming, no ability grouping within classes, very little acceleration of any kind, no held-backs of students with learning difficulties, and no course options regarding the main academic subjects. Also, there are almost no private schools, students attending their local public school.

This means that the students of the same grade are all about the same age, have attended school for an equal number of years, and have to a large extent had access to the same knowledge. The egalitarian practice of the Norwegian educational system for students 7 through 15 years, provides a unique opportunity for studying achievements as related to sex and socio-economic conditions since the biases inherent in the selection of schools, courses and tracks within classes are eliminated. Thus, one should expect somewhat lower correlations between indicators of socio-economic background and academic achievements at 15 years of age in this egalitarian system. At about 16, students start to choose different educational tracks.

Even so, the effect of socio-economic factors should be lessened by the support system characteristic of a social-democratic society. However, the educational resources of parents and the concomitant attitudes toward schooling, are undoubtedly still expected to be powerful determinants of school achievement, apart from any formal choices or provisions. In particular, excellent academic performance may be strongly dependent on parents being good role models and able to support excellency through their own academic knowledge and experience.

The elimination of possible bias in the selection of school, and inherent in any system of tracking and ability grouping, should lead one to expect very small achievement differences related to sex. However, the egalitarian educational system does not eliminate socialization differences related to sex-related stereotypes and preferences. Previous data on average achievement have shown small sex differences in Norway through the age of 15. However, considering the findings of more frequent math excellence in U.S. boys, the present report will look more closely at high achievement. A study of high achievement in Norwegian youngsters may test one of the explanations for the Stanley and Benbow finding, the effect of ability grouping within classrooms. National statistics on level of education for parents and offspring were presented, as well as graduate records for the total 1989 cohort of 9th grade students (15 year-olds) in the city of Trondheim. Those records represented more than 95% of the youngsters this age in the country of Trondheim (N=1750). A subgroup of those students had been identified as having high ability at the age of 12. This high-ability group was studied more intensively at the age of 15 and later at 16 years (cognitive abilities, questionnaires, interviews).

The analyses indicated that the educational level of parents was strongly related to children's achievements. Also, sex differences were found as in international studies, including higher frequency of math excellence in boys. The results were discussed in relation to policies of egalitarianism and ideas of meritocracy.

The paper by Beltran Llera and Gonzales Roman focused on the role of cognitive skills in university studies. The authors tried to answer the question of the degree of influence of cognitive skills upon students' academic achievements. The purpose of that work was to determine the level of cognitive skills of university students. The planned hypotheses tried to show if the students used different strategies depending on the subject of their careers. The work was based on the Inventory of Cognitive Skill by Francis J. DiVesta and Virginia Moreno from the University of Pennsylvania. In one session, 323 third-course students from Biological Science, Law, Education, Psychology and Philosophy, completed the inventory. The analysis of the results showed several factors that may be basic for the study of cognitive learning process in university students. What seemed of primary importance in the paper was the influence of emotional-cognitive variables upon students' learning process. It was stressed by the authors that while examining achievements it is impossible to consider the influence of the cognitive sphere and at the same time disregard the emotional-motivational one.

The paper by A. Sękowski, entitled "The role of preferences of cognitive styles and intelligence in different kinds of achievements" included the results of empirical research conducted by the author. At the same time the paper was an attempt at comprehensive expression of the symposium's topic, namely, "structures and processes in intellectual achievements". One of the fundamental issues approached by specialists in the field of the psychology and pedagogics of the gifted is the criteria which determine membership in such a group. A psychological criterion can, for example, be high intelligence level, creativity, or the concurrent strong motivation, while a major pedagogical criterion is the level of achievements in various fields of activity. In determining whether a given person is exceptionally gifted or capable of remarkable achievements, both the psychological and the pedagogical criteria should be taken into account. Such psychological criteria as high intelligence, certain preferences concerning cognitive styles, level of self-esteem, the hierarchy of values or psychomotor abilities, are sometimes called achievement predictors. The predictors discussed in this article belong to the group of personality

predictors within which two spheres, dispositional and emotional-motivational, can be distinguished. The basic question asked by researchers in this field is about the interdependence of achievements and predictors belonging to both spheres. Some of the personality predictors belonging to the dispositional sphere are intelligence level, creativity, cognitive style preferences. The emotional-motivational sphere encompasses the level of self-esteem, preferred hierarchy of values, and interests.

There is a slight difference between the achievements-dispositional sphere relation and that between achievements and the emotional/motivational sphere. It is much easier to determine the direction of the relationship between achievements and the dispositional sphere than it is in the case of the emotional-motivational sphere of personality. The relation between achievements and the level of intelligence or creative ability is unidirectional, while it is not unlikely that remarkable achievements may inspire man's creativity. It is much more difficult to determine the direction of relationship between achievements and self-esteem level, preferred hierarchy of values or interests. One could say that they are interdependent or that it is a feedback dependence. For example, high self-esteem exerts a beneficial influence upon the level of achievements, but at the same time remarkable achievements raise man's self-esteem. In much the same way the preferred hierarchy of values affects the level and structure of achievements which, at the same time, modify the hierarchy.

The central issue tackled in that paper was the importance of personality traits belonging to the dispositional sphere, i.e. intelligence level and cognitive style preference, to the structure and level of achievements.

The results of the research can be formulated in the following way:

1. The significant predictors of outstanding achievements in mathematics are reflexiveness and field independence, as well as internal locus of control.
2. The significant predictors of outstanding achievements in the humanities are impulsiveness and field dependence higher than in the case of mathematicians, as well as a higher level of external locus of control.
3. The regularities vary in relation to the most creative students in both groups.
4. The significant predictor of achievements in mathematics is a high level of general intelligence, especially the ability for convergent thinking.
5. The significant predictor of achievements in the humanities is a high level of creative capabilities (the level of divergent thinking, especially in handling verbal material).
6. The students belonging to both the examined groups, with outstanding achievements in mathematics or in the humanities, obtain higher results (on the statistical level) in tests investigating both the level of general intelligence (convergent thinking) and the level of creative thinking (divergent thinking) than the average students. Therefore, it can be assumed that levels of divergent as well as convergent thinking constitute significant predictors of outstanding achievements in mathematics and in the humanities.

There is a need then for psychologists and educators to concentrate, more than they have done so far, upon the system of values, emotional preferences, and interests demonstrated by gifted people. Their satisfaction derived from the accomplishment of their life aims, not necessarily limited to wealth, independence, comfortable life, must also be taken into consideration.

The paper by E. Farkasova was devoted to special abilities in foreign language learning. Changes in the Czecho-Slovak society facilitated a change in the understanding of the function of foreign languages. The foreign language is no longer understood as something exceptional, but as a means of communication. The previous approach also influenced a system of learning

at school. Students learned more about the language than the language itself. The result was a small capability of graduates to communicate with native speakers at an adequate level.

To reduce this bad experience of the past they have leant towards an experiment to establish learning foreign languages at several elementary schools from the age of 6. Various questions concerning forms, methods, and curriculum arose for teachers. Questions of possibility and ability of pupils turned up for psychologists as well. Different approaches were possible to solve the outlined problems, and individual schools could choose their own way. The author's institute worked out a conception and dealt with two different kinds of procedures at two schools (each school had its own).

It must be made clear that this type of education demands certain psychological qualities. Future pupils of those classes ought to pass a psychological examination. Not every child is able to attend those classes. The submitted research paper dealt with some aspects as can be observed in a year:

- a comparison of personal traits of high and low achievers,
- social environment and parent support according to the above mentioned categories,
- performance of pupils in single subjects of the curriculum with special attention paid to the foreign language,
- generalisation of special abilities needed for good performance at this type of classes.

The paper by D. J. De Tombe was entitled "A Method for Defining Complex Problems". It stated that before a problem can be solved or handled, it has to be defined. The literature about problem-solving concentrates mostly on solving the problems already defined, often problems within a domain, like mathematical problems or chess problems. The focus of the literature is mostly not on finding a solution, but on how a person solves the problem. One person is solving a domain-related problem of which in most cases there is already a known and right answer.

A lot of real societal problems are complex interdisciplinary problems, problems, for which the solution is not known, like pollution and AIDS. Solving interdisciplinary problems demands a different approach than that used at solving domain-related problems. The paper discussed a special method of analysing complex problems and focused on complex policy problems.

The first step in solving or handling real societal problems is to realize that there is a problem. The second step is deciding who must handle the problem.

After having recognized the problem and decided to take some action on it, one person or more persons will be selected for handling the problem. It will depend on the importance of the problem to the policy makers as to how much effort will be set on handling the problem. Defining interdisciplinary problems is not a one-person job. Several experts of different domains must work together in trying to define the problem. Which experts of which domains will be selected depends on the initiator(s) mental model(s) and point(s) of view upon the problem. The definition of the problem will be influenced by the selection of the experts. The selection of the experts includes or excludes some definitions and solutions of the problem already.

In the beginning, the experts will have different mental models of the problem depending on their profession, their personal point of view and their experience.

In order to handle the problem fruitfully, the group of experts must try to attain some shared idea about the problem. In a series of meetings, the group must try to define the problem as completely as possible in order to obtain a model of the problem close to reality. This kind of group approach for defining a complex problem has some special aspects which are excluded by single person problem definition. In the group approach, one encounters problems concerning individual and professional differences of power, different professional languages, hidden agendas, group thinking, individual and collective blind spots and context boundedness of the participants' knowledge.

In talking about the problem, it is not always clear what aspect of the problem the person is talking about. For causal problems that can be quantified, a system dynamic software simulation tool can be a good help in trying to concentrate the attention of the whole group on the same aspect of the problem and give the group a mutually shared language.

Having defined the problem does not automatically lead to a solution. At utmost it gives some indication as to where to look for a solution. For solving complex problems, it is not always clear what the best solution is. There can be different solutions for the same problem with different consequences. What the optimal solution of the problem can be depends on the position of the group, the moment of time and the context of the problem. After defining a dynamic problem, a system dynamic computer tool can, to a certain extent, give some idea of the effect of the interventions one wants to make. Due to lack of precise data most of such scenarios tend to have a lot of uncertainty in them. The field of chaos theory belongs to this. The paradigm of chaos theory provides some tools to describe this uncertainty. Normally there is not much opportunity to train this kind of problem defining in education. It is not unlikely that the gifted will be involved in analyzing problems of this kind. Therefore, they should be trained to learn special methods that can help analyzing complex societal problems. The paper dealt with the vital issue of the role of cognitive processes, specifically problem-solving, in gifted adolescents' achievements.

The paper by H. J. Scheblanova presented the results of joint research conducted by the team of psychologists led by Kurt Heller of the University of Munich in cooperation with Moscow Academy psychologists.

According to the Munich concept, "giftedness" is defined as individual cognitive, motivational and social possibilities of attaining excellence in one or more areas. In this sense, the views of the Moscow group are close to the conception of K. Heller and his colleagues.

Till the present time there are no studies in Russia which would cover varied factors of giftedness or the interrelation of cognitive and non-cognitive personal development of the gifted in that country. That is why a joint Moscow-Munich cross-cultural study of giftedness development was planned under the supervision of professor K. Heller and his assistant Ch. Perleth. The study has the following goals:

- the adaptation to the Russian sample and evaluation of the Munich differential diagnostic instruments for the identification of gifted and highly gifted schoolchildren with regard to intellectual abilities and creativity.
- the observation, description and analysis of gifted children development across time - for three years; various forms of giftedness and actual performance; cognitive and non-cognitive personality preconditions.
- comparison of the results of the Moscow-Munich and Munich Longitudinal studies and the factors of gifted children development at Russian and German schools.

The sample design of the study discussed by H.J. Scheblanova was the following: Five-age cohorts were investigated in the study: about three thousand and a half of students of the first, third, fifth, seventh and ninth grades. In each age group there were two groups: experimental and control. The control group of each age consisted of about seventy students from three classes without selection. It remained constant from the beginning until the end of the study. The experimental group of each age was chosen at random and at the beginning of the study included about six hundred students - unselected sample in the picture. Next, the gifted students were selected out of those groups.

1. In the selection of the gifted sample, a two-step procedure was applied. The first step consisted in using teacher's checklists. Teachers of each class were requested to rate the intelligence and creativity of gifted students as compared to those of their peers.

2. According to the rating, thirty per cent or about two hundred formed the preselected sample of each age. The male-female ratio was 1:1.

3. The second step consisted in the investigation of the preselected and control groups with the help of tests and questionnaires in order to identify the top students.

In that phase the following tests were used:

- Cognitive Abilities Test KFT (German CogAT by K. Heller *et al.*) which was preliminarily adapted by the Russian team in 1990.
- Numbers Connection Test by Oswald & Roth.
- Unusual Uses according to Guilford for 5th, 7th, 9th grades.
- Torrance Test of Creativity for the first and third grades.
- Questionnaires of creativity.

Questionnaires of noncognitive personal characteristics:

- achievement motivation,
- thirst for knowledge,
- Moscow-Munich Activity Inventory, and others.

According to the results of KFT and creative tests, 30% of the top students were selected in the group of gifted sample (about 70 students of each age).

In 1992, measurements for the gifted and control students were repeated by the author's team with the help of KFT, tests of creativity, and personal questionnaires.

On the basis of the obtained results, the following conclusions can be drawn:

1. The adopted instruments used to measure cognitive and noncognitive (especially motivational) personality dimensions of the gifted in the Munich study are reliable for the Russian sample, too.

There were clear differences between the highly and normally gifted students in each domain of giftedness. Multiple or many-sided gifted were to be found relatively seldom in each age-group. For example, only 1-2 per cent of students were both highly intellectually and creatively gifted (scores higher than 70 on T-scale). No substantial correlation between intelligence and creativity at any age was observed.

2. The primary screening of the gifted showed that only 50-64% of teacher's ratings were according to test results. The teachers found it particularly difficult to differentiate between the intellectual and creative domains and levels of giftedness.

3. Teachers of the first, third, and fifth classes considered the girls more gifted than the boys. But the test results did not confirm those opinions. On the contrary, teachers of the seventh and the ninth classes considered the boys more gifted than the girls. The test results demonstrated that the boys did better on quantitative and non-verbal subtests, but not on verbal subtests and tests of creativity.

4. The next stage of the investigation conducted by the team will be the evaluation and analysis of the interaction between giftedness, achievement, personality, over the course of time. What can be revealed at this stage is the interaction between high intellectual abilities and motivational characteristics such as "hope for success" and "fear of failure". The gifted students of the seventh and ninth classes scored higher in the "thirst for knowledge" and "hope for success" scales and lower in the "fear of failure" scale than their peers in control groups. Meanwhile the gifted boys of this age scored higher in the "hope for success" scale and lower in the "fear of failure" scale than the gifted girls. This tendency was also observed, less clearly however, in younger children. The interaction between cognitive and non-cognitive personal factors of the younger children was not stable and not significant. Finally, the second phase of the project discussed is being

completed. The data collection process is finished, while not all the evaluation is. In the future, more significant results are expected.

Peter Span of Utrecht University, who was debater at the symposium, evaluated individual presentations. He stressed the importance of a novel approach to the achievements issue. Achievements are often understood as measurable success revealed by school grades or professional career. The traditional achievements measure often takes little or no account of particular needs of the individual. The debater also emphasized the need for a new viewpoint upon creativity. The varied types of research conducted by psychologists and educators should have a common basis as well as similar methodological value. Only then the obtained results can be compared.

The symposium chairman A. Sękowski stressed the necessity to look upon the problem of achievements from a point of view more humanistic than it has been done so far. Indicators which influence the individual satisfaction of a pupil, student or any other person should accompany the traditional achievement indicators.

The presented research results give evidence of the role of intellectual as well as motivational-emotional factors in the learning process. Achievements are to a large extent produced by cognitive prerequisites. Such variables like intelligence level or special abilities level are threshold variables, generating achievement potential. Whether this potential is fulfilled or not often depends upon the system of values, self-image, self-esteem, interests, strong motivation, consistency in reaching the objectives set. The chairman also stressed the importance of the social aspect of achievements. Whether in the West, East, North or South of Europe, the society is not well prepared to face gifted people. Outstanding achievements of individuals meet with anxiety and envy rather than admiration and appreciation. Demonstrating one's extraordinary abilities and achievements often requires a lot of courage.

The symposium entitled "Structures and processes in intellectual achievements" met its aim. Valuable and interesting, the papers presented revealed the need of research on the problems of achievement.

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The role of preferences of cognitive styles and intelligence in achievement

Andrzej Sękowski

Department of Psychology, Catholic University of Lublin, Lublin, Poland

One of the fundamental issues approached by specialists in the field of the psychology and pedagogics of the gifted is the criteria which determine membership in such a group. A psychological criterion can, for example, be high intelligence level, creativity, or the concurrent strong motivation, while a major pedagogical criterion is the level of achievements in various fields of activity. In determining whether a given person is exceptionally gifted or capable of remarkable achievements, both the psychological and the pedagogical criteria should be taken into account.

Such psychological criteria as high intelligence, certain preferences concerning cognitive styles, level of self-esteem, the hierarchy of values or psychomotor abilities, are sometimes called achievement predictors. The predictors discussed in this article belong to the group of personality predictors within which two spheres, dispositional and emotional-motivational, can be distinguished. The basic question asked by researchers in this field is about the interdependence of achievements and predictors belonging to both spheres. Some of the personality predictors belonging to the dispositional sphere are intelligence level, creativity, cognitive style preferences. The emotional-motivational sphere encompasses the level of self-esteem, preferred hierarchy of values, and interests. There is a slight difference between the achievements-dispositional sphere relation and that between achievements and the emotional-motivational sphere. It is much easier to determine the direction of the relationship between achievements and the dispositional sphere than it is in the case of the emotional-motivational sphere of personality. The relation between achievements and the level of intelligence or creative ability is unidirectional, while it is not unlikely that remarkable achievements may inspire man's creativity. It is much more difficult to determine the direction of relationship between achievements and self-esteem level, preferred hierarchy of values or interests. One could say that they are interdependent or that it is a feedback dependence. For example, high self-esteem exerts a beneficial influence upon the level of achievements, but at the same time remarkable achievements raise man's self-esteem. In much the same way the preferred hierarchy of values affects the level and structure of achievements which, at the same time, modify the hierarchy.

The central issue tackled in this paper is the importance of personality traits belonging to the dispositional sphere, i. e. intelligence level and cognitive style preference, to the structure and level of achievements.

Another issue is the recognition of the theoretically justified and practical terminology of achievement. There are many categories of achievements: academic, professional, and many others. Achievements are closely linked with the goals man aims at. Morris (1956) suggested a differentiation between three ways of life in pursuit of different values: Dionysian - the satisfaction of current wishes and relaxation, Promethean - active tendency to manipulate and alter the world, and Buddhist - restraint and self-regulation. Those styles can have an impact on the selection of personal objectives and way of life. The gradation of objectives will determine the order of preference of various forms of behaviour. In general, the behaviour of an individual

will conform to the principal objective through the achievement of sub-goals, i. e. successive stages of the final state (Zaleski, 1987).

Kuhl (1983) presents a very interesting typology of objectives. They occupy three levels: the first level relates to actions, the second to results, and the last one to the consequences of those results. Schank and Abelson's typology is interesting, too (Abelson, 1981). Also, there are a number of other typologies reported by McDougall (1924), Murray (1938), Allport, Vernon, and Lindzey (1960). The hierarchic structure of objectives is a frequently used term. Rokeach's (1973) many years' research points to the fact that values have a hierarchic structure. The system enables man to gauge the situation fairly quickly and to order objects in such a way that he/she perceives relations between them and his/her own position in relation to them. In the multiplicity of attitudes towards objects, people and the world, man tends to adopt the central position.

Similar assumptions are accepted in relation to the structure of objectives; empirical research has proved the existence of a hierarchy of objectives (Wicker, Lambert, Richardson, and Kahler, 1984; Wadsworth and Ford, 1983). Man has one principal objective; intermediate goals are subordinated to it.

What are then the relations between achievements and the preferred objectives, between achievements and the values an individual gives preference to? In terms of the categories proposed by Morris, achievements which fall within the domain of gifted people's psychology are related to the accomplishment of Promethean aims by way of active manipulation and tendency to change the world. Achievements of this kind, which can be called cognitive, dominate psychological research; this results from social expectations as well as from the criteria applied by societies to evaluate and order the achievements of an individual.

One of the categories of achievements is academic achievements, which can be divided into those attained in the humanities, mathematics, technical achievements, artistic achievements of artistic school students. The research whose results are presented here was carried out in Polish secondary schools, but the findings are much the same as other results of piloting research conducted by the author in the U.S.A. and Germany. The research was inspired by educators' experience and by the opinion held in the society that the structure of abilities or intellectual functioning of with remarkable achievements in those apparently completely dissimilar spheres of mental activity are quite specific. The subjects of research were students gifted in mathematics and in the humanities.

The research findings have revealed the fact that cognitive predictors of achievements (intelligence level, cognitive style preference) are not decisive to functioning in the field of humanities or mathematics. Therefore it can be assumed that personality predictors belonging to the emotional-motivational sphere are of greater importance here.

The research presented herein is concerned with psychological determinants of outstanding achievements in mathematics and in the humanities in the process of learning. The research into predictors of achievements in those fields usually considers the influence of dispositional and motivational factors and their correlations. Among the dispositional factors, the level of general intelligence, cognitive styles, and the capability of creative thinking are mentioned, whereas the motivational factors comprise hierarchy of the system of values and self-esteem. The specific nature of cognitive styles consists in the fact they concern both the first and the second group of factors. Cognitive styles constitute both dispositional and emotional-motivational traits. This is the source of their specific nature and of the need for research into their predictive role in different kinds of achievements. Many interesting data on the subject are supplied by the book edited by Ronald Schmeck (1988). The authors of individual chapters, psychologists from the United States, Canada, Europe, Asia, and Australia, analyse the role of cognitive styles in the process of learning thoroughly. It seems that there exists a necessity for

such research, as the preferences in the field of cognitive styles allow to better understand the mechanism of co-operation between the intellectual traits and the emotional-motivational ones. The preferences in the field of cognitive styles determine types of the strategy of learning and of decision taking concerning the subject of learning and memorizing. The works by H. A. Witkin, H. Gardner and other scholars are of particular importance for this type of research.

In the course of investigations concerned with the influence of cognitive style preferences upon the achievements in mathematics and in the humanities, the following questions were asked:

- Which cognitive styles are particularly important in the activity process in the field of mathematics and of the humanities?
- Do the cognitive styles selected (reflexiveness - impulsiveness, field dependence-independence) influence the role of other personality factors such as the level of intelligence or the level of creative capabilities?
- Which preferences relating to cognitive styles are predictive in the field of achievements in humanities, and which in the field of achievements of mathematics?
- What are the indices of achievements in mathematics and in the humanities?

To investigate the predictivity of cognitive styles for achievements in mathematics and in the humanities, two of them were selected, field dependence-independence, and reflexiveness-impulsiveness. The cognitive style "field dependent/independent" determines the force of tendency of an individual to break an organized perception field into separate specific parts. In the field dependent, the perception is to a great extent determined by the overall organization of the field, and its parts are experienced as separated from the organized background (Witkin *et al.*, 1977). Witkin's more recent definitions include qualifications which are slightly more general: the field-dependent cognitive style is a tendency to mostly follow the internal indications in perception (which are the internal standards); the field independent cognitive style is a tendency to follow the external indications to a greater extent. The increase in field-independent ends at the age of 15-17 (Witkin *et al.*, 1971). The beginning of a slow decline has already been detected from the 23rd year of life onwards; in old people the decline is rapid. At the same time, a substantial stability of individual differences in the areas of field dependent-independent is ascertained.

In general, the cognitive style "impulsiveness-reflexiveness" determines the degree to which an individual solving cognitive problems is inclined to think over the cogency of his/her hypotheses (Kagan, 1965; Kagan & Kogan, 1970).

Numerous investigations (Kagan & Kogan, 1970) reveal that the impulsiveness-reflexiveness style is not connected with intelligence at all, or is connected with it to a negligible degree. On the other hand, the connections between this style and other personality variables, such as self-esteem, anxiety level, creativity, as well as intensification and orientation of emotional reactions, are more conspicuous. The long time of consideration while solving problems and a small number of erroneous answers testify to impulsiveness.

Procedure

University students were subjected to the investigation. Preliminary investigation were carried out in the USA, Germany and the Netherlands. The proper investigations were conducted in Poland. The students were divided into three groups. The first group was composed of students exceptionally gifted in the humanities, the second - of the students exceptionally gifted in mathematics, and the third - of the so-called average students, not specially gifted in either mathematics or the humanities. Each group consisted of sixty students.

Techniques

One of the most important issues was to separate the group of students exceptionally gifted in mathematics or in the humanities. To make such a classification, talks were held with eminent scholars in the classics (men of letter, specialists in the field of the humanities). On the basis of those talks, own experience and discussions in the research group, the criteria for the classification of students into those with outstanding achievements in mathematics, in humanities, and the average ones, were established.

The criteria are the following:

- assessment of professors teaching the subjects with particular attention paid to grades given by those lecturers who are in the closest contact with individual students;
- participation in research carried out by the scholars;
- results obtained as well as participation in scientific competitions;
- participation and success in literary and language competitions;
- opinion of literary circles.

To investigate some of the individual differences in gifted students, the following research techniques were employed:

- H. A. Witkin's The Group Embedded Figures Test (GEFT) (field dependent-independent);
- J. Kagan's Matching Familiar Figures Test (MFF) (reflexiveness-impulsiveness);
- Raven's Advanced Progressive Matrices Set II (general intelligence);
- Raven's test for adults (general intelligence level);
- Creativity tests (Application and Anagram Tests) (creative capability level).

Analysis of results

The results obtained by the students of all groups (the first group - students with outstanding achievements in mathematics, the second group - students with outstanding achievements in mathematics, the third group - a group of students selected at random from the entire population/average students) were subjected to statistical analysis. The Student t test was applied and the vitality of the differences between mean results obtained by all the three groups in all the tests was assessed. From the viewpoint of the aims of investigations carried out, the most important was to compare the results obtained by the students with outstanding achievements in mathematics with those achieved by the students who had outstanding achievements in literature. The third group differentiated was treated as a test group, and the comparison of the results obtained by those students with those obtained by two remaining groups make it possible to draw interesting conclusions, too. The subject of the analysis included the results obtained by the groups of sixty students gifted in mathematics, sixty students gifted in the humanities, sixty students selected at random. The most interesting and important from the cognitive viewpoint was the comparison of the results obtained by the students exceptionally gifted for mathematics with those achieved by the students who had outstanding achievements in the humanities.

The results collected demonstrate that the students with outstanding achievements in mathematics are characterized by reflexiveness and field independence, whereas those with outstanding achievements in the humanities are more impulsive and field dependent.

Such conclusions can be drawn from the statistical analysis of the results obtained. The differences between the results obtained in the tests measuring reflexiveness/impulsiveness preferences, and those of the test measuring field dependence/independence are statistically significant at the level from .01 to .05. This is very important from the cognitive viewpoint and interesting as far as educational practice is concerned. The students gifted for mathematics are

inclined to think over the problems they are solving for a longer time while making substantially fewer errors. The students gifted for the humanities make their choices in the problem-solving process much more quickly but, at the same time, they make more errors. The students gifted for mathematics prefer to follow internal indications (such as internal standards), whereas the students gifted for the humanities are rather inclined to follow external indications. It is also connected with the locus of control. One may assume that the students gifted for mathematics are characterized by an internal locus of control whereas those gifted for the humanities by an external locus of control. It is also interesting that these regularities look slightly different in the case of the most creative persons in both groups (the persons winning highest scores in the tests measuring the level of creative capabilities). At the same time, the level of creative capabilities is not an explicit predictor of greatest achievements in the learning process.

The students gifted for mathematics obtained much higher results /at the level of statistical significance .01) in the test measuring the level of general intelligence (the level of convergent thinking in both versions of Raven's scale) than the students gifted for the humanities. At the same time, the latter group obtained higher results at the statistically significant level in the tests measuring the level of creative capabilities (the level of divergent thinking). This, in particular, refers to the results obtained in the Anagram Test, in which verbal material is used.

Conclusion

1. The significant predictors of outstanding achievements in mathematics are reflexiveness and field independence.
2. The significant predictors of outstanding achievements in the humanities are impulsiveness and field dependence higher than in the case of mathematicians, as well as a higher level of external locus of control.
3. The regularities vary in relation to the most creative students in both groups.
4. The significant predictor of achievements in mathematics is a high level of general intelligence, especially the ability for convergent thinking.
5. The significant predictor of achievements in the humanities is a high level of creative capabilities (the level of divergent thinking, especially in handling verbal material).
6. The students belonging to both examined groups, with outstanding achievements in mathematics or in the humanities, obtain higher results (on the statistical level) in the test investigating both the level of general intelligence (convergent thinking) and the level of creative thinking (divergent thinking) than the average students. Therefore, it can be assumed that levels of divergent as well as convergent thinking constitute significant predictors of outstanding achievements in mathematics and in the humanities.

There is a need then for psychologists and educators to concentrate, more than they have done so far, upon the system of values, emotional preferences, and interests demonstrated by gifted people. Their satisfaction derived from the accomplishment of their life goals, not necessarily limited to wealth, independence, and comfortable life, must also be taken into consideration.

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Intelligence - creativity relationship

- Are creative motivation and need for achievement influencing it?

Katya Stoycheva

Institute of Psychology, Bulgarian Academy of Sciences, Sofia, Bulgaria

The Problem

This presentation is concerned with intelligence-creativity relationship. A great deal of efforts has been aimed at investigating relationship between intelligence and creativity measures and a really impressive amount and variety of data have been collected. Of interest in the present investigation is what extensive literature on intelligence-creativity relationship is documenting about factors that influence it.

Testing conditions seem to be the largely studied ones among those factors. Wallach and Kogan (1965) showed that untimed, game-like conditions resulted in greater independence of creativity scores from individual differences in intellectual level. Dellas and Gaier (1970), Nicholls (1972) and Hattie (1977, 1980) reviewed a lot of studies supporting Wallach and Kogan's assumption that pressures of time and evaluation may influence the intelligence-creativity relationship. However, they reported also controversial findings. In a later publication Wallach (1971; cf. Hattie, 1977) concluded that there are consistent individual differences across game-like and test-like administration procedures and that game-like setting does not necessarily decrease the degree to which differences in scores on creativity tests are predictable from information about intelligence level. It might well be that personality-based variables are responsible for individual differences which situational variations failed to explain.

Intelligence-creativity relationship has been found to depend also on intelligence level. McNemar formulated this tendency as follows: "at high IQ levels there will be a very wide range of creativity whereas as we go down to average IQ, and on down to lower levels, the scatter for creativity will be less and less" (cf. Dellas & Gaier, 1970, p. 59). Findings, supporting this "fan shaped" hypothesis are reported also by Torrance (1962, 1974, 1987). Torrance (1987) suggested that characteristics like motivation and test-taking attitudes and skills might cause this differentiation in patterns of relationship.

The nature of creativity measures seems also to be a factor contributing to the variations in intelligence-creativity relationship. Differences between creativity tests can hardly be neglected and should not be ignored when their relations with intelligence tests are examined. Torrance (1987) summarized data from a great variety of studies with Torrance Tests of Creative Thinking (TTCT) and came to the conclusion that correlations involving verbal measures are higher than those involving figural measures. Data reported by Wallach and Kogan (1965), Dellas and Gaier (1970), Guilford and Hoepfner (1971), Nicholls (1972) and Torrance (1987) suggest that indicators derived from tests making use of the creative problem solving process (e. g. Guilford's or from Guilford derived tasks, TTCT) are more often positively related to intelligence scores than those derived from instruments based on the associative concept of creativity (e. g. Wallach and Kogan's battery). Mednick's Remote Association Test which has been severely criticized as being a measure of convergent rather than of divergent thinking usually produces positive correlations with intelligence level (Dellas & Gaier, 1970; Cropley, 1982).

To summarize, the research data on intelligence-creativity relationship that has been accumulated showed that this relationship depends on characteristics of the measures themselves and of the testing conditions. Many of the researchers in this field have also come to the idea that personality variables might account for unexplained variations in intelligence-creativity relationship, but for the moment this idea has not been examined (at least no research works on this topic are known to the author).

The present paper brings attention to the role of personality factors in intelligence-creativity relationship. Such an assumption is supported by a substantial body of evidence in creativity research. Two main areas of investigation will be reviewed here: personality studies of eminent creators and conceptual models of creative behaviour.

Personality studies of acknowledged creators and of persons with outstanding achievements (Albert, 1983; Barron, 1968, 1969; Cattell & Butcher, 1982; Helson, 1988; MacKinnon, 1978; Roe, 1982) investigated productive human behaviour in general as well as the positive interaction of intellectual and non-intellectual variables in real-life creative achievements in particular. The obtained results were quite similar across areas of creative endeavors and across research methodologies. They showed that the creative performance emerges at an intelligence level above the average - the average IQ of groups of eminent creators was already a superior one (Barron, 1968, 1969; MacKinnon, 1978). But their individual scores ranged widely and no correlation existed between rated level of creative achievements and level of intelligence: the correlations between rated creativity of professional activity and measured intelligence among artists, architects, mathematicians, writers, scientists were not significantly different from zero (Barron, 1968, 1969; MacKinnon, 1978).

At the same time several personality characteristics had been found to be positively related to creative achievements: driving absorption in the work (Roe, 1982); concentration and readiness to face endless difficulties (Cattell & Butcher, 1982); intellectual competence and enjoyment of intellectual activity, inquiringness of the mind, independence in thought and action; aesthetic sensitivity and openness to experience; an achievement oriented personality, setting standards of excellence and striving to attain them, with positive self-image, high self-confidence and self-acceptance (MacKinnon, 1978).

In studies of engineers from research and design bureaus, Chougounova (1984) found that interests, motivation and strong identification with the highly valued profession and with the work organization contributed to creative productivity in different engineering professional activities.

The accumulated evidence reveals that high intelligence level is a necessary ingredient for the highest achievements, but a complex pattern of personality factors is equally essential. This interaction between intelligence and personality variables has been discovered also in historiometric and biographical studies of eminent creators (Cox, 1926; Simonton, 1984).

Cox (1926) found that they had been characterized not only by high intelligence but also by forcefulness or strength of character, persistence of motive and efforts and confidence in their abilities. Her conclusion is especially interesting for the present study: "... that high but not the highest intelligence, combined with the greater degree of persistence, will achieve greater eminence than the highest degree of intelligence with somewhat less persistence" (p. 187).

Simonton's (1984) review offers additional support to the idea that cognitive contributions are supplemented by motivational ones in high-level performance and focuses attention especially to the need for achievement.

The idea of the interaction between intelligence and personality variables is incorporated also in different models which are developed to explain and examine creative behaviour. According to Sternberg and Lubart (1991), creativity results from a positive confluence of individual

resources like intelligence, knowledge, intellectual style, personality characteristics, motivation and environmental context. Torrance's model (1979) also takes into consideration creative motivation in relation to abilities and skills. Urban (1990) attempts to design a componential model of creativity, which consists of the following components: three cognitive - general knowledge base, specific knowledge base and skills, divergent thinking - and three personality - task commitment, creative motives, and tolerance of ambiguity. Amabile (1988) also proposes a componential model describing creativity as a result of motivation, domain-relevant skills and creativity-relevant skills, where intrinsic motivation is the most important component.

Therefore, psychological studies of real-life creative achievements and the conceptualization of their individual determinants in multicomponential models of creative behavior both justify the adopted approach, which is designed for studying intelligence-creativity relationship through the means of its personality moderators. Two empirical studies will be reviewed in search of evidence supporting our hypothesis.

Method

The purpose of the first study is to investigate the influence exerted by creative motivation on the relationship between intelligence and productivity on creativity tests. Raven's Progressive Matrices (a measure of intelligence), Torrance Tests of Creative Thinking - Verbal and Figural Forms B (a measure of creativity) and Creative Motivation Scale by E. P. Torrance were administered to 204 9th graders from two public high schools in Sofia.

The second study focuses upon the role of need for achievement in the relation between intelligence and creativity measures. Raven's Progressive Matrices (a measure of intelligence), Torrance Tests of Creative Thinking - Verbal Form A (a measure of creativity) and a questionnaire for measuring need for achievement by Paspalanov and Stetinsky (Paspalanov, 1984) were administered to 126 16-18 years old students from a public high school in Sofia.

Instruments

Raven's Progressive Matrices (1960) which were used in the both studies, are constructed on the basis of Spearman's theoretical assumptions and provide assessment of a person's capacity for intellectual activity.

Torrance Tests of Creative Thinking are among the most popular creativity tests (Davis, 1989). According to their author (Torrance, 1987), they have been translated into more than 32 languages and have been used in more than 1500 studies worldwide. The Verbal form consists of seven and the Figural form of three open-ended tasks which require kinds of thinking, analogous to the thinking involved in recognized creative achievements and lead to a variety of creative production.

The Verbal Form (Torrance, 1974) is scored for fluency (the number of generated solutions to the problem), flexibility (defined as a change in the subject's approach to the task, shifts in attitudes or focus on the problem), originality (the degree to which unusual, unique ideas are generated, that are away from the obvious and commonplace).

The scoring of the Figural form is based on its streamlined revision (Ball & Torrance, 1984). The following norm-referenced indicators are used: fluency, originality, elaboration (the number of details, used to elaborate the pictures), abstractness of titles (the degree to which the titles given by the children to their pictures are going beyond what can be seen), resistance to premature closure (a measure of the ability to "keep open" and to resist to natural psychological urge to close the incompleteness by the simplest, easiest solution).

Creative motivation and need for achievement have been chosen for their proved relevance to creative productivity. As it had been shown, creative motivation and need for achievement

are correlated positively with rated creativity of real-life achievements and they are systematically presented in revised conceptual models of creativity. Aside the proper research interest of the author in these motivational variables, they are playing an important role in the process of personal and social realization of the individual.

Creative Motivation Scale (Torrance, in press) was developed on the basis of analysis of reported research and theoretical works in the field of creative personality, of biographies and autobiographies of eminent creators. The scale measures "...an inquiring, searching, reaching out, persistent and courageous attitude" as a central notion in the conceptualization of the motivational determinants of creative achievement.

The questionnaire for measuring nAch, constructed and standardized by Paspalanov and Stetinsky (Paspalanov, 1984), is measuring predisposition to behavior related to high standards of activity and success in terms of a general behavioral strategy in performing different activities.

Study I

Two hypotheses were set up for the first study:

1. Creative motivation will influence the relationship between intelligence and creativity in the direction that higher creative motivation will result in higher correlation between intelligence and creativity scores.

2. Creative motivation will be a more powerful predictor of individual differences in creativity for highly intelligent subjects than for low intelligent ones. As intelligence in its upper range was found to be less predictive of creative productivity, it is hypothesized that this is related with greater predictivity for personality determinants of creative behavior.

To test the first hypothesis, the subjects were divided into three groups according to their level of creative motivation (low, average, high) and coefficients of correlation between intelligence and creativity scores were computed for each group. The results we obtained didn't confirm the stated hypothesis.

To test the second hypothesis, subjects were divided in three groups again, this time according to their level of intelligence, and coefficients of determination of the creativity measures by creative motivation scores were computed. This time again no support was found for our hypothesis.

Two-way analyses of variance were performed and they didn't reveal as well any significant interaction between intelligence and creative motivation in determining both verbal and nonverbal creativity scores. Data analyses showed a tendency for highly motivated individuals to produce a greater number of ideas and a greater number of details to elaborate them; to use a variety of creative problem-solving approaches; to give more rich titles to their pictures and to produce more original responses to both verbal and figural creative tasks. This tendency however doesn't reach statistical significance. The slight positive correlation we obtained between creative motivation scores and creativity measures are similar to those reported by Torrance (in press) himself and they conform to his theoretical assumption that creative motivation and creative abilities are related, but different however prerequisites of individual's creative behavior and achievements.

Study II

In the second study two analogical hypotheses were examined:

1. Need for achievement will influence the relationship between intelligence and creativity in the direction that higher need for achievement will result in higher correlation between intelligence and creativity scores.

2. Need for achievement will be a more powerful predictor of individual differences in creativity for highly intelligent subjects than for low intelligent ones.

Correlational analyses similar to those described in the first study were performed and the results that were obtained rejected once again our hypotheses, except for originality scores in the frame of the second hypothesis. The correlation between originality scores and need for achievement scores is highest for the high intelligence group and is lowest for the low intelligence group. However, the percentage of explained variance in the high intelligence group is quite low - 8%, and the difference between correlational coefficients just missed significance. That is why we can't consider this fact as something more than just a tendency.

The two-way analyses of variance didn't reveal significant interactions between intelligence and need for achievement in this study, too. But what it shows and what is absolutely away from our expectations is the negative impact of need for achievement on verbal fluency ($F=4.168$; $p=.02$), verbal flexibility ($F=3.847$; $p=.02$) and verbal originality ($F=2.689$; $p=.07$): students with low need for achievement are more productive, more flexible and more original in solving creative tasks.

This finding is even more surprising when compared to previous studies (Stoycheva, 1990), of high school Bulgarian students with outstanding creative and academic achievements who were found to score higher on need for achievement than their agemates that have not been realized such achievements.

In what way can we integrate these findings in the accumulated knowledge about creative personality and creative performance? The following explanation is suggested: Strong orientation towards achievement has negative effect on creative productivity in the stages of idea-finding and solution-finding. Creative attitudes like experimenting with the objects, exploring the unknown, playing with the ideas seem to be more favorable to the creative process at these stages than the desire to stick up to the evaluative standards set by the society. That is why high need for achievement blocks the creative output of the individuals while the freedom of evaluative demands (low nAch) stimulates the idea generation. The slight positive correlation we found between creative motivation and creative productivity is consonant to this explanation. On the next stages of practical implementation and communication of the new ideas however, achievement motivation becomes a factor of crucial importance in finding acceptance and social support for the creative ideas. As Barron (1968, 1969) and MacKinnon (1978) notice, when summarizing the results of IPAR studies of eminent contemporary creators, highly creative individuals are characterized by integrating and reconciling of opposite personality traits within themselves and that's what makes them unusually effective and productive in diverse situations.

Conclusion

As Wallach (1988, p. 13) pointed out, "fulfillment of potential is, after all, one of the goals of trying to reach a better understanding of talent (aside from our interest in the knowledge itself)". The complexity of the productive mechanisms of human behavior, as well as the increasing public awareness of their importance for our future call for exploring every research possibility with the aim of getting more information about their functioning. And enlarging our knowledge in creative behavior predispositions is bringing us closer to its flourishing in human beings. That is why I dare to present you a study which hypotheses were rejected.

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Strategy use and metamemory in gifted and average primary school children

Christoph Perleth

Institute of Educational Psychology, University of Munich, Munich, Germany

Abstract

In the theoretical framework of a variant of the "Good-Strategy-User-Model" (cf. Schneider & Pressley, 1989) a number of studies have been conducted to clarify some aspects of the interrelation of strategy use, metamemory, and giftedness (Perleth, 1992). This contribution reports on two of these studies which were lead through with financial support from the Volkswagen Foundation.

In the framework of study 1 we investigated relations between the level of giftedness, strategy use, metamemory, and variables of personality characteristics in 2nd and 4th graders. Differences in strategy use between levels of giftedness were only found in 4th graders, while the gifted children in both grades showed better memory performance. Concerning the metamemory scales older and more gifted students scored higher. Verbal knowledge as well as intelligence turned out to be stronger predictors of memory performance than metamemory. "Good Strategy Users" are superior in memory performance as well as in academic achievement only in grade 4. All in all, the differences between gifted and average children might increase with age.

Study 3, a training study, should determine whether the (transfer) effects of training for the use of a clustering strategy depend on the level of giftedness in primary school children. The sample included 85 children in the training and 93 in the control group. The experimental factors were training, the level of intelligence and the time of measurement. The training turned out to be very effective in all children and showed diminishing effects with growing transfer distances. All in all, evidence for the hypotheses of larger transfer effects in gifted children with increasing transfer distance could be collected.

Theoretical background

The objective of our research on metacognition and metamemory, including the training of respective skills, is to deepen the understanding of the processes that are essential for learning and problem solving and, thus, of giftedness. On the other hand, results in the domain of metacognition can be used for intervention programs that enable gifted children to use their potentials successfully.

With "metamemory" we mean knowledge about the performance and function of one's own memory (in the tradition of Flavell and Wellman; e. g., Flavell & Wellman, 1977). This is, for example, knowledge about the effectiveness of memory strategies and awareness of the capacity of one's memory. Moreover, a "good strategy user" is a master of special and general strategies and distinguishes himself/herself through effective working styles, favorable motivational characteristics, and a good non-strategic knowledge base (see the description of the Good Strategy User model by Schneider & Pressley, 1989).

With (non-trivial) memory strategies in the presented studies, cognitive operations are meant

which a) are not inherent of the task, which b) aim at storing the material to be learned, which c) are conscious and verbalizable, and which d) can be controlled by the children. Trivial memory strategies on the other side are cognitive operations which are principally necessary for solving the task (e. g., looking at the cards or reading the words).

It is not yet clear whether gifted or intelligent children differ from their average peers in strategy use or metamemory. The interrelation studies reported to date have produced a variety of sometimes contradicting results, some indicating a strong superiority of gifted children, some finding no difference at all. Findings might also depend on the (inner-)cultural background of the samples under investigation (see Borkowski & Peck, 1986; Perleth, 1992; Perleth, Lehwald, & Browder, 1993).

In order to collect more data for typical German samples several studies were conducted in the framework of the Good-Strategy-User-Model using a sort-recall-task as the central method (see Perleth, 1992). Three of these studies which were carried out with financial support of the Bundesministerium für Bildung und Wissenschaft (BMBW) in Bonn (study 1) and the Volkswagen Foundation (studies 2 and 3) are reported in this paper.

The research done in the three studies was expected to contribute to the following general aims: (1) The findings should lead to a deeper understanding of learning and problem solving in gifted children. (2) The research should strengthen a differential perspective in the psychology of memory. (3) Profit for the educational praxis was also intended.

In the studies 1 and 2 the differences in strategy use and metamemory between groups of different levels of giftedness were under investigation while we intended to clarify the question whether training and transfer effects depend on the level of giftedness in study 3.

Study 1

The purpose of study 1 was to investigate whether typical findings on metamemory and strategy use in normal samples can be found in gifted children as well. In addition, the research was planned as a replication or extension study of results reported by Kontos, Swanson, and Frazer (1984), Carr and Borkowski (1987) as well as Kurtz and Weinert (1987) for 5th, 6th and 7th graders in primary school children. The study was conducted as a part of the Munich Longitudinal Study of Giftedness (Heller, 1991; Perleth & Heller, 1993).

Research questions and hypotheses

- 1) What can be said about the strategic behavior and metamemory of gifted and average children in grade 2 and 4?
- 2) What are the relationships between metamemory, strategy use, and memory achievement (in gifted children)?
- 3) Which roles do intelligence and metamemory play when predicting the amount of memory?
- 4) Do gifted children profit from strategy use even when completing respective items of a metamemory questionnaire ("hidden intervention")?

Method

The participants of study 1 consisted of the two youngest cohorts of the Munich Longitudinal Study of Giftedness. All in all, data could be collected from 217 2nd graders (102 boys, 102 girls) and 268 4th graders (137 boys, 123 girls).

The central method in study 1 was a verbal Sort-Recall-Task: This verbal sort-recall-task consisted of 24 word-cards, which were clusterable in 4 categories with 6 words each. The

phases of the task were: 1) instruction, 2) sorting phase, 3) learning phase, 4) keeping phase, and 5) recall phase. Indicators derived from the task were 1) the Adjusted Ratio of Clustering (ARC) for sorting and recall behavior (clustering) and 2) memory performance.

Metamemory was assessed by a questionnaire derived from the scale used by Schneider, Borkowski, Kurtz, & Kerwin (1986). The German Cognitive Abilities Test (CogAT; Heller, Gaedike, & Weinläder, 1985) was used for measuring cognitive abilities/inductive thinking.

The study included two group test sessions: During step 1 (1st day) the verbal sort-recall-task (and other tests and questionnaires not reported in this presentation) were applied. The next day, the children had to complete a metamemory questionnaire first, and second, a parallel form of the verbal sort-recall-task was given (in addition other tests and questionnaires not reported in this presentation were lead through).

Results

The results of this study are summarized in the following theses (for more details see Perleth, 1992):

- 1) Both 2nd and 4th graders showed strategic behavior.
- 2) As expected, older children were superior in metamemory variables.
- 3) The relationships between metamemory scores, strategy use, and memory achievement were relatively small.
- 4) Good strategy users were only found more frequently in the more gifted pupils of the grade 4.
- 5) Intelligence turned out to be a better predictor of memory performance than metamemory.
- 6) The "hidden intervention" showed nearly no effects.

Discussion

From a general point of view, the results proved impressingly that even younger primary school children spontaneously use sorting strategies in a sort-recall-task. This contradicts, for example, Bjorklund's (1985) standpoint that only children from grade 5 on spontaneously produce cluster strategies. Concerning giftedness effects, the differences between the different giftedness groups under investigation in sorting behavior and metamemory variables were - if any - much smaller than expected. Most of the few differences were found in children of grade 4. This might indicate that giftedness effects enlarge with growing age. On the other hand, intelligence variables captured much more variance in achievement variables than metamemory variables. This undermines the results of Carr and Borkowski (1987) and also Kurtz and Weinert (1987) who judged metamemory as a more important predictor than intelligence.

However, the interpretation of the results of study 1 were complicated because (1) reliability problems of the metamemory group questionnaire; (2) the fact that the sample of the Munich Giftedness Study was pre-selected by a teacher screening; (3) the "hidden intervention" via questionnaire cannot be regarded as a real intervention.

Therefore, study 2 and 3 were planned to further clarify the above research questions by designs which were likely to give some answers in two different studies.

Study 2

Research questions and hypotheses

Study 2 was planned as an intensive study (single experimental sessions) of the strategy

behavior and metamemory of primary school children of different levels of giftedness.

The research questions were:

- 1) Do gifted and average children differ in a) the extent of use of a clustering strategy, b) memory performance, c) metamemory, and d) the number and effectiveness of strategies used?
- 2) Are there larger differences in a more difficult (free recall) task?
- 3) Are there relations between good strategy use, intelligence, and academic achievement?
- 4) What are the relationships between good strategy use and personality characteristics.

Method

A rough description of the sample can be seen in the following table:

N (female, male)	IQ ≤ 90	95 ≤ IQ ≤ 105	115 ≤ IQ
Grade 2:	14 (7, 7)	18 (10, 8)	17 (13, 4)
Grade 4:	13 (8, 5)	15 (7, 8)	18 (7, 11)

For measuring cognitive abilities/inductive thinking the German Culture Fair Intelligence Test (CFT; Weiss & Osterland, 1980) was employed in addition to the German Cognitive Abilities Test (CogAT; see above).

The free-recall-task used consisted of a categorizable list with 24 words. There was no sorting possibility: the children had to learn and reproduce the words after a keeping period. Indicators derived from the task were 1) the ARC for clustering of the recalled items and 2) memory performance. Metamemorial interviews were conducted after both tasks.

The scales of the German CogAT and German CFT used as well as additional questionnaires (on self concept, causal attribution, working styles) were applied in group test sessions (step 1). On the basis of the results of the intelligence tests the three groups were selected for the following steps. The verbal sort-recall-task and the metamemory interviews were conducted in single sessions (step 2). Finally, the children had to work on the free recall task (group sessions) and, afterwards, were interviewed on their strategies individually (step 3).

Results

The results of study 2 can be summarized as following (see Perleth, 1992, for a more detailed description):

- 1) Concerning strategy use, a slight superiority of the gifted children was found only in the children of grade 4.
- 2) Older and more able pupils showed a higher amount of memory, the differences being - as expected - larger in the more difficult free-recall-task.
- 3) The older and more able pupils in grade 4 showed a slightly better metamemory, while no differences could be found in grade 2.
- 4) In contradiction to other research reported in the literature, intelligence showed a stronger relationship to memory performance than metamemory.
- 5) In the 4th graders, good strategy user showed better memory performance, obtained better school marks, and were less anxious as well as more stress-resistant.
- 6) Reliability problems of simple metamemory questionnaires became obvious, thus confirming other results reported in literature.

Study 3

Research questions and hypotheses

The results of study 3 were expected to provide evidence about the question whether (transfer) effects of a metamemorial intervention depend on the level of giftedness. The following research questions were under investigation:

- 1) Can we prove general effects of the training?
- 2) If there were any, the sizes of the (transfer) effects should be ordered as following: verbal s-r-task > figural s-r-task > verbal series 2 > figure series > verbal series 1 = 0.
- 3) Do the effects of giftedness resp. the giftedness x training-interactions rise with growing transfer distances.

Bear in mind that the focus of study 3 was not the testing of training components but the analysis of transfer effects dependent on the level of giftedness.

Method

The following table contains the relevant characteristics of the sample of study 3:

N (female, male)	PR < 30	30 ≤ PR ≤ 70	70 < PR
Training	19 (7, 12)	29 (13, 16)	15 (12, 3)
Control	19 (8, 11)	28 (7, 21)	16 (9, 7)

As in study 2, scales of the the German CogAT and CFT were used for assessing cognitive abilities and inductive thinking. The verbal sort-recall-task was employed as a pre- and posttest. In addition, three transfer tasks were constructed in cooperation with Dr. E. Räder from the University of Leipzig.

The figural sort-recall-task consisted of 20 cards with geometrical figures, sortable along two dimensions (form and number/color). The phases were the same as in the verbal sort-recall-task. Indicators of memory behavior and performance were 1) the ARC for sorting and recall behavior (clustering), separately for both dimensions and 2) the amount of correctly recalled items.

In the first part of the test "Completion of Verbal Series", the children had to fill out the blank in a series of words. Here, no categorization was needed. Example: To solve the items of part 2 of the test, children had to choose one out of five possible answers. Here categorization was needed for the correct answer. Example: To complete the items of the scale Completion of Figural Series the children had to find out the missing element of a series of geometrical figures and to draw to missing figure in the free slot. Example: This way the different (transfer) tasks varied along the dimensions task paradigm and material:

Task Paradigm:	Sort-Recall-Task	Series
Material: verbal	Verbal Sort-Recall-Task	Verbal Series 1, 2
Material: figural	Figural Sort-Recall-Task	Figural Series

The different tasks were given in the following procedures:

(1) Pretest:

- Session 1: German CogAT, German CFT to measure intelligence or inductive thinking.
- Session 2: (Verbal) sort-recall-task.

(2) Training:

The short training (all in all about 60-70 minutes in two sessions) started with a

demonstration of the strategy and the teaching of strategy knowledge by attractive models in a winning story. The children then applied the strategy (to enhance their self control strategies and demonstrate the usefulness of the strategy). Variation of examples (taken from real life to enlarge ecological validity) should prepare the transfer.

(3) *Posttest:*

Session 1: (Verbal) sort-recall-task 2; verbal series.

Session 2: Figural sort-recall-task; figural series.

The two sessions of the pretest were lead through on two successive days. The two training sessions took place about one week later. About another week after the training sessions, the posttest sessions were carried out.

Results

- 1) The training turned out to be highly effective in increasing the use of a cluster strategy in children of all levels of giftedness or intelligence.
- 2) Strong training effects were found for near transfer, smaller training effects for middle and far transfer tasks.
- 3) Only small giftedness x training-interactions could be found. The tendencies indicated that, with growing transfer distance, the more able pupils did indeed profit more from the training.

For more details see Perleth (1992).

Conclusions

Bearing in mind the findings of studies in the relationships between giftedness and metamemory or metacognition (for overview see Perleth, 1992; Perleth, Lehwald, & Browder, 1993), the following conclusions could be drawn from the three studies presented here:

- 1) Even young primary school children (grade 2) of all ability levels use a cluster strategy for learning categorizable items.
- 2) Differences in strategy use and metamemory between groups of children of different levels of giftedness could be found. These differences, however, were much smaller than expected (also in the more difficult tasks). This finding (which contradicts other findings from the USA) could be explained as an effect of (West) German schooling which stresses and fosters the use of appropriate learning strategies especially in poorer learners.
- 3) 2nd graders can be taught a useful clustering strategy in very short training. While most children apply the strategy in near transfer tasks, a trend was found that the more able the children are the higher is the probability to employ the new strategy in tasks of medium and far transfer.

Taken together, the results give some evidence for the intelligence concept of Campione and Brown (1978; see also Campione, Brown, & Ferrara, 1982) who put the breadth of transfer in the center of their considerations. Although this model was originally derived from poor learners and retarded children, it also seems to fit to gifted children. On the other hand, the metamemory variables investigated in the studies here presented might have been too simple (knowledge and use of relatively simple clustering and other memory strategies). "Higher order" metamemorial or metacognitive variables (complex strategic behavior and elaborated plans) were not object of the studies. Especially in older children, however, differences between children and youths of different levels of giftedness might occur under these aspects (see for example the results of Sternberg, 1991, or Shore & Dover, 1987). Especially the training study showed that elements of metamemorial or metacognitive training can be implemented easily

in normal schooling. It was also obvious that not only the more able, but all children profited from the short and not costly training. This is confirmed by training studies with educable mentally retarded and learning disabled children which were carried out with the same or similar material (Perleth, Schuker, & Hubel, 1992; Perleth, 1992). Thus, the research here presented shows that investment in giftedness research can also yield return for average and under-average children.

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III. CREATIVITY AND INNOVATION

Introduction

In his review article, Klaus Urban first approaches the definition problem. He makes a cause for equating creativity and divergent thinking. His main focus is on the creative process using various theoretical models including one of his own - a component model. Finally, so-called foreign, that is, non-psychological research paradigms are discussed briefly with regard to their relevance for creativity research. The next contribution by Edward Necka is concerned with gifted individual's behavior in new task situations. Three experiments are presented whose results, according to the author, point toward a redefinition of the relationship between intelligence and creativity in view of modern models of information processing. The two contributions following this are also dedicated to the empirical analysis of creative thought process in adolescents. Ornella Dentici Andreani varies between logical and physical problems, giving the main credit for solving everyday problems to analogous, inductive thinking and at the same time to moral-social components. The results, which are not always conclusive, are discussed with regard to information theory assumptions and pointing out methodological insufficiencies. Maria Trifonova's experiment is designed to study the role of creative process within the context of semantic perception - with the aid of undefined (figural) materials - in a cognitive psychological study. The theory this is based on is mainly learning, cultural and knowledge theory out of Russia. The results are presented very differentially pointing out consequences for creativity research and educational practices with regard to creativity.

Whereas the previous contributions were more or less directed at the individual, in the following papers, the focus is more on situation and organizational or rather system conditions (without, of course, losing sight of the individual entirely). First, Lutz von Rosenstiel presents a

synopsis of the results from the symposium "High ability in organizations". Despite various emphases on personal or institutional influences, all six contributions clearly point out how interlocked individual and situation or organizational factors are with regard to professional or industrial innovations. Whereas Helmut Kasper focuses on "the role of actors in organizations from the perspective of self-referential system theory" and presents implications for management to be discussed, Heinz Schuler attempts to support Edison's theory of genius in the light of modern research on problem solving in his concluding contribution. His central premise is that a minimal role is played by intelligence or inspiration in the development of creative performances. This agrees, on the one hand, with current results from creativity research (for example, as presented by Weisberg in his well-known book "Creativity and other myths of genius") but on the other hand, leaves certain questions unanswered from the differential psychological point of view or from the developmental life span paradigm (e. g. Simonton's "constant probability of success" model). In the last presentations, important situation determinants of creative performance are pointed out that are all too frequently neglected or blended out in the research approaches based more on the individual. This completes the circle to the coming contributions: A satisfactory explanation of creative performance will not be able to do so without all of the approaches shown here.

Recent trends in creativity research and theory

Klaus K. Urban

University of Hannover, Hannover, Germany

Increasing interest in the topic

Interest in creativity seems to have increased a lot during the last 5 to 8 years again. This is reflected in recent publications and events; for example: Beside the "old" "Journal of Creative Behavior" there is "The Creative Child and Adult Quarterly" and since 1987 the "Creativity Research Journal". The 8th World Conference on Gifted and Talented 1989 in Salt Lake City was predominantly devoted to creativity. There are freshly installed international networks like the "Institute of Creative Intelligence" (ICI) or the "International Creativity Network" (ICN) with its seat in Buffalo. Four recently published readers give good insights into the state of the art, namely Sternberg's "The Nature of Creativity" (1988), "The Creative Mind" by Flach (1988), the "Handbook of Creativity", edited by Glover, Ronning and Reynolds (1989), and Runco and Albert's book "Theories of creativity", published in 1990.

Four years ago at the 1st ECHA Conference I tried to summarize developments in creativity research and theory in Western Europe from 1977 on; that paper was published in the first issue of the ECHA Journal (Urban, 1990). Some of those findings will have to be mentioned here, too, though in a modified way since mainly other than European literature will be referred to. Again, I will omit all literature dealing with mainly psychoanalytic or therapeutic views of creativity.

Creative thinking is more than just quantitatively measurable divergent thinking

The long-lasting dominance of American creativity approaches and their adaptation, especially in test application, has partially and for some time led to a limited view of creativity, finally seen as being synonymous with divergent thinking. Some recent new developments in the field of diagnostic assessment of creativity, which interestingly enough all derive from the German speaking area, try to have a broader cognitive basis, including qualitative aspects. The "Test for Creative Thinking - Drawing Production TCT-DP" (Jellen & Urban, 1986, 1989; Urban & Jellen, 1985, 1986; Urban, 1991b) or the TSD-Z in German, elicits a drawing production, more or less based on given simple figural fragments; this is assessed by means of a set of 14 categories. A verbal-literal form and a more psychomotoric, bodily expressive, playful version are in progress. A withdrawal from one-dimensional instruments can be observed, too, in the multi-dimensional diagnostic procedures by Krampen, Frielinger and Wilms (1990).

Interplay and integration of divergent and convergent thinking

The seeming opposition of intellectual versus creative respectively convergent versus divergent thinking does not seem to be useful any longer (Wolters, 1987). Two new diagnostic tools developed by Facaoaru (1985), explicitly consider both modes of thinking in a mediated or integrated way. These are the "Test des räumlichen Einrichtens" (TRE), a test of spatial arrangements, and the "Test der Zahlenreihen und Analogien (TZRA)", working with sequences of numbers and analogies. Heller (1992b) states that only the simultaneous use of both components together with comprehensive expert knowledge will improve the productivity for

effective solutions. Initially more divergent thinking is necessary in order to generate hypotheses, later on more convergent thinking is needed in order to test and decide upon solutions. Referring to Dörner's et al. (1983) studies about solving highly complex problems, Preiser (1987) stresses that it is not only necessary to have both convergent and divergent thinking at one's disposal, but to integrate both processes into a new way of problem solving thinking. Turning away from traditional intelligence studies, Ruppell from Cologne, changes the term IQ into QI, meaning the quality of information processing. He has studied those cognitive styles and operations that might be basic and necessary for innovators for inventing, especially in the natural-scientific-technical area. As a foundation for his computerized DANTE test, he worked out and described the following qualities or parameters of inventive thinking which involve, differentiate, and extend the classic dichotomy:

- analogy guided thinking: sensitivity for analogies (SA),
- selective elaboration (SE),
- logical-deductive capacity of coordination (CC), including quick reception and processing of information and abstraction,
- spatial-topological flexibility of structuring (FS),
- synergetic co-playing of different representational formats or synergetic thinking (ST).

In spite of several indicators for sufficient validities of "creativity" tests, problems remain concerning criterion validity and prognostic validity. Relatively low coefficients for reliability and validity could be due to the fact that most instruments are trying to measure general creativity, independently of area-specific potentials, whereas the recent cognitive psychology and research in expertise have worked out the critical relevance of field-specific knowledge and abilities.

The dialectics of/in creativity

The idea becomes increasingly clear that not only the old opposition of convergent and divergent thinking has to be overcome, but that it is essential for the creative process and the creative person in general that apparently opposite styles of thinking, cognitive abilities, personality traits and dimensions have to be balanced or integrated. Only through the principle of dichotomy (Jeffmar, 1980), the balance of opposites (Vaughan, 1985), through the dialectic interaction of personality traits and of the components of the creative process, the creator is prepared, free, and able to successfully search for something the new. This dialectic approach can be seen in Preiser's (1987) simultaneous need for influence and control versus the need for safety and security, as well as in the integration of intuition and analysis in Heller and Facaoaru's (1987) contribution about self- and system-knowledge or in Wolters' (1987) description of a theory of productive thinking.

The creative process

Weisberg's attempts at "de-mystification"

Weisberg's book (1986, 1989) stimulated the recent discussion about creativity a good deal. Among others, he tried to demonstrate that apparently sudden insights are not special processes but extended ways of normal processes of perception, memory, and problem-solving. For him the well-known steps of incubation and illumination are nothing but insufficiently investigated and described steps of a highly complex, but normal step-by-step problem solving process on an extremely high thinking level. I cannot discuss this position here, but I think one has to differentiate at least concerning two aspects; first, asking for the innovative power and original importance of the respective creative product, and second, considering that different people with differing knowledge and potentials could go about solving the same problem in very different ways.

A definition

Focussing for the moment on the cognitive side of the creative problem solver and the process, I would like to define creativity as follows; the definition implies the ideal-typical description of the process from the problem to the creative product:

Creativity means the

- (1) the creation of a new, unusual, and surprising product as a solution of an insightfully and sensitively perceived problem or of a given problem whose implications have been perceived sensitively;
- (2) on the basis and by means of a sensible, insightful, and broad perception of existing, available and open data as well as of information searched for and acquired openly and purposefully;
- (3) by analyzing, by solution-oriented but highly flexible processing and utilizing unusual associations and new combinations of this information and with the help of data from one's own broad and comprehensive knowledge bases (experiences) and/or with imagined elements;
- (4) by synthesizing, structuring and composing these data, elements, and structures into a new solution-gestalt (whereby the processes in #3 and #4 may partially run simultaneously on different processing and consciousness levels);
- (5) a new solution-gestalt, which is elaborated as a product or in a product in whatever shape or form;
- (6) and which finally through communication may be grasped directly via the senses or via symbolic representation and experienced by others as meaningful and significant (Urban, 1990).

As already indicated in (4), the creative process is not to be seen as a simple step-by-step, one-dimensional procedure, but as a back-and-forth, up-and-down swinging, multidimensional, partially simultaneously occurring process dependent on personality variables, like motivation, as well as on environmental conditions, like material resources, social obstacles etc.

The term "problem" here is understood in a very broad sense; not only a stated and formulated question is considered to be a problem, but also the idea of creating a musical composition, of designing a new dress for specific purposes, the idea of looking at something in a new way etc., even a need may constitute a problem; but not every problem is one to be solved creatively. We may differentiate between different degrees of openness vs. closeness of a problem regarding the input information or entrance question on the one hand and the solution or product on the other hand (open problem / open product; open problem / close product; close problem / open product; close problem / close product). Normally less creativity is used for the last type of problems which at most give room for creative thinking and doing only as the process, the way from the problem to the product, is regarded, and if suddenly an unexpected and unusual obstacle arises.

The definition attempt shows again, that, even under a mainly cognitive perspective, creative thinking is much more than "mere" divergent thinking. A broad perception and deep multiple networking of information is a presupposition for divergent and associative thinking, which again is accompanied and supported by convergent forms of thinking. The open, but goal-oriented process is aiming at a solution-gestalt, which makes sense and has relevance in itself, is meaningful and provides an adequate solution for a given, found, sensitively seen problem. This is true for a new kind of car tire as well as for a sculpture or a new processing method for hamburgers.

Finally a creative solution-gestalt has to become communicated, it has to be recognized and appreciated by others in order to unfold its inherent creative and stimulating power. A new,

highly creative product which lies "hidden in the dark" has not any effect or sense, probably not even for the creator on a long-term basis.

What is obvious and substantial for the creative process and the creative person, as mentioned above, is the "interactional" or better "dialectic" principle which can be found at several stages/places when "gliding through the cosmos of creativity". The apparent, above mentioned, dichotomies, which have to be linked dialectically, appear, for example, in

- the broad, comprehensive, open **and** the purposeful, selective perception;
- the analytical **and** the synthesizing thinking;
- the logical combining **and** the free associative thinking;
- use of broad general knowledge base **and** topic specific knowledge;
- using "pieces of reality" **and** imagined elements.

These "dialectics in the creative process" (Urban, 1990, p. 106) are substantial and characteristic not only for the cognitive side but for the personal side of the creative problem solver, too; this may become clearer by means of the componential model, which I will present at the end of my paper.

Einstein and the change of focus

Using Einstein as an example, Lesgold (1988) demonstrates an essential difference between creatively productive and "normal" problem solving processes. This lies in the obvious importance of the change between focussed, intense activity and the withdrawal, the taking back of this intensity, that is, defocussed phases.

If one works harder, the arousal is growing, increased attention is paid more to the central traits of the present task and situation and less to the more peripheral traits. One becomes faster and more efficient, but only in following the most clear and obvious path. Since creativity is at least partially the discovering of new paths, some periods of lower intensity are necessary, periods of relaxation, more of musing than fighting.

Thus the genius of Einstein lies, on the one hand, in the adequate combination of mighty and focussed thinking and his expertise in natural sciences and, on the other hand, in his ability to withdraw and muse from time to time. Here again, we find the balance of oppositions. An additional factor is the possibility to inhibiting or slowing down an execution of products and simply allow less directed thinking to dominate by spreading patterns of activity.

Following this path of thinking, the "mechanics and dynamics of the functional componential system", the interplay between personal and cognitive components, which will be summarized in the final part of my presentation in a componential model, the interaction between different levels of consciousness or awareness may become enlightened by recent neurophysiological deliberations and findings.

Martindale (1981, 1989) considered three older theoretical approaches as identical in principle and tried a reformulation in terms of recent neurophysiologically oriented cognitive psychology. The first of those three approaches is close to Lesgold's ideas, namely Mendelsohn's (1976) *defocussing hypothesis* which at the same time necessitates a large attention capacity. This is supported, for example, by empirical evidence, that low-creative persons have much more narrow focused attention than more creative ones (Deving & Battye, 1971; Dykes & McGhie, 1976; Mendelsohn & Griswold, 1966).

A comparable - if not the same (see Mendelsohn & Griswold, 1966) - phenomenon is meant by Mednick (1962) in his associational approach describing that creative people have flatter associational hierarchies than non-creative ones, and are thus able to produce unusual associations by bridging very far distances in the associational network.

Again in different terms, Kris, as early as 1952, had postulated that creative individuals are very capable in alternating/switching between the primary and secondary mode of thinking. Both modes are seen as opposite poles of one continuum. While primary cognitive processes are more autistic, free-associative, analogous and deal more with concrete images than with abstract concepts, are to be found in dreaming, day-dreaming and hypnosis, secondary process thinking means the abstract, logical, reality-oriented thinking of the daily waking consciousness. According to Kris, the creative inspiration implies a "regression" towards a primary status of consciousness; elaboration and verification require a return to the secondary process status. Here, again, the principle of dialectic interplay becomes obvious. A number of empirical studies support Kris' thesis that creative persons have an easier access to those primary processes of thinking (Martindale, 1989; Suler, 1980; Wild, 1965), they demonstrate more fantasy activity (Lynn & Rhüe, 1986; Singer & McCraven, 1961), do remember their nightly dreams better (Hudson, 1975), and may be more easily hypnotized than uncreative persons (Aston & McDonald, 1985; Bowers & van der Meulen, 1970; Lynn & Rhüe, 1986).

Martindale (1981, 1989) considers the mind/brain as a huge set of nodes and connections between these nodes, as a neuronal network. In order to be creative as many nodes as possible must become activated simultaneously; this can happen most easily in a state of low, but general cortical arousal. Then there are more and to a same degree activated nodes than in a state of higher arousal. According to Martindale there is good evidence for the assumption that primary process thinking, defocussed attention, and flat associational hierarchies are linked to states of low cortical activation, to low arousal.

Recent applications of "foreign" theories to creativity

Again and again it is the creative process and the finding of the original, new, and innovative solution, the classical phases of the so-called incubation and illumination/inspiration, which seem to be most mysterious and unexplainable, which are most attractive and stimulating for researchers and theorists. During the last few years at least four new theoretical approaches have been used for explaining the creative process, all of them originally stemming from areas outside of psychology or the social sciences.

The most recent attempts are the psycho-economic theory and the investment approach using (as the names suggest) economic terms, partially in a metaphoric way (Rubenson, 1991). Nearly simultaneously they have been proposed by different researchers (Magyari-Beck, in press; Rubenson, 1989; Rubenson & Runco, in press; Simon, 1988; Sternberg & Lubart, 1991a; Walberg, 1988). Among others they are trying to explain the production of creative results respectively the engagement of single persons and groups by means of implicit or explicit cost-effect-calculations or to transfer investment strategies to creative production. For further information I refer to the controversial discussion between Runco (1991ab), Rubenson (1991), and Sternberg and Lubart (1991b) in one of the most recent issues of the *Creativity Research Journal* (Vol 4, No 2).

Three other theoretical approaches stem from the field of mathematics and natural sciences; only the third one will be discussed in more detail here.

The first one is the "catastrophe theory" described by Zeeman (1977) and Woodcock and Davis (1978); it was used by Boles (1990) in order to explain creative behavior as a special form of problem-solving behavior which under certain contextual factors involves a "catastrophic jump" leading to a creative solution.

A kind of 'jump' is critical, too, for the so-called "idealistic interpretation" of quantum theory applied to creativity as formulated especially by Goswami (1988, 1989, 1990ab; McCarthy, 1990). For him, the creative act literally consists of a "quantum jump in the mechanism of the

mind" (Goswami, 1990, p. 2). At the same time, he considers the quantum approach in a much broader meaning by integrating the more mechanistically and the more organismically oriented creativity theories. Thus, the quantum theory of creativity becomes a theory of the developing and changing self.

It is the consciousness, or better: the awareness which makes the discontinuous and a-causal status of quantum collapse and which makes a selection from the transcendental and superpositional pool of opportunities. Through the action of selecting, the result is lifted to the level of awareness, and this new possibility is linked to a new conscious state of the self. This is an analogy to the action of measuring in quantum physics, when something, light, for example, is existing in different unknown states or superpositions at the same time and simply the action of measuring defines the status of the object, or said in another way, when the observation is inevitably influencing and changing the observed.

The questions remains though, in which way and when, and not only by chance or accident, the awareness is grasping the new idea out of a quantum state.

The third and most recent of those three theories applied to creativity is the chaos theory. It has generally been described by Briggs and Peat (1989), Pagels (1988), and Rasband (1990), adapted to thinking and brain activity by Babloyantz *et al.* (1985, 1986), Freeman (1991), Skarda and Freeman (1987), to creativity especially by Briggs (1990) and by Sterling (1991). The chaos theory is the result of nowadays possible and necessary endeavours to describe and explain phenomena in nearly all scientific areas, specially the natural sciences, not only - and insufficiently - in a mechanistic, mono-causal, and linear way as aggregates of simple components, but to re-interpret as complex, nonlinear, dynamic systems. According to Davies, an expert in theoretical physics, "regular", i. e. non-chaotic, behavior seems to be more the exception than the rule in the natural sphere.

Chaos means a "behavior" which occurs in such complex, nonlinear, dynamic systems. Internal and external factors make a dynamic system change continuously whereby cause and effect are not related in a simple proportional way. Nonlinear systems behave from time to time in an unpredictable manner, therefore the name "chaotic"; the tendency for such behavior is called the chaotic dynamics. The subjacent power is stemming from the highly sensible dependency on the starting conditions. The chaotic dynamics lead to a new self-organization, a process, in which a system in a far-from-equilibrium-state makes an abrupt transition, into the direction of a more elaborate and complex state. This state is relatively stable until a new "crisis" of equilibrium comes up.

Every level of organization produces something fundamentally new which was not existent in the constitutive elements or parts of the previous level (Briggs & Peat, 1989); this is the archetype of creativity.

Recent neurophysiology and cognitive psychology, now, describe the infinitely complex, in a parallel and simultaneous way working neuronal network of the brain as a highly complex, nonlinear, dynamic system with chaotic dynamics. Freeman (1991) is convinced that chaos and chaotic fluctuations are fundamental for brain functions. Chaos, keeping the system in a far-from-equilibrium-state, allows for an easy, fast and direct access to all possible "attractors", latent in the brain; thus, the step-by-step searching through the memory stores becomes superfluous. This idea of a flexible and interactive memory system, overcoming the rigid separation into long term, short term, and working stores, seems very obvious and useful in terms of creative thinking; I refer to Rüppell's factor of synergetic thinking which is possible only in a store interactive mode.

It is interesting, too, that this chaotic state is close to the state of low cortical arousal described by Martindale. Possibly the chaos theory in connection with recent neurophysiology of the brain may light up a substantial part of the creative process. It can stand for a motor and steering

unit of the creative process, but for the one side only. Again, in stressing the dialectics of opposites, what is still missing is the conscious acting of the creative person; the other unit must be seen in the powerful will of the creator and his/her conscious striving for a new solution. While creativity in these theoretical approaches is seen more as a "bottom-up-process" than as a "top-down-process", the personal side of the creative person remains excluded, the person who on the one side has to (be able to) allow such chaotic states, and on the other side must use or has to be able to use these states.

There is another theory in parts relatively close to chaos theory and connected with the same problem: the so-called "chance-configuration-theory" by Simonton (1988ab). Here, too, it is assumed, first, that a large number of possibilities for varying and combining mental-cognitive elements is available, and second, the occurrence of certain combinations cannot be predicted. While in Feldman's coincidence theory, creative products sometimes are result of lucky accident or even of an error, here "chance" similar to chaos theory is not meant to be absolutely accidental. The relation between the factor "luck" and creativity has extensively been discussed by Austin (1978); he differentiates into four categories of chance, the mere accident, "serendipity", the luck of the expert, and the "elicited luck". Similar to Cropley's (1992) formulation of luck as "the openmindedness for the igniting idea" the creative person with his/her motives, knowledge, and active work plays an essential role.

Comprehensive, interacting components model

Though up to now, especially for reason of actuality, a more cognitive view of the creative process was predominant, generally complex approaches of creativity are preferred more and more, stressing the procedural interactive structure of cognitive and personal components of the creative individual, and the mutual interdependence of person and environment in creative acting.

In Sternberg's "three-facet model of creativity" (1988) three basic aspects are interacting in the creative activity. The first, "purely" cognitive facet Sternberg takes over from his triarchic theory of human intelligence, including intellectual traits with relation to creativity, like insightful thinking. The second aspect implies functions of intellectual styles as a kind of mental self-government. The third aspect refers to personality traits which probably more than others contribute to creative achievements, like high tolerance of ambiguity and the readiness to overcome obstacles.

Amabile's work on a "social psychology of creativity" (1983ab) was highly appreciated by her scientific peers (e. g., Brown, 1989). She proposes not to conceptualize creativity as a personality trait or a general ability, but as a behavior resulting from certain constellations of personal characteristics, cognitive abilities, and social environments. The three main components she suggests, namely (1) area-relevant skills, (2) creativity-relevant skills, and (3) task motivation, not only interact with one another, but each of these components itself arises from an interplay of different internal and external factors.

The cognitively oriented process described in the definition above is dependent on personality components as presuppositional, supporting, and interacting factors. In order to describe all factors participating in the creative process on the side of the creative problem solver it is necessary to design a more complex model. Trying to integrate (both) seemingly opposite positions I have tried to design a *componential model of creativity* (see figure 1).

This model is built from six components which all work and function together for and in the creative process. The first three representing the cognitive components are:

- 1 Divergent thinking and acting
- 2 General knowledge and thinking base

- 3 Specific knowledge base and area-specific skills;
 the other three representing the personality components are:
- 4 Focusing and task commitment
 - 5 Motivation and motives
 - 6 Openness and tolerance of ambiguity.

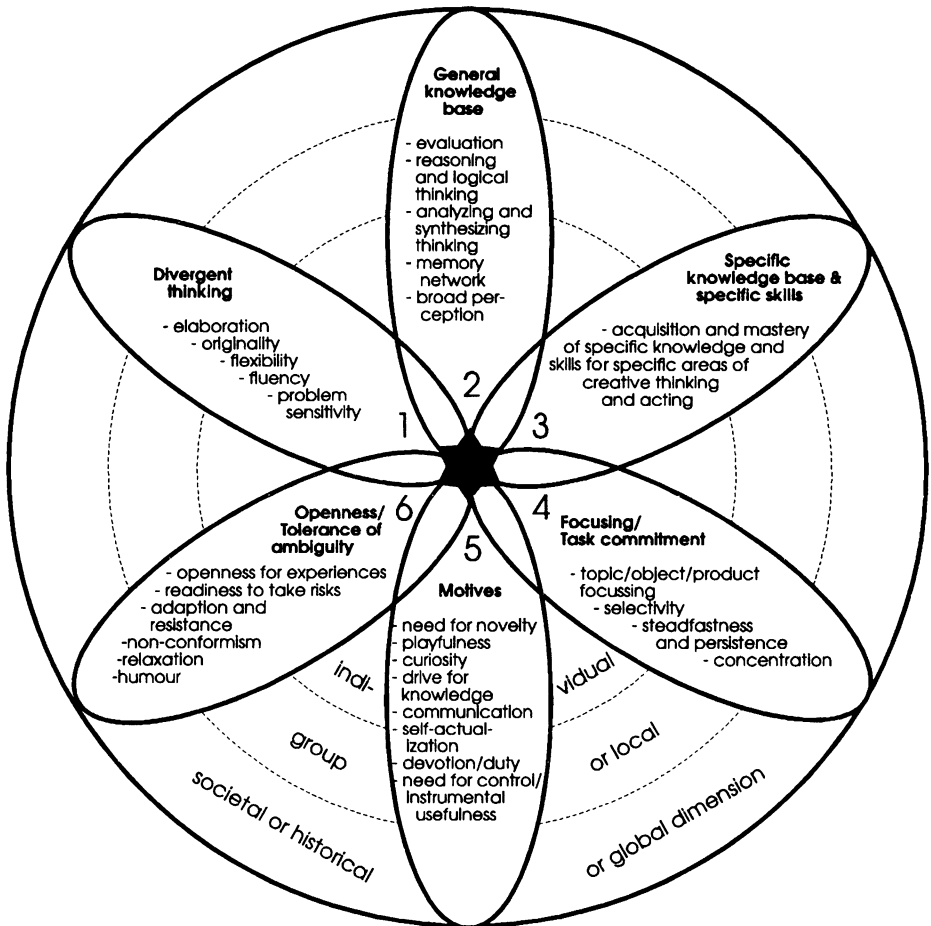


Figure 1: Components model of creativity

The six components again are composed by different subcomponents as described below and in figure 1. No single component alone may be sufficient or responsible for the whole creative process leading to a creative product, but working together as a functional system, they are

used for or participate in or determine the creative process to differing degrees and with differing subcomponents resp. combinations of subcomponents. The respective componential structures or the different creativities are dependent on some conditions:

- the kind of the problem,
- the stage or phase of the creative process,
- the kind of process in relation to the kind of the problem,
- the kind of process in relation to the kind of the product striven for,
- the respective conditions of micro- and macro-environment.

Again, the integration of opposites becomes essential, generally expressed by components 1 to 2 (or 3) as well as 4 to 6, and differentiated in detail by various subcomponents.

Components and subcomponents work together as a functional system which builds up itself, whereby each (sub)component plays its interdependent, functionally adequate role at a certain stage, a certain level, a certain situation. Each component is a presupposition and a result of the others. Only some interdependences may be mentioned briefly:

In spite of some ongoing critiques of the concept of divergent thinking - which stem from a view isolating and generalizing it - *divergent thinking*, like the other components, is considered essential for the creative process and production but it can only work in relation and connection with the other components. Thus, it must found on *broad perception and general deep knowledge and thinking base*; those are presuppositions for fluent and flexible thinking. Reformulations, for example, have to be analyzed and evaluated in regard to their usefulness before their elaboration makes sense.

Divergent thinking alone will not lead to creative excellence in a special field without *special field mastery*. In recent years increasing attention has been given to area specific knowledge and expertise as a presupposition for generating creative ideas and products, especially for those of outstanding and original, of historic and revolutionizing importance. In following Amabile (1983), Brown (1989) considers area relevant skills as being fundamental. A similar position is held by Hayes (1989) pointing out convincing evidence for the statement that in many areas years of preparation and committed work are necessary in order to achieve in really creative products. Even Weisberg's (1988) results, regardless of his attempts to destroy several so-called myths about creativity, support the component of area-specific knowledge. They clearly show that insights are not very likely if task relevant knowledge is missing; insights are dependent on the availability, accessibility, and integration of knowledge representations which are necessary and useful for a given task.

The acquisition of comprehensive and detailed area specific knowledge and skills requires disciplined *topic commitment and persistence* on a high level. The problem in question and the connecting thematic field has to be kept in the focus of attention over a longer period of time and with varying intensity. Concentration and selectivity are necessary for collecting, analyzing, evaluating, and elaborating information and data.

Here, again, an appropriate *motivation*, preferably intrinsic in nature, is a presupposition. Amabile (1983), having this component in the focus of her research, emphasizes the role of intrinsic motivation which emerges by the reaction of the individual to intrinsic traits of the task. Her research shows the relevance of social and contextual factors for creative productions which may become negatively influenced by external factors, like the expectation of evaluation or even by reward or the lack of choice regarding the own engagement.

Hayes (1989), too, stresses the essential role of motivation for creative achievements. According to him, no purely cognitive variables have been found suited to differentiate between creative and non-creative people. Thus differences in creativity seem to have their origin in differences of motivation which lead to cognitive differences, for example, by the differing

intensity of acquisition and the extent of necessary knowledge and skills; together they explain the observed differences between creative and non-creative individuals.

Finally, in dialectic relationship with focussing and task commitment, the component of *openness and tolerance of ambiguity* is of substantial relevance.

Creativity and the creative process resp. the degree or level of creativity are not defined by the procedural and componential characteristics alone but by the final creative product and the quality of its new gestalt. Its success and its acceptability depend on its inherent communicative, innovative, "infectious" power and on the receptivity and evaluation of significant others and the public.

An important point differentiates between reference levels. Considering the criterion of newness and the aspect of creative development in childhood, it is important to work with the components model in three relations, namely referring to individual, to group or local, and to societal, historical or global dimensions.

Rooted in the curious and playful behavior of the little child, creativity may develop in spiral circles, becoming broader with increasing creative experiences, developing to full (adult/mature) creativity containing all componential dimensions. As far as it seems possible, the respective subcomponents in the figure are listed in a developmental order from the inner to the outer dimensional circle.

The three mentioned reference levels are not only important and necessary in order to assess the respective creative quality of a product or from a developmental view, but also as affecting variables for the respective creative process.

This model allows one to place empirical results in order as well as to derive, to name diagnostic and empirical questions, to isolate them for some time without forgetting and neglecting the whole structure. The model still is relatively static and has to be worked on further; it may be transferred into or become connected with a homeostatic process model, perhaps partially a chaotic one, which leads the creative process, starting from the original problem, and including all the components in a problem-person-specific way, to the elaborated creative product, as it is indicated in the definition above or/and may become elaborated to a developmental model respectively combined with other models like Cohen's stage model (Cohen, 1989) or her developmental spiral model (Cohen, 1990).

What can be derived from developmental studies of creativity (e. g., Urban, 1991) is that general cognitive development and creative thinking/acting can not be separated in very young children. But socialization and education disconnect the former common line of development because a certain way of intelligent behavior is favoured and challenged more. The introduction of order and regularities into the child's "creative chaos" inhibit and hinder further creative development. Still, normal traditional education in schools is far from stimulating and supporting creative behavior and thinking in our youth. To change this situation is one of our great challenges for the future.

It might be interesting to see if and how those models and new theories of creativity will be reflected some time in education, training, or daily life. Perhaps one day we will answer to the question "How do you do?" with "Oh thanks, very fine, everything is in chaos with me!"

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Gifted people and novel tasks

- The intelligence versus creativity distinction revisited -

Edward Nęcka

Jagiellonian University, Cracow, Poland

Abstract

The modern information-processing approach to giftedness suggests a new basis for the classical intelligence versus creativity distinction. It is suggested that, although intelligent people deal with novelty quite efficiently if they have to, they do not deliberately seek out such situations. Creative people, on the other hand, are more willing to confront novel tasks, and enjoy tackling them, even though the efficiency with which such tasks are performed is moderate. This thesis is illustrated with experimental evidence, and serves to suggest some new procedures concerning identification of the gifted and stimulation of the human intellectual potential.

Introduction

There are many facets of giftedness but the area may be roughly divided into two kinds of abilities: those connected with general mental ability, measured by IQ tests, and those connected with creativity, assessed by divergent production tests. It is quite well documented (e. g., Sternberg, 1988) that these two kinds of abilities are separate at the psychometric level of analysis. In other words, exceptional intelligence may or may not be associated with exceptional creativity, and vice versa.

The problem arises of whether it is possible to differentiate intelligence and creativity at the information-processing level as well. Intelligence may be described at this level as, for instance, speed of information-processing operations (Vernon, 1987), increased capacity of working memory (Nęcka, 1992a), or increased attentional capacity (Nęcka, 1992b). It seems interesting to check if elementary cognitive tasks that are used to assess the information-processing correlates of IQ may also reveal some important aspects of creativity. Consequently, it seems worth investigating the information-processing correlates of both intelligence and creativity in order to check whether the distinction between them takes place also at this elementary level of analysis.

Novel tasks seem especially relevant in this respect, since intelligence may be defined as dealing with novelty, whereas creativity could be defined as producing novelty. In other words, intelligent people are probably more efficient in dealing with difficulty imposed by novel tasks, whereas creative people are more willing to produce novel information and to enjoy novel tasks. This hypothesis is examined with three experiments, in which three different cognitive tasks were used to investigate how the subjects behave in novel situations. These studies are not original, they were conducted previously and have been published elsewhere. Thus, the present paper is just a comprehensive and concise review of the data gathered by the author and his colleagues.

Experiment 1

This study is a replication and extension of the experiment previously conducted by Chawarski and Nęcka (1989; see also Chawarski, 1990).

Subjects

Ninety-eight candidates for university studies were examined. Their mean age was about 19, and they were equally divided into males and females.

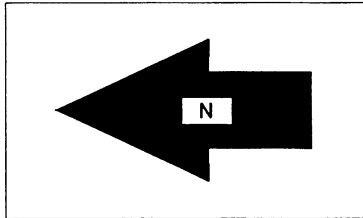


Figure 1: Exemplary stimulus used in experiment 1

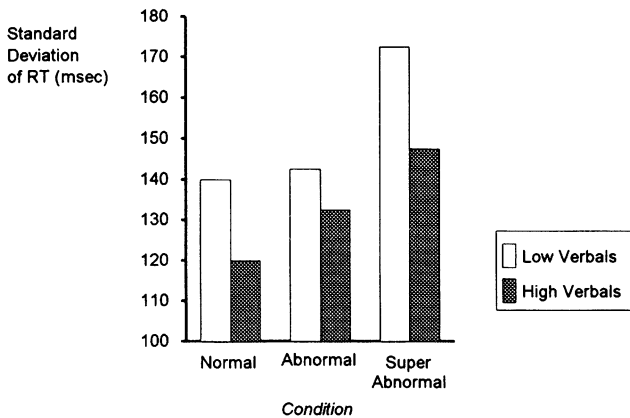


Figure 2: Intraindividual standard deviation of RT as dependent on experimental condition and level of verbal abilities (experiment 1) (significant effects: Condition by Verbal Ability $p < .05$)

Materials

Computerized test. A huge arrow appeared on the computer screen (Figure 1). A subject was supposed to press the joystick as fast as possible in the direction suggested by the arrow (in the normal condition). In the abnormal condition, a subject was supposed to press the joystick in the opposite direction, whereas in the superabnormal condition a subject had to respond perpendicularly to the direction suggested by the arrow (see Chawarski, 1990, for more details). A letter inside the arrow was critical because it indicated which condition was valid in the given

trial. There were 24 normal trials, 24 abnormal trials, and 24 superabnormal ones. The trials were presented either in blocks (homogeneous series) or at random (mixed series). Reaction time, intra-individual standard deviation of RT, and response accuracy were registered. It was assumed that the more "abnormal" the condition is, the more novelty is associated with it; therefore, the analysis of subjects responses in these conditions should reveal their attitude towards novelty.

Psychometric tests. A variety of instruments were applied, including Raven's Advanced Progressive Matrices, two versions of a verbal analogy test, and Urban and Jellen's (1986) Test of Creative Thinking - Drawing Production.

Results

Only a selection of results will be presented here. Subjects were dichotomized according to the scores obtained with the Raven test, and, separately, according to the Urban and Jellen test scores. The intelligent subjects responded faster (RT), more regularly (reduced standard deviation of RT), and more accurately than less intelligent ones. No relationship has been found between reaction time and creativity; however, the other dependent variables (i.e., SD of RT and accuracy) brought about interesting results. Figure 2 shows that the instability index rises as the experimental condition changes from normal to abnormal to superabnormal, but the slope of this function is much steeper for less intelligent subjects. And Figure 3 shows quite similar relationships although this time subjects were dichotomized according to the creativity criterion.

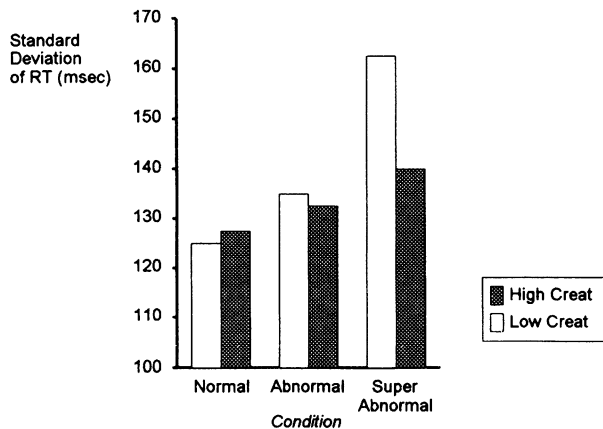


Figure 3: Intraindividual standard deviation of RT as dependent on experimental condition and level of creativity (experiment 1) (significant effects: Condition by Creativity Interaction $p < .003$)

Figure 4 shows that accuracy of responses decreases almost linearly with experimental condition, but this effect is typical of less intelligent subjects. The intelligent sub-group, on the other hand, behaved unexpectedly well in the most demanding "superabnormal" condition.

Exactly the same relationship has been observed in the case of creativity (Figure 5), to the effect that less creative subjects decreased their accuracy as the experimental condition changed from normal to abnormal to superabnormal, whereas more creative ones did not show any significant deterioration in the "superabnormal" condition.

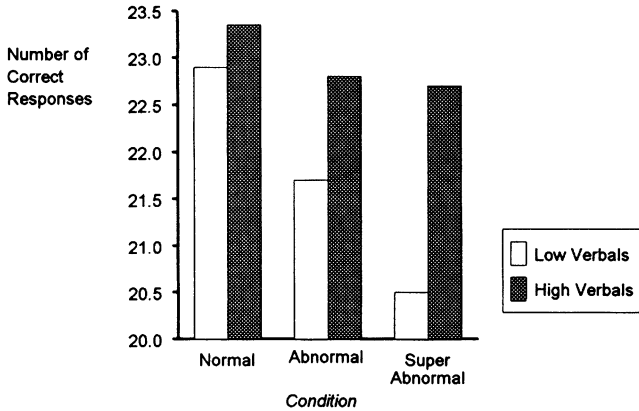


Figure 4: Number of correct responses as dependent on experimental condition and level of verbal abilities (experiment 1) (significant effects: Condition by Verbal Ability $p < .002$)

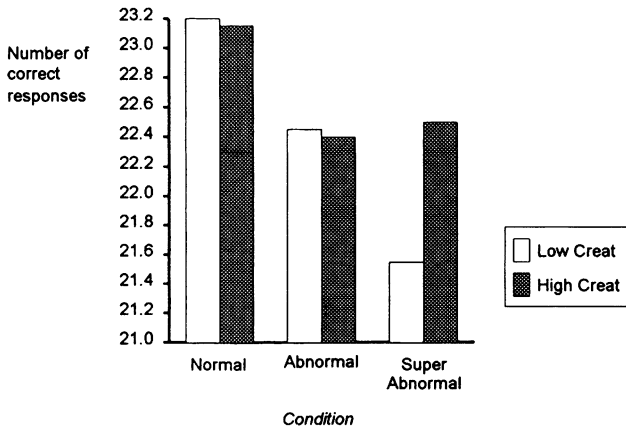


Figure 5: Number of correct responses as dependent on experimental condition and level of creativity (significant effects: Condition by Creativity Interaction $p < .05$)

Discussion

As we can see, creativity can be differentiated from intelligence only on the basis of the reaction time: intelligence seems to be associated with increased speed of responding, whereas creativity does not correlate with this dimension at all. However, the indices of stability and accuracy suggest that such a distinction is not tenable. On the contrary, creative subjects showed exactly the same patterns of stability and accuracy as could be observed in the case of intelligent subjects. In other words, novel and unusual versions of the task provoked high IQ people to fast, regular, and accurate responding. The same situations provoked creative people only to increased regularity and accuracy, but not to increased speed. Why so?

It seems that the motivational factor took place in this case. Creative individuals were probably fascinated by the unusual versions of the task and, therefore, they responded with increased attention, concentration, and thoughtfulness. The normal condition, on the other hand, was probably too boring for them to induce the cognitive curiosity or fascination. As to intelligence, the efficiency factor seems more appropriate to explain the data. Intelligent subjects probably processed the information with increased efficiency, that is, without micro-errors and unnecessary repetitions that are typical of less able individuals. The increased efficiency of information-processing probably caused three consequences: short RTs, short SDs of RT, and low error rates; in fact, all these effects took place as far as the first study is regarded.

Experiment 2

In this study, we adopted a verbal analogy task, modified according to Sternberg and Marr's (1986) principles. The modifications were introduced in order to make the task more novel and unusual for subjects. The data presented here have been extracted from the already published study by Necka, Stocki, and Wolski (1990).

Subjects

Ninety-nine seven graders were examined. They were not especially selected for the study, since we examined pupils from four forms of one of the public schools in Cracow.

Materials

Computerized test. The modified verbal analogy task consists in completing the analogy (e.g., "Fire is to Forest as Fox is to — ") with one of the given words (e.g., Water, Hen, Balloon, Wood). The analogy is preceded by a precue statement (e.g., "Foxes are Needles"), which is necessary to take into account while doing the completion task. Without such a premise, the proper solution would be "Hen", since fire is dangerous to forests as foxes are to hens. However, the subjects were supposed to respond as if this premise were true, so the solution "Balloon" should be chosen, because fire is dangerous to forests as foxes (=needles) are to balloons. In other words, the premise introduces the element of novelty, oddity, and unexpectedness, and at the same time it changes the terms under which the task should be dealt with.

The nature of the premises was varied, though. In the familiar condition, premises were quite natural, like "Foxes are mammals"; in the metaphorical condition, premises were a little bit unusual because of their metaphorical meaning, like "Foxes are thieves"; only in the odd condition were the premises completely absurd, thus introducing the greatest amount of novelty.

The elements of the task appeared on the computer screen one by one in the self-paced procedure. Four words from which the answer should be chosen were located up, down, left, and right on the computer screen. Subjects made the decision with the joystick.

Psychometric tests. Raven's Matrices, version A, B, C, D, and E, were used to assess the

level of intelligence. Creativity was assessed with the verbal divergent thinking test proposed by Nečka and Rychlicka (1987).

Results

The most representative relationship discovered in this study is shown in Figure 6. As we can see, the more novel the situation was, the more mistakes the subjects committed. The metaphorical and odd conditions seem to be much more difficult for all subjects than the familiar condition. However, this general trend became weaker as the level of intelligence increased. In other words, novel versions of the task were significantly less dangerous for more intelligent subjects than for less intelligent ones.

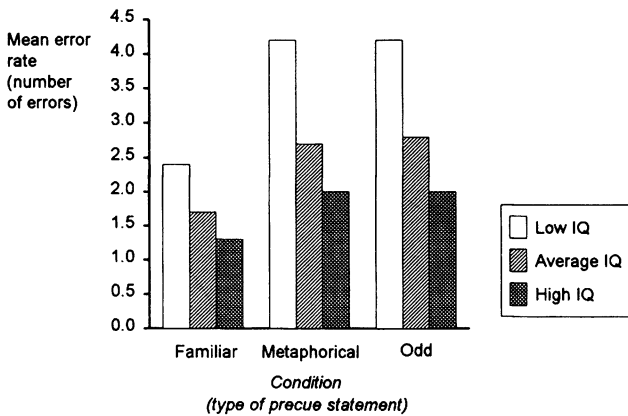


Figure 6: Mean error rate as dependent on amount of novelty in the task and level of intelligence (experiment 2, adapted from: Nečka et al., 1990) (significant effects: IQ x Condition $p < .001$)

Now, let us look at the creativity data. The response accuracy did not appear important as a dependent variable, but reaction time did. It can be seen (Figure 7) that highly creative subjects were slower than their less creative colleagues in the "familiar" condition, but they were faster in the most strange and novel "odd" condition; in the intermediate "metaphorical" condition no differences were observed.

Discussion

The results of this study clearly indicate that intelligence amounts to efficient adaptation to novel tasks, whereas creativity should be associated with the increased motivation to deal with such tasks. Intelligent people respond to novel tasks more accurately than the less able ones, although with the same speed. Creative people, on the other hand, respond more speedily in novel and unusual tasks than the less creative ones, although at the same level of accuracy. In other words, creative people show the increased mobilization if the situation is unusual or odd, that is, they try to respond quickly. The opposite effect of "laziness", reflected by their prolonged solution latencies in the "familiar" condition, may also be observed. The intelligent people do

not seem to mobilize themselves in unusual situations, but they are capable enough to commit less number of errors in this rather demanding version of the task. Thus, the creativity versus intelligence distinction has been shown with the use of an especially prepared cognitive reasoning task.

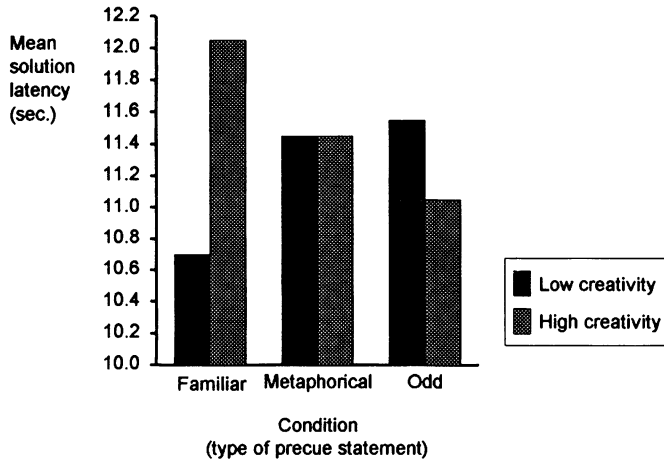


Figure 7: Mean solution latency as dependent on amount of novelty in the task and level of creativity (experiment 2, adopted from: Nečka *et al.*, 1990) (significant effects: Creativity x Condition $p < .018$)

Experiment 3

The procedure employed in this study has been devised by Anna Rychlicka (1993). She has carried out a series of three experiments. The data presented below were extracted from her third study.

Subjects

Thirty-eight psychology undergraduates participated in this study as volunteers.

Materials

Computerized test. Subjects were presented with the pair of two words which appeared in the middle of the computer screen. The words might be closely related (e. g., "chair - table") or quite unrelated (e.g., "chair - grass"). Apart from this, there were three values of SOA (stimulus onset asynchrony): the second words might appear simultaneously with the first one, after three seconds, and after six seconds. Subjects were asked to press the YES button if they decided that they could see some relationship between the words in a pair, or the NO button if they could not discern any relationship. They were encouraged to make a free decision, without any

pressure and presupposed "accuracy" criteria on the experimenter's side. After having made the decision, subjects proceeded to the next trial in the self-paced manner.

Psychometric tests. Raven's Advanced Matrices and Urban and Jellen's TCT-DP were used, as in Experiment 1.

Results

The number of YES responses was significantly higher in the "close" condition than in the "remote" condition. It means that the subjects associated the words which were semantically close to each other more frequently than the words, which were semantically distant from each other. The between groups comparisons are also very interesting. High IQ subjects produced greater number of affirmative responses than the less intelligent subjects, but only in the "close" condition. When the words were semantically distant, though, high IQ subjects preferred to respond NO more frequently than their less intelligent peers (Figure 8). In other words, intelligence seems to be associated with the ease to accept obvious relationships and, at the same time, the ease to reject clandestine or unclear relationships. Low IQ people, on the other hand, are not so sure that what seems to be unrelated really is.

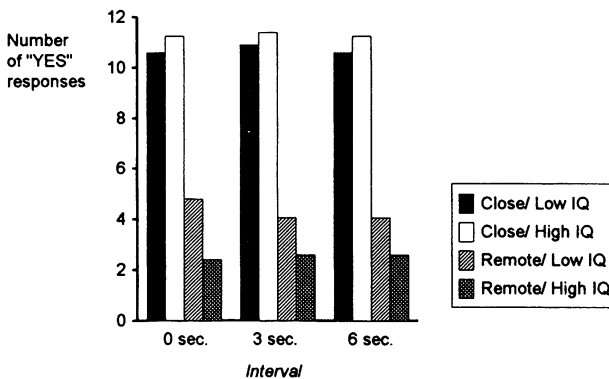


Figure 8: Number of positive associations as dependent on semantic distance between stimuli, inter-stimulus asynchrony, and level of intelligence (experiment 3, Rychlicka, 1993) (significant effects: Remoteness $p < .0001$; IQ x Remoteness $p < .043$; Remoteness x Interval $p < .0001$)

As to creativity, the picture is completely different. Highly creative people are more eager to respond YES, regardless of condition, that is, they show an inclination to perceive the words in a pair as mutually associated in some way. This inclination is even stronger in the "remote" condition (of course, in comparison to the less creative subjects, not to the "close" condition, Fig. 9). In other words, creativity seems to be related with the ease with which a person discerns various relationships between different pieces of information, particularly if these relationships are distant, unclear, and should be inferred on one's own rather than being just noticed (compare: Mednick, 1962).

It is also worth stressing that the creativity by remoteness by interval interaction appeared statistically significant ($p < .005$). Figure 10 shows the section of Figure 9 in which we can see that the intermediate (3 sec.) interval between the first word and the second one produced the greatest number of YES responses, regardless of the ability group. And Figure 11 shows the lower section of Figure 9 which refers to the "remote" condition only. We can see that, in this case, the long (6 sec.) interval produced the greatest number of affirmative responses; it was particularly true in the case of the more creative group.

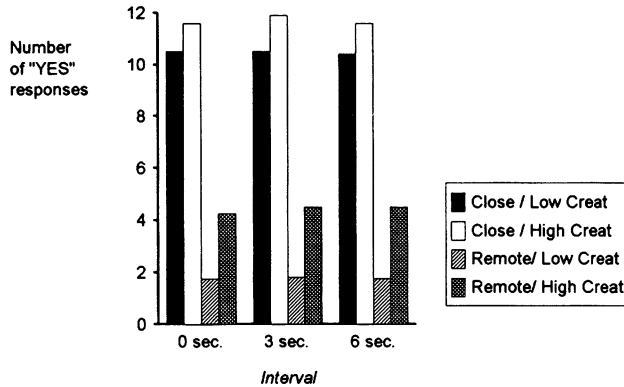


Figure 9: Number of positive associations as dependent on semantic distance between stimuli, inter-stimulus asynchrony, and level of creativity (experiment 3, Rychlicka, 1993) (significant effects: Creativity $p < .001$; Remoteness $p < .0001$; Creativity x Remoteness $p < .04$; Creativity x Remoteness x Interval $p < .005$)

How can we interpret this effect? It seems that the longer the SOA, the more time is allowed for the subjects to produce divergent associations with the first word. When the second word appears afterwards, it is easier to say that it is related to the first one - just because the first word has already "soaked" with various and divergent pieces of associated information. If the words appear simultaneously, there is no possibility for the first word to "soak" with many associations, and thus to "await" the second word with some semi-prepared semantic connections. The effect of "soaking" is stronger in the case of highly creative people, which suggests that the possible cognitive mechanism of creativity amounts to making numerous links between the elements of one's semantic memory, so that a person be prepared to make even the most unusual connections if the task demands so.

Finally, let us look at the latency data. As we can see (Figure 12), it takes less time to respond in the "close" condition than in the "remote" condition, regardless of the nature of the response (YES or NO). It is also interesting to see that high IQ subjects did not differ from the less intelligent ones as far as the "close" condition is regarded; they were, however, significantly faster, in the "remote" condition. As we recall (Figure 8), they were also more willing to say NO in this condition. In other words, the intelligent subjects preferred to reject distant associations and are accustomed to making such rejections quite quickly. Creative individuals, on the other hand, preferred to accept unusual, remote associations (Figure 9), and are accustomed to making their

decisions quite slowly (Figure 13). The general conclusion may be formulated that it takes time to say YES and to accept a remote association; the negative decision can be made much faster. However, the more frequently one says YES for remote association, the more creative one is, regardless of the fact that an amount of time is consumed as a consequence.

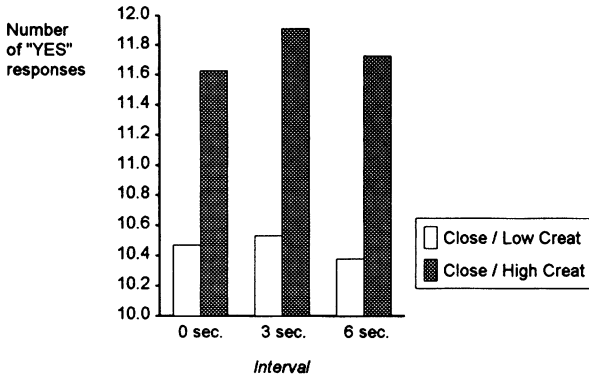


Figure 10: Upper section of Figure 9 (close associations only) (significant effects: Creativity $p < .001$; Remoteness $p < .0001$; Creativity x Remoteness $p < .04$; Creativity x Remoteness x Interval $p < .005$)

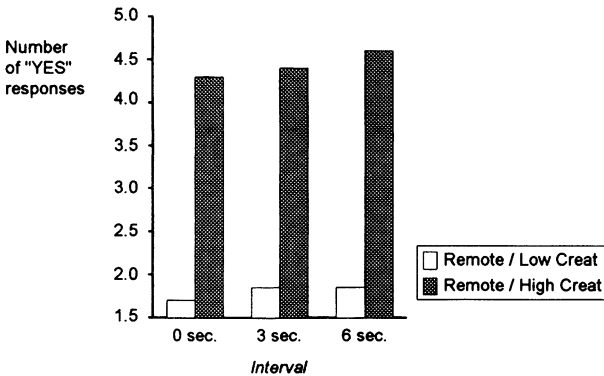


Figure 11: Lower section of Figure 9 (remote associations only) (significant effects: same as described in Figure 10)

Discussion

The data clearly suggest that intelligence may be redefined as an ability to discern quickly and efficiently the logical connections between various pieces of information. At the same time, it amounts to the ability to reject quickly and efficiently the connections which are not logically obvious. In other words, high level of intelligence makes people accept the obvious relationships and reject the unclear ones; both operations are performed quickly, efficiently, and probably without hesitation.

Creativity, on the other hand, may be viewed as an ability to make connections, especially the ones that are not obvious in themselves. Creative people pay for this ability with prolonged response latencies. In other words, they respond slowly but show the increased preferences to discern the relationships that are not logically obvious.

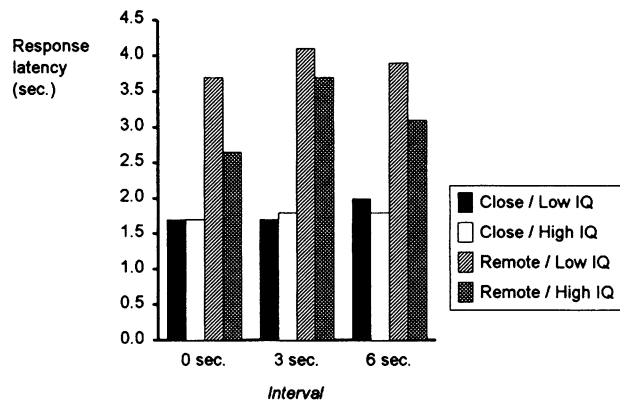


Figure 12: Response latency as dependent on semantic distance between stimuli, inter-stimulus asynchrony, and level of intelligence (experiment 3, Rychlicka, 1993) (significant effects: IQ $p < .047$; Remoteness $p < .003$; Interval $p < .012$; IQ x Remoteness x Interval $p < .048$)

General Discussion and Conclusions

I believe the data clearly indicate that the intelligence versus creativity distinction may be established anew on the basis of the elementary information-processing characteristics. Intelligence is probably connected with the increased speed of information-processing, as well as with the increased efficiency and regularity of responding. These characteristics manifest themselves all the time but they are particularly salient in the new, odd, and unusual versions of our elementary cognitive tasks. Creativity, on the other hand, is connected with the increased preference toward new, odd, and unusual situations. This effect is probably based on the motivational factors, such as cognitive curiosity and intrinsic motivation. Therefore, creative people do not respond particularly well in the usual versions of the cognitive tasks, but they concentrate themselves on the unusual variations of the tasks, thus showing increased regularity and accuracy - not in general but only if the situation is novel enough. It may be concluded,

then, that intelligence means better adaptation to novel situation, whereas creativity means increased predilection to deal with such situations.

These conclusions lead us the supposition that giftedness has many facets also at the elementary cognitive level of analysis. It should, therefore, be identified with the use of elementary cognitive tasks, not only the psychometric measures which are applied at present. Such elementary tasks have many advantages over the traditional tests and identification procedures: (1) they show higher reliability scores, (2) they provide us with numerous dependent variables, thus making our diagnostic decisions more subtle and diversified, and (3) they are precise enough to reveal the latent traits that are normally not accessible through the traditional diagnostic instruments. The latter point seems especially important for the identification of underachievers and other individuals whose capacities, though existent, are "blocked" or impeded for some reasons.

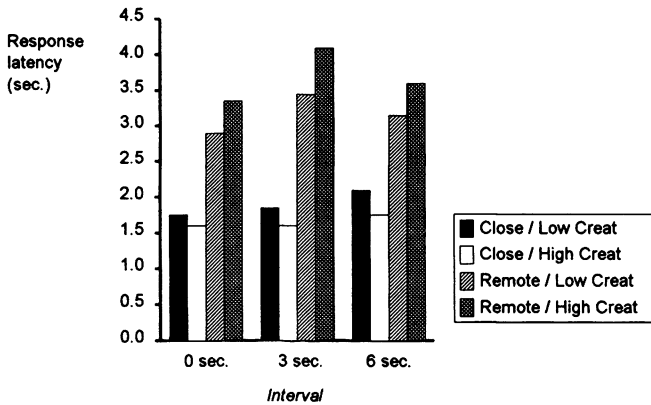


Figure 13: Response latency as dependent on semantic distance between stimuli, inter-stimulus asynchrony, and level of creativity (experiment 3, Rychlicka, 1993) (effects: Remoteness $p < .001$; Interval $p < .002$; Remoteness x Interval $p < .038$; Creativity x Remoteness n. s.)

These elementary cognitive tasks may also be used in order to boost people's giftedness. The results of the third study are especially encouraging in this respect. If creative people make more "odd" associations, it might be possible to reverse this relationship, that is, to teach people how to make such associations in order to increase their creativity. For instance, the subtle cognitive feedback could help people in making "strange" associations, even at the expense of time needed for that, because it is very unlikely that the "creativity-remote associations" connection works only in one direction.

To sum up, the data presented in this paper indicate that creativity differs from intelligence on the information- processing level of analysis, and that elementary cognitive tasks may be, and should be, used both in identification and in stimulation of giftedness.

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Logical and creative thinking in adolescents

Ornella Dentici Andreani

Institute of Psychology, University of Pavia, Pavia, Italy

Introduction

The aim of the present paper is to discuss the results of a research in which we have tried to combine psychometric approach with the study of processes in comparison of gifted with normal adolescents. The *psychometric approach* has been dominating the research until the Sixties and Seventies, because it made possible large scale research and prediction of success in academical career and in work; it was centred on the products, and explained the performance of subjects by the role of one general factor (as Spearman or Binet, Thurstone and others) or multiple factors acting on specific contents (verbal, numerical and so on). This last interpretation, which perhaps is more congenial to American psychology, reappears in recent theories of multiple intelligences (Gardner, 1983) and in the emphasis given to expertise in different domains (Feldman, 1986). On the other end the *cognitive approach*, which started in the Seventies has directed attention on the *processes* which sustain performance and which are at work during perception, memory tasks or problem solving. The authors of HIP theories try to identify kinds and levels of information processes and to identify the components of abilities like Sternberg (1984, 1985, 1990), who distinguishes three basic kinds:

- meta components = executive processes to plan and monitor action, and to evaluate the results
- performance components, like encoding, inference inductive reasoning, analogies
- knowledge components (like learning new words from a context).

Intelligence is understood in terms of components facets and contextually based skills, and cognitive style plays a great role in explaining individual differences, between which is also *giftedness*. This is conceived as a *preference for novel tasks and solutions*, as the use of the *best strategies* and as *automatization of performances*, which results in availability of larger resources of attention and in speed. So the gifted have *superiority in metacognitive components, in performance components (problem solving strategies)*; sometimes also in *knowledge acquisition*, that is the capacity to learn from all situations and to transfer old and new information. Sternberg and Davidson (1982) note that gifted are superior in *insight, selective encoding and selective combinations*. These are also the features of creativity.

The other big and relevant theoretical approach is the cognitive-developmental view by Piaget and the Genevan school, which emphasizes structures and stages. We shortly remark some important recent development of the theories:

- in Genève: Piaget himself in the last period studied the relationship between "*The possible and necessary*" (1976), and used open problems with children in order to show that at the formal level there is an "explosion" of possibilities that is related to the hypothetical deductive aspects of thinking, while the inference produces stronger necessities, and permits also to construct new models; so the reality is a product of law of necessities, but also a source of new possibilities and virtual systems.
- Inhelder and coworkers (1985) start a new type of research based not only on structures, but on procedures of discovery and invention and on the observation of individual differences.

- Rieben, de Ribaupierre, Lautrey (1986, 1990) study individual differences and *décalage* looking for an explanation in *two cognitive styles, analogical and propositional*. In United States Pascual Leone (1970, 1987) and Siegler (1981) (Neo-piagetians) try to understand cognitive development in placing some of Piaget's ideas in an information processing framework. For our purpose (the study of gifted) these authors present very interesting suggestions, which point to three types of schemes (figurative, operative and executive) which evolve with age (Case, 1985), and to the acquisition of increasingly powerful rules for solving problems (Siegler, 1981).

The relationships or the transition from figural to formal is surely an interesting way to study gifted and talented subjects, who often use a figural mode in order to represent a quantity of information, but when they become mature, they make the transition to formal mode or complex type of functioning and apply it to specific domains (evolving systems: see chapter by Gruber in Wallace & Gruber, 1989).

Table 1: Characteristics of the samples A and A1

SAMPLE A by sex and age

Sex	males		females		total	
	f	%	f	%	f	%
Age 15	90	48	92	51	182	49
17	99	52	90	49	189	51
Total	189	100	182	100	371	100

SAMPLE A 1 by sex and intelligence

Sex	males		females		total	
	f	%	f	%	f	%
Level of intelligence High PR > 90	15	16	27	28	42	22
Average PR: 45-55	43	45	37	38	80	42
Low PR < 20	37	39	32	33	69	36
Total	95	100	96	100	191	100

Table 2: Subsamples B to E drawn from A1 (N total =191)

B	C	D	E
32	32	32	32
Logical thinking	Logical thinking	Logical thinking	Logical thinking
Creativity	Creativity	Creativity	Creativity
Moral Reasoning	Moral Reasoning	Moral Reasoning	Moral Reasoning
EPL (formal level)	EPL (formal level)	EPL (formal level)	EPL (formal level)
	Mental Imagery	Mental Imagery	
	Problem Solving	Production of stories and drawings	Probabilistic reasoning

Objective

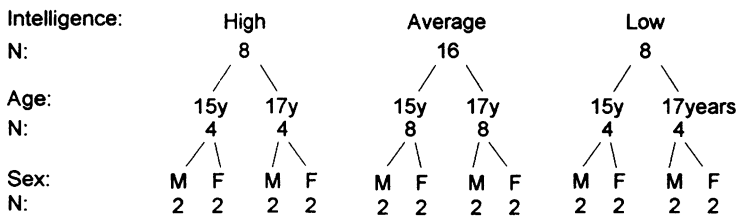
This background is the framework of our research, in which we have tried to use in a complementary way psychometric methods on a large sample and experimental observation of processes in individuals. The general objective is to study many aspects of intelligence in gifted and highly gifted as compared with a large sample of normals, starting with group tests of logical and creative thinking and analysing in a subtler and deepened way the level of formal reasoning, various creative tasks, the role of imagery in creative test, and in problem solving.

In this paper we will present the part of the research concerning imagery and its role in cognitive processes: in fact imagery seems to be one of the best candidates to find the source of superiority of gifted in memory and productive thinking. If we accept as guideline the hypothesis of different developmental paths suggested by Rieben, de Ribaupierre and Lautrey (1990), who refer the individual differences to the modalities of information processing, we may expect that High Imagers shall be superior in tasks which require restructuring of data, visualisation in parallel, analogical representation, while Low Imagers with high intelligence level shall be superior in logic mathematical problems which require sequential processing and propositional representation.

The specific aim of this part of the research is:

- 1 - Relationship between individual differences in *Imagery and creative thinking*.
- 2 - Relationship between individual differences in *Imagery, logical reasoning and problem solving*.

Table 3: Building Subgroups of sample D in order to study Mental Imagery/Creativity



Design of the research

It is shown in Tables 1-3: We have examined the first sample A, N=371 students, 15 to 17 years old, from two schools (Lyceum). They have been tested by a general reasoning test (D 48), a test of creative thinking (C 91) and a Moral Reasoning test (Dilemmi), which aimed to study the relationship between abstract reasoning and moral-social problems. From sample A we choose sample A₁, representative of three intelligence level, defined by D 48, then from sample A₁ we took 4 subsamples (B, C, D, E) matched for sex, age and intelligence, which were individually tested (see table 2). Each sample had the same composition; table 3 presents sample D, which has been studied for Mental Imagery and Creativity. In sample C we analysed the relationship between Mental Imagery and Physical Problems, in sample E between formal reasoning in Longeot and probabilistic reasoning, studying the effect of visual and verbal cues.

Table 4: Measurement instruments used with sample D

IMAGERY QUESTIONNAIRES

VVIQ - Vividness of Visual Imagery Questionnaire by Marks (1973)

VMIQ - Vividness of Movement Imagery Questionnaire by Isaac, Marks and Russell (1986)

TVIC - Test of Visual Imagery Control by Gordon (1949)

VVQ - Verbalizer-Visualizer Questionnaire by Richardson (1977)

CREATIVITY

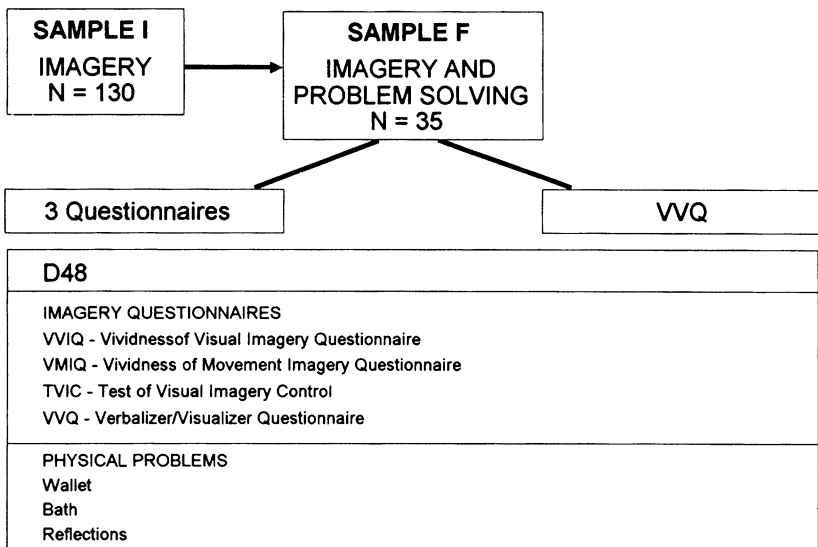
C91: What would happen if all SHADOWS disappear? What would happen if you were INVISIBLE?

WARTEGG (drawings and title)

Description of a REAL and IMAGINARY TOWN

Story of a CAR

Table 5: Characteristics of the samples I and F



In the second part of the research we tested another sample of 130 (group I; table 5) by the four Imagery questionnaires, we did a factorial analysis on the results, and we extracted one subsample (F) of 35 subjects of High and Low Imagers who were individually given physical-mathematical problems chosen because they required a visual representation (comprehension of a graph; construction of a graph; reflection of lights).

The rationale of this procedure is to have background data of ability level for the general sample, and to analyse in a deeper way the processes in smaller, but equivalent subgroups in which we wanted to examine the functional role of imagery in different types of thinking (logical vs creative thinking).

Methods

The tests used for the large sample were D 48, a classic test of inductive reasoning, C 91, a test of creative thinking experimented in our institute with three questions which explore the consequences of an imaginary event (Shadow, Invisibility, Words: see Table 4), and a Moral Reasoning Test: this latter presents dilemmas about life and death topics, like Abortion, Euthanasia, War, and is evaluated according the models of Kohlberg and Rest (see Andreani Dentici, & Pagnin, 1992) in order to see if the level of moral judgement is parallel to the level of logical reasoning. Individual test are Longeot test of operational level (1978, 1979), logical problems of probability, physical problems; tests of creativity are production of stories and drawings; Imagery tests are the four questionnaires Vividness of Visual Imagery by Marks, Vividness of Movement Imagery, Visual Imagery Control, and Verbalizer/Visualizer Questionnaire by Richardson (1977).

The differences between subsamples and within samples have been analysed by analysis of variance, Student's t and chi square according to the variables examined.

First research - Imagery and creativity

First we analyzed the correlations between instruments, which are self-report questionnaires. Then we examined the functional role of imagery in all the variables of creative thinking (like fluency, flexibility, shifting, originality, elaboration of details).

The three questionnaires, Vividness, Movement and Control have very high correlations between them and with total (.50 - .85) while VVQ is clearly different from others. The dimension VISUALIZER - VERBALIZER by Richardson looks independent from the others because probably it is a mixture of skills, strategies, habits, cognitive style more than an ability due to functional features of the processing system (like as vividness).

Factorial analysis

Our coworker L. Vecchio conducted a factorial analysis of the four questionnaires on another sample of 130 subjects (sample I) from which we extracted the High and Low Imagers who did the physical problems.

The analysis confirmed the difference between the VVQ and others, and the importance of *Movement* and *Human Figure* (which are considered signs of creative potential in Rorschach Test)¹, but confirms also that the self-reports questionnaires are instruments of low reliability and validity, because they mix different dimensions without separating the scores.

Probably the assessment of high imagery should be conducted by a multiple test battery including self-report of cognitive style and objective tests of vividness of imagery which discriminate color, shapes and spatial ability.

For purpose of research each dimension should be measured by a specific test, for validity purposes one could construct a multiple-factor test which would be predictive for some class of tasks. Any way, since this actually does not exist, we start to analyse the results based on the actual instruments, which are largely used in current research on imagery.

Table 6: Mental imagery and creativity measures for subgroups of sample D, built on the basis of three questionnaires

VARIABLES	Subgroups				t
	HIGH		LOW		
	mean	s. d.	mean	s. d.	
WARTEGG					
People	1.88	1.46	1.13	0.83	
Objects/animals	3.88	2.03	4.50	1.93	
Landscapes	0.62	0.52	0.75	1.03	
Symbols	2.38	2.83	1.63	1.92	
TOTAL	7.50	0.93	8.00	0.00	
Static elements	3.50	2.62	5.00	1.60	1.38
Dynamic elements	4.00	2.33	3.00	1.60	1.00
Originality (range 1-8)	4.12	2.53	1.75	1.39	2.33**
Flexibility	6.38	1.60	6.88	1.33	
REAL TOWN					
Details	1.75	2.71	1.75	1.75	
Structure	6.25	1.98	6.50	3.11	
People	1.13	0.99	1.13	1.55	
Judgement	2.50	2.56	1.75	1.83	
Static elements	3.37	3.16	3.25	2.66	
Dynamic elements	5.75	1.98	6.13	3.78	
IMAGINARY TOWN					
Details	3.63	3.74	2.00	1.93	
Structure	4.75	2.19	6.00	4.47	0.71
People	1.38	0.74	2.63	2.39	1.41
Judgement	1.25	1.17	1.25	1.39	
Static elements	4.38	2.39	4.12	4.36	
Dynamic elements	5.38	2.62	6.63	3.02	0.88
Originality	3.13	1.64	1.75	1.39	1.81
CAR					
Details	4.25	3.28	5.25	3.69	
Objects/animals	1.38	1.06	2.25	2.52	
People	6.50	5.07	4.25	2.43	1.13
Static elements	4.38	2.33	7.38	4.57	1.66
Dynamic elements	8.63	6.70	6.00	3.93	0.96
Originality	2.13	1.36	1.88	0.99	
D48	32.25	5.80	31.00	3.67	0.93
C91 Flexibility	6.50	2.14	4.38	1.77	2.17*
C91 Originality	0.88	0.99	0.25	0.71	1.45

High = equal or higher than 75th percentile in combined scores of three questionnaires
 Low = equal or lower 25th percentile

Imagery and creativity: results

Then we have examined the differences between High and Low Imagers, chosen the first time according to the three questionnaires, the second time according the VVQ Richardson (High: ≥ 75 percentile, Low: ≤ 25).

The trend is in favour of High Imagers for all the *indexes of originality* (Wartegg, Imagined town, Car, Shadow test, Invisibility) and flexibility, but many variables do not reach significance, although the Imagers have more richness of details in imaging a town and a running car. Since the average score in D 48 is higher in the Visualizers (34 vs 29), we can think that the differences are not only an effect of Visualization ability, but of *tacit knowledge* described by Pylshyn (1981), which enrich quasi-perceptual image by knowledge of details and are better utilised by the brightest.

Where High Imagers are assessed through the Verbalizer-Visualizer questionnaires, we find more difference (High Visualizer were superior in perception and imagination of details in real and imaginary town) but it is interesting to observe that all the *differences in originality disappear*.

Table 7: Mental imagery and creativity measures for subgroups of sample D, built on the basis of the Visualizer/Verbalizer Questionnaire

VARIABLES	Subgroups				
	HIGH		LOW		t
WARTEGG	mean	s. d.	mean	s. d.	
People	0.89	0.92	1.13	0.84	
Objects/animals	5.22	1.86	4.25	1.91	
Landscapes	0.89	0.93	0.75	1.04	
Symbols	1.67	2.65	1.86	2.10	
TOTAL	7.78	0.67	7.75	0.70	
Static elements	4.89	1.76	4.63	1.92	
Dynamic elements	2.89	1.27	3.13	1.64	
Originality (range 1-8)	3.44	1.13	2.75	1.75	
Flexibility	6.78	1.30	6.38	0.92	
REAL TOWN					
Details	2.00	1.32	2.13	2.80	
Structure	6.67	3.00	5.63	2.45	
People	1.11	1.17	1.38	0.92	
Judgement	1.78	2.54	2.50	2.20	
Static elements	2.67	2.06	3.88	2.90	1.00
Dynamic elements	7.11	2.39	5.25	3.81	1.23
IMAGINARY TOWN					
Details	3.78	2.39	2.25	2.61	1.26
Structure	7.00	3.65	5.25	3.62	0.99
People	2.67	2.69	3.13	4.16	
Judgement	1.00	0.87	0.88	1.46	
Static elements	6.22	3.70	4.13	3.64	1.17
Dynamic elements	7.22	2.99	6.50	5.40	
Originality	3.00	1.22	2.25	1.45	
CAR					
Details	7.22	3.53	3.25	3.81	2.23*
Objects/animals	2.44	2.56	1.63	1.19	
People	4.33	3.12	4.63	3.86	
Static elements	6.44	3.68	4.25	3.15	1.31
Dynamic elements	8.89	6.90	6.50	3.46	0.88
Originality	2.67	1.23	1.38	0.74	2.58*
D48	34.56	3.17	29.00	5.93	2.45*
C91 Flexibility	6.00	1.58	5.13	0.35	1.53
C91 Originality	0.44	0.73	0.38	0.74	

High = equal to or higher than 75th percentile in Visualizer/Verbalizer Questionnaire by Richardson; Low = equal to or lower than 25th percentile

This is particular evident in the *Wartegg test*, and it is easily explained if we look at the task: the originality can be due to the drawing itself or to the title, the interpretation, which can transform a very poor drawing in a significant symbol or an humoristic situation.

So a High Verbalizer subject designs the small point of stimulus 1 as an eye (banal and frequent answer), but the title is: *"An alien who looks at me asking: Who is that funny fellow?"* Another

Verbalizer sees the point as a flake of "a sweet, peacefully snow-fall"; the same gives a symbolic interpretation of all the stimuli, with a complete restructuring: so the sign of stimulus 2 (~) becomes "A river passing through a forest", the ascending lines of stimulus 3 the walls of "a chaotic, jam-packed, inhabitable town", the small-square of stimulus 4 "a squared soul" and so on. The noticeable thing is that all the physical aspects are transformed in symbolic forms starting from a figural analysis; and that, in general, High Verbalizers produce more symbolic interpretation in Wartegg and more imaginary hypothesis in the Shadow and Invisibility test.

So we can say that there is a relationship between vividness of imagery and the capacity of restructuring, changing, imagining things in movement and transformation; but in more complex tasks, like the invention of a drawing or a story, the modalities of visualization and verbalization alternate and interact, and a lower imagery vividness can be compensated by the richness of semantic nets and the power of deductive capacities which bring to the production of novelty.

Second research - Imagery and problem solving

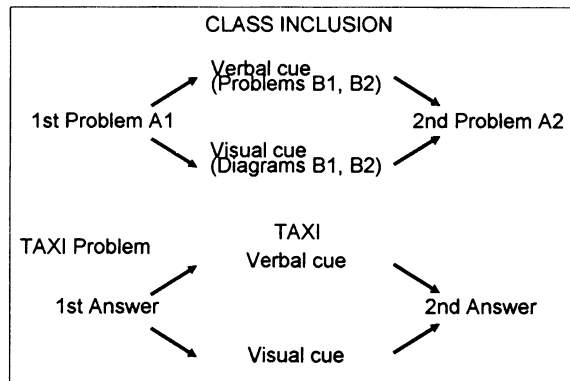
The second research studies the function of images in Problem solving. We used two types of problem solving;

- (a) logical problems - probability - class inclusion,
- (b) physical problems.

In the first experiment (Sample E - Probability problems) we studied the effect of visual or verbal cues in order to see:

- 1) which *type of cue* is effective in avoiding the typical mistakes of heuristic of representativeness,
- 2) if *verbal cues are more effective for verbalizers subjects* and, conversely, visual cues are more effective for visualizers. The scheme of procedure can be seen in table 8.

Table 8: Probabilistic reasoning: Procedures (From S. Danelli: *Lo sviluppo del pensiero formale negli adolescenti: strutture, procedure ed euristiche di ragionamento*. Tesi di Dottorato, Pavia, 1992.)



In short, we found that cues are effective only if the subjects have an ability level which already approaches the right solution; visualizers in our sample E do not utilize the cues, while verbalizers seem more ready to improve their performances with these cues. This confirms Johnson-Laird's assertion that although images may be useful in the initial phase, linguistic strategies and propositional representations are more effective in the problems of class inclusion. In our sample verbalizers were slightly superior in all formal reasoning tasks (Longeot test, Tests of probability) but we think that the effect of cues is related to a variety of factors with an interaction between subject, task and instruction.

Table 9: Physical Problems

1 - Constructing a graph (<i>Wallet</i>)
The graph represents sums of money spent during day time
2 - Constructing a graph (<i>Bath</i>)
Water level in a bath at different times
3 - Interaction light/filters and light/coloured in objects (<i>Flags</i>)
Es. Italian flag, blue light
Spanish flag, green light

In the second experiment (sample F) we tried to assess the function of imagery in physical problems which required a graphical representation, basing our choice on problems that utilize visual representation both in its aspects of model of reality (graph) and phenomenological qualities (colour). The problems were

- comprehension of a graph,
- construction of a graph,
- drawings of reflection of light on different object,
- answers to questions on reflection and transmission of coloured light.

The subjects were chosen for High and Low Imagery scores from the sample I of 130 subjects (see table 5); we gave the problems in individual interview; we analyzed the difference in quantitative (number of right answers, right drawings, abstract drawings) and qualitative variables (type of errors; graphic or conceptual, realistic or formal strategies, systematicity).

As you can see from table 10, *no difference emerges*: if any trend exists, it is in favour of Low Imagers (reflection of light, *right* and *abstract drawings*).

If we examine the strategies, we observe that Low Imagers use more systematic, formal strategies, and are more flexible in using verbal, visual or mixed strategies in different items.

The causes may be different:

- 1) Our sample is too small.
- 2) The three questionnaires measure a dimension of imagery (vividness) which is not relevant for our tasks: probably for these physical problems the relevant independent variables are the visuo-spatial ability, and the capacity to use abstract, symbolic forms.

There is a large difference between quasi pictorial images, rich in vividness, details and colours, and abstract images like geometrical forms, graphs, diagram of flux, maps.

Probably the first type of Imagery plays a role in episodic memory, flash bulb memories, in concrete problems, in the invention of poems, pictures, while abstract images play a role in

mathematical and physical problems. Analogic processing can vary from realistic analogies to structural analogies, but sometimes the realistic images may be detrimental if the subject is not able to simplify the figures eliminating what is not relevant.

Table 10: Problem solving (Physics) measures for two Imagery subgroups built on the basis of the three questionnaires (upper part) or of VVQ (lower part of the table)

Variables		HIGH N=7	LOW N=12	Student t
WALLET: right answers	mean	1.86	2.00	-
	s. d.	0.35	0.00	
BATH: errors	mean	2.14	1.92	-
	s. d.	1.35	1.04	
INTERACTION LIGHT/OBJECTS: N. right drawings A	mean	3.71	4.25	-
	s. d.	1.38	0.92	
INTERACTION LIGHT/OBJECTS: N. abstract drawings A	mean	2.86	3.67	-
	s. d.	1.55	1.49	
INTERACTION LIGHT/OBJECTS: N. right answers B	mean	3.29	3.33	-
	s. d.	0.70	1.79	
INTERACTION LIGHT/OBJECTS: Total strategies B	mean	15.14	12.08	-
	s. d.	2.42	4.03	

Variables		HIGH VVQ N=6	LOW VVQ N=10	Student t
WALLET: right answers	mean	1.83	2.00	-
	s. d.	0.37	0.00	
BATH: errors	mean	1.33	1.60	-
	s. d.	1.25	2.20	
INTERACTION LIGHT/OBJECTS: N. right drawings A	mean	4.33	4.60	-
	s. d.	1.49	1.20	
INTERACTION LIGHT/OBJECTS: N. abstract drawings A	mean	3.67	2.70	-
	s. d.	1.10	1.68	
INTERACTION LIGHT/OBJECTS: N. right answers B	mean	3.33	3.00	-
	s. d.	0.74	1.34	
INTERACTION LIGHT/OBJECTS: Total strategies B	mean	16.00	13.40	-
	s. d.	1.83	4.32	

High = higher than or equal to 75th centile

Low = lower than or equal to 25th centile

3) Many subjects process information in analogical format in the first coding of the data of the problem, but are unable to effect the successive transformation and to make the necessary inferences (error are more frequent in the 2nd part of the graphs).

4) Complex problems, like the one on Light Reflection, require a *shifting* from figural representation of physical objects to the use of rules and inferences derived from the analytical description of the problem and L.T.M., and these are better represented in propositional format (or may be amodal).

As we already observed in creative tests (Wartegg), the *creative products* can be obtained starting from a figural representation or a verbal metaphor, but this starting point is followed by an interpretation derived from semantic nets or personal emotional experience; in the same way the solution of *complex problems alternates phases* of holistic synthetic insight, which may have an analogical form, with processes of deductive reasoning, which must proceed by sequential steps according to logic rules and analytical processing.

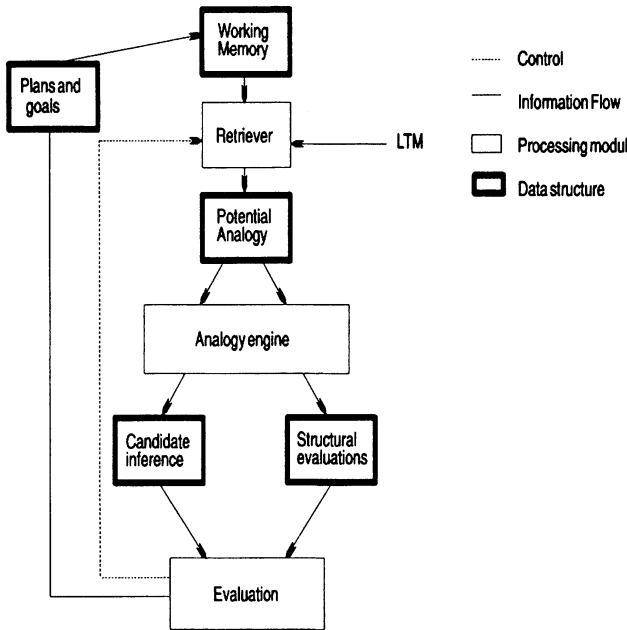


Figure 1: Gentner's (1989) model of analogical reasoning

I would like to mention that Binnig, Nobel prize laureate for Physics, in his wonderful book on creativity *"Aus dem Nichts"* (1989) describes the alternative role of synthesis and analysis in the process of scientific discovery, and that Wallace and Gruber in their biographic studies of *"Creative people at work"* (1989) emphasize the changing aspects of creative persons (*"evolving systems"*).

Gentner (1989) in her model of analogical reasoning observes that "analogy in problem solving is only a special case of analogy" and proposes an architectural model of analogical reasoning that includes, besides the subjects traits, Short Term and Long Term Memory, inferential and evaluation processes, plans and goals (Figure 1).

Probably Mental Images in their pictorial form are useful in the initial phase of solution of many problems, but in successive phase must be transformed in abstract form and integrated with other processes; and probably the most productive thinkers are not High Imagiers, but people who can shift from one to another mode of processing. So, the best type of instruction for the gifted should not be aimed to emphasize too much specific abilities or techniques of visualization, but to integrate them with verbal strategies; figurative aspects of knowledge might be more appropriate for problems concerning infralogical operations, while in logic-mathematical problems propositional aspects might be better.

Relationship of imagery to thinking is complex, and differs in the various steps of production of hypothesis, problem solving, discovery and invention: and the education for the gifted should aim to develop analogical and logical reasoning and to use them in the most convenient way.

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Notes

- ¹ The factors of movement have also significant correlations with some items of Longeot (mechanical curves and probabilistic test of formal operation)

Subject's semantic orientation and creative thinking

Maria Trifonova

Permanent Mission of the Republic of Bulgaria to the United Nations, Geneva, Switzerland

Educational institutions are designated by society to maintain, exercise and communicate the collective human intellect (the culture, the civilization) of the past. The most frequent style of teaching and old didactic methods are most suited to the conservation of information acquired over generations, but don't stimulate creating new contributions to that culture.

The education refers to the processes whereby children are introduced to, and come to master the principal notational channels of their culture. How we can build the notation system of different scientific domains, preventing human mind from stereotypes in using such kind of system? It would be a radical pedagogue indeed who would attempt to circumvent or subvert it altogether.

Perhaps one must master the symbolic system, as it is supposed to be mastered, before one can take fresh advantage of it. Because of its recent development, psychology now has the opportunity to give an answer to questions concerning the nature of creativity and become more useful to education than it has ever been before. The fruits of psychological and educational research are mainly writings intended to provide educators with guidance on how various aspects of schooling should be conducted. Thus, it's becoming socially important to find out what are scientific explanations of human creativity in learning and cognition.

The nature of creative thinking is a longstanding topic within psychology. Theories of creativity undergo an evolutionary process that theorists believe brings us to successively deeper levels of understanding of the psychological construct under investigation.

Whereas the fundamental unit of analysis in most psychometric theories is the factor, the fundamental unit of analysis in most cognitive theories is the information-processing component. The point to be made is that human thinking and especially creative thinking cannot possibly be understood fully, except at multiple levels of the processing of information. No one approach to studying cognitive processes is apt to be "complete". A continuing challenge for the future will be the integration of results from various paradigms of research so that our understanding of intelligence and creativity will be trans-paradigmatic rather than specific to the research approach that it happens to use.

During most of this century, the dominant approach to theory, research, and practice in the field of human intelligence has been the psychometric approach. Investigators using this approach have sought to understand intelligence by examining patterns of individual differences in scores on various kinds of mental tests. Psychometric theories deal with intelligence primarily in its structural aspects. Cognitive theories deal with thinking primarily in its processing aspects. A component is an elementary information process that operates on internal representations of objects and symbols. The point is that psychometric and cognitive (information-processing) approaches to studying thinking are complementary and mutually beneficial. The role of cognitive theory is not to overthrow psychometric theories, but rather to fill in details. Cognitive theories elaborate on rather than replace psychometric ones.

Investigators studying human thinking from a cognitive viewpoint have proposed several classification schemes for understanding information-processing components, and have proposed several schemes for understanding sources of individual differences in these components and in the ways in which they combine. One of these sources of individual differences in information processing, according to R. Sternberg, is mental representation on which components act: some individuals may use one particular representation for information, whereas others use a different representation. The components of intelligence are manifested at different levels of experience with tasks and in situations of varying degrees of contextual relevance to a person's life.

The knowledge-based approach assigns a central role of old knowledge in the acquisition of new knowledge. Proponents of this approach encompass research focusing on general world knowledge, knowledge of structures or classes of text, and knowledge about strategies for knowledge acquisition. According to F. Keil (1984, p. 91), "...the structure plays a more important role than process in explanations of many instances of cognitive change...". This view also puts an emphasis on a priori constraints on knowledge, and on content-bound versus content-free knowledge.

Some psychologists usually cite instances of differences between expert and novice performance - in verbal and other domains - that seem to derive more from knowledge differences than from processing differences. For example, Keil (1984) suggests that development in the use of metaphor and in the use of defining features of words seems to be due more to differential knowledge states than to differential use of processes or speed of process execution. Chase and Simon (1973) found that differences between expert and novice performance in chess seemed largely due to differential knowledge structures rather than to processes.

Much of the insight into the problem solving and learning in the Newell and Simon programme is in their description of the knowledge structures that are brought to a problem, and of how the problem itself is encoded or represented. Differences in strategic knowledge are often used to explain differences in older and younger children's ability to acquire information about specific content. Siegler and Richards suppose that this equation can be reversed, however, knowledge of specific content may influence the acquisition of strategies (Siegler & Richards, 1982). They cited a study done by Chi that presented somewhat more direct evidence that knowledge of the content to be remembered can play an eminent role in the acquisition of strategies.

In his triarchic theory, R. Sternberg attempts to specify what aspects of thinking might be universal, and what aspects might be relative. He provided three basic kinds of information-processing components, which are referred to as metacomponents, performance components, and knowledge-acquisition. His position is an integrative rather than segregative view of perceiving the differences between positions. "The overemphasis on process that may have characterized some past research should not be replaced by an overemphasis on knowledge in present research. Rather, it should be recognized that knowledge and process work interactively in complex ways. The knowledge-based approach is complementary to the process-oriented approaches, not a replacement for them" (Sternberg, 1985, p. 110). According to the triarchic theory, components of information processing are closely tied to one's experience. Assessing cognitive processes requires one to consider not only components, but the level of experience at which they are applied.

Another trans-paradigmatic approach to creative thinking is provided by H. Gardner in his theory of multiple intelligence. According to this author, "... somewhere between Chomskian stress on individuals with their separate unfolding mental facilities, the Piagetian view of the developing organism passing through a uniform sequence of stages, and the anthropological attention to the formative effects of the cultural environment, it ought to be possible to forge a productive middle ground..." (Gardner, 1985, p. 312).

The theory of multiple intelligences puts forth on a position that takes seriously the nature of innate intellectual proclivities, the heterogeneous processes of development in the child, and the ways in which these are shaped and transformed by the particular practices and values of culture.

The concept "creativity" covers a wide range of different skills. Most of psychologists associate with creativity features as novelty and originality of the product. We can study and analyse the behaviour of creative people, but this will not tell us very much, because often such people are themselves unaware of what triggered the brilliant idea. According to Edward de Bono, the lateral thinking refers to moving sideways across the patterns instead of moving along them as in normal thinking. The brain is a wonderful device for allowing incoming information to organize itself into patterns. Once the pattern has been triggered, then we follow along it and see things in terms of previous experience. The creativity of students seems to lie directly in their insight abilities, rather than simply in their IQ-test-type abilities or in their abilities to process information rapidly. The gifted can interpret genuinely novel situations, whereas typical individuals often have difficulty in even comprehending the nature of such situations. According to Vigotski's and Leontiev's theories of culture-historical experience, the human semantic system consists of acquired meanings, common for the members of the same culture. That is why they will show a tendency to code in a comparable manner. Applying this methodological approach in the field of cognitive psychology, the Russian psychologist L. Gurova achieved more complex understanding of insightful and creative thinking. She outlined a dialectic relation between formal processing and unformal, content emphasis in problem-solving. In the situations of new problems the role of unformal encoding and representations is more important than in process of solving of familiar tasks and problems.

What kind of available knowledge, stored in long-term memory, is involved in the process of applying creative strategies in problem-solving? Another Russian psychologist, E. Artemeva, supposed that in the cognitive processes of problem solving not only our knowledge, but also our affective experience with the certain content take part. This idea corresponds to the theoretical assumption that thinking operates on internal representations of objects and symbols at multiple level of information processing. Dominating of a process at a certain level determines the main characteristics of its direction.

Our main hypothesis is that semantic orientation to content be represented influences the choice of creative strategies in problem-solving. To be original and creative, thinkers have to reach beyond the bounds of their concept structure (learned notation system) and to apply their personal coding criteria. The vital parts of creative thinking are subject's skills to overcome existing stereotypes, in which one perceives and imagines, abilities to manipulate material in a flexible manner, and to represent information from different points of view.

We attempted to show in our research the interaction between some parameters of individuals's semantic structure (in the field of geometry) and creative strategies, used in problem-solving of geometric tasks. The study is designed to evaluate a model of structural relations, among major cognitive process variables.

Experimental study

Our study had two objectives. The first one was to investigate the characteristics of the process of creating a semantic context for perception of indefinite visual material in order to determine biases of individual's space of representation of visual stimulus. According to this purpose, we used some psychosemantic methods like semantic differential, classification etc.

The second objective was to find out the influence of dominating semantic orientation (denotative and connotative) on creative problem-solving of geometric tasks. Our study took

into account individuals' preferred "coding" language and the contribution this factor makes to creative reasoning. The dependent variables in this study were the numbers of creatively solved geometric problems, and tasks for analogical reasoning; the independent variables - numbers and type of dimensions of individual space for representation of geometric content.

Subjects

Subjects investigated were 127 students from Bulgarian and Russian high schools and 64 students from the University of Sofia. Ten children (aged 11 and 12) and 25 students were also asked to do the tasks in an earlier pilot study. The experiment is group-administered in sessions of about 45 minutes.

Experimental material

In our experimental study we used three different methods - a classification, a semantic differential and a problem-solving, applying them to the same experimental material - sixteen indefinite geometric figures. That allowed us to investigate the different psychological variables in their functioning in the same content area.

The main idea of designing the experimental material was to use it for assessment of different strategies in classification, moreover to provide the possibility for problem-solving at different levels, especially at the level of finding a creative decision.

These figures and the rules for solution of the task make easier applying of stereotypes instead of creating a new approach. Original decision is possible only in case if individual ignores misleading stereotype.

We used also Bongard's task for analogical reasoning. In these problems are given the elements A, B and C, and the task is to select element D so that the relation between C and D is the same as that between A and B.

Procedure

The sequence of tasks was chosen initially accordingly to our conception. In the first session we used the method of classification: the subjects were required to classify all the figures into groups. They must determine the principles of sorting and the number of groups, involving the figures submitted to these principles. In the second series we applied the method of semantic differential - the same figures are an object of assessment through several bipolar scales. Each item on a semantic differential form has the subject rate a figure on a 7-step scale defined by a pair of polar qualifiers with the middle position on the scale defined as neutral and the three steps outward in each direction defined as slightly, quite and very. The third method we used is the problem-solving of a geometric tasks. The rule that must be followed determine the goal - the construction of a simple figure like a triangle, a square, or a trapezium from the initial indefinite geometric configurations, dividing it into two parts and rotating them in order to construct the final figure, or figures. Finally, we provided the subjects with Bongard's tasks for analogical reasoning.

Results

The results are organized into two sections, corresponding to each of our research questions. The data collected from all series of our study are interpreted on two levels - on the level of the relation of parameters as type of significant dimensions in individual semantic space, productivity, problem-solving and analogical reasoning, and on a global level - as a general tendency in the dynamics of the correlations in the three groups with different semantic orientation towards geometric notational system.

First. The parameter "semantic orientation" is a complex one and its experimental definition is based on the data obtained with semantic differential and classification of geometric figures.

The data obtained with semantic differential and information about system of criteria applied in the process of classification allows us to divide all subjects into three groups. The groups are formed in accordance to subjects' semantic orientation towards content representation and respectively reflect their level of activity in creating semantic context.

The Group I: Subjects with strong "denotative" orientation. They rely heavily on the geometric notational system and use only denotatively relevant scales, describing and sorting out figures.

The Group II: Subjects with connotative orientation. For most objects qualifying scales used by these subjects are rotated in the affective space toward that factor on which they have their dominant loading - factor "evaluation". Affective scales are not meaningless for these subjects assessing geometric figures.

The Group III: Subjects with metaphorical orientation. They apply not only denotative but also emotional scales for describing geometric content but their approach is quite different from those of Group I and Group II. There is an active process of creating a new metaphorical object and association in the subject's mind on the base of the stimulus presented. These metaphorical designs mediate the direct assessment of the former geometric figures on the scales. These subjects demonstrate high level of activity in the process of content representation.

Second. The three groups were compared on the basis of their performance on the problem-solving of geometric tasks and on Bongard's problems for analogical reasoning.

Given the exploratory nature of this research, multivariate, univariate and nonparametric statistical procedures were employed with alpha level .05. ANOVAs using planned comparisons were conducted to identify group differences on the performance in problem-solving of geometric tasks and in analogical reasoning.

Between-group differences were significant for performance variable investigated in the process of finding out a creative solution of geometric tasks [$F(4, 120)=3.14; p<.01$].

These results reject the first null hypothesis "The factor 'metaphorical semantic orientation' doesn't relate to creative problem-solving". Differences concerning the other performance variable - analogical reasoning - were all statistically nonsignificant. Such results allow us to accept the second null hypothesis "The factor 'metaphorical semantic orientation' doesn't influence the successful analogical reasoning".

In addition, we discovered that there is a positive correlation above the mean values between productivity in creating more than one decision of geometric tasks and successful problem-finding, but there is a statistically significant but weak correlation between productivity and analogical reasoning. The correlation between problem-solving and analogical reasoning undergoes great fluctuations. In Group I this correlation appears with positive values; in Group II and Group III. this correlation disappears. The fluctuation is revealed also for the correlation between productivity and problem-solving. There is a highly positive correlation between productivity and solving of geometric tasks in the Group III but in Group I and Group II, it becomes slightly negative.

Discussion

One main finding emerged from this study: the correlation between connotative (metaphoric) semantic orientation and creative performance on problem-solving of geometric tasks.

The subjects with denotative orientation demonstrate a low ability to solve geometric tasks in the first experimental series and a low level of productivity. The subjects with denotative orientation are good performers in tasks which don't require creative strategies. The subjects with connotative orientation deal more successfully with analogical reasoning but they failed in

solving the geometric tasks where a high level of activity is necessary in moving into the content. Group III demonstrates high productivity and high level of problem-solving but the subjects from this group are not good performers in analogical reasoning.

The creating of a metaphorical context for representation of the indefinite content means that the subject actively structures and manipulates in a flexible manner. Acquired geometric notational system doesn't limit the representation of the geometric tasks in the shape, specific for this domain. The activity required for the creative solutions of geometric tasks accumulates in every moment of the specific energy for designing hypothetical domains of probable solutions. This process which runs ahead of the successive decision-finding is due to existence of multiple levels of representation, including not only relevant denotative schemes but also connotative space. The findings of this study support suggestions that an expanded view of cognitive functioning is needed that may yield greater understanding of creative thinking.

The results from this study indicate that the dominating of the aesthetic, metaphoric and nonspecific for the content, semantic orientation is a factor for overcoming barriers and stereotypes in problem-solving. Thinking becomes increasingly creative when the experience and relationships from different domains can be harnessed to work together on specific problems to be solved. This is easier for children with a more playful disposition to tasks. For these young children internal representations of geometric structure are not yet fixed in their attachments to the conventional meanings associated with external notation systems. They have an unusual capacity for representing geometrical figures to themselves in multiple ways.

The effect of mental representation upon strategy shows, I believe, the importance of considering representation and cognitive strategy in conjunction. Neither can be well understood independently of the other. The use of psychosemantic methods represents a praiseworthy start in this direction.

The advantage of theoretical scheme is to direct research efforts towards particularized and interrelated aspects of creative activities. In consequence, empirical research would not approach creative thinking as a simple, undifferentiated process but rather as a coherent unity.

From present research we can draw implications for educational practice and suggestions for further research of creative thinking. One conclusion that follows from this study is that there is a need to develop instructions accordingly to V. V. Davidov's principle of education to follow transition from abstract (semantic rules, concepts) to definite examples. Applying this principle correctly, teachers provide students with a notation system that allows a flexible manner of using it. Because of its abstract nature such kind of knowledge suppose active task commitment. It is relevant to principles of dialectic logic. Another useful approach might be applying diverse activities, using the same geometric content. The children might enjoy their education taking part in the games, require applying the aesthetic criteria in the evaluation of geometric configurations.

Education as an aptitude development program must aim at much more than the development of academic intelligence. It must aim at producing aptitude for creative problem-finding, and for all kinds of problem-solving needed to advance and sustain human civilization.

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Personal and situational determinants of innovation

Lutz von Rosenstiel

Institute of Organizational Psychology, University of Munich, Munich, Germany

If problems of application are of interest in organizations of business and administration, the question arises, under which conditions innovations will occur. These innovations can relate to procedures or products. In search for solutions for these problems, psychologists tend to a purely person-centered perspective. Concerning motivation they stress independence, curiosity, achievement motivation etc. Concerning cognition they point to flexibility, originality, fluency, all in all divergent thinking. In order to achieve innovations in organizations, psychologists try to select applicants with these traits or to form them through measures of personal development.

This point of view neglects the situation. Innovations in organizations are the product of an interaction between person and situation. In psychological perspective this results in two major consequences. The first consequence is discussed now, the second is presented at the end of the chapter:

The creative person, thinking divergently, has to recognize the restrictive circumstances of the situation. Even extremely original and fluent ideas, combining everything, will hardly lead to applicable and useful results. It is not astonishing, that research shows how a combination of divergent and convergent competences favours innovations (Facaoaru, 1985). That has to be considered in selection and training.

The perspective of the individual was discussed intensively in the workshop. Dymshitz (1992) presented criteria of selection in the Soviet bureaucracy. Schuler (1993, see p. 112ff.) wondered which personal characteristics can be identified as determinants of performance in intellectually high demanding occupations. Wu (1993, see p. 412ff.) studied the relationship among the vocational interest, career maturity, academic aptitude and academic interest by senior-high students talented in science and mathematics. Pascher (1992) stressed innovation competence, a criterion for recruiting managers:

Innovations serve among others to solve problems and to adapt to changing environmental conditions. "New ideas can only be generated and realized by humans." (Thom, 1980). Drucker (1985) argues that successful entrepreneurs must use "systematic innovations, which consists in the purposeful and organized search for changes, and in the systematic analysis of the opportunities such changes might offer for economic and social innovation."

The following problems encountered by managers in corporations:

- markets getting narrower which necessitate quick reactions to changing market needs,
- instead of linear-causal planning models and detailed rules, it is more important to plan the dynamic processes flexibly,
- the results of many decisions can not be estimated as well,

indicate that managers have to react to the increasing pressure of rapid changes. On the other hand, these situations allow new levels of order to emerge out of the "creative instability". A lot of definitions tend to suggest that the value of innovation is to be judged from the point of view

to the shareholder interest in maximising profits. This represents both a *value assumption* (that seeking of profits is in the best interest of all of those affected by the innovation) and a *mistake* since innovation may not always be economically valuable for an organization. Regard at this point the discussion about the social acceptance of change in connection with conceptions as "lean-production" or "lean-management".

Innovations include social processes as well and they are only then successful, when the managers and co-workers accept and cope with the changes that are approaching them quicker and quicker and therefore adapt their behaviour to these changes. One of the most obstinate problems is the resistance of the co-workers to change. A study of Knetsch (1987) showed that over 40% of innovation processes are rejected by non-technical factors, but by individual or organizational influences (or resistance). A central task area of tomorrow's managers lies in the area of preparation, advising, steering and controlling the social processes.

Innovation competence in managing means that the manager has the ability to influence people, departments and regions as well as the entire organization in a way that creates innovation. The manager must also be able to deal with the conflicts that arise due to this.

Theoretical background

In the scientific discussion innovation surprises by a lot of different definitions, range from highly specific foci on technical innovation to very broad generalisations, too imprecise to enable operationalisation.

Innovation is mainly seen as

- a result of a change process,
- a change process,
- a phase of a change process,
- a whole process of change.

The term innovation is usually employed in four different contexts (according to Zaltmann, Duncan, & Holbek, 1973):

- product-innovation, e. g. an introduction of a new product,
- method-innovation, e. g. changes in the production facilities,
- structural innovation, e. g. change of the responsibilities of departments,
- social innovation, e. g. recruiting new co-workers or qualifying the staff.

You have to begin with a theory of innovation if you want to find a psychological framework for the initiation of innovation processes. However, the divergent aspects of innovation research only show a small degree of integrative character. "A promising strategy could include research work on creativity and problem solving and define innovation as the result of creative problem solving processes" (Meißner, 1989).

While representing a lot of other models of this process, the following model is an analogy to change in industrial organizations (Wallas, 1926; according to Meißner, 1989):

1. Preparation - the discovery of a problem

Crisis can support the development of new ideas in business firms.

2. Incubation - hatching over a problem

Precise analysis of the facts (e. g. discussion with the colleagues, establishing of working groups).

Problems:

The managers are affected by pressure of time:

- an inaccurate analysis often leads to an inadequate problem-solving process.

Results:

- waste of time and money;
- growing competence problems.

3. Illumination - the spontaneous inspiration

Working out the solution (=invention).

4. Verification - the investigation of the new idea

Realisation

- with a strict plan of time, budget and competence;
- all departments which are affected by the realization are to be embraced in the change process;
- review of the objectives.

The analogy to the creative problem-solving process is obvious. But is innovation simply an innovative name for creativity in the organizations? According to a lot of definitions creativity involves uniqueness, a novel relational product. (E. g. Rogers [1954]: "It is the emergence in action of a novel relational product, growing out of uniqueness of the individual on the one hand, and the materials, events, people, or circumstances of his life on the other." E. g. painting a picture, developing a scientific theory ...)

But not all innovations will be creative. Setting up autonomous work groups in a factory may not be creative, but is innovative to most terms of the definition.

Innovation in industrial context (according to West & Farr, 1988) means:

- Innovation always involves intentionality of benefit;
- Innovation has a very clearly social and applied component which impact on others in the organization, work group.

And this necessary component differentiates it from creativity. For most of the business firms is it no question "if they should realize innovations, rather than to organize them in a planned and steady way ..." (Grochla, 1980).

In my study I use the following definition of innovation (according to Dreesmann, 1988, 1989): "Innovation means the realisation of subjective new ideas, or a combination of still existing new ideas, which are supported by active or passive members in a different way. There is no significant difference between technical, social or structural innovations. Innovation embraces the whole process of change."

Objectives of the empirical study

The theory of planned organizational change stresses the important role of the acting individuals concerned in change processes.

Here is a short survey of some empirically verified characteristics of individuals with a high ability to innovation (according to Dreesmann, 1989):

- a good education
- high ability to learn
- good understanding of complex coherences
- creativity
- open-mindedness
- high ability to take the risk
- sensitive for problems

- self-confidence
- a high task-orientation
- a high team-orientation
- a high tolerance of frustration
- tenacity.

The question of selecting such "innovative personalities" is of central importance to corporations. They can avoid and lessen losses that result when initiating and carrying out innovations when the corporation considers innovative competence when selecting the managers of the future.

The leading idea of my study is that the management of change, the ability to innovation, is a management of resistance against change, the mastering of the resulting certainty.

Empirical Investigation

In a pre-study, industrial corporations were questioned by means of interviews and partially structured questionnaires about the instruments and processes already existing to evaluate the "innovative personality".

This questionnaire consists of items about e. g.

- the structure of resistance against change,
- the kind of departments with great number of proposals for change,
- the extent of participation of the management while the process of change,
- the development of typical situations of resistance,
- the development of strategies to overcome this resistance,
- a listing of characteristics of the "innovative personality",
- a listing of typical tasks for this "innovative personality".

These results were analyzed with newer scientific concepts: as hypothetical-intuitive classification of innovation-relevant ability dimensions is made with the empirically determined behavioral demands. From this, hypotheses are generated to evaluate the "innovative personality", predictors are chosen and constructed. Resulting from this, a method to recruit "innovation-competent" managers is introduced and used to validate the predictors and to test the hypotheses.

Now we turn to the second of the major consequences which were announced at the beginning of the chapter: *Not only the individual is important for innovations!*

Organizational psychologists should promote the formation of situational conditions that lead with a higher chance to innovations (Gebert, 1979; Meißner, 1989). Such conditions are among others (von Rosenstiel, 1989):

- high complexity of tasks,
- exchange of information within the organizations,
- intensity and frequency of external contacts,
- decentralization of decisions,
- low standardization of procedures.

These and similar structural conditions offer chances for development to persons ready to and capable of innovations. They enable such persons to decide to be a member of the organization and to continue the membership.

The interaction between the individual and organizations can be discussed in a system view. This point of view was offered by Kaspar (1993, see p. 106ff.).

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Innovation processes in self-organizing and self-reproducing social systems

Helmut Kasper

University of Economics and Business Administration, Vienna, Austria

Introduction

The following aspects deal with theoretical considerations on the role of actors in organizations from the perspective of the self-referential system theory. The focus of the self-referential system theory centers around the "Eigenleben" of operatively closed systems, that is the creation of social reality on self-organizing processes. Up to now starting points for research of high performance in organizations were intended innovations of actors. This group of innovations is only of minor significance in the actual organizing process, though it dominated research in the past and has been overvalued by researchers. In contrast, I hold the view that the majority of innovations in organizations "occurs" without being intended or justified by actors. It is time to introduce these particular processes into innovation research and to define the roles of actors by means of this concept.

Self-organizing in Social Systems and Self-reference of Social Systems

How does self-organizing come about in social systems? Self-organizing evolves from the mere fact that actions within a system are set and observed simultaneously. At any given moment, observations draw any number of impacts within a social system. These impacts can be defined as any noticeable or perceivable form of reaction (actions, omissions, words, and even failures). Self-organization of the system is a process that 'happens'. Events take place that are observed in the system. If this conversion in the system is operatively effective, that means there is a reaction to the observation, a self-organization of the system arises. Action and observation merge.

Complex social systems are active and observe their own activity. Complex social systems reproduce their unit, structures and elements in a continuous manner and in an operatively closed process with the aid of the elements that they consist of. Every system controls its recurring reality assumptions in this manner through observation of its observations (Willke, 1987, p. 6). Self-referential social systems are - simply defined - systems, in which "elements that they consist of reproduce with the help of other elements that they consist of and through this reproduction process set borders with the environment" (Luhmann, 1984, p. 58). The main importance of self-reference is that social systems can only carry out their self-reproduction with the aid of diverse forms of self-reference. Included here are also self-observations and self-descriptions. In order to manage its own advance, the social system works out descriptions of itself from itself. Self-reference is, in fact, the only way a social system can handle the complexity of the environment. In order to cope with the complexity of the environment, social systems use these self-referenced simplified (self)observations.

In the course of time, expectations are developed which take on the appearance of structures. All processes that proved successful in the past become effective with regard to such structures. Here we must remember that successful is not to be mistaken for efficient. It must be

emphasized: Not only what is said and done builds a structure, but also what is perceived and stored.

Social Systems are Collections of Communications

Social systems are not to be considered collections of people but collections of communications. Thus processing of communications is the central point of our observances. We cannot observe communications directly but can include them in our observances. Adding communications to actions takes place through social descriptions with the aid of schemes of differences. Only if observations in social systems are operatively effective do they become part of the social systems. This can take place solely in social systems through communications and according to the rules of the social system in question. Observations that are not communicated, play no role in the social system.

An example: Without people there are no social systems, without such systems there is no cooperation between persons. Only the action but not the person himself or herself is part of the organizing process. The inquiry of the sales manager in the EDP department, his or her expectations of the subordinated employee etc. but not for example his/her psychic dispositions or extra-organizational interest and commitments compete with the changes within the company (Exner, Königswieser, & Titscher, 1987).

It is typical for self-organizing processes (and therefore also for innovations and changes) that articulating the desire for organizational change is neither a prerequisite nor a requirement for changes. The concept of self-organization starts one stage earlier, namely with what is observed and perceived within a system and leads to consequences later on.

At present it is important to make people aware of these self-organizing processes. Contradictory expectations are ideal to start with. The emergence of contradictory expectations triggers the desire for resolution within the system and offers the acting managers an excellent opportunity to discuss and to debate the situation and to remove it from self-organization. More important than clarifications and/or formulations or desired changes by the actors is what will happen in the system down the road.

According to the theory of self-referential systems we have to expect that everything that is set by actors is subsequently completed with meaning, interpretations and reasons (selection process).

Verbalized changes are also completed expediently and meaningfully in the course of the so-called selecting process and are also subject to modifications. But that does not mean a completion of the process of change. An end occurs when the system remembers the new expectations of expectations. All that, in turn, occurs when the changes become part of the organization's memory in the course of the so-called retention process and when they thus have the chance to obtain a structure-forming value on a behavioral level as well.

Breakdown of the Processes of Selection

The connections in figure 1 can be presented as follows: Enacting/carrying out change is being dealt with. Points are interpreted, explained, debated, discussed, but an agreement need not be reached (1). The products gained in this process of selection (=the negotiated explanations, interpretations, etc.) may end up in the semantic retention of the social systems and thus be generalized. These products can only be deemed stored, if the system remembers them in future situations. We speak of them as stored if a social system in future self-organizations or selection processes recurs or this should, could or even would have to take place. If this is the true, in the end these stored contents flow in self-organizing processes and in the process gain tangible structural value. In other words: Whether the original negotiation of

changes gains structural value in the end, meaning if it is suitable to form expectations, cannot be determined until afterwards. The situation and the means used in convincing are the decisive factors. One of the most important means of persuasion (but not the sole means) is semantics.

Let's return to semantic storage: Whatever is once admitted to the semantic storage becomes semantic structure and belongs to the memory of a social system. The contents of the storage need not be logical in consistency. Precisely the opposite is true: There are many indications that semantic storage is full of inconsistencies, unclarified points, half measures and ambivalencies.

Figure 1 shows the model of self-organizing processes in complex social systems (Kasper, 1990, p. 350).

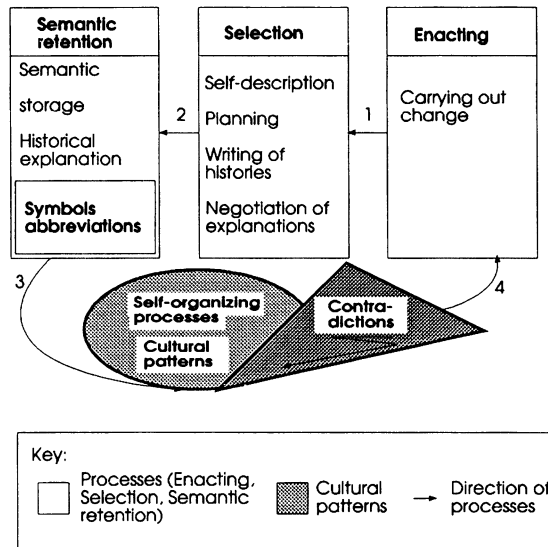


Figure 1: Self-organizing process

A system can refer to stored interpretations of actions. In this way a system can recall matter in storage in self-organized processes without explicit speech. The supposition that these stored interpretations can be referred to and even have to be referred to if needed suffices. Thus self description flows via the detour of semantic storage (2) into the self organization (3) of a system. Self-organizing processes can lead to negotiations of change (4) so that the cycle begins all over again.

Innovations through the process of selection

Basically three forms of innovations are imaginable (Kasper, 1990).

1. Alteration action (formations) that result from self-organizing processes is sprinkled with old semantics (Figure 2).

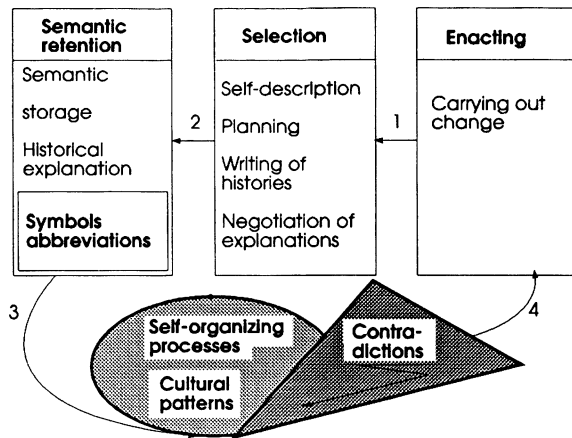


Figure 2: Giving of meaning trusts semantic memory

If innovations occur, but the new is mixed with old semantics, this has no effect on the direction of processes or future expectations. The "old" semantics remain. By "readjusting", adapting, or cancelling an innovation that has taken place, the innovative character is undermined and reduced. The innovation was merely ephemeral, a sudden blossoming that disappears again without leaving any traces.

The cultural parts of the semantic retention, symbolic abbreviations (the shaded parts in Figure 2) experience the least number of situational limitations. The selection process is rapidly shortened by them. They are altered less strongly than other elements of semantic retention in the course of selection processes. On the level of semantics it is mainly symbolic abbreviations such as statements of expectations, concepts of duty, references to habits, normalities and customs, and on the level of tangible behavior-myths, rituals, customary matters of course etc. (Kasper, 1987) that have taken their place on the level of expectations (Luhmann, 1984, p. 416).

2. Actions leading to alterations (structures) that have resulted from self-organizing processes are borne in mind with new semantics (Figure 3).

In this case an innovation is not seen in the old light but modelled by means of new semantics. These new semantics can only be brought into the system in a credible way from outside (environment/persons) in the course of the selection processes. There are chances for a lasting genuine innovation and here too the system has to continue to remember them later as well.

3. Carrying out of change is to be effected on the basis of new self descriptions. In this case change is attempted to be carried out without taking into consideration, for the time being, the self-organizing processes. The attempt is made to introduce innovations that have already been made successfully elsewhere or statements about wishes and expectations referring to innovative actions in the system are brought in. Extensive managerial innovation research has up to now more or less solely concentrated of this type of innovation. The cognitive interest has been limited to questions concerning how workers are to be motivated to be innovative and/or how they can effectively be convinced of the necessity of innovative behavior (and actions). What the memory (semantic and determinants of behavior) of this system (retention) already has

accessible is not considered. In this connections, operations were only carried out on the semantic level.

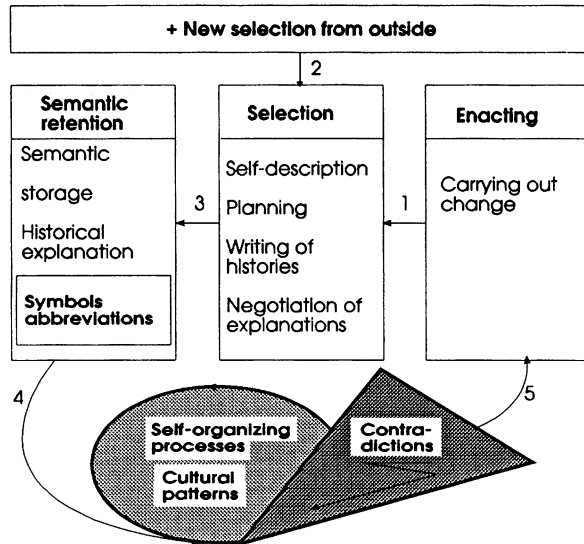


Figure 3: Giving of meaning mistrusts semantic memory

That would be then a so-called conformed deviation (Luhmann, 1984), an allowed innovation, a type of amendment to a law. This new self description remains merely a single event, unless it reaches the semantic retention of the social system and thus in the end makes expectation and structural formations possible. A change can indeed be ordered and created. But if the system no longer calls it to mind (or is willing to call it to mind) on one of the upcoming occasions, this was simply an individual new act.

In any case the essential point is that the result of the process of selection is capable of being placed in the semantic retention. That means that the expectation must be communicated and that the stored matter must also be recalled later. Even just the possibility of being able and having to refer to such semantics in principal (for example in organizational charts that have been stashed away, which can/must then be pulled out in a dispute) suffices. An innovation has not taken place in earnest until it lands in the semantic retention and thus stands the chance in future of being used for directional purposes in self-organizing processes or in selection processes.

Implications for Management

Following this approach leads to the implications listed below for management of the innovation process and thus for the creation of high capabilities:

- Structural changes are important:

It is essential that innovations be built into the structure of expectations and that the system

use these altered expectations of expectations in future.

– Self organizing processes are of fundamental importance:

The starting point for lasting innovations are self-organizing processes, during which old structures are used as a basis for new ones or simply remodeled.

– Intended innovations are first of all only descriptions:

Innovations are, in the first instance, only requests, which have to become self descriptions of the system. They do not last very long (preliminary innovations) if it is not possible to pull them out of the semantic storage and thus form self-organizing processes.

The question arises once more of the possibilities and necessary steps to such semantic storage. That means precisely: How can changes be made attractive to co-workers? How can they be persuaded either to make a change or not to make a change? How can their personal resistance against alterations be prevented or how can they be motivated? The relationship seems to be extremely plausible: The more unknown such a permitted change turns out to be, the greater the likelihood, that it will remain a single event and therefore without any impact.

The chances of a change entering the self-organizing processes by means of the semantic storage appear slight. Micro-policy and culture patterns play a relatively important role.

The subsegment treatment (interpretation) / reasoning / evaluation (assessment) of opinions according to changes that occur during selection processes are of crucial importance. Thus processes and routines are to be analyzed retrospectively even more than they have been up to now. Briefly stated: The "beginning" of processes of change can be traced back further into the past in this way. Up to this point such "beginnings" have not been consciously processed. The following is an example of this idea: Not only the decision about the introduction of a computer system should be observed, controlled, checked and prepared, but also what takes place afterwards. We should consider how the actors deal with the computer facilities in the organizations in question, provided the facilities are used at all, or whether the computer system is used for the purpose it was bought for or not.

Expectations are not to be seen as something definite with their contents concretely defined. Instead, expectations provide an array of possibilities. They can exclude specific alternatives, thus defining what is allowed in an indirect way, in the sense of "Anything that is not forbidden is allowed."

For management it is important to locate every aspect of an innovation process. Managers have to focus on the creation of potential for reflection in the whole system. At the same time the content of the reflection should not be determined. The main goal is to motivate the system, to observe itself in a better and permanent way (= increased self-description). It is crucial to differentiate more strongly between acting and observing by means of self-observation and thus in turn to get a better grip on innovative processes.

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Communication rather than inspiration and perspiration?

On performance requirements in highly qualified occupations

Heinz Schuler

University of Hohenheim, Hohenheim, Germany

The title of this report is chosen in honor of T. A. Edison who, in response to the inquiry what makes up a genius, is said to have answered "Genius is made up by one per cent of inspiration and ninety-nine per cent of perspiration".

We can take this as a kind of performance theory, telling us that

1. cognitive abilities or processes,
2. effort, hard work, persistence

contribute to performance or to occupational success; and: Effort is more important than creativity. This does not go without saying, as Edison did not mean performance of the the Sisyphos-type, but tasks like bulb invention.

My question - or hypothesis - is now: Shouldn't we add a third factor to inspiration and perspiration - the ability and willingness to cooperate with others, here called communication for the sake of linguistic correspondence. This hypothesis is based on the presumption or fore-knowledge that even very high-standing or innovating achievements require information from others, discussion with others, stimulation by others, in some cases even opposition from others. Thus, the development of ideas requires their creators to talk, to ask, to listen, to behave in an agreeable manner, and to convince or dominate. In other words, it is suggested that somebody's ideas just cannot be so brilliant that they could compensate a striking deficit of social competences - under contemporary working conditions and performance criteria (which actually may have changed since Edison's times). So non-cognitive personality traits are assumed to play an important role in facilitating intellectual functioning and social skills to be crucial for effective performance in several stages of complex tasks.

An empirical study was conducted to test this hypothesis. 155 engineers and applied scientists from the Research and Development (R&D) units of seven German high-technology companies served as subjects. Their mean age was 35 years. Two thirds of them worked on a technical level, one third were first level supervisors. 150 of the 155 persons were male. The subjects belonged to a wide variety of departments and research units within the participating firms; concentrations were in car construction, chemical engineering, communication engineering, and high frequency engineering. In detail, this study is reported by Schuler, Funke, Moser, and Donat (in press).

The first step consisted in the development of a standardized job analysis instrument. It included two levels of analysis, 1) a task and behavior approach leading to the construction of work samples and simulations, and 2) as an attribute approach, a matrix of corresponding task-attribute ratings delivered the most relevant traits for the assignment of construct-oriented tests.

The resulting job analysis instrument consisted of 217 items which can be grouped into 13

consistent and interpretable factors. These task dimensions are given in table 1, together with their mean importance as rated by job incumbants and supervisors.

Table 1: Task dimensions and their importance

Task dimensions	Mean importance ratings
Management	1.96
Solving Complex Problems	3.34
Presentation	1.78
Consulting Customers	2.00
Experimenting and Testing	2.67
Technical Communication	3.26
Technical Service	1.93
Formal Analysis	2.26
Innovation	2.98
Workplace Organization	2.14
Purchasing and Coordination	2.23
Cooperation with Supervisor	3.41
Interdisciplinary Contacts	2.32

Note: Importance of task requirements was rated on a six point scale; 0 = does not apply, 1 = low importance, 5 = high importance

These importance ratings already demonstrate that communication and cooperation belong to the most highly valued requirements in R&D. For separating homogeneous groups of jobs ("job families") according to the importance of requirements, a cluster analysis was calculated which resulted in the six groups or job families Consulting, Testing, Technical Service, Applied Research, Development, and Construction. The formation of job families by cluster analysis allows for classification of job applicants and for improved validity generalization within these clusters.

The results of job analysis served as a basis of deriving predictors as well as criteria. As the question "What shall be predicted" logically precedes the question "How can it be predicted", criteria have to be described first. There is a big variety of possible classifications of criteria. Distinction of results, behaviors, and traits has proved an especially fertile one. Each one of these levels of measurement is characterized by special qualities - advantages and weaknesses (Schuler, 1989). So it seemed useful to represent them all in performance appraisal. Among the 28 rated abilities/traits were Verbal Abilities, Concentration, Memory, Open-Mindedness, and Conscientiousness. For the 16 behavior/knowledge ratings Behaviorally Anchored Rating Scales (Smith & Kendall, 1963) were constructed, including items like Scientific-Technical Knowledge, Analyzing and Testing, and Interdisciplinary Cooperation. Among the 9 output-dimensions at the results-level were Number of Ideas, Patents, Public Reactions, and Efficiency. Performance appraisal was done by the engineers themselves and by their supervisors. Rating instructions were to evaluate performance of the last 12 months. Retest-reliabilities for the different types of scales were between $r=.60$ and $.70$, the combined value for the total of 53 single scales came up to $r=.92$. For validation, only the data taking supervisory ratings as criteria are reported.

As predictors of performance, two groups of instruments were developed - simulations or work samples and tests. Most simulations were tasks which are common in assessment centers, including individual work samples, role plays, and a group discussion. In addition to conventional

assessment methods, a computer-based simulation was included to measure complex problem solving, tasks simulating typical R&D problems, and a highly structured interview containing biographical and situational questions.

Additionally, a personality test was constructed or adapted, representing the most relevant personality dimensions as derived from job analysis. Six of these dimensions turned out to be sufficiently homogeneous for further analysis. 10 measures of cognitive ability corresponded to the respective job dimensions. In table 2, simulations are listed completely together with the corresponding task dimensions. For cognitive tests and personality tests, a selection of those showing significant validity will be given when validity coefficients are reported.

Table 2: Simulations corresponding to task dimensions

Task Dimensions	Simulations
Innovation	} Interview
Cooperation with Supervisor	
Management	
Technical Communication	} Group Discussion
Interdisciplinary Contacts	
Workplace Organization	} In-Basket
Purchasing and Coordination	
Solving Complex Problems	} PC-Simulation
Experimenting and Testing	
Formal Analyses	Formal Analyses Tasks
Presentation	Presentation
Consulting Customers	Role Play
Technical Service	(not included)

In the context of a one-day assessment center, tests and simulations/work samples were applied to the sample of 155 scientists and engineers in groups of three to seven persons. Assessors were three to six trained organizational psychologists. For 140 of these persons, performance appraisals could be collected from their supervisors as validation criteria. This way, the investigation has the character of a concurrent validation study.

For validation, a combined performance score can be used, but there is also sense in using the best-fitting single criterion scale or, for reasons of reliability, a combination of several relevant dimensions. These problems are discussed and detailed results are reported in Schuler *et al.* (in press). Here, only a small selection of results can be offered. Table 3 gives a compilation of uncorrected validity coefficients for the most valid cognitive tests and personality tests, and for all of the work samples or simulations. In all cases, the most highly aggregated performance

score (supervisory ratings) is taken as criterion. For specific criteria, higher coefficients were calculated in average.

Table 3: Validity of several tests and work samples and total score

Predictor	validity for total group n=140	validity for ≥ 2 years of coop.; n=88
<u>Intelligence/Creativity Tests</u>		
Concentration	.14	.20
Ideational Fluency	.15	.22
Semantic Redefinition	.14	.22
Creativity (aggregated score)	.21	.28
General Intelligence (aggregated score)	.19	.27
<u>Personality Tests</u>		
Self Confidence	.39	.44
Achievement Motivation	.30	.38
Dominance	.43	.41
<u>Simulations</u>		
Interview	.33	.51
PC-Simulation	.08	.18
In-Basket	.25	.38
Role Play	.32	.39
Presentation	.30	.42
Group Discussion	.28	.36

As expected, the values in Table 3 demonstrate that personality tests and interactive simulation measures turn out to be better predictors of occupational performance than cognitive tests, even when several subtests are combined to a creativity or intelligence score (as opposed to single measures for the other assessment tools). Concerning the criteria, however, we were suspicious about data quality as several of the supervisors declared themselves hardly able to assess their subordinates' performance correctly. A closer inspection of the data revealed the existence of two moderators of predictor validity. The first one is the time of acquaintance between supervisor and subordinate, the second one the importance of task dimensions.

Concerning the first one of these moderators, an approximately linear relationship between time of cooperation and validity of predictors was found. This relationship holds for 22 out of 24 predictors and thus may be seen as rather reliable. Especially, a period of cooperation below two years leads to low validity coefficients - presumably because of insufficient criterion quality. If we take only those pairs of supervisors - subordinates as a basis of validity calculation who work together for at least two years, validity coefficients show substantially higher values, as can be seen in the second row of Table 3.

Roughly the same picture is shown when only those dimensions of task requirements are taken into account that were rated as important for the respective job. In combination, these two moderator effects even lead to quite uncommonly high validity estimates - but as the number of cases at the same time is highly restricted by this double contingency, these data are not reported here.

Also for data that are restricted to cases of sufficient criterion quality, the effect holds that measures of social skills and of temperament traits are superior to most cognitive measures and that, overall, interactive measures (role plays, group discussion, structured interview) are more valid than conventional psychological tests, although a kind of ceiling effect for some of the coefficients can be expected caused by only moderate predictor reliabilities. This result seems to be in opposition to meta-analytical findings that general intelligence is not only a positive predictor for all occupations, but that it turned out to be of higher predictive validity for more demanding jobs (Hunter & Hunter, 1984). In our case, we have to take into account a stricter - although, unfortunately, unknown - preselection for intelligence than for other relevant traits and competencies by the educational system and by the organizations, including self-selection. Consequently, also a meta-analysis of older validity studies for scientific and parascientific occupations resulted in higher validities for personality tests than for intelligence tests (Funke, Krauss, Schuler, & Stapf, 1987); simulation measures of social skills were not yet included in these studies.

Having found this effect, some older data can be viewed in a new light: When inspecting data from Dörner's Lohhausen experiment, a famous study on complex thinking (Dörner, Kreuzig, Reither, & Stäudel, 1983), it can be found that subjects' results were not correlated with intelligence tests. Instead, they are correlated with a test called Questionnaire for Cognitive Process Variables. This sounds quite cognitive. But when items are inspected somewhat closer, the formulations read like "My thoughts tend to digress" or "Problems tend to be too much for me". Feelings like these actually should inhibit cognitive processes, but they do not represent cognitive measures themselves!

Correspondingly, this variable is positively correlated to Neuroticism, negatively to Extraversion, and virtually by $r = .74$ to Self-Esteem. Dörner himself never seemed to give much weight to these results and held to his conception of complex problem solving as a successor of structuralist intelligence research. But in the light of the results presented here, Dörner's data actually confirm the hypotheses stated at the beginning - interpreted, of course, in the light of today's working and selection conditions:

Creative performance comes from inspiration to a small amount, from perspiration to a moderate amount, and to a high amount from self confidence and social skills.

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IV. DEVELOPMENT OF GIFTEDNESS AND TALENT

Introduction

In her review article, Brigitte Rollett first discusses the various research approaches to personality development in the gifted. In the author's opinion, the lack of interdisciplinarity of developmental results is a research deficit, i.e. the neurophysiological vs. cognitive approach or the biological vs. the learning theory approach. Franz Mönks and Christiane Spiel summarize the results of the symposium "Development of giftedness in a life-span perspective". The idea that studying the developmental career of the gifted beyond childhood and adolescence could be rewarding has only become popular in the last decade, although the thought has older roots. The theoretical basis of more recent developmental studies in the life-span perspective is the Baltes and Schaie seven-component model initially presented in 1973 and modified since then numerous times.

Three developmental studies follow which focus on various contents and age levels. The follow-up study by Christiane Spiel and Ulrike Sirsch analyzes the stability or instability of giftedness in the developmental process from early childhood to early adolescence. Four different cognitive developmental profiles were identified and discussed with regard to test theory and educational measures. In the follow-up study by Aysenur Vontar, developmental changes in the creative thinking of 11- to 18-year-old Turkish students were measured. The Torrance Test of Creative Thinking (TTCT) was employed over a time period of seven years, and retest reliabilities of .53 to .70 were obtained. The well-known decline effect in creativity development was also seen here, although in contrast to the linear decline of measured creative potential in the American TTCT standardization sample, a non-linear developmental curve was

found in the Turkish youths: After TTCT scores increased to the age of 15 years, a decline followed during senior high school. In addition, various developmental curves were found with regard to individual creativity factors (fluency, flexibility, originality, elaboration). Hans Günther Bastian made use not of test data but rather of narrative interviews in his biographical study of national winners of a competition in music. Although the winners studied here were instrumentalists, Bastian comes to the conclusion that musical talent is a multifaceted phenomenon. All of the cases interviewed emphasized the importance of early childhood experiences and impulses. At the same time, they denied - as is frequently assumed - that they had been viewed as child prodigies. This observation about young gifted individuals is also frequently made in other contexts, e. g. among participants of accelerated school programs for the gifted or summer courses. This may, of course, reflect the young people's great desire to avoid the conflict between academic achievement motivation and social exclusion (by peers). It is also possibly a reaction to social conformity pressures, i. e. to (appear to) be unexceptional or average.

Finally, Herbert J. Walberg *et al.* attempt to take the data from the Terman study and analyze it according to Walberg's educational productivity model using modern multivariate statistical methods. Thus, the attempt is made to throw new light on the data based on contemporary theoretical insights in the development of giftedness. Using somewhat new variable divisions (e. g. relatively fixed vs. alterable conditions), the effect of early socialization conditions on later development were to be determined. This could only be partially realized. The authors do, however, report a number of valuable detailed results which should be useful for future longitudinal studies, especially those with a life-span perspective.

Development of high ability

Brigitte Rollett

Institute of Psychology, University of Vienna, Vienna, Austria

In spite of the fact that the development of higher ability and giftedness has now been studied intensively for almost a century, there is still a broad range of questions that has yet to be investigated: foremost amongst these are the causes for the highly gifted individual's exceptionally efficient ways of information processing. Although the relative importance of nature versus nurture has been studied in detail, the neurophysiological basis of cognitive and personality development, and the interaction of the factors pertaining to these, have been more or less ignored.

A possible exception is the recent, still highly speculative debate on left brain/right brain functions and their relationship to forms of giftedness. The crucial question is: how does the gifted mind work and develop and how does this translate into neuropsychological findings pertaining to the optimal development and functioning of the neural system?

Some aspects of the neuropsychological bases of expert information processing

The cerebral cortex is routinely excited by all new and unexpected stimuli, in other words, by stimuli that have low subjective probability and are thus highly informative, but this excitation occurs only as long as they are considered to be novel. To counteract an overloading of the processing and storing capacities of the brain, repetition of the same information causes the cortical response to disappear almost completely, a process known as habituation. The ability to habituate quickly is therefore an early sign of giftedness, since it shows superior processing faculties. When habituation sets in, the information of these particular stimuli is no longer transmitted and processed by the nervous system, either because it is considered unimportant or because it has already been stored.

Since this subsiding of transmission happens to all stimuli, irrespective of their importance, a second process, sensitization, counteracts this: When a stimulus or a set of stimuli excites either the reward or the punishment area of the limbic system, thus indicating that the sensory experience is of consequence to the well-being of the organism, repetition leads to a steady increase in the readiness for synaptic transmission and in cortical response and thus to the creating of strong memory traces (Guyton, 1991).

Deciding whether an item of information is relevant is therefore primarily an emotional process, involving the limbic system of the brain. These same processes are the origin of selective attention and of the selective processing of information and as a consequence, of higher order information processing (Rollett, 1984, 1993). This is the reason why motivation plays such an important role in realizing the promise of early signs of giftedness.

Children who were later identified as gifted often show interest in their environment at a very early age (Rollett, 1989). Even as newborn infants, they are "efficient orienters", as Stapf and Stapf (1988) established in an investigation of 51 gifted children. The orienting reaction is an indicator of the child's readiness to learn from his or her environment. This active information-seeking behavior is optimal in furthering the development of the functional units of the brain.

To begin with, any stimuli that elicit an emotional response automatically are considered to

be important and cause the individual to store them. In the long run, this leads to the formation of a range of valid working models of the environment. It can be assumed that sensitization is possible through feedback loops in the hippocampus, which causes information labelled as relevant to be rehearsed and thus included in the existing knowledge base of the individual by comparing it with the information already in the storage systems of the brain.

Similar information units cause the existing knowledge units to be strengthened, dissimilar ones may either weaken them or lead to conflicting information in the individual's memory system. These conflicts can be resolved by differentiating and restructuring the knowledge base, another accomplishment in which gifted persons are more expert. Klauer developed very efficient training programs of cognitive thinking skills for children, inducing them consciously to observe similarities and dissimilarities when solving problems (Klauer, 1987, 1990, 1991).

Giftedness as expert information processing

One of the basic observations made when comparing efficient learners with their less able peers is that the former seem to be better able to identify relevant information and to concentrate on processing it rather than unimportant data.

A general theory of giftedness must therefore include a theory of expert construction and handling of relevant information (Kraak, 1991).

The definition of giftedness is still somewhat contentious in literature (Freeman, 1986, 1993; Heller, 1989; Horowitz & O'Brien, 1985; Passow, 1989). However, clear-cut diagnoses of giftedness, which might form the prerequisite for a selective early stimulation of exceptionally competent infants, are only possible once we can proceed from exact definitions of giftedness. Sternberg and Davidson (1986) identified no fewer than 17 concepts of giftedness, which are connected with one another in specific ways, but differ as regards fundamental features. In their own approach they accorded "insight", a particularly efficient form of processing information and solving problems first described by Wertheimer (1945), central importance in their definition of intellectual giftedness (Davidson & Sternberg, 1984; Sternberg, 1985). Important aspects are 1. *selective encoding* (differentiating important aspects of a problem from unimportant ones), 2. *selective combination* (efficient fusing of isolated facts, structuring them in such a way as to be helpful in solving the problem at hand), and 3. *selective comparison* (comparing new insights with previous knowledge about the problem and developing higher-order structures) (Davidson & Sternberg, 1984).

We therefore want to define giftedness as the ability expertly to identify, construct, process and handle relevant information in one or more culturally defined fields of action, calling for "multiple intelligences" (H. Gardner, 1983) as a necessary (but not sufficient) prerequisite of expert performance. Renzulli's classic model of giftedness further elaborates this by drawing attention to the role creativity (the ability to produce relevant new ideas) and task commitment (willingness to work towards high accomplishment) play in attaining superior results.

Indications of exceptional ability

It is not surprising that novelty preference is a better predictor of cognitive development between the ages of 2 and 6 years than the parents' educational level, as Rose and Wallace (1985) showed in a longitudinal study of the cognitive functioning of preschool children. Rheingold (1985) even defined mental development as the process of transforming the novel into the familiar.

In their famous book "The Mind and its Brain", Popper and Eccles proposed the theory that high-quality information processing during the first year of life makes for more efficient brain

functioning and, consequently, higher ability in later life, since most of the cells are built into the cerebral cortex after the child is born. The amount of cells and their inter-relations in the cortex are a result of stimulating experiences in the first years of life, including early playful language training. In the course of this interaction with the environment, the brain develops as an "organon", a tool.

Highly gifted children need less time to react to and process new information and they are keen to do so. As most functions of the cerebral cortex only develop after birth in response to stimulation by the environment (Geschwind, 1980), this interest in novelty brings about a significant leap forward in the child's development, one which can, of course, be increased if the child's persons of reference know how to play with him or her in a stimulating way and to encourage it (Carew, 1976, 1977).

Lewis, Jaskir, and Enright (1986) tested over 150 children at 3 months, 12 months and 24 months with the Bayley-Scales of mental development and with the Stanford-Binet at 36 months; the relationships of the various skills were described by means of a path-model. Social attention proved to be an important early characteristic, determining lexical skills at 24 months (.22) and Stanford-Binet results at 36 months (.28), which in turn were to some degree supported by imitative skills (.16) and verbal skills (.19) at 12 months. Imitation at 12 months led to imitation at 24 months (.21) and measured intelligence at 36 months (.30). Social attention and imitation therefore seem to be crucial symptoms of later intellectual performance. Auditory production at 3 months had a small but significant influence on verbal skills at age one (.18), which determined verbal-symbolic achievement at 24 months. This faculty had a major influence (0.46) on intelligence measured a year later. Early mastery of the symbolic nature of language seems to be a milestone in intellectual giftedness.

In his "Three Worlds Theory", Popper (1979, 1980, p. 144) describes the development of the mind as an interactive process, inducing the individual to build up its own World Two (the subjective psychological world) by reacting to World One (the physical world of objects and their relations) and World Three (the world of culture). Gifted individuals are better equipped to make the most of this interactions with their environment (Rost, 1993).

Degree of lateralization of cerebral functions and giftedness

The general interpretative or Wernicke's area in the brain plays the most important role in the development of language and the handling of meaningful information in general. Consciousness and self-awareness are mediated through this area. Thus, it represents the core of the personality and its development.

In more than half of all newborn babies this area is about 50% larger in the left hemisphere (Guyton, 1991; Niebergall & Renschmidt, 1981). Activation of Wernicke's area makes it possible to decode speech patterns and recall complicated memory patterns that may involve a range of different memory modalities stored elsewhere in the brain, interpreting, reorganizing and augmenting them when dealing with basically familiar problems or finding ways to solve new ones.

As one hemisphere, usually the left one, is principally used when processing new information, it gains dominance over the other hemisphere, becoming more and more expert in dealing with new learning experiences and their results. This process of lateralization leads to an efficient division of labour between the two hemispheres (Sperry, 1974): With most people, the left hemisphere is devoted to the processing of language and numbers and the development of the writing and reading centers, while the right hemisphere is dedicated to spatial orientation and construction, the processing of pictorial and colour information, music and the understanding and interpreting of higher order emotions.

An interesting demonstration of the different types of messages processed by the two hemispheres is provided by the well-known Stroop-effect: When the names of colours are written using the appropriate coloured ink (red for red, blue for blue, etc.), the time necessary to read them is significantly shorter in comparison with reading a list printed in different colours (the word blue written in red ink etc.). The reason for this is that the written names are decoded in the reading center in the gyrus angularis of the dominant hemisphere, while the colours are decoded in the contralateral hemisphere, thus producing clashing messages that have to be reorganized.

Gifted individuals not only show a higher degree of lateralization and, in consequence, specialization of the two hemispheres, but are also more proficient in integrating the messages of the "two brains".

Early signs of giftedness and their impact on family life

Gifted children often have a higher weight at birth, learn to walk earlier and are more interested in social activities (Sirsch & Spiel, 1992; Stapf, 1983). Generally speaking, the so-called "learning processes contingent on development", as I would like to term them, i. e. the learning processes connected with and indispensable to promoting a specific stage of development, occur earlier. Linguistically gifted children learn to speak earlier and evince sooner than others the first signs of judgement independent of adults in the form of criticism.

Very often highly gifted children require less sleep than other infants, can occupy themselves earlier for lengthy periods of time (admittedly, only if they have been given an upbringing that encourages independence) and attract attention by virtue of their thirst for knowledge and their interest in the independent acquisition of competence. At an early age they know how to differentiate relevant things from less important ones and delight in new insights. However, as Stapf and Stapf (1988) have established, for this reason they are more easily disturbed than other children and react negatively to noise and disorder in the household.

Should the family situation be adverse, these very attributes can set a negative development in motion (Webb, Meckstroth & Tolan, 1985). If the parents are too much caught up with themselves and their own problems, are pressed by time, demonstrate little educational competence or reject the child, to list just a few possible causes, they will feel that the child's intelligence is a strain on them.

In a study conducted by Deimann and Kastner-Koller (1992) on the causes of parental recourse to psychological counselling, in 6% (in contrast to the 1% or 2% expected) of the cases unrecognized intellectual giftedness on the part of the child was the reason for his or her problems.

It is interesting to study the types of problems which the gifted children's parents named (see table 1). Emotional problems play an important role, not few of them clearly induced by the parents themselves: "Smacking lips when eating", e. g., is surely an unusual type of problem for parents to seek professional help about.

Although normally most cases are presented to the counselling services at school age, problems with gifted children seem to appear already at nursery-school age. At the advisory centre for gifted children in Hamburg, up to 1988 21.5% of the clients were children aged 3-6, and at the advisory centre in Tübingen 20.5% belonged to this age group. 3/4 of those presented were boys (Stapf & Stapf, 1988, p. 89).

Need for intellectual stimulation

Intellectual stimulation of gifted children is a necessary prerequisite at all ages. At a mean age

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of about 8 years, we found a definite rise in interest in philosophical questions. The "philosophy for children" - movement capitalizes on this, providing children with challenging programs to develop their critical thinking, their understanding of reality, the fallacies of naive realism and other issues.

Table 1: Types of problems named by parents of gifted children

Age	Sex	IQ	Test	Problem
5	m	VT 130 HT 137,5	HAWIVA	Kindergarten or school?
6	m	VT 137,5	HAWIVA	Difficulties adapting to peers in class, "loner", teacher doubts his readiness for school
7	m	138	HAWIK	Aggressiveness, hyperactivity, teacher of 1st grade had him transferred to preschool
8	m	130	AID	Aggressiveness, attention deficits
8	m	140	AID	Smacking lips when eating
9	f	130	AID	Mother thinks daughter is "hypersensitive"
10	m	130	AID	Demanding parents
10	m	140	PSB	Aggressiveness, sibling rivalry type of schooling to be chosen
13	m	130	PSB	Effort avoidance, over-protectiveness on the part of the mother

Developmentally, this stage is linked to the mastering of the Piagetian conservation tasks, the emergence of a reflective in contrast to an impulsive cognitive style and the first steps towards metacognition as a new intellectual tool. It is interesting to note that the mastery of these stages can be observed in EEG-data, as Stauder (1992) showed: he tested children who were either identified as Piagetian "conservers" or "non-conservers" and found a distinct and characteristic pattern of event-related potentials (ERP) in the gifted "conserver"-group.

Highly gifted children need not only a nurturing and encouraging, but also a stimulating, social environment to fulfill their potential and develop into emotionally and psychologically well-adjusted adults.

Adjustment of the gifted

Luther, Zigler and Goldstein (1992) studied a group of 51 12-15 year-old intellectually gifted, high-achieving youngsters (25 male, 26 female), a group of 30 undergraduates their equals on the cognitive level, and another group of 39 athletically gifted young people, and compared all of these with a control group of 47 adolescents of normal intelligence and the same age group.

The intellectually gifted group, as a whole, was more similar to the older group of students

and the athletically gifted group than to their own age group, which indicates that being "outstanding" is a characteristic which affects the lives of young people more than chronological age, and that intellectual maturity influences an individual's attitude towards life in general, and his social adjustment in particular.

Only the gifted girls had adjustment problems, which seemed to be culturally determined, since these difficulties could be explained in terms of "Horner's effect". They found it hard to solve the conflict between their need for social acceptance, on the one hand, and their striving for achievement, on the other. This is a typical US-American issue, since evidence of a "fear of success"-motivation is scarce in Europe. Rost and Hanses (1993) found no differences in self-concept between gifted and normal 4th graders.

Thus, it is not giftedness as such that causes problems in adjustment, but the reaction of the social environment to it.

Drawing on his experiences of working with gifted boys, Hebert (1991) listed 6 adjustment issues facing the gifted:

1. Image management
2. Self-inflicted pressure
3. Being labelled "different"
4. In the case of boys: the need for male bonding
5. Cultural expectations that have to be met
6. Gender role conflict

These points highlight the emotional problems and coping needs of gifted children in our society.

Time budget and giftedness

Since task involvement plays such an important role with regard to any exceptional achievement, time budgeting becomes a major consideration. The day has only a certain number of hours, but the things trainers and educators of the gifted urge them to do usually exceed their powers by far. A four year-old, mathematically and musically gifted boy once argued, when his parents were discussing another activity he should take up, "but I also want to have time to live!" Many talented and gifted youngsters give up their careers before they have really started, because they feel the work load to be too heavy.

When counselling parents, we often found that they insist on too broad a range of activities for the child to pursue, causing them to have no time for recreation or playing with friends. Since the development of creativity presupposes leisure, this tight time schedule can even endanger the evolution of the child's special abilities. Therefore a good guideline is to let the child decide which of the various activities he or she really enjoys and to discontinue those that do not meet this criterion.

Developing multiple intelligences

Howard Gardner (1983) formulated the theory of "multiple intelligences", which proceeds from the premise that the abilities to solve a problem competently in a specific field (e. g. music, art, different areas of science etc.) develop relatively independently of one another and lead to qualitatively different forms of intelligence. Even with 1 1/2 year-olds, for example, different gifts can be observed. The technically gifted "patterners" prefer playing with building blocks and other construction toys, whilst the linguistically gifted "dramatists" like playing with dolls at an early age (Shotwell, Wolf & Gardner, 1979) and thus develop different types of intelligence and learning-behavior (Spiel & Kubinger, 1988).

For this reason we have turned to a dynamic concept of giftedness today. Giftedness can only unfold if there is a beneficial interaction with the environment (Heller, 1986; Heller & Feldhusen, 1986). This is in keeping with the new theories of development, which, when explaining human behaviour, no longer proceed one-sidedly from a theory of heredity or, just as one-sidedly, from one of environment, but assume an interaction between both components. Inherent potential and a conducive environment must combine in the development of supreme achievement. After all, the word gift has the connotation of endowment.

If general and selective fostering is so important in the development of giftedness, the question as to the definition of the population of gifted children must be posed anew. In this context a study by Steffens (1989) is informative, which contains a new analysis of data from the study on giftedness initiated by Heller in Munich in 1985/86 (cf. Hany, 1987; Heller, 1992). To identify gifted children, the following 5 focuses of giftedness were differentiated in accordance with Heller's multidimensional model of giftedness:

- cognitive (intellectual) giftedness
- creative giftedness
- social competence
- psychomotoric giftedness and
- artistic giftedness.

A total of 6,815 boys and girls from the 9th form were assessed by their teachers as regards these features on a five-grade scale. It was prescribed that the best 5% of a category should receive the rating 1, the next 10% of the category the rating 2, the following 15% of the category 3 and the remaining test persons of the category 4. With the aid of the method of configuration analysis according to Lienert (cf. Krauth & Lienert, 1973) it was seen that about 2% of the students could be classified among at least the upper 30% in *all* six fields of giftedness. Steffens calls them the "universally gifted", i.e. they are students who possess a broad spectrum of giftedness. When we refer to "gifted" people in everyday life, we usually mean those who belong to this special group of the "universally gifted". So we ignore the fact that far more people have an exceptional focus of giftedness, which enables them to reach supreme achievement, but only in one specific field. As a subsequent career usually requires specialization in one area, the substantial group of "singularly gifted", as Steffens calls them, are at least just as interesting as the universally gifted. In the Munich longitudinal study the former comprised 1,337 boys and girls. This corresponds to not less than 20% of the overall sample. For pedagogical practice this result is of the greatest significance since, on the one hand, it shows that giftedness is much more widespread than has hitherto been assumed and, on the other, it compellingly suggests the necessity of selectively fostering special gifts within the kindergarten and school systems.

In infancy there are additional problems in identifying multiple gifts as the pace of development of the individual, relevant abilities and skills is very varied. Evidently, a law exists for the initial years of a person's life, which I would like to call the "Economy of Development": in certain periods development concentrates on a delimited area which makes major progress, whereas other fields have secondary importance. It can frequently be observed among one year-olds, for instance, that either language or motoricity experiences a special jump forward in development. After some time the neglected area catches up. This applies especially to gifted children. Evidently, the new experiences with learning in a specific field exercise such a fascination that children specialize in mastering it thoroughly. For this reason in the development test we often can observe surprising performances in one field at a certain point in time that can no longer be seen at another. Hence, in traditional development tests of gifted and talented infants, major differences can usually be noticed in the results for the individual dimensions tested. For this reason such tests are ill-suited to a psychometric assessment of giftedness or a

reliable forecast of future achievements, as Roedell, Jackson and Robinson (1989) of the Seattle project on giftedness have elaborated (cf. also Stapf, 1992). It is necessary to employ information from different tests, supplemented by long-term behavioural observations by parents and nursery-school teachers, to be able to make fairly safe judgements.

So it is a substantiated fact that at this age there are significant differences in the areas of giftedness in which children display unusual achievements, whereby the results are very variable. Only when a field remains fascinating for a child over a long period at time can further exceptional progress in achievement be observed that finds expression in consistently high test results.

Parent-child interaction: encouraging the gifted child

The way parents treat the child when solving problems together has proven to be of special significance to the development of cognitive competences. Parental interaction with the child when dealing with problems acts as it were as the "scaffolding" for the development of intelligent strategies to solve problems, as e. g. Brown, Palinscar and Armbruster (1986), Rogoff (1984) and Wertsch *et al.* (1980) have been able to prove. In the course of dealing with problems in conjunction with parents the child experiences more and more success in constructing its own solutions, thus developing its intellectual competences.

Shore and Dover (1987) have been able to demonstrate that there are characteristic differences between gifted and normal children as regards the use of metacognitive strategies. "Metacognition" refers to "thinking about thinking", i. e. rational deliberations about the best strategic employment of one's own competences and strategies to solve problems. Gifted children manage to guide and thus optimize their handling of problems through metacognition earlier and more systematically.

Moss and Strayer (1990) have conducted an informative study on this issue. 20 gifted children, whose Binet IQs were higher than 130, and 20 children with Binet IQs of between 100 and 120 were selected from a group of 150 3 1/2 - 4 1/2 year-old children. Further testing methods to assess their cognitive performance corroborated the excellent competences of the group of gifted children. The children's mothers were then requested to do with them three problem-solving tasks with differing degrees of difficulty: a jigsaw puzzle, a game with creative toys and free play with building blocks. The mothers were asked to help the children as much or as little as was necessary in their opinion to solve the task. The statements were recorded on video, typed and coded.

Highly interesting differences were seen between the group of gifted children and the control group. The gifted children used metacognitive strategies more frequently by emulating their mothers, on the one hand, and, on the other, developing the adopted strategies independently in a creative fashion. Frequently they only required short tips from their mothers to do the right thing. But the mothers, too, behaved in different ways. The mothers of the gifted children gave more helpful advice, which enabled the children to solve the task independently, whereas the mothers of the control group gave more direct instructions or offered the solution themselves; they also tended to reproach more. In contrast, the mothers of the gifted children used more praise and helped structure the process of solving the problem by pointing out to the child the desired final result. They encouraged the development of metacognitive strategies on the part of their children by predicting the consequences of certain actions and empathetically aiding self-monitoring in their endeavours to solve the problem and in their reality test, i. e. the control of the correctness of their actions and results. This led to the gifted children working towards their goal more efficiently, guiding in an intelligent fashion their own attempts to solve the problem and themselves controlling the adequacy of these attempts to reality. In other words, the mothers of the gifted children exhibited much more encouraging and productive behaviour,

which had the consequence that the children were able to utilize and expand their competences better. Of course, these strategies were of the kind that lead to good results and to the development of a child's own competences with children of *all* levels of ability, if the parents, nursery-school teachers and schoolteachers know how to use them.

As Moss and Strayer elaborate following Vygotsky's theory, metacognitive strategies are initially adopted by infants as a result of direct parental advice. The critical point for the child's future development is whether it remains dependent on parental assistance or is in a position to employ and expand these strategies on its own. Evidently, the mothers of the gifted children in the study were better able to guide their children towards independent and intelligent solutions.

It must be assumed that an important condition for stimulating pedagogical interaction with an infant consists in the educators being able to face the fact that naturally many new tasks cannot be solved right away by the child. Neither resignation, nor doing the task oneself, nor reproach are beneficial to development; quite the opposite is productive, so-called "helpful feedback" (cf. Rollett, 1991, p. 106), which in the long term develops the ability to find independent solutions. Mothers of gifted children seem better able spontaneously to employ these techniques.

This means, of course, that the disparity between the different ability groups will continue to grow, as the stimulated children can further develop their capabilities, whilst the others are increasingly disheartened or turn to other more satisfying activities.

Today we are progressing towards a "new educated elite", as I would like to term this trend. In modern society those people who have the good fortune to grow up in a friendly stimulating environment have the best opportunities of attaining personal and professional self-realization. For this reason public information about propitious and less propitious measures of education and stimulation is becoming all the more important.

Creativity and giftedness

Creativity, the ability to make unusual associations of ideas and find uncommon solutions, presents a special problem (cf. Urban, 1992). It is central to extraordinary achievement in many fields and to success in later life, but is rarely stimulated by parents and educators, not least because you have to be creative yourself in order to be able to recognize creative attainments as such and to react to them in a suitable way, that is, by developing the idea in a playful manner.

At the age of about four, most children make a "creativity jump". At this age language especially develops, but also the imagination and, with it, joy in new, surprising associations of thoughts and words, new word creations and creative, imaginative games. Depending on whether this development is fostered by the environment or dismissed a "nonsense", it can grow into a stable feature of character or merely atrophy.

In a retrospective study of successful Austrian authors, we asked them to describe their experiences in school, paying special attention to their grades in creative writing (Rollett & Schuller, 1988). 40% mentioned that their overall grades had been generally good, 38% that they had been in the middle range, but no less than 22% confessed to having been poor students at school. In creative writing, the picture naturally was more favourable, but even there their giftedness in the field had not shielded all of them from negative results: 9.4% had always received bad grades and 26.4% had only been considered c-students by their teachers. Felix Mitterer, a well-known Austrian author, told us e. g., that he wrote such imaginative and unusual essays in primary school that his teacher thought he had copied them out of a book, and severely reprimanded him. Another problem gifted writers have to face in school is the pressure to conform to what is regarded as "good" writing in the textbooks. Gustav Ernst, a world-famous

author we interviewed, confessed to having been perpetually puzzled: "I never knew what the teacher wanted to hear..."

Success in life and the importance of mentoring

Terman and Oden (1959, 1960, 1967) and Oden (1968) investigated the most successful 10% of the Terman longitudinal (which had originally started in the 20s with 1528 children, cf. Terman, 1925) study and compared them with the most gifted 10% who had had the least success in their lives. It turned out that there were significant differences between both groups. The less successful, for example, had as children not been aware of their special position. From this it can be inferred - something which also emerged from their reports - that they had not received from their parents and teachers any support commensurate with their gifts. Similarly, in their choice of profession they showed themselves to be not particularly fortunate. On questioning, they stated that they found true fulfilment not in their jobs, but in their hobbies. With the group of successful people the opposite was the case: they were absorbed in their work and considered it an agreeable enrichment of their lives.

In relationships with partners, characteristic differences could also be seen between the two groups. The less successful were frequently divorced and their family relationships were on the whole worse than those of the successful. From this information we can conclude that a high potential of giftedness alone does not suffice to provide such people with opportunities to make something of their abilities. An environment that stimulates their development and satisfactory relationships with loved ones are indispensable.

When counselling gifted adolescents or young adults, still another point appears to be important: it becomes apparent that giftedness, even if it is accompanied by high degrees of creativity and task involvement, is not sufficient if the issue is to be success in a given field. In Sternberg's terminology, this calls not only for contextual intelligence in general, but also for specific "tacit knowledge", i. e. information about how "the game is played" in the chosen profession. This type of knowledge is never taught openly - hence the term - but it is crucial to success in a career.

A tragic example of a lack of tacit knowledge was Mozart as an adult. As a prodigy he had been used to being admired by the celebrities of Europe, including the Austrian Empress Maria Theresia. As a grown-up, he found that he was treated little better than a servant by his employer, the Archbishop of Salzburg.

What he lacked was a mentor to help him and instruct him how to play his new role as an adult musician and composer in a world where only gentlefolk were valued. Goethe, on the other hand, searched for and found such a helpful person in Frau von Stein at the court of his employer, Duke Karl August. That Goethe had been well aware of the problems at that time facing a talented youth of "low" origin is shown by his novel "Werther's Leiden", where he described the ensuing difficulties and disappointments in detail.

The type of "tacit knowledge" indispensable to outstanding success in a career has changed, but the fact remains that giftedness alone is no guarantee of attaining it. So in recent years mentoring and its effects have been studied extensively (Beck, 1989; Kaufmann, 1986; Porter, 1991).

Effects of accelerating the gifted

In the course of their study of mathematically precocious youths, Swiatek and Benbow (1991) compared accelerated gifted math students with others who were not accelerated, following their academic and psychosocial development during a 10 year period. The accelerated group finished college about one year earlier. Both groups showed outstanding academic and personal

satisfaction at the age of 23. The authors concluded that the accelerates had only a slight advantage over the nonaccelerates. A reanalysis of their data in terms of effect sizes shows, however, a clear shift of the accelerates in contrast to the unaccelerates towards academic preferences, while the unaccelerated group developed higher self esteem, presumably because they were not continually exposed to academic peer pressure.

Renzulli and McGreevy (1986) investigated 23 pairs of twins, of whom only one twin had been diagnosed as being gifted and admitted to a training programme. It was seen that the other twin indeed displayed a poorer academic performance, but was much more creative and independent in thought, whereas the twins on the training programme had tended to follow the example of the adults and had been interested in praise from them. The message is clear: acceleration means limiting the range of interest, but attaining higher competency in the chosen field of activity, while abstaining from accelerating the gifted results in giving them more options to chose from in later life, but might impair early success in a given field.

One-sided stimulation is another issue to consider. It can have negative consequences if it is related to - initially impressive - basic skills in a specific field, but the opportunity is not taken to introduce the child to the more demanding areas of the subject. This can happen very easily with children gifted for mathematics.

Unusual mathematical abilities can be discerned very early in life in a pronounced interest in numbers and their relationships (Oden, 1968). Mathematically inexpert parents and educators are pleased with the child's arithmetical stunts, but are not in a position to familiarize the child in a playful manner with mathematics itself. This results in mathematics coming to a standstill at the level of the "mental calculator", the acrobat in mental arithmetic. Hope (1987) cites a case in point. At the time of the investigation 13 years old, as a small child Charlene had already discovered that it was fun "to play with numbers". She then developed quite exceptional abilities in mental arithmetic. At the first go she was able to solve the problem 87×23 at lightning speed and correctly. On being asked, she stated that she had restructured the problem as follows. She had immediately realized that 87 corresponds to the product of 3×29 and had made the following mental rearrangement: $87 \times 23 = (29 \times 3) \times 23 = 29 \times (3 \times 23) = 29 \times 69 = 69 \times (30 - 1)$. So all that remained for her to do was the simple calculation $69 \times 30 - 69$, and she came to the correct solution, 2001.

It is clear that a lengthy preoccupation with numbers and their qualities and the extensive knowledge base deriving from it are necessary to sense such a calculation as a "relief". However, Charlene had received no further encouragement and had thus come to a standstill at the level of perfect mental arithmetic, something she had taught herself. She had found no access to higher mathematics. This case shows dramatically that giftedness alone is not enough, finely attuned stimulation of the individual case is indispensable.

The case of the Indian boy Balamurati Krishna Ambati represents an example demonstrating the opposite. At the age of 4 he possessed extraordinary mathematical abilities and at the age of 10 he reached the impressive number of 750 points (corresponding to a percentage of over 99) in SAT, the official American college entrance test for 17-18 year-olds, assuring him a place at college (Papalia & Wendkos-Olds, 1992, p. 269).

Motivating the gifted: beneficial and adverse conditions

Renzulli introduced another important aspect about encouragement into the discussion. In his model a high degree of task-commitment, apart from general above-average abilities and a high level of creativity, is necessary to realize the gift. This means that the creation of a positive achievement motivation, one characterized by pleasure in success, must be a central concern in any stimulation of giftedness (Rollett, 1989).

Mönks added to this model by including the agents of stimulation (family, school, peers) (Mönks, 1963; Mönks, Boxtel, Van Roelofs, & Sanders, 1986). Supreme achievement is only possible when parents and teachers manage to make the activity in question pleasant for the child. Whoever in later life is not prepared to train at least 5 hours a day will, for example, never be successful in competitive sport today, however great his gift for sport may be. Yet such training sessions can only be endured by somebody for whom they are a source of pleasure and satisfaction (cf. Rollett & Schuller, 1988).

As early as 1943, Sawyer made an important distinction when he wrote: "To master anything - from football to relativity - requires effort. But it does not require unpleasant effort or drudgery" (p. 9).

In the course of the Munich Longitudinal Study on the Genesis of Individual Competencies (Weinert, 1986), Helmke (1987) could demonstrate this effect. He compared mathematics pretest achievement and self-concept at the end of 5th grade and mathematics posttest achievement at the end of 6th grade. A path-model showed that both, mathematics pretest results and self-concept, influenced *quality* of effort i. e. perseverance and engagement (.26 and .28 respectively), which was in turn linked to mathematics posttest results (.29).

Quantity of effort or "drudgery", to use Sawyer's term (time spent on homework), on the other hand resulted in more debilitating cognitive interference (.18) and lower mathematics posttest results (-.15). There was no direct path from quantity of effort to post-test results, indicating that longer hours spent at homework do not necessarily produce better grades. It can be assumed that it only led to negative motivation.

The younger children are, the quicker it is to spoil for them a potentially stimulating activity, if the learning atmosphere is unpleasant, or they are overtaxed (Dörner, 1993). If an activity is stigmatized by negative feelings and children have had a chance to learn to avoid it, it is hardly possible to motivate them to apply themselves to it, however gifted they may be for it. As we could show, this results in the development of a special form of negative motivation, the so-called "effort avoidance motivation" (cf. Rollett, 1971, 1987; Rollett & Bartram, 1981). The latter varies from the simple refusal to do something in this specific field of action, to fits of temper or subtle tricks to prevent having to do the undesired activities.

The more intelligent children are, the more astonishing are the strategies they invent to evade an activity they hate. A highly gifted pupil in the second grade of primary school, who exhibited extreme tendencies to avoid effort, on instructions from his father and as the price for being allowed to watch television that evening was to write the sentence: "Dear Daddy, dear Mummy, may I watch television?" What he handed in was the following sentence: "Dear parents, may I watch television?" In an intelligent way he had at least succeeded in saving two words.

Studies of gifted children who display extremely poor performance at school demonstrate that adverse learning conditions can impede the development of children of all levels of competence, i. e. also particularly gifted ones. In 1992 Keller was able to establish that gifted children who, contrary to expectations, performed badly at school had the following problems to contend with: their teachers had not recognized their giftedness and demanded too little of them (a condition that already led to scant success in later life in the study of gifted children by Terman, which has already been mentioned), and their learning and work behaviour was extremely inappropriate. Moreover, the results of a work behaviour inventory showed that they had evolved an inadequate ability to defer gratification, heightened failure motivation, deficient memory strategies, difficulties in concentration control and poor learning organization (cf. Keller, 1992, p. 129).

Too few demands on the part of the teachers can have another negative consequence: the children perform well at primary school, simply because of their intelligence and without making any great effort, and only fail at secondary school level when they are asked to process complex material (cf. Evans, 1993), lacking the strategies to make their effort pleasant.

The major significance of hard application experienced as pleasure is underlined by the following results. In an early study Roe (1952) examined 64 well-known scientists. It was seen that they all possessed a comparatively high level of intelligence, which, however, was evidently not solely responsible for their great achievements, as there were major differences in intelligence between the researchers. Their outstanding career success was occasioned above all by their unusual willingness to work, which was kept alive by the scientists' great interest in their field of research. As can frequently be observed among gifted scientists, their special interests had already become manifest in their early childhood and had been sympathetically encouraged by their environment.

A study conducted by MacKinnon on architects in 1964 yielded similar results. He compared a group of creative architects with another group of less creative ones. It was seen that it was not possible to differentiate them on the basis of IQ, but certainly in terms of their devotion to their work. Thus, for the pedagogics of the stimulation of giftedness it is of the utmost interest to examine the conditions necessary to create good work motivation. The latter determines whether giftedness can be turned into achievement. Two studies can provide us with clues. Lauren Sosniak (1985) questioned top pianists as to how their musical development had progressed. It turned out that the decisive factor had been their personal situation and the resultant, particularly sympathetic support of their first music teachers. Similarly, Judith Monsaas (1985) was able to establish that the world-ranking tennis players she investigated were able to develop their sporting gifts because they grew up in families where the members had a particularly close relationship to each other. The parents devoted a great deal of time to their children, the atmosphere was loving, and much interest was shown in all of the children's activities. Nevertheless, demands were made on the children. The parents were of the opinion that everything worth doing was also worth doing well. The same applied to the first coaches of the future tennis champions. They were warmhearted, kind persons who liked working with children and knew how to create a conducive and encouraging atmosphere. This way the tennis court could become a second home for the budding stars.

It was particularly interesting to note that the first teachers did not need to be experts themselves. It was enough for them to be outstanding teachers, who moreover knew how to give the children the feeling of having found genuine persons of reference, who were interested in their progress and for whom it was worth making an effort.

The three principles of any early stimulation of exceptionally gifted children can be summarized as follows: providing a highly motivating, metacognitively stimulating learning environment at home and at school, positive peer-group experiences and, above all, appropriate mentoring taking the special gifts of the child into account.

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Development of giftedness in a life-span perspective

Franz J. Mönks and Christiane Spiel
University of Nijmegen, Nijmegen, The Netherlands,
and University of Vienna, Vienna, Austria

Introduction

As early as in 1933, Charlotte Bühler introduced a life-span view into developmental psychology with her book "Der menschliche Lebenslauf als psychologisches Problem" [The human course of life as a psychological problem]. In a more systematic way the life-span view in developmental psychology in Europe was substantially influenced by Thoma (1968; 1976). *From a life-span perspective human development is viewed, analyzed, and studied from conception to death.* The life span view tries to weave together a portrait of who we were, are, and will be (Santrock, 1983).

Until about three to four decades ago, human development was seen as synonymous with child development. According to Havighurst (1972) the interest in adult development has only seriously begun to develop in the latter half of the 20th century (see Figure 1).

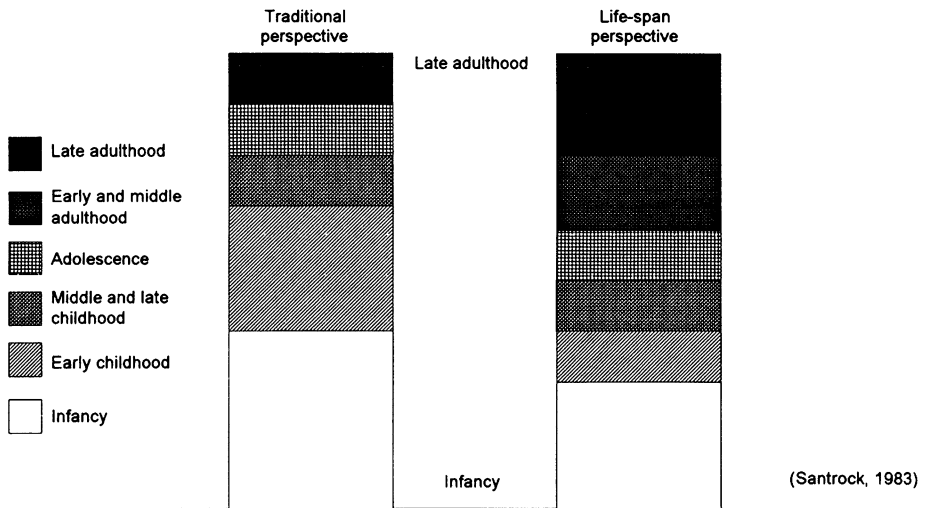


Figure 1: Approaches to development

The traditional approach to development emphasizes extreme change from birth to adolescence, stability in adulthood, and decline in old age. Decrease of cognitive functioning has been discussed extensively in the literature under the heading 'deficit model'. According to this view there is a decrease of cognitive functioning from 40 years on (some authors mentioned the age of 20 years, others the age of 40 years; see Schaie, 1970; Rudinger, 1971). If, however, a distinction is made between fluid and crystallized intelligence it turns out that there is no decline of crystallized intelligence with age, while the fluid intelligence decreases indeed from roughly the age of 30 years (Schaie, 1970). Rudinger (1971) concluded that not age as such has influence on cognitive functioning but more important is the amount and quality of academic training and health conditions. Age must be regarded as an index of experiences and not as independent variable which influences human behavior.

The life-span perspective emphasizes that changes of behavior and motives occur not only during childhood and adolescence but throughout the life course (Baltes, 1973, 1987; Hetherington, Lerner, & Perlmutter, 1988).

The aims and assumptions of the life-span view of human development have been extensively discussed in the last decades (Baltes, 1973; Baltes & Schaie, 1973; Lerner & Ryff, 1978; Nesselrode & Reese, 1973). Baltes (1973, 1987) summarized a number of *characteristics of the life-span perspective* (see Figure 2):

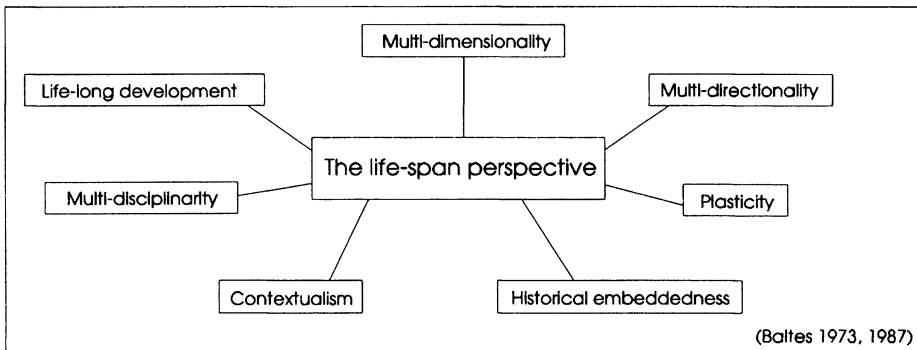


Figure 2: Characteristics of the life-span perspective

- *Life-long development*: Development as a process of change takes place throughout the whole life, no age period dominates development.
- *Multidimensionality*: Human development consists of different dimensions and different components within these dimensions.
- *Multidirectionality*: Some dimensions or components may increase, while others decrease.
- *Plasticity*: Development may take different paths, depending on the individual's life conditions.
- *Historical embeddedness*: Development is influenced by historical as well as economical and cultural conditions.
- *Contextualism*: The individual is responding to and acting on contexts; heredity is not a fate but is always "heredity in a specific environment" (Vossen, 1992, p. 92).

- *Multidisciplinary*: Development needs to be studied in an interdisciplinary context.

Especially in research on intellectual abilities the pervasiveness of change throughout the life-span has been empirically demonstrated (Baltes & Schaie, 1973, 1976; Schaie, 1983). Therefore, theoretical views of development as being finalized in early life (Flavell, 1970; Freud, 1949; Kohlberg, 1969; Piaget, 1972) or those characterizing the latter half of life in terms of decrease had to be discussed from this new perspective and revised.

Discussion of the papers presented under a life-span perspective

In the symposium three papers were presented:

- Balogh, L., Imre, D., Nagy, K., Szabo, J., & Toth, L.: *Learning techniques and development of self-knowledge by means of special programs with talented school children.*
- Yontar, A.: *A follow up study about creative thinking ability of students.*
- Neitzke, C.: *The professional development of gifted men: Two case studies.*

Each of the three papers presented were primarily conducted under a traditional approach of development. However, if one changes the perspective, that is looking at these studies from a life-span perspective, each of them has its special contribution to the research field of life-span development. Consequently, these papers were summarized and discussed under a life-span perspective.

Table 1: Summary of the papers presented in the symposium "Development of giftedness under a life-span perspective"

	Presenters		
	Balogh et al.	Yontar	Neitzke
Type of study	intervention	longitudinal	retrospective
Number of data collections	2 pre - post	3	1
Subjects	13-14 years old talented children	randomly selected subjects from 11-18 years	creatively productive and academically gifted adults
Topic	learning techniques self-knowledge	creative thinking	life course

Balogh and his associates (see Table 1) presented an intervention study to prove the effectiveness of a training program for gifted children. The intervention performed by *Balogh et al.* focused on the psychosocial competence of gifted children. Results from the literature are extremely inconsistent regarding this topic. Nevertheless, it is one of the main topics when studying giftedness. *Balogh et al.* applied two special training programs - regarding learning techniques and real self-knowledge - with special goals to their subjects. Especially the training regarding self-knowledge seemed to be very important for the later development of the subjects.

Under a life-span perspective it will be very interesting to do an additional data collection to prove the effects of this training in the long-term approach.

Yontar (see Table 1; this volume, p. 147ff.) investigated the development of creative thinking - in the sense of Torrance - in a longitudinal study from 11 to 18 years. *Yontar* primarily did

not focus on giftedness. Subjects of her study were randomly selected. Creativity is an important aspect in all definitions and theories about giftedness. However, there is a lack of longitudinal studies in this field. Therefore, more information is needed about the development of creativity not only in gifted children. First results suggested that Torrance's tests only grasp special facets of creativity which are intercorrelated. However, with regard to the life-span perspective this project should be continued to investigate what type of professions the subjects will take up.

The study Neitzke presented (see Table 1) is not a longitudinal one, but a retrospective study. Nevertheless, the data have longitudinal impact. Under a life-span perspective her study is very interesting. Subjects were asked to reconstruct their life course to discover personality or environmental conditions determining which either facilitated or hindered their career. Neitzke did a two group comparison focusing on creatively productive versus academically gifted subjects independently from the professional field of the subjects. Because the investigation of development from early childhood to old age in the longitudinal approach is an extremely hard task, retrospective interviews are very helpful. A similar study conducted by Panagl (1984) in Vienna demonstrated that creative scientists are more independent than not creative scientists; and independence was more important for them.

Studying giftedness under a life-span perspective

When Terman in the 1920s launched his study of the gifted, "Terman began the first psychological investigation involving a longitudinal research design in which a sample of subjects was followed over the course of several years" (Minton, 1988, p. 112). Actually, the Terman study is still ongoing and is regarded the most thorough study ever done with regard to the psycho-social development of people. As a pioneer he had to devise many of the instruments he used because his aim was to collect an assessment of his subjects as complete as possible. He attempted to measure characteristics which were not previously assessed. In spite of many deficits of such pioneering approach, his data provided us with rich material and new perspectives on the development of gifted subjects.

In a recent study Subotnik and Arnold (1993) made an overview on longitudinal studies of giftedness. Many researchers avoid longitudinal research since it takes years to get data. At the time the data are available for interpretation, they might no longer be relevant for the new situation due to environmental and cultural changes. Therefore, the most promising approach seems to be a mixed longitudinal study according to Schaie's *most efficient design* (see Mönks *et al.*, 1975). Such a design is based on a trifactorial developmental model which isolates the contributions to developmental data of the factors *age, cohort and time of measurement*. In addition, independently selected control groups (cross-sectional groups) are employed to assess e. g. the impact of testing effects in the subjects included in the longitudinal study. This design was applied in the Nijmegen Growth Study. The efficiency of this design became evident because within a time period of 5 years longitudinal data were available from the age of 4 years up to the age of 14 years. This was possible because three different age groups (4, 7, and 9 years old subjects) were followed over a period of five years.

Such an approach as briefly outlined should include the characteristics as shown in Figure 2. Studies of this kind could provide us with information on (a) which conditions facilitate or hinder development of giftedness, (b) whether there are 'typical' developmental processes which exist in the gifted in comparison to the non-gifted, (c) whether there are domain specific patterns of development in the gifted, (d) the relationship between creativity and giftedness, and (e) what the 'g'-factor contributes to the cognitive development and whether the 'g'-factor shows stability and/or change over the life-span or parts of the life-span. This final objective is a central research question of behavior genetics.

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Giftedness from early childhood to early adolescence: A pilot study

Christiane Spiel and Ulrike Sirsch
University of Vienna, Vienna, Austria

Abstract

The study investigated stability versus instability of giftedness - identified by advanced cognitive competence - from early childhood (C) to early adolescence (A). Data stem from a longitudinal project conducted in Vienna (Austria). 94 children participated in the first phase of the study (C), 58 children (29 boys, 29 girls) were included in the follow-up (A). The children were randomly selected from public day-care centers. Four different profiles of cognitive development were identified: Group 11 gifted both in C and in A; group 10 only gifted in C; group 01 only gifted in A; and group 00 neither gifted in C nor gifted in A. The four groups were compared in different cognitive tasks, school grades, and task commitment. Biological risk factors and psychosocial conditions were analyzed to explain differences in the developmental pathways.

Introduction

In the last decades the research area of giftedness has attracted much interest and born out numerous studies. However, comparatively few studies investigated giftedness in early childhood. Especially there is a lack of longitudinal studies from infancy to adolescence. Most researchers preferred to study giftedness in older children or adults, probably because it is much more difficult to identify children between two and five years as potentially gifted (Fatouros, 1986). Teachers' judgement and peer nomination could not be used for this early age period. Parents' ratings are probably the best source of information but their frame of reference of typical behaviour is rarely broad enough (Fatouros, 1986). The to-date probably best single indicator for giftedness in early childhood is provided by scores from individual intelligence or developmental tests.

However, cognitive abilities are not very stable in early childhood. It is difficult to make reliable predictions of the development of intelligence beyond the age of four years (Heller, 1986). Poor prediction of intellectual performance in infancy and early childhood was shown in numerous studies. Birns and Golden (1972) found no correlations in a sample of 89 infants between the Cattell Infant Intelligence test scores and the Piaget Object scores at 18 months and the 36-months Stanford-Binet scores. Willerman and Fiedler (1974) investigated 100 children with IQs of 140 and above at four years of age who had been tested with the Bayley Scales of Mental and Motor Development at eight months. The results showed that not all of these children had been advanced as infants.

Accuracy of prediction increases when the children become older. Gössler (1971) e. g. observed a correlation of .54 between developmental scores at preschool age and later intellectual performance in childhood and adolescence (age ranged from 7 to 18 years). The correlation between developmental scores and school achievement was .72. Tramontana, Hooper, and Selzer (1988) reviewed 74 studies published from 1973 to 1986 regarding preschool prediction of later academic achievement. In most studies a significant relationship between preschool IQ and later academic achievement was observed.

Besides differences in identification of talented children, scientific approaches to giftedness differ from one another in the importance they ascribe to environmental factors and personality traits (Stapf & Stapf, 1988). More recently, the importance of family conditions is becoming recognized (Mönks, 1990). Hence, there seems to be a lack of studies investigating the significance of biological conditions (e. g. birth weight) for giftedness. However, in the research area of risk children the effects of biological and psychosocial conditions are analyzed and discussed in detail (e. g. Cohen, Parmelee, Beckwith, & Sigman, 1986; Kopp & McCall, 1982; Meyer-Probst & Teichmann, 1984).

The aims of the present study were to investigate stability versus instability of giftedness - identified by advanced cognitive competence - from early childhood to early adolescence; to identify subgroups of children with different profiles of cognitive development; to compare these groups in actual performance: cognitive tasks, school achievement, and task commitment; and to investigate whether the differences in cognitive development due to biological risk factors and/or psychosocial conditions.

Procedure

Subjects

Data stem from a longitudinal study conducted in Vienna (Austria). The children were selected from 13 public day-nurseries and were chosen at random. 94 children participated in the first phase of the project. 58 out of these children (29 females, 29 males) could be evaluated three times. The first examination was done one month after entering kindergarten (mean age 30 months, ranged from 25 to 36 months), the second approximately seven months later, and the third examination was done after leaving primary school (mean age 142 months, ranged from 135 to 151 months).

Measures

At the first and second examination the children were examined with the scales for the third, fourth and fifth year of life of the "Kleinkindertest" [Early childhood test] by Bühler and Hetzer (1932). Six items from the Denver Development Scales (Frankenburg & Dodds, 1967) which had no equivalent in the Bühler and Hetzer test were added. In sum 36 dichotomous items were presented to the subjects.

At the third evaluation, the "Adaptives Intelligenz Diagnostikum" (AID) [Adaptive intelligence test battery] (Kubinger & Wurst, 1988) was used which examines cognitive competence in eleven different domains similar to the Wechsler Intelligence Scale for Children (WISC-R) (Wechsler, 1974). The subtests can be divided in verbal (e. g. Everyday Knowledge - crystallized) and performance domains (e. g. Digit Span - numbers).

In addition, two Piagetian tasks were administered to the subjects. It was assumed that competence in these tasks is less influenced by family background variables than competence in the classical psychometric tests like the AID. The first task consisted of two syllogistic deductions (based on Kodroff & Roberge, 1975). The first statement referred to a real life situation; the content of the second statement was abstract. Both statements were presented in four syllogistic forms (affirmation of antecedent, denial of antecedent, affirmation of consequent, and denial of consequent). The combination of two statements and four syllogistic forms resulted in eight tasks. The second Piagetian Task was Isolation of variables (based on Kuhn & Brannock, 1977). In the present adaptation, the material consisted of three real life problems (raising plants, getting presents, coating a roof). For each problem the children had to isolate the operative variable and to identify the inoperative variables. Psychometric analyses demonstrated that both Piagetian tasks can be used as one scale consisting of at least 14 items.

In addition, at the third examination school grades and task commitment - assessed by a trained observer - were obtained from the children.

In all three examinations data from the parents were collected via questionnaires and/or interviews to get information about the psychosocial conditions (global social screening score, care conditions, parental education, family climate, social economic status - SES) and about possible biological risk factors (global biological screening score, birth weight, pre- and perinatal risks).

Definition of cognitive giftedness: In infancy, giftedness was defined by the criterion "12 months or more advanced in cognitive development in the first and the second examination". Five children reached this criterion. In early adolescence (third examination) giftedness was defined by the criterion "percent rank above 75 in cognitive competence" (AID). Thirteen children reached this criterion.

Results

Results demonstrated that three of the children identified as gifted in the first and the second examination could be identified as gifted again in the third examination (group 11, see Figure 1); two children were identified to be gifted only in infancy (group 10); ten children were identified to be gifted only in early adolescence (group 01); 43 out of the subjects showed low or average intellectual capacity at all three time points (group 00). There was a significant correlation of .51 between the test scores in infancy and in early adolescence.

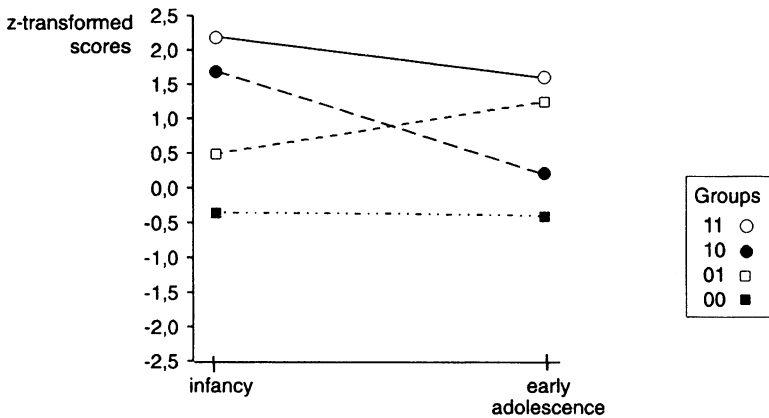


Figure 1: Profiles of cognitive development

The four groups were compared regarding the subtests of the AID belonging to verbal and performance domains. Results showed similar differences between the four groups both for the verbal and the performance subtests (see Figure 2). Group 11 showed the highest scores followed by group 01. The lowest scores were observed in group 00. Because of the small group sizes no statistical analyses were conducted.

Then, the groups were compared in the Piagetian tasks. Results showed similar test scores for groups 01, 11, and 10 but lower scores for group 00 (see Figure 3). These results were contrasted with differences in "Everyday Knowledge - crystallized". This subtest of the AID was assumed to be more influenced by support (Kubinger & Wurst, 1988). Results showed higher scores for group 01 and group 11 than for group 10 and group 00 (see Figure 3).

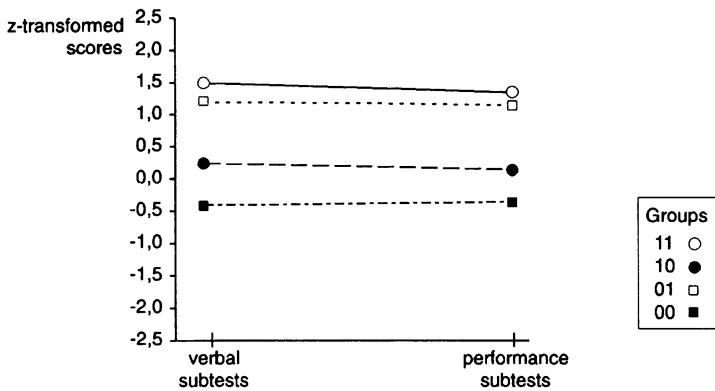


Figure 2: Subgroups in different domains

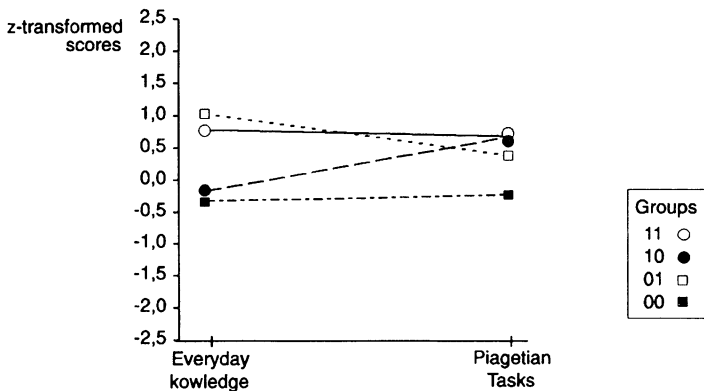


Figure 3: Everyday knowledge - Piagetian tasks

Results regarding school achievement (standardized values) showed differences between all four groups (see Table 1). The subjects of group 11 had received the highest grades while subjects of group 00 had gotten the lowest. Similar results were observed for task commitment (s. Table 1). Subjects of group 11 showed highest task commitment while subjects of group 00 showed lowest task commitment.

Next, the four groups were compared regarding biological and psychosocial conditions. Group 00 was characterized by a large range in birth weights and the highest biological risk scores. In addition, the subjects of this group showed low social screening scores. Only few children had positive care conditions, parents with average or high education and average or high SES (see Table 1). Group 01 was characterized by positive psychosocial conditions (social screening score, care conditions, parental education and SES). Subjects of group 10 had optimal birth weights. These subjects were characterized by high social screening scores, average or high SES, but negative care conditions. Group 11 was as well characterized by optimal birth weights. In addition, subjects of group 11 showed positive family climate. None of them had parents with average or high SES.

Table 1: Biological and social conditions, school achievement and task commitment

Group	00 n=43	01 n=10	10 n=2	11 n=3
BIOLOGICAL CONDITIONS				
Biological screening score (mean)	19.3	19.7	19.5	19.7
Birth weight (g) range	2250-4200	3000-4050	3280-3300	3490-3770
Pre- and perinatal risks (mean; range)	1.69 0 to 5	1.30 0 to 3	1.50 1 to 2	1.33 0 to 3
SOCIAL CONDITIONS				
Social screening score (mean; range)	9.60 6 to 14	11.4 10 to 14	11.5 12 to 12	10.0 8 to 12
Positive care conditions (n of N)	9/43	5/10	0/2	1/3
Average or high parental education (n of N)	10/43	6/10	1/2	1/3
Positive family climate (n of N)	24/43	6/10	1/2	3/3
Average or high SES (n of N)	8/43	5/10	2/2	0/3
SCHOOL ACHIEVEMENT AND TASK COMMITMENT				
School grades (z-scores) (mean; range)	-.60 -4.6 to .8	.58 -.6 to 1.3	.29 .1 to .5	.76 .1 to 1.1
Task commitment (mean; range)	15.21 10 to 19	17.70 16 to 18	16.50 15 to 18	18.67 18 to 20

Discussion

First, it should be mentioned that all findings of the study have to be carefully discussed because of the small number of subjects in group 10 and 11. Results confirm previous findings that it is difficult to make reliable predictions regarding cognitive development from infancy to early

adolescence based on test scores. In addition, results suggest that psychosocial conditions and biological risk factors can help to explain stability versus instability in cognitive development not only in risk children but also in average gifted and gifted children. Results regarding subjects of group 01 who showed an increase in cognitive competence suggest that socio-economic conditions can positively influence cognitive development in the longitudinal approach. In contrast, negative care conditions (in that case divorce of parents and institutional care) can cause a decrease in cognitive development. Differences between the four groups in school achievement and tasks commitment are similar to differences in AID subtest scores. Therefore, it can be assumed that the same latent competences are necessary for these tasks. In contrast, no differences between groups 01, 10, and 11 were observed in the Piagetian tasks, which are different to the classical psychometric tasks like the AID. As mentioned above, the Piagetian tasks are assumed to be less influenced by family background variables. These observations indicate that identification of giftedness is influenced by the type of cognitive tasks used which are more or less affected by psychosocial conditions or parental support.

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A follow-up study about creative thinking abilities of students

Aysenur Yontar

Bogazici University, Istanbul, Turkey

Physical characteristics of human, such as height, colour of eyes or hair are known to be genetically determined and they are stable throughout the life period, but the same analogy can not be used for the mental characteristics. For example, there are high correlations of IQ measures of older ages but it shows some fluctuations from infancy to childhood. Research studies (Torrance, 1963; Urban, 1991) indicate similar fluctuations for creative thinking abilities of children. Torrance (1963) conducted some cross-sectional and longitudinal studies from age 3 to grade 12 and derived a developmental curve of creative performance of children. More currently, Urban (1991) conducted a cross-sectional study with a sample of children who are between four and eight years of age. Aim of his investigation was to detect the age trends by using *Test for Creative Thinking* scores. As a result of quantitative and qualitative analysis, he had proposed six developmental stages of creativity. He has also compared the developmental changes with the results of Torrance's study. Results of both studies were similar in terms of the developmental curve of creativity in children, which generally goes up but also shows some sections of decline.

Literature often stresses that social environment is more inhibiting than nurturing the creative abilities of children. In another way, environmental conditions prevent children from being creative. Adaptation to social life, acceptance of social authorities and understanding traditional expectations affect creative performance of individuals to some extent. So in any case the development of the inborn creative thinking and acting potentials of children are highly dependent on environmental conditions, of course including educational institutions.

Aim of the present investigation is to detect developmental changes in creative thinking abilities of students between 11 and 18 years of age. This investigation is unique for being the first longitudinal study about creative thinking abilities of Turkish students by using the *Torrance Test of Creative Thinking*.

Sample of the Study

Subjects of the study were chosen from a private primary school in Ankara which has also junior and senior high levels education. 35 fifth grade students were selected randomly. Students who have attended the same school for seven years became the respondents of the study. As in most of the longitudinal studies, loss of subjects limited the sample of the study to 23; 11 of them are female and 12 of them are male.

Instrument

Torrance Test of Creative Thinking - Figural Form A (TTCT) which has been developed by E. P. Torrance (1966) was used in order to measure creative thinking abilities of the subjects. The instrument emphasized the ability to generate many new ideas (fluency), that are unusual (originality) and represent a variety of categories (flexibility), as well as the ability to embellish

the ideas (elaboration). Fluency, flexibility, originality and elaboration are the components which were used for the assessment of creative potential. The battery includes three activities. First activity, picture construction, is designed to stimulate originality and elaboration. The author of the instrument advises against the use of incomplete batteries but the first activity was excluded during measurements of the present study. Cultural unfairness of scoring the task caused the elimination. The other two tasks which are used in the study elicit increasingly greater variability in fluency, flexibility, originality and elaboration. In the incomplete figures activity, flexibility, originality and elaboration has been considered. Fluency has a minor consideration. In repeated figures activity, fluency competes with originality, elaboration and flexibility.

Reliability study (Yontar, 1985) was conducted by using 58 randomly selected subjects who were attending the fifth grade of the same private school in Ankara. Before presenting the evidence concerning test-retest reliability, it seems desirable to review evidence about inter- and intra-scorer reliability of scoring. Norms-technical manual of the original test indicates that interscorer reliability coefficients range from .86 to .98 with an average of .95. As a result of a similar study which was conducted by a Turkish fifth grade student sample, comparable interscorer reliability coefficients were calculated (see Table 1).

Table 1: Sample Data on Interscorer Reliability

Coefficient of correlation	Fluency	Flexibility	Originality	Elaboration
Original study sample of 100 tests	.98	.98	.86	.92
Turkish study sample of 50 tests	1.00	.91	.96	.94

In order to calculate intrascorer reliability coefficients, researcher scored sample of 20 tests two times with a time interval. Results indicated a high intrascorer reliability (see Table 2).

Table 2: Sample Data on Intrascorer Reliability

	Fluency	Flexibility	Originality	Elaboration
	.99	.90	.96	.94

Test-retest reliability coefficients of the study are presented in Table 3 in comparison with three studies indicated in the norms-technical manual of the test.

In order to obtain evidence about validity of the instrument, class teachers, fine art teachers and administrators were asked to nominate ten of the most creative students among fifth graders. It was seen that more than half of the students in the list were the ones who obtained the highest scores in the test.

Unfortunately, there is not any norm study about TTCT scores of Turkish student sample. So the core of normative data will be based on another study conducted by the researcher in 1985. Sample of that study consists of 144 fifth grade students who were attending state-supported primary schools in that year. Normative data of the 1985 study will be given in comparison

with the mean scores of sample indicated in the norms-technical manual of the instrument and the mean scores of the present study (see Table 4).

Table 3: Studies about Test-Retest Reliability

Measure	Coefficients of Correlation			
	study 1*	study 2*	study 3*	Turkish study
Figural Fluency	.71	.50	.80	.63
Figural Flexibility	.73	.63	.64	.68
Figural Originality	.85	.60	.60	.53
Figural Elaboration	.83	.71	.80	.70

*(Torrance, 1974, p. 19)

Table 4: Normative Data About the TTCT Scores of Three Different Samples

Measure	Original Sample** \bar{x} (N=112)	Present Sample \bar{x} (N=23)	Turkish Sample (1985) \bar{x} (N=144)
Fluency	26.77	24.34	20.31
Flexibility	18.79	17.61	15.86
Originality	23.72	34.74	28.25
Elaboration	54.51	80.57	46.46

** Table 4 prepared by using mean scores of particular test tasks presented in the manual of the instrument (Torrance, 1974, pp. 49-52)

Procedure

This study is a longitudinal one, with triple testing situation on 23 subjects. They have attended the same educational institution for seven years. Table 4 will be helpful in clarifying the creative abilities of the sample. As it is seen in the table, mean scores of the sample are higher than the mean scores of the Turkish norm sample. So it may be concluded that creative thinking abilities of the subjects in the present study were above the average of the other Turkish fifth grade students. *Torrance Test of Creative Thinking* was administered for the first time in 1985 when the subjects were 5th graders. Retesting took place four years later when they were 8th graders at the end of secondary school. Three years later in 1992 at the senior year of high school, the test was administered for the last time.

Analysis of data, results and discussion

Because of the limited number of subjects, non-parametric statistical tests were performed for analysing the data. In order to investigate if there are any differences between performances of subjects related to TTCT scores in different ages, a Friedman two-way analysis of variance was used. It is a non-parametric analogy of the parametric two-way analysis of variance. While analysing the sex differences in the performance of creative thinking abilities of subjects, the Mann-Whitney U test was used.

As it is indicated before, fluency, flexibility, originality and elaboration are the variables which

Torrance Test of Creative Thinking measurements are based on. So results and discussion will be based on those variables.

The question of male versus female superiority in creative abilities has been of research interest for several decades. Studies (Gupta, 1981; Raina, 1980; Richardson, 1986; Urban, 1991) show divergent results as male superiority, female superiority and no difference between the sexes, depending on age and procedure of measuring creativity. Gupta (1981) observed that Indian boys showed superiority on verbal fluency, verbal flexibility and verbal transformations. Indian girls scored significantly higher on non-verbal dimensions, such as originality, complexity and productive designing ability. Richardson (1986) found significantly higher scores for Jamaican girls on test of verbal fluency. Raina (1980) found no differences between the scores of fluency, flexibility and originality from the *Torrance Test of Creative Thinking*. Also Urban's study (1991) indicates similar results with no differences between the means of German girls and boys from *Test for Creative Thinking-Drawing Production* for various age groups.

Results of the study are congruent with the previously mentioned literature, differences between the score ranks of girls and boys were not significant for three age groups except the ranks of flexibility scores of 11 year old group. Results of Mann-Whitney U test, showed that there is a significant difference between the rank scores of 11 year old girls and boys in favor of girls, at $p=.004$ level of significance.

Table 5: Results of Friedman two-way ANOVA for 11, 15 and 18 years old groups

Variable	chi square value	df	significance
Fluency	5.826	2	.050*
Flexibility	10.630	2	.004*
Originality	5.304	2	.070
Elaboration	4.195	2	.122

* $p < .05$

The results of Friedman two-way ANOVA for all age groups were statistically significant for the variables of fluency and flexibility, but chi square value just fail to reach statistical significance for the other two variables originality and elaboration (see Table 5).

When all possible differences between the pairs of samples were compared in relation to the variable fluency, statistically significant differences were found between 11-18 and 15-18 years old groups against the 18 years old group. This means, ranks of fluency scores of students were similar between the ages of 11 and 15 but the distribution has changed when students became high school seniors.

Also there were statistically significant differences between flexibility score ranks of 15-18 and 11-18 years old against 18 years old group which means that distribution of flexibility ranks were not similar in high school in comparison to secondary and elementary school years. Ranks of students have changed as they became 18 years old. So the rank distributions of the sample were not similar for the variables of fluency and flexibility in different ages.

No statistical significant differences were found between the ranks of originality and elaboration scores which means that ranks were remaining similar in different ages.

In order to compare the result of the present study with the former findings of Torrance (1973), mean scores of the sample were also calculated and compared with the mean scores

of the American sample as indicated in the norms-technical manual. Of course those samples cannot be compared in terms of methods of studies, sample size, cultural differences, etc. - but the author finds it helpful in showing some tendencies in the development of creative abilities of students.

Table 6: Mean Scores of TTCT Form A by Educational Level

Level	fluency		flexibility		originality		elaboration	
	USA	TUR	USA	TUR	USA	TUR	USA	TUR
5th	21.8	24.4	16.0	17.6	28.1	34.7	68.2	80.6
junior high	19.9	25.1	15.7	19.0	25.5	36.3	74.7	77.4
senior high	19.6	21.0	15.7	16.0	27.4	29.0	70.6	96.0

Table 6 indicates that development of creative potential tends to be non-linear. Both mean score distributions show patterns of declines in different ages. For example, the American sample shows a linear decline in their fluency scores while Turkish sample performs an increase until the age of 15 and then a decline in the senior high school years.

Conclusion

In conclusion, results of the study indicate that score distribution of students in fluency and flexibility change after 15 years of age while ranks of originality and elaboration remain similar during the range of those seven years included in the study. As it was indicated before, sample of the present study performed above the Turkish norms when they were 11 years old. They were attending a private school which has sufficient environment for the development of their creative potentials with respect to state supported schools. But as a result there were some declines in their creative potentials. Senior year of high school is an important point in the life of Turkish youth because at the end of senior year, most of the students get university entrance examination. In general, Turkish education has a competitive characteristic and university entrance exam is one of the important competitive situations in the system. Positive results of the exam are the greatest reward for the high school graduate, and most of the students focus on this exam which is the greatest evaluation of their performance. Such kind of a situation may affect the intrinsic motivation of an individual. As it can be seen from the picture, students had some of the negative consequences which affect their creative performance. They were working for an expected reward in a competitive situation and focused on expected evaluation of their performance in an exam. Competitive characteristics of the education system may be one of the factors which is effective in the creative performances of students, but reality consists of more complex interactions occurring among sociological variables, individual differences in upbringing and genetic factors. Ideally, the students' total environment including home, school and community should be supportive for his/her creative behavior for him/her to reach fullest degree. Although this utopia will probably never come into being, developmental studies with large samples and many carefully selected sociological and psychological variables will be helpful in enlightening the ways for reaching that utopia.

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From the every-day world and the musical way of life of highly talented young instrumentalists

Some findings from a biographical study of national winners
of the competition JUGEND MUSIZIERT

Hans Günther Bastian

Institute of the Didactics of Music, University of Paderborn, Paderborn, Germany

Andreas, born 1968, first attempted to play on a Clarina with coloured keys at the age of four, started piano lessons at six, was initially successful in Jugend Musiziert at age seven and eight, became a pupil of the piano professor Karl-Heinz Kämmerling at twelve, won first prize (in a national competition) at age fourteen, won first prize at age sixteen, in the same year he participated in the Eurovision competition of the ARD in Geneva, gave several successful and highly praised concertos in the Frankfurt Old Operahouse and the Herkules-Saal in Munich, was engaged by a well-known concert agency at the age of sixteen with eleven concerts each year. His ambition at the time of the conversation (1985): a concerto with the Berlin Philharmonic Orchestra ...

His press notices: A cool wonderboy - He can really play! - A wonderpianist - A vigorous piano talent with a future - There is also something worrying about his success - A thirteen year old following in Chopin's foot-steps ...

And Joachim Kaiser wrote in more detail in the "Süddeutsche Zeitung" (January 15, 1985):

What happened at this remarkable recital was more exciting than mere splendid virtuosity ... The young man revealed himself as a remarkably lyrical talent. The sixteen-year-old artist was aware of every intimacy of this great abstract music: all of its profound emotional content without posing, without precocious posturing. He executed the madly difficult leaps in Chopin's B minor Scherzo more exactly than Pollini and Horowitz in their latest concerts. Bach's debut reminded many of the young Bruno Leonard Gelber, a remarkable prospect ... (author's translation from German).

The dream career of an individual, the career-dreams of many? Above all it is a career dream for those national winners in JUGEND MUSIZIERT, who have high hopes of a successful career. Absolute one-to-one identity of music and daily life, phenomenal performance levels, eager readiness for unusual effort, the highest level of training and early success characterise our relatively unusual sample of instrumentalists. In our society, there is frequently talk of child prodigies, little Mozarts, but also there is talk of fixated, blinkered instrumentalists, greenly naive, whose personal commitment to music has been at the expense of normal personality development and has led to psychological disadvantage and deprivation.

This is a high price to pay. Prejudices and platitudes, the best substrate of mythology, become entwined around those who stand out from the norm. An up-to-date-example from the media 1987: Boris Becker as "The Mozart of Sport". What lies behind these headlines used so naturally that research has not analyzed in Germany until now?

The Questions

In a biographical study (1985-89), I set out to lift the veil of secrecy and prejudice by focussing my attention upon the life-history and learning-history of young talented instrumentalists who had won national prizes. For six months I travelled between Hamburg and Kempten, Saarbrücken and Berlin and held 3- to 4-hour-conversations that had to be recorded and transcribed. Sixty narrative interviews with a definite structure (early childhood and family life, instrumental development, personality, school and musical education, leisure time and friends, daily life and musical way of life) provided us with a systematic construction of the biographies of talented musicians, enabled us to recognize the subjective and intersubjective processes of development and to elucidate the person's discovery of music and subsequent development, the genesis of personal musical identity. From the standpoint of music teaching and instrumental training, we were looking for everyday definitions of musical talent. We were interpreting musical development from the retrospective accounts of talented instrumentalists. We were interested in lifestyles, norms, values, orientations, developmental landmarks, the classification of musical functions, ambitions, actual experiences of instrumental learning, success and crisis, highpoints and lowpoints, instrumental lessons and instrumental teachers ...

The Method

The narrative interview is a method of inquiry which allows the subjects the freedom to present and reveal themselves, to report on their own identities, and we were interested in precisely these individual profiles. The conversations with these young people became hermeneutic instruments for the discovery of their individual relevance-structures. Only in this way could we find our way through the research to the unique aspects of the individual, unique in process and in product.

Results

Key Experiences and Early Contact with Music, or "I was already listening to music before I was born".

Whatever our theoretical standpoint, there is consensus in the awareness that the early socialization of a child in the family is of the utmost importance for a child's further development. For musical development, the early years are apparently even more important than for many other fields of activity.

The reminiscences of young people and their parents show that the "revelation on the road to Damascus" that set the "born artist" on the path to greatness is far less common than outsiders might suppose. It would be true to say however that early musical activities and aesthetic interests are unambiguously established by the parents. Musical achievement will not take place without a strong and even fanatical parental interest in music. The contribution of parents to the discovery and development of the child's musical talents was highly and gratefully regarded in the interview accounts of the young people.

Our mother invested 100% in us. She was always there for us and for us alone (21-year-old female).

And the young people reveal what was and is important to them:

Even if my mother can't help me very much artistically, it is very important that she shows interest. If she isn't there even on one occasion, I miss her (15-year-old female).

The key to the child's early encounter with classical music lies in the dreams and wishes of parents in their educational attitudes. How apt was Zoltan Kodaly's statement: *The musical education of the child begins 9 months before birth ... (Pause) ... of the mother!*"

The parental involvement in music is revealed by the many parents who are instrumental teachers, who lead a musical life, who own a lavish, carefully chosen record collection. There is no doubt about what the family should listen to: Not Abba and Muzak but Haydn and Mozart during Sunday breakfast and Mahler evenings, organized by father.

Classical music was part of my daily life from morning to evening, because my sister practiced, my father practiced, my mother practiced, and we all practiced at the same time (17-year-old male).

Talent emerges only when a child experiences music, plays, listens, copies, or transforms music. And the first discoverers are mostly the parents. Who else? In the words of the young people themselves:

In our house music was there as long as I can remember. My father studied music and later my sister studied music too. For me a key experience was listening to my father playing and practicing the piano in the evenings. I always found that great, and I went to sleep with music in my ears (15-year-old female)

The absence of music in the family - a family music deficit - can be balanced, if fate allows, by other influences outside the family such as that of the many lay ensembles (such as brass bands).

Parents and young people emphasized certain observations which revealed the child's musical sensitivity and enjoyment:

The delight in dancing to all kinds of music, the playing by ear of nursery rhymes on toy instruments (xylophons, clarina, chimes), early experimentation in tonal organisation with two-voice playing on the piano, enormous musical memory from the first instrumental lesson, relatively rapid progress, creative sound-production on home-made instruments, obvious singing abilities and the early solo in the children's choir. Also the media, much cursed by many in music education, often play a decisive role: by this I mean the frequent early exposure to classical music on children's records (Peter and the Wolf, Piccolo and Sax, The Little Flute) and fairy tale cassettes.

Key-Categories:

- *Mother's influence and early practice*
- *Music-making by siblings*
- *Participation in public concerts*
- *Their own singing and music-making*
- *Listening to music on records and cassettes*
- *Early musical education*

The Preconditions for Instrumental Development

In numerous cases, the desire to learn a particular chosen instrument became clear between the ages of 6 and 11. An instrument-specific differentiation was apparent. For string-players an early start was characteristic. For brass-players a relatively late start was no impediment to a subsequently successful "career".

In early childhood the recorder or the toy xylophone were often useful introductory instruments. In not a few examples the parents dictated that the child learn the piano, but this enforced approach brought little success, and sometimes generated an aversion to the piano.

The special feature in the instrumental success of these young people was the 100% correspondence between their particular profile of talent and their choice of instruments, a one-to-one-identity between instrument and player in which the chosen instrument becomes, in effect, a "part of the body".

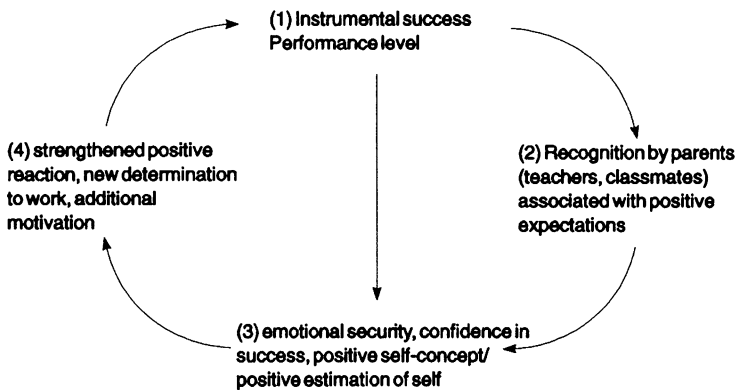
With regard to the importance of the first instrumental teacher, our findings agree with those of an American study of very talented musicians:

The first teacher was usually of modest ability, but warm, generous with praise, and able to make lessons into an enjoyable game. For pianists, the teacher was often a local person living in the neighbourhood. In all instances however, the children received individual lessons, and their parents were very involved. The second, already more competent private teacher emphasized skills and discipline more strongly. As soon as the child's exceptional talent was recognized by parents and child, the emphasis shifted further in the direction of high achievement. Eventually the family sought a master-tutor, one of those rare experts who train professionals and open the right doors for them. Parents spared neither time nor expense in this and many travelled right across the continent in their quest (B. S. Bloom, in: Der Spiegel 1982; author's translation from German).

The same can be said for the parents in our study. They spared neither time nor money in journeys to distant music schools or private teachers. This phenomenon has been discussed in greater detail under the heading of the "sacrifice" of the parents of talented children.

Lessons with master-tutors are used to breakdown the perceived deficit: a deficit of technical capacity and musical interpretation. Here however, there is no common pattern, although there is a tendency for technical perfection to dominate as artistic demands increase and stage fright becomes more of a problem. In lessons at music schools there is often an imbalance between technical work, artistic interpretation and awareness, and musical analysis. An understanding of the sense of the music as a prerequisite for a fully prepared performance seems to be neglected. Training in physiognomy, questions of interpretation and reflection about the work; in these three aspects of artistic interpretation should be given equal weight, and they must result in more than mere instrumental finger-acrobatics. There were hardly any special crises of the kind characterized by self-doubt and the desire to give up. The increasing quality of their instrumental playing - as confirmed by qualified teachers, and the successful participation in the competition "Jugend musiziert" enable them to be convinced of their talents.

Our young musicians enter into a positive developmental spiral very early on: talent and effort breed success on the one hand, and success breeds a renewed commitment, new motivation on the other hand. The circular strengthening-process of instrumental progress, complemented by the educational influence of the parents, can be presented as follows:



Of quite decisive importance in this circle is the achievement of a productive synthesis between an awakening of self-confidence and a firm belief in one's own capabilities. Self-confidence is, by no means, an automatic component of exceptional talent, but it matures little by little with the experience of performance. Lack of stimulation in this respect will constrict the emergence of talents.

And what about practice - that standard-question which causes a stir in interviews with these young people.

Exceptionally able people are extremely well motivated from within, and are relatively independent of outside stimuli, and can therefore practice well. In addition, and I will speak more about this under the heading of "personality", they have a high potential for self-realization and great interest in the development of their own talent. Their very success with their instrument is itself a self-generated reward. Of course, there is also a type of "psychic pressure" upon many of these participants which we must acknowledge - a more subtle pressure which can be more effective. When parents pay for expensive lessons, expensive instruments, and the best possible conditions for musical development, a moral obligation arises. Particularly if, as was often the case, those parents had gone without a holiday for years, or had made do with the same old car, or put up with the threadbare carpet, a sense of a responsibility can compel the young person to match the parental sacrifices with effort, hard work and also success. In fact, we can identify a relatively *powerful, achievement-oriented* educational climate in the homes of our young people. As represented in metaphors such as:

- Achievement is not swept under the carpet in our house.
- We work all the time as well.
- Everything is governed by laws, and children must learn to subordinate themselves.
- Not like at Summerhill.
- It's the Christian code: thou shalt do this, but thou shalt not do that!
- You should make the best of your aptitudes.
- Or (self-critically): My ambition was detrimental to the development of my son's personality.

And a single event:

I could be driven to every first performance, but I couldn't even get 10 Marks to go to a party. My parents accept nowadays, that this was wrong (21-year-old male).

Parental attitudes could be summarized as: *Don't spoil the child, provide a challenge instead!*, the idea which underlies the behavioral-ecological theories of Cube and Alshuth. How do they challenge the child? They take time for their Children's education. Time that we increasingly feel we cannot afford. Above all, *everything* that the child does has a high value and full recognition in the family.

If a youth decides upon an *orchestral career* then not only does s/he dream of a top-class orchestra, but also aims to work in such an orchestra. "*The standards have got to be good enough*" is an oft-quoted demand, and here Rohlfs's observations are quite correct:

Unlike many foreigners, our German musicians are not often prepared to apply for a middle position in a mediocre orchestra, even as a means of gaining a foothold on the professional ladder. Most of them dream of the first chair immediately (Rohlfs, 1984, p. 224); author's translation from German).

Of course such a wish is understandable in the context of their efforts, their ambition, and their early success in the national competition. Who wants to "go to seed in any old provincial orchestra" or "to be swallowed up by an anonymous orchestral grave"? For them, the fascination of an orchestra career lies in the heightened sense of belonging generated by the orchestral teamwork. The mediocre pay, the social inconvenience, and the dependence upon a conductor bother them less.

We don't want to be child-prodigies

Talented youngsters and particularly talented young artists run the risk of being stigmatized as "little Mozarts", "geniuses", or "prodigies", by our sensation-creating, star-hungry media. One's admiration for the outstanding performer, the expert, quickly transforms the individual into an outsider, a pitiable victim of career-conscious parents and educational forced feeding resulting in dyssynchronous personality development. One admires them, in compensation, perhaps, for one's own lack of talent, but one would not necessarily like to change places with them: the apparent stress, the privations and single-mindedness, the unacceptable excesses of achievement - people often dissociate themselves from talented people in this way.

The many professional music critiques of regional newspapers, themselves specialists, describe our young instrumentalists in a ponderous, cultivated language which stylises them as exceptional artists.

In response to the frequently encountered best-selling euphoria about child prodigies, we can say quite categorically that the successful young musicians of our investigation do not want to be child prodigies! The use of superlatives in concert-reviews, the notion of genius in public opinion, or standing ovations of several minutes duration seem not to irritate them. They do not go along with the illusion which is only created by others. In our conversations I asked this obvious question - a question which was expected and which is so often asked.

Are you or were you a child prodigy?

They all refuted my suggestion immediately: they frowned, looked at me suspiciously, shook their head or raised their hands defensively, when speaking of that "fatal mistake" which was invented and cultivated by the media. The label "child prodigy" left them with a "nasty aftertaste"; it evoked connotation of obsessional, one-dimensional fixation on an instrument, effortless achievement, talent and giftedness without hard work or difficulties. They had worked too hard for too long to be described as "child prodigies". "Child prodigies" was something else as far as they were concerned. Child prodigies lacked that essential depth of involvement with music.

I never wanted to be a child prodigy, but always to be seen as a fully developed adult, and, from a certain point of time, a mature artist. Of the child prodigy, one says: "Yes, that's great, but he's still a child", and I never wanted to be seen in that way (16-year-old female).

For them, all talk of "child prodigies" is a reification which belongs in the realm of mythology, not in the mundane everyday world of hard graft and practice. They are far too critical, far too down-to-earth to be able to see themselves as pampered child prodigies. They talk instead of the harsh realities of competition and struggle, and they want to live like others of their age. And then, there are the hard facts to consider: technical deficiencies, immature musical statements, inadequate interpretations, little crisis and depressions - not the stuff that child prodigies are made of. They counter any talk of child prodigies with descriptions of their work and industriousness.

That, for a child prodigy, would be somewhat atypical:

I take issue with people who say: "Oh, what a fantastic talent!" or "what a prodigy!" I blame it on the press which invents all these stupid ideas. No, first and foremost comes hard work and industriousness. That is the most important. The hard work enables you to develop your particular natural aptitudes. It is simply not the case that someone gives you a flute, and you find you can play beautifully. First comes the hard graft! (18-year-old female).

Musically Talented People are Multi-Talented People

If specialists themselves suspect that specialisation on a single instrument leads to a narrowing of musical horizons: "A pianist runs the risk of seeing piano music as central and other music as of only peripheral importance. Specialisation on a single instrument can therefore

lead to a narrowing of musical horizons ...", I can only say, that my biographical documents refute this completely.

For the national winners of "Jugend musiziert", this supposition is entirely false. They play second and third instruments (83% in the sample), and not only as a side-line. One youngster won the 3rd National Prize on recorder and reached performance level 2 in the same competition on the oboe. A 17-year-old played at national level on the flute, and entered the next competition with the violin. And many are capable of playing at regional or national level on second and third instruments.

Their talents are not restricted to music either: a young violinist wins a regional public speaking-competition, a trombonist copied pictures by Dürer with startling accuracy and paints whole walls with nature pictures, paint-bucket in hand, a 17-year-old oboist writes poems and wins first prize in her state competition: An example (17-year-old female):

Seiltanz

*Wenn sie mir zulächeln,
lache ich zurück.
Ich tanze über das Seil
und falle herunter
und staune
daß keiner mich auffängt.*

*When they smile at me,
I answer with laughter.
I walk on the tightrope
and fall off
and am astonished
that no one catches me.*

The above-mentioned recorder player composes, and one of his compositions won outstanding honours for the Avantgarde-Prize of his city. School graduates with an Abitur-grade of 1.0 (equivalent to 7 or 8 A-levels) are no rarity in our sample, and they still want to study music, because for them music is everything. Others plan to study medicine, law, information technology, electrical engineering, economic journalism, politics or philosophy. And most of them emphasized, that for them the demands of schools have presented little or no difficulties in spite of the intensive involvement with music.

A young organist writes short stories that have been published, a clarinettist made a historical study of the persecution of Jews in his hometown, and was awarded a prize by the city of Amsterdam. A 19-year-old violinist talks of her earlier interest in painting, and shows a self-portrait in oils: the big instrument, the little pupil, the important-looking teacher. One thing is sure: these young musicians know what they want, their ambition on the instrument, their tenacious constant practice, their stamina and their exceptional efforts have shaped them for life. They certainly do not give up easily. They refer to orchestral tours including local, national and European.

My theory of the multi-talentedness of exceptional artistic ability can be explained with reference to the characteristics of an individual talent: Exceptional performance ability is a complex combination of different talents (intellectual, creative, practical, psychomotor), of motivational factors (industriousness, commitment, independence, continuity, stability) and of articulation, thought and work (involving flexibility and originality). Said another way: outstanding musical capability is accompanied by creative, artistic and psychomotor capabilities, and these have a positive influence upon other areas. In their self-evaluation, the young people identified the following aspects of talentedness to which they laid claim:

1. an expressive ability
2. sensitivity to feelings
3. ability to conceptualize structures
4. memory

5. essential physiognomic features

6. sensory capabilities

I can confirm without reservation the findings of the American Terman in his longitudinal study (1921 to 1965). Young instrumental talent reveals itself through:

- goal-directed integration of their work
- unusual staying-power
- high self-confidence
- interest in leadership (1st violin on the 1st chair of the orchestra, H.G.B.)
- very high standards with respect to the quality of their work.

High expectations of self and self-criticism or "dilettantism" is deadly nerve-racking for me

The description of the self-portrait of talented youngsters (using the Semantic Differential method) emphasizes determination, ambition, and self-criticism as important personality components of musical talent. According to Weiner's (1972) achievement motivation model, the inner factors "effort" and "capability" explain the motivational action of young musicians. "Luck" as an external and random factor has no place in the focussed goal-directed lives of these young people.

Also inherited talent (a hypothetical concept), a certain "gift", figures less than industriousness, endeavour, effort and a healthy portion of self-discipline: "Talent is not a present, it's an obligation". Our musicians provide empirical conformation for the assumptions of de la Motte-Haber (1984, p. 25; author's translation from German).

Human action, such as the playing of an instrument, does not depend on how gifted the person is, but is influenced by motivational factors, and people with similar levels of giftedness perform at vastly different levels for this reason. There is a complex correlation between aptitude and motivation.

Self-confidence, self-criticism, and a constant striving for improvement are the overwhelmingly conspicuous personality characteristics that we recorded again and again in our interviews. The reasons for these are various: a performance-oriented, working-motivated parental home, positive experiences of instrumental playing (very good lessons, rapid progress), national success in "Jugend musiziert", public acclaim, and praise from all sides (including talk about child prodigies).

Their self-concept has been shaped during a very long instrumental training by highly qualified experts: ever higher standards, ever greater accuracy, never casual, never sloppy, always new and more exacting aims, the utmost striving for perfection. The side-effect of their music-making is clear: knowingly or not, they are laying the foundation of their future-life's work.

In my study of the competition "Jugend musiziert" (Bastian, 1987, p. 22), I have already described the reaction of participants who did not win prizes: "Frustrated, but motivated!"

Often the disappointments with the comments and decisions of the jury ignite sparks of ambition and the desire to show teachers, parents, jurors, and oneself, that "next time I'll be the winner".

Such a reaction is characteristic of young people whose achievement motivation concept is shaped by the "hope for success" (Heckhausen, 1968). These young people are very critical: of the low status of art in our society, of music teaching in ordinary school (satiram non scribere difficile est!), of their early music-lessons, and, above all, of themselves. This self-criticism is so conspicuous that it can be worrying, and it can give cause for concern. It was the only unpleasant aspect of the many conversations, because it was often overdone, excessive, far beyond natural ambition and essential healthy *laissez-faire*.

It immediately makes one wonder, what effect these exorbitant expectations of self have upon friendships, partners, colleagues. Are they entitled to make human mistakes, to be careless or thoughtless, to underachieve? The extraordinary instrument-determined approach to life sets standards at almost unattainably high levels.

This raises questions about the quality of life, the degree of psychological fitness for life, when untrammelled ambition grips and dominates the entire life of a young instrumentalist. All too easily, daily life becomes controlled and planned in the same way, as a piece is prepared for performance. The habit of attention to detail, the rubato-triplets, the exciting details of the tarantella, the need for more musicality in the andante, become all pervading. The share quantity of self-criticism, self-imposed work-ethic, and discipline of the girl described above tends to define her as an outsider who will probably find the all-too-human side of life difficult to cope with one day. Our study confirms the comments of Federal President Richard v. Weizsäcker (1985, p. 3) in his address at the International Music Festival of Stuttgart:

"Our up and coming young musicians find it difficult, and often feel that they are of lower quality, for example, than many foreign competitors. At music school, they cannot make up the ground that should have been covered when they were younger. They often say that we do not attach sufficient importance to the very earliest stages of musical education. Perhaps many young musicians worry too much and demand too much of themselves. A violin student said to me recently, that a violinist who could not play the Bruch Concerto at the age of 16 had no chance of gaining a position in a good German orchestra against all the foreign competition. And if you wanted to get into the Berlin Philharmonic, you had to be able to play the Bruch at the age of 12." (author's translation from German).

The exacting standards and over-high expectations of the young people are clear from their own words.

I place high demands upon myself because I always have to prove something to myself (19-year-old male).

I always strive to improve my best performance. That's my basic attitude: to set myself attainable goals which are higher than my previous best (20-year-old male).

Whenever I play, I am my own biggest competitor. If the performance is not my best, then I see it as the worst possible failure. No one poses such a threat to me as I do myself (16-year-old female).

These comments of young ambitious up and coming musicians who are dreaming of big careers as first chair orchestral musicians (or sometimes as soloists) speak for themselves and need no commentary. If we ask about the educational consequences of these attitudes, the words of Sir Georg Solti (1987) provide a good answer:

"One must encourage children to work, obviously! If my mother hadn't done that, I would have never become a musician. But do not flog the children for 5 or 6 hours daily, and neglect general education. That's wrong. They can be child prodigies until they are 20 years old, but then we demand mature musical performance of them. They usually fail to deliver the goods. One could say: if a child is not forced, but treated gently and prepared slowly for this difficult and stressful career, then no harm is done (...). If I had an outstandingly promising son or daughter, I would allow the child to develop musically under certain conditions:

1. that schooling is not neglected,
2. that the child is not over exerted,
3. that the child is not too specialized,
4. that the child is protected emotionally.

We've seen enough sad and tragic examples". (Author's translation from German.)

In the meantime, I hope that these young people will realize some of their dreams. Their positive self-concept, high attitudes, and self-discipline seem to be a sure guarantee of future success.

Methodological Reflections

The biographical researcher who wants to reconstruct and interpret life-stories, life-pictures, and life-pathways, has inevitably to make abstractions in many details. He is like a geographer who cannot look at every molehill and furrow. He would lose himself in chaos, but he has to look at the contours of the land in order to determine its special structure, and its distinctness from other landscapes. The researcher has to use his experience and sense which is determined by the many live interviews to decide which details to leave out, which to interpret, which to emphasize. Biographical research is not so different from historical research in general. An objective biography is as impossible to achieve as an objective historical text.

And you will understand, that the researcher cannot allow himself to be rendered incoherent by well-intentioned caution, not can he write a self-justifying footnote to cover every possible criticism. Neither did I want merely to report on musical development (nor could I; such a task may seem modest, but it is actually quite enormous and could not succeed). Egon Friedell's (1927) view of historical research, described in his *Cultural History of Modern Times*, is relevant also as a starting point for my biographical studies:

"Many historical consequences and effects become hidden, out of sight, and only become apparent much later if at all. We do not know the true basis for the mysterious progress of human development. However, if a mere mortal should ever become able to unravel this mystery and write such an impartial work (i.e. an objective historical study, H.G.B.). An even greater difficulty would arise, namely to find a second mortal who had the strength to read something so boring." (author's translation from German).

Biographical research is a tightrope-walk, a balancing-act between the individual and the population, between cause and effect, between subjective memory and objective content, between legitimate and illegitimate criticism and evaluation, between unnecessary overcomplication and unreliable oversimplification. To listen to self-aware, critical, and single-minded young people, telling their life-stories, is not only exciting, but also highly instructive. And, of course, it is well known, that the best, most instructive stories are stories from real life.

I could not do better than to finish with the words of one of the youngsters:

"For me, music is a way of summoning the strength to explore the most important aspects of being. Music has something absolute about it, something that means more than a 500-page philosophical treatise. If I listen to Strauss' Zarathustra, I am reminded so vividly of Nietzsche's writings, that I could be reading one of his books. When I listen to the 2nd movement of Beethoven's 7th symphony, the part where only an absolutely calm chord is played, I experience a shuddering sensation in my scalp, the Absolute. That's something which is independent of human beings and can only be experienced through music. It even lifts me out of depression. Music has often been my only source of help in times of difficulty. If I imagine Bach, for example, who wrote his music for God and man, and whose inspiration is a mystery to me. Perhaps it is simply his creativity that we find so irresistibly fascinating." (author's translation from German).

And this is how he sees his role as a musician:

The highpoint of a concert for me is, when someone weeps not when someone strokes his belly and says: "Oh, that was nice." I see the weeping as an ecstatic statement. The listener should go home disturbed after a concert, have a sleepless night, feel different from normal. In central Europe, people live so close together and are so reluctant to allow themselves feelings, passions, emotions. It often feel very stultifying, like a bad tape-recorder in which all the high and low sounds are missing. Extreme passions are castrated! And I want to generate them in my music. I want to affect people, so that they are emotionally shaken. And I will strive to do that, even if it is perhaps a utopian aim. To do that, one has to perform with complete honesty, emotions laid bare. And this demands a lot and rarely brings success. When I am successful, I am struck by the reactions of people who sit there, perhaps even crying. I remember the experience of an old man who cried uncontrollably, although I could

see, that he was ashamed of his tears. I had the impression, that he hadn't cried for twenty years or more. I am afraid of that, of penetrating the intimacy of people's inner feelings. Yet nonetheless, that's what I want to do." (21-year-old male; author's translation from German).

I am happy to announce to you the start of a longitudinal study of my exceptional young musicians: "10 YEARS LATER - WHAT HAS BECOME OF THEM?"

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Early educative influences on later outcomes: The Terman data revisited

Herbert J. Walberg, Guoxiong Zhang, Eileen P. Haller, Timothy A. Sares,
Winifred E. Stariha, Trudy Wallace, and Susie F. Zeiser
University of Chicago and Chicago Public Schools, Chicago, Illinois, USA

Abstract

Using data collected on 856 males and 672 females with IQs over 135 followed by Lewis Terman since 1922, relatively fixed conditions such as parental socioeconomic status (SES) were employed to predict the influence of relatively alterable conditions such as home library size, malleable character traits such as self-confidence, and as adult accomplishments such as occupational prestige and work satisfaction. In addition, the alterable conditions and traits were used to predict adult outcomes with fixed conditions controlled. Canonical correlations showed that the fixed variables predicted both alterable variables and outcomes, but the alterable variables made no independent contribution to the prediction of outcomes. Although the Terman longitudinal sample is unique in several respects, it appears to support other studies showing unpredictability of adult outcomes from alterable conditions after, say, ten years of age.

Educational outcome research usually focuses on immediate results indicated by achievement tests, attitude measures, and behavioral performance. Although such indicators are useful, they hardly constitute the complete set of intended outcomes since many educators and parents hold that early conditions and accomplishments foreshadow long-range success in later life.

The purpose of the present study is to attempt to estimate the relative effects of early socioeconomic advantages, abilities and accomplishments, and subsequent educative environments and proclivities on long range success among gifted students. The study makes use of the Terman (1940) data on highly intelligent California children born early in the century. Although generalizations must be limited to this unique sample, the Terman study provides one of the most comprehensive, carefully collected, long-range data sets available on gifted children.

Early Interventions

Considerable research shows that the amount and quality of instruction as well as educationally-stimulating environments of classrooms, homes, peer groups, and mass media strongly and consistently influence short-range academic learning (Fraser *et al.*, 1987; Walberg & Stariha, 1992). Yet long-term research provides little evidence that early educational advantages and experiences independently confer large or consistent benefits in adult life.

Indeed, it has even been difficult to find specific educational effects on achievement and other educational outcomes two or three years beyond the termination of special programs intended to promote achievement. White (1992), for example, analyzed more than 300 evaluations of

preschool intervention programs for economically disadvantaged children. Comparisons revealed a substantial (.5 standard-deviation) achievement superiority of program over control groups measured at the end of the programs, but this advantage disappeared within three years.

Socioeconomic influences

In contrast to short-term programs that only occupy a limited fraction of children's daily life, enduring family characteristics such as wealth and poverty might be expected to show large, enduring effects. A vast literature bears upon the inter-generational effects of parents' socioeconomic status (SES) on their children's academic development and life success. Many national surveys and secondary analyses by economists and sociologists such as Featherman, Griliches, Hauser, Jencks, Lazear, Taubmann, and others bear upon this question (see reviews by the economist Michaels, 1982, and the sociologist Sewell, 1981). Other studies have examined the influences of parents' education on the cognitive development and health status of their children.

The reviews conclude that student learning is consistently associated with levels of parent education, but the relation is surprisingly weak. White (1976), for example, compiled 636 correlation coefficients of parental education, occupation, and income indexes of SES with ability and academic achievement from 101 studies. The average correlations of learning with parent income, occupation level, and education were respectively 0.31, 0.20, and 0.19.

The SES-learning correlations, of course, may be underestimated because of restriction of range in sampling, unreliability of measures, and other reasons. Still, the best learning correlate - income - accounts for less than 10 percent of the variance. Since the SES indexes were taken at roughly the same time as the learning measures, moreover, the actual longitudinal predictivity of learning over time from SES might be even lower because of intervening environmental vicissitudes.

Moreover, the causal influences of SES on academic learning are unclear since they may operate in several ways that are difficult to disentangle. Highly educated parents, for example, may themselves provide better child rearing as a result of their superior education; but they may also purchase, because of their higher income, better child-rearing goods and services. Both SES and learning may also be influenced by genetic and environmental factors that account for their weak correlation. In any case, longitudinal analyses can help sort out such influences by estimating the influences of intervening education and environments taking into account initial SES, ability, and other relevant measures.

Educational effects

If the effects of generalized intervention programs on learning are evanescent and the influences of socioeconomic status are small and complex, what are the effects of learning itself on adult success? Surveys of adult outcomes provide little evidence that students with good grades succeed much better than their fellow students. In 35 studies of business, military, and civil-service people, as well as teachers, professors, scientists, physicians, and nurses, grades accounted for an average of 2.4 percent of the variance in income, self-rated happiness, and job satisfaction, numbers of patents and publications, and effectiveness rating by peers and supervisors (Samson *et al.*, 1984).

All these groups, of course, are more homogeneous than the general population in abilities indexed by grades that presumably make for personal and career success; such small variance limits covariance and therefore predictive validity. Having a specialized degree, moreover, even though one's grades were poor, must surely confer some technical competence and may lead to higher income and other outcomes than that of a comparable person without such a degree. Still, the low correlations inspire little confidence that added effort to achieve higher grades

results in better long-range outcomes than that, say, gained by specific training, on-the-job experience, social intelligence, and character traits such as independence and perseverance.

Why the absence of linkage of educational and life success? The derogatory connotation of the word "academic" suggests one set of explanations. More formally, Resnick (1987) argued that school learning is individual, abstract, symbol manipulating, and generalized in contrast to learning outside school which is shared, contextualized, tool manipulating, and situation specific. For these reasons, school conditions and outcomes may have little independent added value in lifelong success and may even be counterproductive in encouraging too much of the wrong thing. In any case, most educational research has naturally focussed on short-term, school outcomes; and research on long-term outcomes is sorely needed.

Multivariate influences

If education by itself does not decisively influence adult success as measured by various indexes, neither do SES and other aspects of social background. Walberg and Weinstein (1984) analyzed the statistical dependencies of adult outcomes on 25 indexes of SES and background (including age and sex of the respondent and parental characteristics), diplomas and degrees, and a vocabulary test obtained on about two thousand men and women in the General Social Survey - a set of comprehensive, personal interview data obtained on cross-sectional national cohorts over several decades.

All independent variables in combination accounted for only small amounts of estimated variance in adult outcomes. Family background, diplomas and degrees, and vocabulary, for example, together accounted for less than 13 percent of the variance in income, health, and happiness.

Among the combinations of predictors and outcomes, however, diplomas and degrees accounted for 43 percent of the variance in occupational prestige. This, the strongest association, merely confirms the obvious relation of education and prestigious employment; professional degrees, for example, in law and medicine forecast work in these prestigious occupations. However, the unique contribution of diplomas and degrees to occupational prestige (beyond that accounted for by social background and verbal competence) was only 2.3 percent.

These findings seem typical of recent associations of educational and other formative effects on long-range adult outcomes. One of these, perhaps the most important in life - happiness ("subjective well being" in research jargon), has been quantitatively synthesized. Witter, Okun, Stock, and Haring's (1984) collection of 176 (zero-order) correlations from 90 studies showed that the amount and quality of education accounted for only one to 3 percent of the variance in indexes of life satisfaction and happiness; the association had apparently remained constant for the preceding half century. When the association was controlled for occupational prestige, the variance estimates were even smaller.

Even some fixed or relatively unalterable factors that appear to have moderate short-term effects when examined in isolation from other causes fail to show long-term influences in longitudinal research. Sewell and Retherford (1992), for example, examined early influences on occupational attainment in large, random sample of Wisconsin students followed over many years. Contrary to many cross-sectional studies, neither gender nor birth order had discernible effects on occupational attainment when controlled for differences in age and educational attainment.

Searching for efficacy

It appears at best that social background and education in combination lead to slight advantages on indicators of adult success. Their separate influences independent of one another,

however, are very weak - perhaps nil - and difficult to detect. Although they remain systematically and statistically undocumented, many other factors, such as accidental opportunities, initiative, character, and social intelligence may play far larger roles - although these may be even more difficult to measure and document.

From a parental or educational standpoint, it would be desirable to know what specific, alterable experiences in the formative years yield payoffs not only in academic learning but also in adult accomplishment, well being, and other life outcomes. Since 23 large scale surveys of 250,000 students show fairly consistent influences of nine proximal factors on academic learning and other short-term accomplishments (Walberg & Stariha, 1992), they can serve as a useful conceptual framework (discussed below). The longitudinal Terman data, moreover, may allow a better isolation and estimation of causal effects since it can be assumed that low to moderate intelligence could not have deterred accomplishments. In addition, the data allow statistical control for measured intelligence, social background, and experience at an early point in time so as to isolate the influences of subsequent experiences and propensities on subsequent accomplishments. For these reasons, the unique features of the Terman study are worth considering.

The Terman Study

Early in this century, Lewis Terman, a Stanford University professor of psychology, translated the Alfred Binet's intelligence test from the original French and standardized it on U.S. samples. During this work, he began to question the turn-of-the-century stereotype of the gifted child as physically frail, prone to neurosis, and likely to decline intellectually by late adolescence. He therefore sought to investigate the mental, physical and personality characteristics of highly intelligent children and the nature of their development.

Sample

Beginning in 1922, Terman initially identified a group of bright California school children, then periodically assessed their personality characteristics, social attitudes, and mental capabilities. He defined gifted children as those with IQs over 135, "whose ... tested intelligence is equaled by only about one in two hundred of the school population" (Terman, 1939, p. 66).

The age range of Terman's initial sample of more than 1,000 was four to fourteen years with a median between nine and ten. Later 378 high school students and 58 younger siblings were added to the study making the total sample size 1528. The professional status of the fathers exceeded that characteristic of the general population. A third of the fathers were professional, one half were semi-professional or business class, and less than 7 percent were from the semiskilled or unskilled class (Terman & Burks, 1931). Siblings of gifted children also were found to be above average intellectually (between 120 and 130 IQs).

Method

The initial testing protocol included the Stanford-Binet Intelligence test, Stanford Achievements tests, a general information test, interest questionnaires, and medical examinations (Terman, 1924). The study included measures of personality, social behavior, instructional experience, as well as measures of home environment such as the number of books in the home, the amount of time spent reading, and parental marital satisfaction. Field workers made home visits for parent interviews and assessment of the home environment. In 1928, the students and parents were again interviewed and completed questionnaires. In 1936, 1950, 1955, 1960, 1972, and 1986 questionnaires were mailed to the participants.

Terman's findings

Confirming his initial suspicions, Terman found that the gifted children belied their stereotype. They scored above average on measures of emotional stability, and had more hobbies than other children. Gifted girls scored higher on masculine tests than average girls and were less interested in stereotypically feminine activities. The sample was bookish, however, and Terman suggested that the close relationship between the IQ and reading scores is, "probably because gifted children are such omnivorous readers" (Terman & Burks, 1931, p. 779).

To obtain a clearer view of factors that influence successful career achievement, Terman divided the male sample into the top and lower fourths by the criterion of "the extent to which a subject had made use of superior intellectual ability" (Terman, 1940, p. 300). He limited the study to men since the majority of women were homemakers whether by choice or lack of opportunity. (In some parts of the study, however, he compared the responses of men to those of women who entered the work force).

Using this approach Terman found differences between the early backgrounds of relatively successful and unsuccessful adults. Twice as many parents of the successful adults were college graduates, and their fathers were more likely to be professional. Divorce and separation was less frequent among their families. Although there was little difference in academic achievement during the elementary school years, those who were later successful, by Terman's criterion, began to excel in high school. Ninety-seven percent of the successful participants in the study entered college, an 90 percent graduated while only 68% of the unsuccessful group enrolled in college and only 37% graduate.

Terman's findings are consistent with many subsequent studies (discussed in a previous section) showing positive influences of parental socioeconomic status and other family characteristics on success in school and college. Indeed, Terman's results show large difference between in college matriculation and graduation rates, but these results may be an artefact of Terman's weighting his criterion by education rather than nonacademic accomplishments.

The purpose of the present study is to extend Terman's approach by using modern multivariate analyses and a theoretical framework to guide the analyses. These analyses avoid the subjective judgement of "the extent to which a subject had made use of superior intellectual ability" (Terman, 1940, p. 300) and allow 1) examination of the full range of variation in the sample rather than the top and bottom quarters; 2) exploration of a wider range of indicators of success; 3) a search for explanatory or independent variable beyond parental SES and marital status particularly those that might be relatively alterable by parents and educators; and 4) estimation of the separate or unique influence of such alterable factors by statistically controlling for early ability, socioeconomic status, and family and educational conditions.

Because the opportunities of the boys and girls in the first half of the century differed more widely than they do today, the present study employed separate analyses of the data for females and males. Even so, it should be recognized that findings on gifted children from earlier decades are not, by themselves, sufficient to suggest implications for today's youth.

Method

Sample Attrition

Despite Terman and his colleagues' extraordinary efforts to retain participants in the study, the sample grew smaller with subsequent waves of data collection because of deaths, moving, and indifference. For this reason, several conflicting criteria had to be considered: maximize the sample size, minimize the numbers of missing cases on important variables, and gain the longest-term indicators of success. All things considered, 1950 seemed the best cutoff point

for the last wave of data collection to be included. During this year, those still in the sample were between 33 and 42 years of age. This left a potential sample sizes of 856 males and 672 females.

Although this decision provides a balanced choice among the criteria, many in the sample were still missing information on certain variables. Therefore, the variables with the largest amounts of missing information were omitted. A large set of such omitted variables were health characteristics identified for only about one-third the sample in a medical examination. In addition, parents in relatively large numbers did not respond to some questions, and these also had to be omitted.

In addition, some participants had not responded to particular questionnaire items, and some missed a wave of data collection. To keep them in the sample, the means of nonmissing cases were substituted for their missing values. This substitution provides for a neutral value, neither high nor low, so as to limit distortion the analyses. Since the extremes of the variable distributions mainly determine their correlations with other variables, this seemed a better choice than omitting further variables or cases.

Selection and classification of variables

Since the Walberg educational productivity model has an extensive record since 1976 as a framework for organizing empirical findings on factors influential on academic learning and other accomplishments (Fraser *et al.*, 1987; Paschal & Stariha, 1992; Stariha & Walberg, 1992), it guided the classification of variables in the Terman data. The model posits nine psychological factors grouped into three clusters: a) aptitude - 1) ability or prior achievement, 2) motivation, and 3) age or developmental level; b) instructional - 4) quality and 5) quantity; and c) the environments of the - 6) classroom, 7) peer group, 8) home, and 9) mass media. In multivariate analyses of large-scale survey research, measures of these factors have shown consistent influences on learning when controlled for one another and other factors. Experimental and quasi-experimental studies, moreover, have shown consistent effects of quantity and quality of instruction and home environments.

In addition, life-outcome variables were also included as were socioeconomic status indicators and other respondent information. In the analyses, the variables were grouped into the following classifications.

Relatively Fixed Variables. Collected in 1922 and 1923 when the sample ranged from 5 to 14 in age (Terman, 1924, p. 158), these variables included prior experiences and relatively unalterable traits. Ability included the following: the Stanford-Binet Intelligence measure (mean: 149 for boys and 148 for girls), psychological ratings of originality and mechanical ingenuity, and the ages of beginning music, dancing, language, and reading. Motivation included attitude toward school, number of youthful collections, ages at beginning collections, hobbies and things constructed. Age and development related variables included age at initial testing, ages of beginning kindergarten and first grade, grade skipping, grades skipped, and grade repetition. Respondent information included ethnicity (white or other), rural or urban, natural or adopted child, and father's and mothers' education and occupation.

Relatively Alterable Variables. Also collected in 1922 and 1923, these variables were regarded as relatively alterable particularly by educators and to some extent by parents. Quantity of instruction included weekly hours of school instruction. Home environment included the size of the home library, parental stimulation of the child, hours of weekly home study, hours per week spent with child by parents, the use of punishment, and the child's leisure activities.

Also, included in the category of relatively alterable variables were psychological traits that seemed possible to encourage, as well as experiences and practices that might be fostered. These included the Terman teams' ratings of such traits as health, prudence, self-confidence,

sense of humor, and popularity with other children, as well as activities such as using tools and apparatus, housework, leading a team, creative performance, leisure reading, and the practices of music, drawing, and dancing.

Outcomes. These data were mostly collected in 1950 when the sample ranged from 33 to 42 in age. This category included earned income, occupational prestige, political offices held, and marital status; number of honors, publications and other creative works, and service activities; life satisfaction with respect to work, accomplishments, marriage, children, religion, and the fulfilling of intellectual potential; and number and education of children.

Analytic approach

Since there were many independent and dependent variables, chance relationships would have been exploited by examination of individual correlations of the many variables. Canonical correlation analysis protects against such chance findings by determining the strength and significance of relations between two sets of variables (Darlington *et al.*, 1973).

In addition, canonical analysis yields "loadings" (or correlations between the original variables and the canonical variates) which objectively identify statistical patterns, influences, and results linking specific variables. Since many SES and educational experiences vary together, canonical analysis avoids the redundancy of multiple findings but reduces the relations to the most parsimonious accounting. In much the same sense that factor analysis identifies the underlying factors in a single set of variables, canonical analysis identifies factors (and associated loadings) that statistically link two sets of variables.

For both boys and girls, three canonical analyses were computed which predicted 1) the outcomes from the relatively fixed variables, 2) the relatively alterable variable from the fixed set, and 3) the outcomes from the alterable variables with the fixed variables controlled (by partial correlation). Although all three analyses may be of interest, the third was of greatest practical interest because it might provide hints about alterable practices and malleable proclivities might lead to successful adult outcomes beyond that accounted for by socioeconomic status and other relatively unalterable influences.

Results

For males, the first canonical correlation predicting outcomes from relatively fixed variables (Model 1, Table 1) was .37. The results show the familiar pattern of parental SES predicting children's years of schooling and level of occupation, although not reliably since the variances accounted for are quite small. Associated with this pattern, however, was a somewhat stronger finding for the number of adult honors. In the case of girls, the corresponding canonical correlation was insignificant which suggests a lack of effect of socioeconomic advantage and opportunity for bright girls on the outcomes measured during the thime period in question.

Table 1: Canonical Correlation Results for **Males** in Three Models

Model 1: Fixed Variables ==> Outcome Variables	0.37 (0.02)
Highest School Grade of Father	0.19
College Degree obtained by Father	0.18
Father's Occupation 1922: Census Grouping	0.15
School Grade at Time 1922 Interest Blank	0.14
Highest School Grade of Mother	0.14

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Number of Honors Since 1940	0.50
First Child: Years of Schooling Completed	0.37
Second Child: Years of Schooling Completed	0.36
Occupation: 1946-1950	0.29
Life Satisfaction: Work	0.27

Model 2: Fixed Variables => Alterable Variables 0.81 (0.0001)

General Intelligence	0.69
Originality	0.66
Mechanical Ingenuity	0.19
Original IQ	0.18
Facts about Home Environment	0.14

Variety of Interests	0.78
Common Sense	0.67
Will Power and Perseverance	0.49
Self-Confidence	0.47
Desire to Excel	0.47

Model 2 (Cont.): Fixed Variables => Alterable Variables 0.77 (0.0001)

Originality	0.63
General Intelligence	0.62
Mechanical Ingenuity	0.26
Father's Occupation 1922: Census Grouping	0.22
Highest School Grade of Father	0.11

Variety of Interest	0.70
Common Sense	0.65
Self-Confidence	0.46
Sense of Humor	0.45
Will Power	0.41

Model 2 (Cont.): Fixed Variables => Alterable Variables 0.70 (0.0001)

School Grade at Time 1922 Interest Blank	0.63
Chronological Age in Months	0.61
Combined Quotient (Stanford Achievement)	0.45
Original IQ	-0.26
Childhood Residence	-0.19

Number of Hours of Home Study Per Week in Last Year	0.69
Age of Beginning Collection	0.37
Age of Entering School (Above Kindergarten)	0.34
Age of Beginning Music	0.32
Age of Beginning Dancing	0.32

Model 2 (Cont.): Fixed Variables => Alterable Variables 0.62 (0.001)

Mechanical Ingenuity	0.52
Original IQ	-0.15
Highest School Grade of Father	-0.15
Facts about Home Environment	-0.13

Using Tools or Working with Apparatus	0.64
Intellectual Modesty	0.21
Size of Home Library	-0.20
Will Power	0.20
Amount of Reading Compared to Average Child	-0.18

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Model 2 (Cont.): Fixed Variables \Rightarrow Alterable Variables 0.56 (0.001)

Highest School Grade of Father	0.39
Highest School Grade of Mother	0.32
Father's Occupation 1922: Census Grouping	0.29
Childhood Residence	-0.17
Facts about Home Environment	-0.13
Size of Home Library	0.60
Early School Entry	0.30
Earliest Half Grade Skipped After Entrance	0.25
Studying Your Lessons	0.23
Desire to Excel	0.22

Model 2 (Cont.): Fixed Variables \Rightarrow Alterable Variables 0.50 (0.001)

Facts about Home Environment	0.37
Mechanical Ingenuity	0.15
Mother's Occupation 1922	0.13
Highest School Grade of Mother	0.12
Freedom from Vanity and Egotism	0.40
Truthfulness	0.35
Using Tools or Working with Apparatus	0.31
Truthfulness	0.26
Conscientiousness	0.26

Model 2 (Cont.): Fixed Variables \Rightarrow Alterable Variables 0.48 (0.001)

Mechanical Ingenuity	0.18
College Degree Obtained by Father	0.18
Facts about Home Environment	-0.18
Original IQ	0.16
Childhood Residence	0.13
Conscientiousness	-0.26
Prudence and Forethought	-0.25
Desire to Excel	-0.24
Offices, Positions, Honors Held (First Mention)	0.23
Theory of Child Training: Answering Questions	-0.22

Model 2 (Cont.): Fixed Variables \Rightarrow Alterable Variables 0.43 (0.01)

Father's Occupation 1922: Census Grouping	0.22
Mechanical Ingenuity	0.15
Chronological Age in Months	0.10
Original IQ	-0.09
A natural, Foster or Adopted Child	-0.09
Liking for School	-0.33
School Grades Skipped (First Mention)	-0.30
Size of Home Library	0.25
Desire to Excel	-0.22
Age of Beginning Collection	0.20

Model 3: Alterable Variables \Rightarrow Outcome VariablesControlling for Fixed Variables 0.52 (0.356)

Child's Leisure Time Activities (Second Mention)	-0.28
Health	0.23
Prudence	-0.22
Kindness	0.22
Plays and Games: Play Info, Masculinity	0.22

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Creative Work Other Than Writing	-0.39
Number of Honors, Awards, Accomplishments	-0.30
Number of Service Activities	0.25
Lived Up To Intellectual Abilities?	-0.25
Second Child: Occupation	0.24

Model 3: Alterable Variables \Rightarrow Outcome Variables
 Controlling for Fixed Variables 0.51 (0.824)

Cheerfulness	0.35
Emotional Self-Control	0.23
Will Power	0.23
Leadership	0.22
Being Leader in a Team or Club and Management	0.22
Earned Income 1946	0.34
Feeling About Present Vocation	0.33
Publications Since 1940 (Second Mention)	0.28
Life Satisfaction: Other	-0.27
Earned Income 1947	0.25

With respect to fixed predicting alterable variables, eight canonical correlations were significant for males (Model 2, Table 1). They may be briefly characterized as follows: General intelligence and originality predicted a variety of interests, common sense, and motivational traits. The same variables also predicted a slightly different weighting of interest variety, self-confidence, and related traits. Mechanical ingenuity predicted tool use, working with apparatus, intellectual modesty, will power, a small home library, and little leisure reading. Higher grade levels completed by parents, father's occupation, and advantaged home life predicted a large home library, grade skipping, and academic motivation. Advantageous home circumstances, higher levels of mother's education and occupation, and mechanical ingenuity predicted tool use and several character traits - modesty, truthfulness, and conscientiousness. Mechanical ingenuity, father's graduation from college, disadvantaged home circumstances, urban residence, and IQ predicted political offices, positions, and honors held but lower ratings of conscientiousness, prudence, forethought, desire to excel, and questioning as a prominent means of child rearing. Father's occupation and mechanical ingenuity predicted less liking for school, fewer grades kipped, a larger home library, less desire to excel, and an older age of beginning collections.

As shown in Table 2, seven significant canonical correlations related fixed and alterable variables for females: General intelligence and originality predicted early school entrance and positive character traits. General intelligence, originality, and mechanical ingenuity predicted self-confidence, sensitiveness, conscientiousness, and unselfishness. Older, higher achieving girls were more likely to have entered school later than kindergarten, studied more, and begun collections and music study. Higher originality and mechanical ingenuity predicted truthfulness, prudence, leadership and a stronger sense of humor but less sensitivity. Father's occupation and highest school grade predicted a larger home library, early school entry, a later age of beginning music, and some self-centeredness. Greater parental education, father's occupation, advantageous home circumstances, and mechanical ingenuity predicted a large home library, exercise-driven game playing, generosity and unselfishness, leadership, and an absence of intellectual modesty. The length of first employment, disadvantaged home environment, and absence of originality predicted leadership, vanity, and physical energy but less conscientiousness, sympathy and tenderness.

Table 2: Canonical Correlation Results for Females in Three Models

<u>Model 1: Fixed Variables == > Outcome Variables .41 (.106)</u>	
Is a Child a Natural Child, Fostered or Adopted	-.66
Mothers's Occupation 1922	.40
Highest School Grade of Mother	.34
Highest School Grade of Father	.26
Facts about Home Environment	-.18
Cumulative Marital Status 1950	-.35
Ever Regret Marriage?	-.30
Third Child: Years of Schooling	.24
Number of Children	.20
Creative Performance	-.19
<u>Model 2: Fixed Variables == > Alterable Variables .81 (.001)</u>	
General Intelligence	.80
Originality	.76
General Intelligence	.31
Mechanical Ingenuity	.29
Originality	.21
Early School Entry	.32
Sociability	.18
Physical Energy	.18
Sense of Humor	.16
Desire to Excel	.15
<u>Model 2 (Cont.): Fixed Variables == > Alterable Variables .78 (.001)</u>	
General Intelligence	.90
Originality	.41
Mechanical Ingenuity	.16
Self-Confidence	.73
Will Power	.73
Sensitiveness	.60
Conscientiousness	.58
Unselfishness	.52
<u>Model 2 (Cont.): Fixed Variables == > Alterable Variables .73 (.0001)</u>	
Chronological Age in Months	.85
Combined Quotient (Stanford Achievement)	.57
Original IQ	-.27
General Intelligence	-.20
Mechanical Ingenuity	-.13
Number of Hours of Home Study Per Week in Last Year	.63
Age of Beginning Music	.40
Age of Beginning Collection	.35
Age of Entering School (Above Kindergarten)	.35
Popularity with Other Children	-.30
<u>Model 2 (Cont.): Fixed Variables == > Alterable Variables .61 (.0001)</u>	
Originality	.72
Mechanical Ingenuity	.48
Facts about Home Environment	-.27

(continued on next page)

General Intelligence	- .25
Mother's Occupation 1922	- .21
Sense of Humor	.49
Truthfulness	.30
Sensitiveness	-.29
Prudence	.26
Leadership	.19
<hr/>	
Model 2 (Cont.): Fixed Variables => Alterable Variables	.58 (.0001)
Father's Occupation 1922	.59
Highest School Grade of Father	.57
Highest School Grade of Mother	.56
Original IQ	.34
Mechanical Ingenuity	-.26
Size of Home Library	.60
Early School Entry	.38
Age of Beginning Music	-.33
Generosity and Unselfishness	-.26
Freedom from Vanity and Egotism	-.25
<hr/>	
Model 2 (Cont.): Fixed Variables => Alterable Variables	.52 (.0007)
Highest School Grade of Mother	.45
Mechanical Ingenuity	.44
Highest School Grade of Father	.43
Facts about Home Environment	.41
Father's Occupation 1922	.39
Size of Home Library	.42
Playing Games That Require Lots of Exercise	.26
Generosity and Unselfishness	.25
Intellectual modesty	-.23
Being Leader in a Team or Club and Mangement	.21
<hr/>	
Model 2 (Cont.): Fixed Variables => Alterable Variables	.50 (.039)
Duration of First Employment	.53
Facts about Home Environment	-.31
College Degree Obtained by Father	.26
Leadership	.29
Freedom from Vanity and Egotism	-.25
Physical Energy	.23
Conscientiousness	-.22
Sympathy and Tenderness	-.21

In Model 3, outcomes were predicted from alterable variables with fixed variables held constant through partial correlations. In no case was the canonical correlation significant, which suggests that the alterable variables had no independent effect on outcomes.

Discussion

Although the Terman sample is unique, the results confirm much prior research: Socioeconomic status (SES) weakly predicted school success and occupational standing. Relatively fixed advantages, moreover, predicted alterable circumstances and traits. Some of these predictions

reveal general patterns of social and psychological advantage. Other patterns are more specific such as mechanical ingenuity predicting tool use, and abilities predicting character traits such as self-confidence.

Alterable circumstances and traits, nonetheless, appeared to offer little advantage on outcomes beyond that already afforded by SES and other relatively fixed variables. Thus, the present study joins others in failing to find optimal alterable conditions of childhood and youth that add substantially and consistently to their adult prospects.

Several problems may account for this apparent absence of linkage: Heredity and the first six to ten years of life may be most powerful in determining adult outcomes; even environmentalists have acknowledged their preponderant influence (Bloom, 1976). Early conditions are substantially correlated with later conditions as indeed shown in the present and previous research (Walberg & Stariha, 1992); this means it is difficult to detect the independent contribution of later environmental influences, although they may actually be important for adult development. The variables, moreover, may be insufficiently well measured to show their true relations.

Still another problem is that the longitudinal data presently available in large-scale surveys lack specificity with respect to parallel opportunities and outcomes. Some research shows, for example, that independent nonacademic accomplishments during the high school and college years predict with a modest degree of accuracy similar accomplishments in college and adult life (Munday & Davis, 1974) in such areas as business entrepreneurship, music, science, and writing. Such research, making use of observations closer in time than childhood and middle adulthood, may have yielded higher correlations than the present study for this reason alone since older students are more thoroughly developed than younger ones, and fewer random interventions occur in the shorter time to reach middle adulthood.

All these problems appear plausible, and it may be difficult to solve them without more intensive and extensive longitudinal research over long time periods. In view of the paucity of statistically and educationally significant findings, it may be still more difficult presently to draw practical implications for educators and parents. In short, it appears that we have far better evidence on how to improve learning in school than success in life.

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V. GENDER ISSUES

Introduction

In recent years, there is growing concern about the participation of females in high-level educational opportunities. Cross-national, representative studies have demonstrated significantly sex-specific patterns of participation in different domains of study and occupation. This part of the book joins three papers which describe male-female differences in several areas of personality and achievement and look for major causes of these differences. In the first paper, Janice Leroux reports evidence from literature and from her own intensive small-sample investigations that gifted women are faced with many difficulties when they attempt to realize their potential by pursuing a professional career. A persistent matter of conflict is the question of how to combine career and family efficiently. Gifted women need a strong personality, i. e. a positive self-concept and a strong desire for success, which has to be nurtured by encouraging parents.

In the second paper, David Goldstein and Vicki B. Stocking report the results of investigations done with young people who participated in the Duke University Talent Identification Program. They demonstrate by using data from more than one decade of research that gender differences of mathematical ability are more and more disappearing, even at high levels of ability. Despite this tendency, differences of attitudes seem to remain much more stable. Female students prefer art/music and languages as school subjects whereas male students prefer science and physical education. This difference of preferences continues to college majors: Male prefer mathematics, computer science and other sciences, females prefer arts, languages and social subjects. Preferences of occupations mirror these sex differences, too. The authors conclude that gender differences of highly gifted students in the domain of attitudes are not based on an objective

lack of ability but presumably on the perception of ability which is triggered by ability-related sex stereotypes.

In the third paper, Linda Brody, Linda Barnett, and Carol Mills take a closer look at ability differences of talented male and female students. After reviewing data from several years taken from Talent Search participants at the Johns Hopkins University, amongst others, and gathered from different sources, they conclude that there are sex differences of quantitative ability and mathematical achievement which have remained rather stable through the last years. These differences are more pronounced at the upper levels of ability and can therefore affect admission to selective institutes of higher education. Brody *et al.* describe in detail sex differences in mathematics of the participants of the CTY summer programs. First, more male than female applicants pass the criteria of being admitted to mathematics courses. Second, of the participants admitted, more male than female students actually choose mathematics or science courses. Third, male students demonstrate higher achievement than females in mathematics and physics classes. The authors, as well as the other authors of this part of book, point to significant sex differences of motivation and self-concept which may be more or less responsible even for the development of sex differences of ability.

An asset or a liability? Voices of gifted women

Janice A. Leroux

University of Ottawa, Canada

Abstract

How do the expectations of young gifted women compare with those of successful career women? In two studies conducted with 1) able young women in university and; 2) prominent Canadian women, similar concerns were voiced. Pressures to conform to stereotypical roles, inconsistent vertical development of careers, and the importance of connections were reported. Independence and contributing to the welfare of others were emphasized, as were concern for the multiple responsibilities of active career women.

I knew I was smart, but I certainly didn't consider it an asset. It was more of a millstone around my neck.

Margaret Lawrence (1989, p. 86, in her memories of adolescence)

Introduction

The role of successful females in the intellectual, professional and business communities is a significant reality today. It is vital, however, to consider with a critical eye the experiences that lie behind the current publicity. Kerr (1985) documented that even those gifted females who were recognized in schools and whose programming was specialized, did not consistently produce outstanding accomplishments. When one looks at research on the academic and vocational achievements of females, one notes that we are usually compared to a male counterpart. Female performance has been measured by a male yardstick and thus success appears to be in short supply.

Females must be considered on their own terms, as individuals within a unique group in order to fully understand their particular characteristics and behaviours. In the quest for a "definable female model of success" (Northcutt, 1992) this paper will focus on two groups of high ability females to determine their perceptions of family influences, mentors, career aspirations, coping skills, and self-esteem.

Review of the literature

Several key factors impact on the achievement patterns of females. The first is *family relationships*. The early relationship of females with their mothers appears to be an important factor regardless of whether the mother works at home or outside of home. As Maitlin (1987) suggested, mothers who did not work outside of the home "may have encouraged their daughters to aspire to careers that they themselves had not been able to reach" (p. 153).

Fathers, too, play a vital role in creating expectations of achievement in their female children (Raymond & Benbow, 1989). The unspoken parental attitudes and values that are internalized by the gifted female child are vital in determining whether or not she emerges from childhood

with a sense that she can excel, notwithstanding the fact that she is a woman (Frogatt & Hunter, 1980; Gordon, 1988).

Mentor relationships is another key factor. Someone who takes an abiding and intense interest in a person as well as her talent can provide significant encouragement for a young student as well as for the potential career woman. Kerr (1985), Leroux (1988), and Rose and Larwood (1988) suggested that females need same sex mentors to facilitate identification and role modelling. Other researchers contended that male mentors might be problematic in that this might reinforce the dependence of females on male measures, male-defined values or male approval (Horney, 1926; Shapiro & Farrow, 1988). Whatever the gender of the mentor, research supports the significance of such relationships.

Cultural expectations also, are factors which help shape the attitudes and values of females towards their career goals. Noble (1989) determined that females were subjected to loneliness and ostracism if they deviated too far from cultural norms in terms of competence and achievement. Moving out of societal expectations for females as mother and nurturer, can distance young women from those who see success only through the traditional female roles (Heilbrun, 1988; Keown & Keown, 1985; Rose & Larwood, 1988). For the women who want career success, who shift away from conventional gender stereotypes, and who openly seek "to demystify the forces that have told us what we should be before we can value what we are" (Steinheim, 1992, p. 109), the price may be very costly.

For those who marry, the selection of a mate is seen as a very important choice, one which will affect career goals as well as personal ones. The relationship with a mate was seen more as a partnership, with both individuals possessing equivalent goals, aspirations, and pressures (Hertz, 1986). The introduction of children into the equation makes the integration of career and personal life much more difficult. More frequently this is achieved by hiring someone else to perform the child care and household duties (Hertz, 1986). However, though there is much talk of reciprocity between wife and husband, it is still widely acknowledged that women were perceived as doing more in terms of traditional duties at home.

Another key factor pointing to success is *self-esteem*. Many researchers have identified low self-esteem as a major factor contributing to the underachievement of highly able females (Kerr, 1985; Noble, 1988; Reis, 1987). Having adopted a morality that revolves around nurturing and encouraging others (Gilligan, 1982), young females tend to reject their own abilities at a deep psychological level and disavow their own values and perceptions (Brown, 1989; Gilligan, 1984; Rogers & Gilligan, 1988). They tend to attribute their success to factors other than their own abilities (Arnold, 1987) and find it difficult to accept success once it is recognized by others.

Research on successful women, indicated a high sense of self-worth and efficacy (Northcott, 1991). There was a sense of being in control of one's destiny and a belief in one's own innate value and self-worth (Frogatt & Hunter, 1980; Kerr, 1985). Whether self-esteem is a cause or an effect of success has not been clearly established.

Personal characteristics are another factor in the achievement patterns of females. Research identified the ability to "fall in love with an idea" (Kerr, 1975, p. 69), to have "an intense love affair with their work" (Frogatt & Hunter, 1980, p. 180), or the need to follow "a powerful dream" (Daniels, 1985, p. 429). Northcott (1991) described the successful women in her research as being consistently responsible, competent, and committed to their careers. The ability to use situations to their advantage, flexibility, and skill in managing dual roles in their daily lives were powerful traits cited. Combine all of this with the need and ability to interact well with others and one has a rich recipe for success.

Women's *career goals and aspirations* are the final factors to be considered. Often women who attain great success tend to do so with no clearly defined goals (Keown & Keown, 1985). Although flexibility of goals is cited as a valuable characteristic in integrating one's personal and

professional life (Northcutt, 1991), women do not appear to undertake long-term career planning. Perhaps this is still due to the feeling among young females that someone is going to come along and take care of them. However, the potential demands of child care and housework may still be perceived as interruptions to a career and consequently women's career paths are less consistently vertical than those of men.

Daniels described this as the "legacy of drift" (p. 434) in women's careers which leaves one with the perception that achievements just happen to women as opposed to being the result of careful and calculated planning by them. Northcutt (1991) found that the women who later achieved success in the world of business usually started out in traditional occupations or entered business more or less "by default".

However, whatever the route to career achievement, women perceived satisfaction to be associated with not only salary, but the chance to contribute to others' well-being. In keeping with females' need to link self-efficacy with a caring connection to others, successful women tended to include all aspects of their lives in their assessment of personal success. For them, a career was a means of personal fulfillment if it was successfully combined with being a female both inside and outside of the workplace.

Methodology

Two studies are represented in this paper. One of a six year follow-up study of eight gifted young women (ages 22 and 23), who were first interviewed when they were in gifted programs in high school. They responded to a series of questions from the original study, a vignette of a gifted girl to whom they had to give advice, and open-ended statements about perceptions of their current career status (Leroux, 1990).

In the second study, twenty-seven successful Canadian women responded to a 16-page questionnaire designed to reveal environmental factors, coping strategies, and personal characteristics that contributed to their high levels of achievement. These women (ages 36 to 60) were in the "Who's Who" anthology of Canadian Women, were noted for extensive publications, international awards, and prestigious positions in business and technology in Canada. They included successful engineers, scientists, artists, corporate executives, and academics from across the country.

Though the two studies were carried out separately, they revealed similar patterns in their perceptions of life concerns.

The following discussion compares and contrasts the two studies.

Discussion

Family Interactions. Both groups of women indicated a strong sense of family nurturance and connectedness. The young women valued the opinions of their parents, but expressed concern that mothers "have no power". Several of them said they valued the independence they had been able to achieve in university, although one was still so sensitive to her parents' wishes that when she changed majors at graduate school she was unable to tell her parents until near the end of the academic year. The experienced women looked back on family life and almost unanimously agreed that both parents had contributed positive values to their development. "My mother was influential as an independently minded individual who developed and maintained her own career. I grew up knowing that women could do anything" reported one woman. "My father emphasized upward mobility, the importance of striving for excellence and rugged individualism," said another.

However, a different perception was voiced by several successful women; the mother's lack

of career being influential. These women were determined "not to end up like her". As one woman said, "I inherited her stymied ambitions". Daughters of working mothers appeared to feel empowered by mothers who were self-sufficient and who valued education for themselves and their children. When mothers were at home, there was sometimes an inverse relationship to the role modelling.

The results of these familial interactions support earlier research which indicated that a mother's attitudes to her daughter's potential was a key factor in future achievement, whether or not the mother had a career of her own. Frequent identification with fathers raised questions about what areas of early lives each parent actively influenced. In any case, it could be argued that family nurturance helped the successful women develop a strong, dynamic determination which would carry them through various life stressors in the future.

Career Aspirations. Both groups of women cited interest in career paths early in their lives and this interest influenced the amount of effort they would spend on achieving their goals. The younger women spoke about making decisions for themselves, but would add that they often took parents' opinions into consideration. For them positive reinforcement was a great motivator. Over half of the experienced women said that they had first decided on what was to be their career of choice in university.

When all subjects were asked what help was missing for them in their attempt to select an appropriate career, the common thread was a plea for more guidance and counselling in high school. In an attempt to seek help in high school, one young woman said, "My interests had no time or place (in the guidance office)." One successful engineer repeated the theme: "My high school counsellor told me (in front of the class) that my aptitude test results indicated that I was best suited for work as a cocktail waitress!"

Though these able women knew they wanted to establish careers, limited options were presented to them. Often gender stereotyping was evident. "Sexism (role stereotypes) precluded me from studying mathematics and physics in school," said one experienced woman. Another responded, "More awareness of different careers, what choices are available, are needed. I was only really aware of very traditional jobs - nurse, teacher, etc." These two groups of women recognized need for expanded career choices, more female role models, and an elimination of gender barriers in the vocational counselling of young females.

Mentor Relationships. When the young women recalled their school days, few teachers were mentioned as significant influences. For this group, deferring to adults at school was a matter of personal choice required to please those whose displeasure might feed powerful fears or insecurity. "If a teacher praised my work in front of others, it made them (peers) feel inadequate. I might try harder for a teacher I liked even if I felt frustrated" commented one respondent. School which emphasized conformity or singled them out as being different in a class, was difficult, particularly during adolescence. Finding an understanding mentor was not possible for them at school.

These young women preferred affiliation over competition, realizing the incongruities of being able but at the same time different, wanting to be popular, but also trying to be true to themselves. For this group, wise guidance and counsel often came from a trusted adult, usually a relative, who understood and respected them as individuals with needs, not gifted students without feelings.

However, when they reached university, many of the young women like their successful counterparts, noted individuals who were powerful influences on their careers. University professors and other graduate students accepted their abilities and allowed them to risk voicing their ideas. "I used to be teased about being smart, but now I am happier because others respect and admire me when I get something right, and I'm not afraid to speak out (in university classes)" said one young woman.

Likewise, the successful women identified mentor-type relationships, particularly from supportive husbands and individual men in the work place who helped them forge new paths in their careers. As one said, "I had mentors - early training in business from very tough, demanding superiors." Another agreed: "A series of senior members of the Canadian research community worked with me and supported my development." As previous studies have shown, the need for committed individuals who take a sincere and strengthening interest in the aspirations of gifted females was clearly portrayed in the responses of the experienced women.

Career and family Life. Many of the younger women saw themselves delaying marriage and childbearing; others saw themselves as childless by choice. One-quarter of the experienced women believed that marriage had a negative, restricting impact on their careers due to non-supportive spouses ("My husband was very competitive and jealous of my accomplishments. He tried to sabotage my career."). One third of the married respondents believed that their husbands had been supportive and encouraging. Fifty per cent of the women had no children, which supports data that professional women were more likely than nonprofessionals to be without children (Rose & Larwood, 1988). Fifty eight per cent of all in this group advised that a woman "think twice" before having a family if she were to be successful in her career.

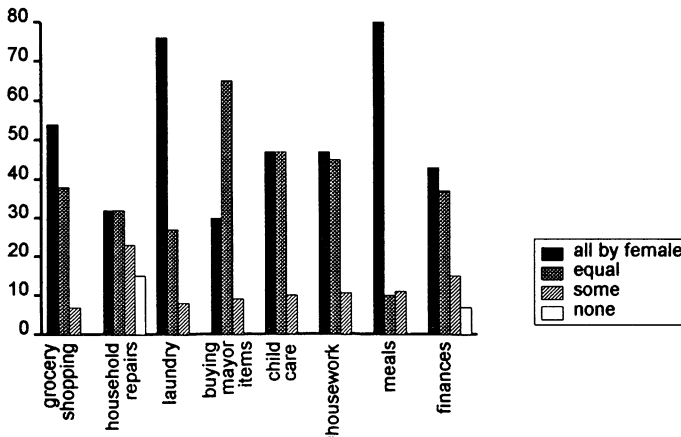


Figure 1: Percentage of shared of household responsibilities

Several of the women stressed the importance of hiring outside help to do the housekeeping and child care. This was described as "the only reasonable solution no matter what the cost!" The hiring of housekeepers leaves one to wonder how much husbands actually shared in household responsibilities. In the breakdown of responsibilities it was evident that traditional duties such as meal preparation, laundry, and grocery shopping, were primarily women's domain, leaving the question open on how much traditional roles have changed (Figure 1).

The diversity of beliefs about the impact of relationships was most evident in this realm and it was apparent that many factors were at work in determining whether a married relationship was a positive or negative influence in the careers of successful women in the study. However,

in giving advice to a younger woman, the majority of experienced respondents stressed the vital importance of finding a companion who will actively share in the duties at home. "Find a partner, not just someone you love," concluded one woman.

Self-Image. Though describing themselves as determined, capable individuals, the young gifted women had doubts about their ability to cope, particularly with the excellence they demanded of themselves. "I fear I won't be able to achieve what I aspire to become. I tend to push myself too hard, not accepting my weaknesses" said one woman. Or as another commented "I feel everyone expects me to be perfect and I'm not really allowed to make mistakes. My weaknesses frustrate me." They were passionate about the personal fulfillment of a career, but had doubts about societal acceptance if they were less than perfect.

They resented the societal stereotypes of women, the inherent obligations and responsibilities they perceive expected of career women. "I hate the current image of ideal women because it is an impossible goal. We have to juggle everything (career, home, family), and be successful on top of it, too" said one. "Maybe I'm too sensitive about this, but I'm intelligent and I wish they (society) would back off a bit", stated another.

Balancing career achievements with a healthy acceptance of one's strengths and limitations appeared to cause discomfort and concern.

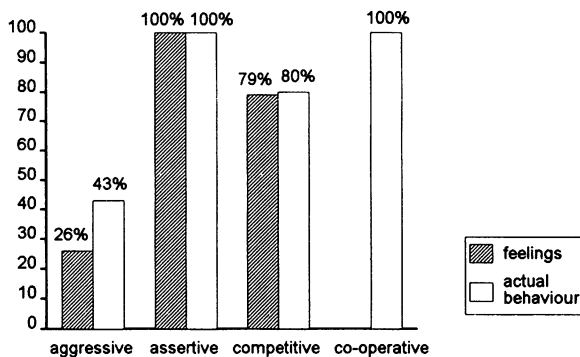


Figure 2: Feelings vs. actual behaviour for career success

Comparing society's ideal, a personal ideal, and the perceived real self, these able young women found themselves lacking, continuously pushing themselves towards a higher, self-imposed ideal of improvement.

An on-going sense of striving was evident in the successful women group as well. While 100 per cent described themselves as successful, over half of them attributed success, in varying degrees, to good luck. They went on to say that this luck was accompanied by effort and the ability to recognize opportunity. "Fate and fortune played a significant part of my achievements. I was in the right place at the right time and always said I was born clutching golden horseshoes" commented one woman. "Being open to what fate offers is important", added another.

At the same time, over half of the experienced women thought a woman must be "twice as good as a man in the same position" in order to succeed in her career. Assertiveness was listed

as an important quality for success, as was cooperation (Figure 2). The key was to trust themselves to select the appropriate behaviour for each different situation. This was believed possible with no concomitant loss of feminine values. As one woman concluded, "To succeed, women must be competent, more cooperative, truly feminine, continue to care for their families and not follow the male model." After hearing these words, is there any doubt why the younger gifted women felt some apprehension?

In a summary of self-image, the young able women felt they were hard workers, proud of their independence and ability to interact with, as well as nurture others. They felt they pushed themselves to achieve, but in so doing did not allow sufficient time for relaxation. They often described themselves as tense about many things and perceived that their internal drive for success was getting in the way of an easy-going enjoyment of life.

In giving advice to a young gifted girl, they cautioned her to remember to enjoy herself, to enjoy achievements, and not seek for perfection. It appeared that striving for a personal ideal, taking responsibilities for others, and trying to prove they were capable in so many areas had been at the expense of their own personal sense of identity. In searching for self and success, these young women appeared to feel that self had been the neglected factor.

Several of the experienced women voiced the same concern. "Having put so much energy into a career I've neglected my emotional needs and find myself living a very unbalanced life" said one successful woman.

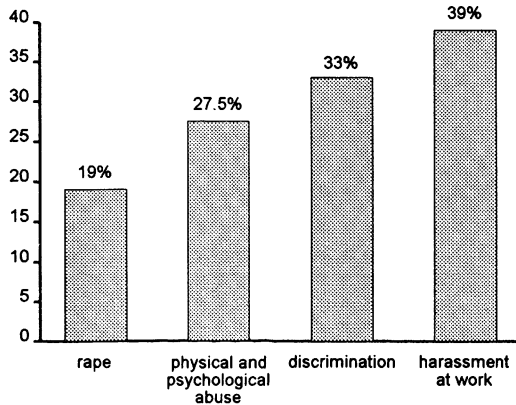


Figure 3: Traumatic experiences reported

Traumatic Experiences. A variety of life stressors were reported by the successful women. Relocation to another part of the country (74%), or to another country entirely (52%), and coping with the death of a close friend (59%), and caring for family members in time of illness (80%) were some of the events described. In workplace, 39% had been victims of sexual harassment, 33% reported some form of discrimination, 64% indicated that male colleagues tended to feel threatened when they were with a woman who was more successful in the career than they were. In addition, 19% had been raped at some point in their lives, 11.5% had been physically abused, and another 15% reported psychological abuse (Figure 3).

This group, however, did not feel defenceless in the face of stressful situations. They appeared to tap into an inner strength, and transform adversity into life affirmation. Their personal intelligence and determination combined with a powerful connectedness with friends enables them to face each crisis and continue to achieve.

Many in this group acknowledged the importance of self-knowledge, talking through anxieties with trusted friends, and using difficult experiences as springboards for growth. There was a consistent, strong pattern in the perceptions of the importance of relationships.

Implications and Conclusions

Gifted women appear to know themselves and their own personal values intensely. They have a strong sense of their own abilities, and appear to have a survivor instinct which carries them through various trials and life stresses. Even though in post adolescence they are uncertain of their coping abilities, they seem to rely on this instinct from early ages onward. In later life, they recognize the valuable asset female connectedness can be in helping them cope with problems. They seek to reach for challenges, speak opinions freely and play energetically. In their drive for success, they choose not to lose sight of their feminine values, defining success in terms of contributing to the welfare of others or the community at large. If educators acknowledge the connectedness females seek, reinforce the social skills females display, and encourage more risk taking, then there may be less need for women to fight the conformity and the traditional stereotyping that plagues them.

Successful women refuse to blame men in general for obstacles in their career paths. They choose not to see themselves in competition with others but rather partners in making their society a little better place to live. They believe to be successful one must plan carefully to combine professional and personal lives. Though they decried the pressure to be "Superwoman", they often push themselves to accomplishments that even they had never dreamed of or planned. Sensitive educators can make opportunities to help able females discuss career opportunities that incorporate interests, talents, and personal values while at the same time counselling the females in ways to have fun and enjoy living.

Successful women pay a high price for their accomplishments, but from the descriptions of these women, they never lose faith in themselves. Being socialized to care shouldn't preclude the element of choice in a career path, nor should social stereotypes of ability cloud females' options for future aspirations. Vocational counselling needs to be more comprehensive and diverse so that able females can make more informed choices about careers and eliminate the "legacy of drift" that still seems to be in evidence. In looking at the lives of gifted young women and highly able career women, we see a tapestry of influences, life struggles, and coping strengths. We learn how they have capitalized on their own gifts to become achievers determined to go beyond any narrow traditional roles for women and still continue a personal commitment to self and others. For them, being female was not a liability if they chose to control their own assets. As one woman stated: "Successful women pay a very high price for their accomplishments, but we must never lose faith in ourselves."

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TIP studies of gender differences in talented adolescents

David Goldstein and Vicki B. Stocking

Duke University Talent Identification Program, Durham, North Carolina, USA

Abstract

Since the Duke University Talent Identification Program (TIP) was established in 1980, data on talented students aged 12 through 16 have been gathered in conjunction with the 16-state regional talent search as well as the Summer Residential Program (SRP) held each summer on the Duke University campus. This paper presents an overview of research at TIP that documents some differences - and some surprising lack of differences - between academically talented young males and females. We begin with a summary of gender differences in both mathematical and verbal ability, as measured by the Scholastic Aptitude Test (SAT): In particular, trends indicating a recent decrease in the gender gap on the mathematical portion of the test are highlighted.

In addition, data from questionnaires administered to talent search participants are presented that highlight gender differences in attitudes about school and career. Attitudes toward school, approached from a variety of perspectives, varied with gender according to traditional sex stereotypes: significant differences were found in girls' and boys' perceptions of classes in terms of degree of liking, perceived usefulness, and forced-choice comparisons as well as gender differences in degree of interest in most - but not all - potential college majors. Questionnaire data also revealed significant differences in the degree of liking of most careers, with a few notable exceptions. These findings are in contrast to earlier studies conducted with TIP SRP students that demonstrated that SRP course selection varied with gender, although *performance* in the courses did not.

These data, taken together, suggest that gender differences in high ability students are found primarily in the domain of attitudes. Gender differences in performance and ability are much smaller than commonly believed. These findings have important implications both for our understanding of the nature of gender differences as well as for educational policies and practices.

TIP Studies of Gender Differences in Talented Adolescents

A rapidly growing body of literature documents the many ways in which students of high academic ability differ from those of average ability (for reviews, see Colangelo & Davis, 1991; Heller, Mönks & Passow, 1993). Less attention has been paid, however, to ways in which students of high ability differ from each other. One notable exception to this generalization has been the considerable interest shown in the question of gender (or sex) differences. As with the question of gender differences in the population at large, the study of gender differences among the highly able has focused on both alleged differences in ability, such as in mathematics or visual-spatial ability (Benbow & Stanley, 1980; Goldstein, Haldane, & Mitchell, 1990), as well as differences in attitudes, such as in choice of college major or vocation (Kerr, 1988).

In this paper, a series of recent studies on gender differences performed by researchers at the Duke University Talent Identification Program (TIP) is reported. Before describing the nature of these studies, some description of TIP is necessary. Covering sixteen states in the American Southeast, Midwest, and Southwest, TIP identifies the brightest children at an early age and works to develop their potential to the fullest. TIP was founded in 1980 and is currently one of four programs of its kind in the nation (see Goldstein & Wagner, 1993, for an overview of these and related programs). To nurture the students' talents throughout their middle and high school years, TIP provides them with various services, including recognition ceremonies, an extensive Educational Opportunity Guide, a Learn on Your Own (by mail) Program, Advanced Placement course materials, and - for truly exceptional students - a summer residential program on the Duke University campus.

The nature of the TIP sample also requires some elaboration. Each year TIP hosts a large population of very talented children as they attend the Summer Residential Program (SRP). The SRP is academically oriented and open to students who have completed grades 7, 8, 9 or 10. To qualify, students participate in a Talent Search which invites seventh-graders who score in the top three percentiles on nationally-normed in-school achievement tests to take the Scholastic Aptitude Test (SAT) or the American College Test (ACT), the leading college entrance examinations in the United States. Students may also take these tests on their own. For the summer program, students must score higher than the average college bound senior. Only about 6 percent of students who participate in the Talent Search are eligible to attend the summer program. For purposes of clarity, the students who participate in the Summer Residential Program will be referred to as *highly talented*, while the students in the Talent Search who do not qualify for the SRP will be designated as *talented*. Finally, talent search students who achieve SAT-Math scores above 700 or SAT-Verbal scores above 630 - scores that exceed the 95th percentile for high school seniors - will be referred to as *extremely talented*. This latter group is isomorphic with the sample used by Stanley and by Benbow in their numerous investigations.

The three studies reported below focus on the domains of academic ability as well as attitudes toward academic and vocational choices. The first study reports data on gender differences in performance on the SAT-Math and SAT-Verbal tests. The second and third studies report data on the attitudes of males and females towards a variety of academic topics, including school subjects, potential college majors, and potential careers.

Study 1: Gender differences among the extremely talented

The starting point for this study is the widely held belief that boys greatly outnumber girls at the high end of the continuum of mathematical ability. This belief has been bolstered by the landmark investigations of Benbow and her colleagues (e. g., Benbow & Stanley, 1980; Lubinski & Benbow, 1992). In these studies, the authors report that twice as many boys as girls score at or above 500 on the SAT-Math and that four times as many boys as girls score at or above 600 on the same test. These investigators also suggest that 13 boys for every one girl score at or above 700 on this test, a ratio that is both remarkable as well as provocative (see Halpern, 1992).

Method

In this study, we analyzed SAT scores from the TIP Talent Searches conducted in the years 1981 through 1992, inclusive, first examining Math scores and then considering Verbal scores, which are studied much less frequently. The total number of seventh grade (12 year old) students who participated in these talent searches is 462,557. An additional 61,700 students participated in the talent search in 1993.

Table 1: Male and Female Talent Search Participants Scoring at or above 500, 600 or 700 on the SAT-M.

	SATM > 500			SATM > 600			SATM > 700		
	Femls.	Males	M/F	Femls.	Males	M/F	Femls.	Males	M/F
1981-1983									
20597 females	817	2071	2.2	51	324	6.4	3	32	10.7
19157 males	(4.0%)	(10.8%)		(0.25%)	(1.69%)		(0.01%)	(0.17%)	
1984-1986									
37854 females	1605	4140	2.6	109	516	4.7	6	54	9.0
35424 males	(4.2%)	(11.7%)		(0.29%)	(1.5%)		(0.01%)	(0.15%)	
1987-1989									
47626 females	2146	4744	2.2	139	876	6.3	6	94	15.7
44642 males	(4.5%)	(10.6%)		(0.29%)	(2.0%)		(0.01%)	(0.21%)	
1990-1992									
52866 females	3837	7415	1.9	348	1290	3.7	33	91	2.8
50231 males	(7.3%)	(14.8%)		(0.66%)	(2.57%)		(0.06%)	(0.18%)	
1981-1992									
158943 females	8375	18370	2.2	647	3006	4.6	48	271	5.6
149454 males	(5.27%)	(12.29%)		(0.41%)	(2.0%)		(0.03%)	(0.18%)	
Lubinski & Benbow (1992)									
	--	--	2	--	--	4	--	--	13

Note: Numbers in parentheses indicate the percentage of that gender participating in the Talent Search who scored at a certain level on the SAT-M.

Results and Discussion

SAT-Math scores. Table 1 provides the frequency of students scoring at or above 500, 600, and 700 on the SAT-Math test from 1981 through 1992, as well as the ratios of males to females for each score cutoff. It is clear from the table that the ratios we obtained for students scoring at or above 500 and 600 are comparable to the ratios reported by Lubinski and Benbow (1992). However, the ratios we obtained - for each group of Talent Search years and over all the Talent Search years - differ from the 13 to 1 ratio those investigators found. Except for the Talent Searches in 1987-1989, all groups of Talent Search years obtained fewer males to females scoring at the highest end of the SAT-Math than suggested by the above study. Note especially the ratio for the 1990-92 Talent Searches, which indicated that fewer than three times the number of males as females scored at this exceptionally high level on the SAT-Math test. This figure stands in sharp contrast to the ratio of 13:1 reported by Lubinski and Benbow (1992).

The overall rates of meeting each criterion indicate that the representation of females at each level is increasing with each successive Talent Search, with the largest jump in representation for each level being made in the most recent group of Talent Searches. Males, however, showed a slight increase in rates of representation at the first two levels (SATM > 500 and SATM > 600) but did not exhibit any real increase at the highest level. Therefore, not only are females increasing in rate of scoring at high levels, but the males are not keeping up with the increase.

SAT Verbal scores. We analyzed males' and females' scores on the Verbal portion of the SAT to supplement the information from the Math test. Table 2 illustrates the patterns of scoring at these levels. Overall, numbers of males to females is more equal than seen with the math

scores. These numbers appear to be somewhat more stable, as well; the ratios of males to females vary little over the course of the Talent Search years. Of note, however, is the decline in the proportion of males who scored above 630 on the verbal test. While the proportion of high scoring females remained nearly constant between the years 1981 and 1992 (0.08% vs 0.09%), the proportion of high scoring males dropped by nearly one half (0.17% vs 0.09%). Indeed, for the years 1990-1992 the proportion of high scoring females has been identical to that of males.

Table 2: Male and Female Talent Search Participants Scoring at or above 500 or 630 on the SAT-V.

	SATV > 500			SATV > 630		
	Females	Males	M/F	Females	Males	M/F
1981-1983						
20594 females	778	869	1.1	17	32	1.9
19156 males	(3.8%)	(4.5%)		(0.08%)	(0.17%)	
1984-1986						
37854 females	996	1286	1.3	31	38	1.2
35423 males	(2.6%)	(3.6%)		(0.008%)	(0.11%)	
1987-1989						
47626 females	1276	1438	1.1	25	45	1.8
44642 males	(2.7%)	(3.2%)		(0.5%)	(0.5%)	
1990-1992						
52866 females	1545	1654	1.1	46	46	1.0
50231 males	(2.92%)	(3.29%)		(0.09%)	(0.09%)	
1981-1992						
158943 females	4595	5247	1.1	119	161	1.4
149454 males	(2.89%)	(3.51%)		(0.075%)	(0.11%)	

Note: Numbers in parentheses indicate the percentage of that gender participating in the Talent Search who scored at a certain level on the SATV.

These findings clearly indicate that the gender gap in mathematical ability is markedly smaller than the data from Benbow's recent articles would suggest. Indeed, it may be the case that if current trends continue, the gender gap may become either very small or nonexistent by the end of this decade. The "disappearing gender gap" has been noted elsewhere (Feingold, 1988; Halpern, 1989). These findings may well occasion a reevaluation of the view that previous gender differences in mathematical ability have, in whole or in part, a biological basis. Rather, these data are consistent with the view that social and cultural forces are largely responsible, both for the initial reports of large gender differences and now the most recent evidence of their attenuation.

The data on the SAT-Verbal scores also supports a socio-cultural view of gender differences in academic ability. What possible biological forces could account for the decrease in the number of exceptionally high verbal scores among males? Although it is beyond the scope of our data to offer an explanation for this startling trend, one is tempted to hazard the guess that computers and video games may play a role. Simply put, bright males who a decade ago spent much of their leisure time reading now use that time playing with the electronic marvels that have appeared since, roughly, the early 1980's.

Given the enormous sample sizes available in this study, one would be hard-pressed to claim that these findings are statistical artifacts. For now it appears clear that the male "superiority" in math is still in existence, but it is nowhere near as large as previously thought. The consequences for women's educational and career choices, as well as for society as a whole, are enormous.

Study 2: Gender differences in attitudes toward school subjects

One increasingly important area of research relevant to academically talented students concerns the attitudes students hold about school and school subjects. The literature is replete with warnings that, while students need to become engaged in their studies in order to achieve, schools are failing to provide the stimulation necessary for students to become interested. Academically talented students are particularly at risk of losing interest due to inadequate stimulation (e. g., Ponder & Hirsch, 1981). For example, Yager (1982) cites NAEP (National Assessment of Education Progress) data reflecting generally negative attitudes about science classes in 13 and 17 year-olds. These attitudes have implications for college study; participation in high school math and science has been shown to be a strong predictor of majoring in those fields in college, with possibly varying patterns of predictors for males and females (e. g., Ware & Lee, 1988).

The current investigation describes attitudes about school for a large sample of academically talented seventh graders. In particular, we consider how much students like selected school subjects, how useful they think these subjects will be in a career, and how much students think they would like particular college majors.

Method

The participants in this study were chosen from the 1991 Talent Search pool of 57,000 applicants. We randomly sampled 1,000 each White males and females, and 500 each non-White males and females. Of the 1,500 males, 1,485 (98.9%) indicated some racial designation. Of these 1,485, 1,000 (67.34%) were White, 178 (11.99%) were Black/African-American, 133 (8.96%) were Hispanic, 15 (1.01%) were Native Alaskan/Native American, 118 (7.95%) were Asian/Oriental/Pacific Islander, and the remainder (41; 2.77%) indicated "other." Of the 1,500 females, 1,481 (98.7%) indicated some racial designation. Of these 1,481, 1,000 (67.52%) were White, 247 (16.68%) were Black/African-American, 121 (8.17%) were Hispanic, 12 (0.81%) were Native Alaskan/Native American, 64 (4.32%) were Asian/Oriental/Pacific Islander, and the remainder (37; 2.50%) indicated "other."

Of the 3,000 students that were contacted, 1,294 (43.2%) participated in this study by returning completed questionnaires. The resulting sample was representative of the mail-out sample of 3,000 in terms of gender, race and geographical location.

Data were collected using the 1991 Talent Search Questionnaire (TSQ). Various generations of this questionnaire have served as the primary method of annual data collection for TIP over the course of the program's twelve-year history. Historically, the TSQ has been administered to the entire pool of Talent Search applicants or some subset to address a particular question of interest. The 1991 version of the TSQ, the pilot for a future longitudinal project to be conducted by TIP in collaboration with the American Institutes for Research (AIR), built upon earlier versions of the TSQ and incorporated concepts found in other longitudinal work (e. g., Project TALENT, National Educational Longitudinal Study). TIP administers the Talent Search Questionnaire for research purposes only; the independence of completion of the TSQ and admittance to any of TIP's programs is stressed to the students and their parents.

The current TSQ is comprised of two separate questionnaires, one each for students and parents. Each household received both questionnaires. The current investigation involves only the Student Questionnaire. The Student Questionnaire is a 240-item measure with items reflecting a variety of behavioral and attitudinal constructs, such as academic performance, interest in college majors, interest in occupations, and attitudes about school. Students indicate their responses to items on a computer-readable answer sheet.

Included in the Student Questionnaire are the following sets of items concerning attitudes about school: (a) how much students usually like particular subjects, (b) how useful students think certain subjects will be in their careers, (c) forced-choice comparisons of subjects, and (d) how much students think they would like particular college majors. Students indicated *how much they usually like* each of ten school subjects (English, Social Studies, Mathematics, Art/Music, Home Economics, Vocational Education, Computer Science, Physical Education, Foreign languages, and Science). Students rated each subject along a five-point Likert-type scale (A = I would like this subject *very much* to E = I would *dislike* this subject *very much*). Students indicated *how useful* they thought each of the ten areas of study would be in their careers according to the following scale: A = Very useful; B = Sometimes useful; C = Not useful at all; and D = I don't know.

Students completed 15 *forced-choice comparisons* of pairs of randomly ordered subjects, choosing which subject of each pair they liked better. Students indicated *how much they think they would like* each of 18 types of college majors according to a five-point Likert-type scale (A = I would like this major *very much* to E = I would *dislike* this major *very much*).

Questionnaire packets were mailed in early February of 1991, and students were asked to return the answer sheets and signed consent forms by early March. The majority of those students completing the Questionnaire returned them by late March. Those received between April and July were processed separately. The two samples were combined to form a larger sample of 1294 after comparisons indicated no differences in responses for the two groups.

Results and discussion

We examined relationships among students' attitudes, especially noting the role of gender in school-related attitudes (e. g., Benbow & Minor, 1986; Ware & Lee, 1988).

Table 3: Mean Liking of School Subjects for Complete Sample and as a Function of Sex

Subject	Complete sample			Males			Females		
	Mean	s.d.	N	Mean	s.d.	N	Mean	s.d.	N
English	2.20	1.20	1261	2.42	1.13	613	2.00	1.23	648
Social Studies	2.14	1.20	1270	2.06	1.13	617	2.22	1.26	653
Mathematics	1.78	1.16	1269	1.68	1.09	616	1.87	1.21	653
Art/Music	1.83	1.09	1267	2.07	1.20	614	1.60	.92	653
Home Economics	2.76	0.91	1254	2.96	.81	608	2.57	.95	646
Vocational Ed.	2.90	0.83	1250	2.72	.87	605	3.06	.76	646
Computer Science	2.38	0.99	1255	2.16	.99	610	2.58	.96	645
Physical Ed.	2.01	1.24	1268	1.79	1.09	615	2.22	1.34	653
Foreign languages	2.45	1.05	1257	2.64	1.06	608	2.27	1.02	649
Science	1.75	1.06	1269	1.65	1.00	616	1.85	1.10	653

Note: Mean liking scores based on the following scale: 1 = I like this subject *very much*, 2 = I like this subject *a little*, 3 = I have no opinion or do not know much about this subject, 4 = I *dislike* this subject *a little*, and 5 = I *dislike* this subject *very much*.

Liking school subjects. Table 3 presents means for the overall sample and by sex for the degree of liking of school subjects. Females indicated liking classes in the following order, from most favored to least-favored: Art/music, Science, Math, English, Physical Education, Social Studies, Foreign Language, Computer Science, Home Economics, Vocational Education. Interestingly, these females defied the "traditional" mold by preferring science and Math to English and foreign languages. Males liked classes in the following order, from most favored to least favored: Science, Math, Physical Education, Social Studies, Art/Music, Computer Science, English, Foreign Language, Vocational Education, and Home Economics. Girls and boys agreed on two of their three top choices, listing Math and Science as two of the most favored classes. Similarly, girls and boys listed Home Economics and Vocational Education as their least favorite classes.

In addition to examining the mean levels of liking for each course, it is useful to consider the percentages of students who liked (i. e., liked "a little" or "very much") and didn't like (i. e., disliked "a little" or "very much") each subject, excluding those who indicated the neutral response (i. e., "I have no opinion or do not know much about this subject") to each item. Table 4 illustrates this information. More girls indicated that they liked Art/Music, Science, and Math than other subjects, and fewer girls reported liking Home Economics. The rates of liking subjects are most informative when viewed in conjunction with rates of disliking subjects (also illustrated in Table 4). Overall, the rates for disliking subjects were lower than the rates for liking subjects, indicating that when a student had experience with a given subject, the student tended to have a positive reaction to that subject. Girls displayed the highest rates of dislike for Physical Education and Social Studies, while boys most frequently disliked English and Social Studies.

Table 4: Rates of Liking and Disliking School Subjects

	Percent liking subject			Percent disliking subject		
	Complete sample	Males	Females	Complete sample	Males	Females
English	75.7 [n=1261]	68.5 [n=613]	82.4 [n=648]	21.4 [n=1261]	26.9 [n=613]	16.2 [n=648]
Social Studies	77.3 [n=1270]	79.0 [n=617]	75.8 [n=653]	19.3 [n=1270]	17.2 [n=617]	21.4 [n=653]
Mathematics	84.5 [n=1269]	87.0 [n=616]	82.0 [n=653]	13.6 [n=1269]	11.5 [n=616]	15.6 [n=653]
Art/Music	78.1 [n=1267]	70.6 [n=614]	85.1 [n=653]	10.2 [n=1267]	14.8 [n=614]	5.9 [n=653]
Home Economics	25.5 [n=1254]	16.8 [n=608]	33.7 [n=646]	10.0 [n=1254]	12.8 [n=608]	7.2 [n=646]
Vocational Education	17.8 [n=1250]	25.5 [n=608]	10.5 [n=642]	10.8 [n=1250]	7.6 [n=608]	13.9 [n=642]
Computer Science	44.0 [n=1255]	54.9 [n=610]	33.6 [n=645]	6.3 [n=1255]	4.4 [n=610]	8.2 [n=645]
Physical Education	76.6 [n=1268]	82.6 [n=615]	71.0 [n=653]	17.3 [n=1268]	11.6 [n=615]	22.8 [n=653]
Foreign languages	45.3 [n=1257]	38.1 [n=608]	51.9 [n=649]	10.5 [n=1257]	13.3 [n=608]	6.8 [n=649]
Science	86.7 [n=1269]	88.7 [n=616]	74.8 [n=653]	11.5 [n=1269]	9.4 [n=616]	13.4 [n=653]

Note: Means are based on the following scale: 1 = Very useful; 2 = Sometimes useful; and 3 = Not useful at all. "I don't know" responses were excluded from the analyses.

Usefulness of school subjects. Table 5 provides the means for the overall sample and by sex for the perceived usefulness of each school subject. Both girls and boys rated Mathematics the most useful subject, with English and Science following. Girls considered Vocational Education and Physical Education to be the least useful areas of study for their futures, while boys named Art/Music and then Home Economics as the least useful subjects.

Forced-choice comparisons of school subjects. A "liking" score for each subject was computed by determining the number of times a given subject was chosen over another subject in a series of forced-choice comparisons. Each subject was evaluated against another five times, so a total score of five was possible; a subject receiving a score of 5 was preferred over every other subject. Table 6 presents means for the overall sample and by sex for the degree of liking of school subjects. Girls liked subjects in the following order, beginning with their favorite subject: art/music, math, science, English, physical education, and social studies; boys liked science the best, which they liked slightly more than math, then physical education, social studies, art/music, and English.

Table 5: Mean Usefulness of School Subjects for Complete Sample and as a Function of Sex

Subject	Complete sample			Males			Females		
	Mean	s.d.	N	Mean	s.d.	N	Mean	s.d.	N
English	1.39	.56	1188	1.44	.58	575	1.34	.53	613
Social Studies	2.01	.63	1092	2.01	.60	538	2.02	.66	554
Mathematics	1.22	.46	1207	1.18	.43	599	1.26	.49	608
Art/Music	2.30	.75	1014	2.36	.73	599	2.25	.76	529
Home Economics	2.23	.81	854	2.30	.79	400	2.17	.83	454
Vocational Education	2.24	.77	763	2.00	.77	390	2.50	.67	373
Computer Science	1.59	.68	944	1.47	.62	499	1.72	.73	445
Physical Education	2.22	.76	1084	2.10	.77	538	2.32	.73	546
Foreign languages	1.86	.65	1044	1.90	.65	510	1.81	.66	534
Science	1.52	.66	1136	1.46	.61	574	1.57	.70	562

Note: Means are based on the following scale: 1 = Very useful; 2 = Sometimes useful; and 3 = Not useful at all. "I don't know" responses were excluded from the analyses.

Table 6: Mean Liking Scores of School Subjects as a Function of Forced-choice Comparisons between Classes for Complete Sample and as a Function of Sex

Subject	Complete sample (n=1272)		Males (n=618)		Females (n=654)	
	Mean	s.d.	Mean	s.d.	Mean	s.d.
Art/Music	2.56	1.74	1.70	2.16	2.93	1.70
English	1.93	1.50	1.54	1.36	2.29	1.54
Math	2.99	1.63	3.11	1.58	2.87	1.54
Physical Education	2.47	1.76	2.82	1.73	2.13	1.72
Science	2.86	1.58	3.14	1.52	2.61	1.59
Social Studies	2.04	1.51	2.08	1.47	2.00	1.54

Liking college majors. Table 7 presents means for the overall sample and by sex for the degree of liking of each college major. Note that males and females did not differ in their ratings

of the college majors of Biological Sciences, Business Administration, Other liberal arts, Pre-Dental, or Pre-Medical.

The rankings of these majors, illustrated in Table 8, are especially interesting. The five most highly rated majors for boys are math, computer science, physical science, engineering, and pre-medical; girls preferred fine arts, pre-law, pre-medical, foreign languages, and math, respectively. These two groups share pre-medical and math as highly rated majors, but they differ dramatically on the rankings of several classes. Computer science and math as college majors were tied for the boys' favorite major, but the girls ranked this major 11th out of 18. Similarly, boys ranked physical sciences 3rd and engineering 4th, while girls ranked these majors 10th and 15th, respectively. Conversely, girls ranked fine arts and foreign languages 1st and 4th, respectively, while boys ranked these majors 11th and 10th, respectively.

Table 7: Mean Liking of College Majors for Complete Sample and as a Function of Sex

Subject	Total sample			Males			Females		
	Mean	s.d.	N	Mean	s.d.	N	Mean	s.d.	N
Biological sciences	2.57	1.24	1260	2.58	1.21	611	2.61	1.26	649
Social sciences	2.79	1.19	1258	3.00	1.26	611	2.59	1.20	647
Physical Sciences	2.43	1.24	1254	2.13	1.26	611	2.72	1.26	647
Political science or economics	3.18	1.18	1258	3.06	1.18	611	3.29	1.17	647
Engineering	2.75	1.31	1258	2.21	1.16	611	3.26	1.23	647
Foreign languages	2.62	1.27	1259	2.93	1.27	611	2.31	1.20	647
Mathematics	2.23	1.31	1259	2.09	1.26	611	2.36	1.34	647
Other liberal arts (philosophy, history, etc.)	3.01	1.24	1260	3.07	1.21	611	2.96	1.26	647
Pre-medical	2.35	1.31	1258	2.40	1.30	611	2.30	1.32	647
Fine arts (music, art, ballet, drama, etc.)	2.46	1.41	1255	2.99	1.17	611	1.96	1.45	647
Pre-dental	3.46	1.24	1259	3.50	1.22	611	3.42	1.25	647
Agriculture	3.63	1.16	1259	3.54	1.17	611	3.72	1.14	647
Computer Science	2.43	1.21	1259	2.09	1.11	613	2.76	1.22	646
Pre-law	2.42	1.33	1259	2.64	1.32	612	2.21	1.30	647
Nursing	3.37	1.34	1253	3.91	1.11	606	2.87	1.33	647
Business administration	2.65	1.16	1256	2.67	1.14	608	2.63	1.17	648
Physical education or recreation	2.82	1.37	1258	2.61	1.32	610	3.02	1.30	648
Journalism	2.94	1.30	1256	3.21	1.24	608	2.68	1.30	648

Note: Mean liking scores based on the following scale: 1 = I would like this major very much, 2 = I would like this major a little, 3 = I have no opinion or do not know much about this major, 4 = I would dislike this major a little, and 5 = I would dislike this major very much.

Comparisons of males' and females' responses. A series of t-tests of ratings indicates significant sex differences in every set of items. Table 9 presents a list of each item in which males and females differed at at least the .05 level of significance corrected for multiple comparisons. This table is arranged to illustrate the preferences of males and females for each set of items. From this table, it is clear that even these very talented students display stereotypical patterns of attitudes about school, in terms of various ratings of school subjects and college majors. In all significantly different comparisons, males preferred math and the sciences, while females gave higher ratings to English, languages, and art/music.

These data are important because they can help educators to understand the attitudes students have about school, and the possible relationship of these attitudes with future plans (e. g., interest in college majors). There is a growing need throughout the industrialized world for individuals versed in technical and academic fields, and it is valuable to note the patterns of academic interests in students as they develop (e. g., Clark, 1988). It is especially crucial to identify when negative attitudes begin, particularly when they are differentiated by gender.

These differences in attitude stand in sharp contrast to earlier studies conducted at TIP that have demonstrated little or no difference in classroom performance in many of the same school subjects (Stocking & Goldstein, 1992). Even in mathematics and science, girls in the TIP SRP performed at levels comparably high to that of males. Thus, if there is an impediment to the recruitment of more females into math and science careers, the impediment appears to be related to attitudes towards these subjects rather than gender-related ability differences in these subjects.

Table 8: Ranking of College Majors by Mean Liking as a Function of Sex

Males			Females		
Rank	Subject	Mean liking	Rank	Subject	Mean liking
1	Mathematics	2.09	1	Fine Arts	1.96
2	Computer Science	2.09	2	Pre-law	2.21
3	Physical Science	2.13	3	Pre-medical	2.3
4	Engineering	2.21	4	Foreign language	2.31
5	Pre-medical	2.4	5	Mathematics	2.36
6	Biological Sciences	2.58	6	Social Sciences	2.59
7	Physical education/ Recreation	2.61	7	Biological Sciences	2.61
8	Pre-law	2.64	8	Business Administration	2.63
9	Business Administration	2.67	9	Journalism	2.68
10	Foreign language	2.93	10	Physical Science	2.72
11	Fine Arts	2.99	11	Computer Science	2.76
12	Social Sciences	3	12	Nursing	2.87
13	Political Science/ Economics	3.06	13	Other Liberal Arts	2.96
14	Other Liberal Arts	3.07	14	Physical education/ Recreation	3.02
15	Journalism	3.21	15	Engineering	3.26
16	Pre-dental	3.5	16	Political Science/ Economics	3.29
17	Agriculture	3.54	17	Pre-dental	3.42
18	Nursing	3.91	18	Agriculture	3.91

Note: Mean liking scores are based on the following scale: 1 = I would like this major very much, 2 = I would like this major a little, 3 = I have no opinion or do not know much about this major, 4 = I would dislike this major a little, and 5 = I would dislike this major very much.

Study 3: Gender differences in career interest

The academically talented are a special group with specific attributes and concerns. One important area of research concerning this group addresses the development of career interests

and choices. Some researchers believe that these processes are especially complex for talented students, because these students tend to have a wide range of interests and abilities that does not lend itself to a clear occupational path (Kerr & Ghrist-Priebe, 1988). This "multipotentiality" creates the need for specific career counseling techniques that emphasize needs and values and provide more structure than open exploration (Colangelo & Zaffrann, 1979). Understanding the patterns of career interest and choice in this group is further complicated by recognizing the implications of gender issues for talented students, especially talented girls (Hollinger, 1985).

This investigation attempts to describe patterns of interests in specific careers for a group of academically talented seventh graders. Career interests tend to become more differentiated during adolescence (Kerr, 1988), a time when students are developing the ability to think in terms of the future.

Table 9: Significantly Different Comparisons by Sex of School Subjects and College Majors

Area of comparison	Rated higher by males (n=618)	Rated higher by females (n=654)
<i>School subjects</i> ^a : degree of liking	Computer Science, Math, Science, Physical Education, Vocational Education	Art/music, English, Foreign languages, Home Economics
<i>School subjects</i> ^b : perceived usefulness	Math, Physical Education, Science	
<i>School subjects</i> ^c : liking as a function of forced-choice comparisons between classes	Math, Physical Education, Science	Art/music, English
<i>College majors</i> : degree of liking ^d	Agriculture, Computer Science, Engineering, Math, Physical Education or recreation, Physical sciences, Political science or economics	Fine arts, Foreign languages, Journalism, Nursing, Pre-Law, Social sciences

Note: All means listed differ at the .05 level of significance corrected for multiple comparisons or higher.

^a Males and females rated all school subjects significantly differently in terms of liking.

^b The subjects of Home Economics, Computer Science, and Vocational Education were excluded from this analysis because of a high rate of "I don't know" responses (over 20%). No significant difference was found in the usefulness ratings of the school subjects Art/Music, English, Foreign languages, or Social Studies.

^c No significant difference was found in the forced-choice comparison scores of the subject of Social Studies.

^d No significant differences were found in the ratings of the college majors of Biological Sciences, Business Administration, Other liberal arts, Pre-Dental, or Pre-Medical.

Method

This study was conducted in a fashion comparable to that of Study 2. Three thousand of the approximately 57,000 applicants to the 1990 Talent Search were selected to take part in the Talent Search Questionnaire project according to the following criteria: we selected one

thousand each White males and White females and five hundred each non-White males and females. Of these three thousand, 1272 (42.4%) participated by returning completed questionnaires. One section of the 1990 TSQ concerns how much students think they would like or dislike each of 60 occupations. Occupations were chosen to represent a variety of fields and, in particular, to solicit information on math- and science-related occupations.

Students rated each occupation according to the following scale: (A) I would *like* this occupation *very much*. (B) I would *like* this occupation *a little*. (C) I have no opinion or do not know much about this occupation. (D) I would *dislike* this occupation *a little*. (E) I would *dislike* this occupation *very much*.

Students were told to rate each occupation only by how much they would like or dislike each according to the specific activity that occupation involves, regardless of salary or status. Students were told that if they indicate they would like an occupation that they are not necessarily stating an intention to pursue that occupation.

Results and Discussion

A series of t-tests indicated that males and females rated many occupations significantly differently. Table 10 presents an alphabetical list of each occupation in which males and females differed at at least the .05/59 comparisons = .0008 level of significance.

Table 10: Alphabetical list of occupations rated significantly differently by males and females

Occupations given higher ratings by males	Occupations given higher ratings by females
Air Force officer	Actor/actress
Airline pilot	Art/music teacher
Architect	Artist
Army officer	Dancer
Athletic coach	Daycare center operator
Auto mechanic	Editor
Biologist	Elementary school teacher
Carpenter	English teacher
Chemist	Foreign language teacher
Computer programmer	Guidance counselor
Electrician	Homemaker
Engineer	Interior decorator
Laboratory technician	Lawyer
Marine Corps Officer	Math teacher
Navy officer	Musician
Physicist	Newspaper reporter
Professional athlete	Nurse
Research scientist	Psychologist
Stockbroker	Social worker
Surgeon	Veterinarian
	Writer

Note: No gender differences were found for the occupations of Accountant, Banker, College professor, Dentist, Farmer, Insurance agent, Judge, Mathematician, Medical doctor, Physical Education teacher, Politician, President of a large company, Real estate agent, Sales representative, Science teacher, Social Studies teacher, and Statistician.

These results suggest significant gender differences in occupational interests, with males rating vocations (e. g., Auto mechanic, Electrician) and science occupations higher than females, and the females demonstrating preferences for teaching and the arts. It is notable that Medical doctor, part of a traditionally male-dominated field, was rated equally attractive by males and females, but this is one of the few areas that did not reflect a gender difference.

It is widely recognized that the number of females currently working in or entering highly technical fields such as mathematics or the sciences is small. The reasons underlying this phenomenon, however, are unclear. The present research effort represents a step in trying to understand this issue, as it pertains to high ability students.

The present findings may indicate that gender differences in occupational choices are attributable to factors occurring earlier than the seventh grade, implying that any interventions aimed at steering females into math and science occupations (for example) may need to be implemented at an earlier point in time.

A careful examination of the list of favored occupations for males and females also suggests that differences in prestige and potential income among various careers may be more salient for males than for females. These issues deserve further scrutiny.

Conclusions

These three studies demonstrate the extent to which gender differences among high ability students are found primarily in the domain of attitudes rather than in the domain of ability or performance. It is increasingly clear that the low ratings that females give to mathematically related school subjects, college majors, and careers is not based upon an objective lack of mathematical ability. Rather, it is the *perception* of low ability that may be responsible. Young females and their families have no doubt been influenced by the host of studies that have suggested lesser female ability in mathematics and the accompanying explanations that emphasize the biological inevitability of that lesser ability.

The data presented here suggest that the occurrence of low female ability in mathematics is rapidly becoming outdated. Indeed, the dramatic decline in the ratio of extremely high-scoring males to females on the SAT-Math test from 13:1 in 1981-1983 to less than 3:1 in 1990-1992 suggests that the gender gap is closing rapidly and may well disappear - as it has for the SAT-Verbal test - by the end of the decade. It may be fitting that as we approach the 21st Century, we will be able to discard some of the perceptions that shaped the lesser role of females in the worlds of math and science during the 20th Century.

The next generation of high ability youngsters needs to be educated in such a way that gender is no longer a barrier to career choice. The needs of the next century will be such that the abilities of half of our citizens cannot any longer be systematically and wrongfully underestimated.

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Gender differences among talented adolescents:

Research studies by SMPY and CTY at The Johns Hopkins University

Linda E. Brody, Linda B. Barnett, and Carol J. Mills

Center for Talented Youth, The Johns Hopkins University, Baltimore, USA

Researchers at The Johns Hopkins University have been studying gender differences in aptitude and achievement among talented adolescents for approximately two decades. Since 1972, talent searches conducted under the auspices of the Study of Mathematically Precocious Youth (through 1979) and the Center for Talented Youth (since 1980) have revealed gender differences in performance on the mathematical portion of the Scholastic Aptitude Test (SAT-M) (Benbow & Stanley, 1983; Durden, Mills, & Barnett, 1990; Fox & Cohn, 1980). Concern about this phenomenon has stimulated considerable research in an attempt to shed light on the extent and causes of gender differences in aptitude and achievement, particularly in mathematics and science.

This paper presents an overview of gender differences in students' performance in the talent searches and academic programs sponsored by the Center for Talented Youth (CTY). In addition, other studies conducted by researchers at Johns Hopkins that have described or attempted to understand gender differences in the talent search population are summarized briefly.

Gender Differences in CTY Talent Searches

Seventh Grade Search. CTY's annual talent search invites 7th graders who score in the top three percent on an in-grade standardized test and who live in the appropriate region of the United States or abroad to take the Scholastic Aptitude Test (SAT). CTY's talent search region includes 19 states and the District of Columbia, plus an international component. Regional talent searches are also conducted in the United States by Duke University (see related paper by David Goldstein and Vicki B. Stocking in this volume), Northwestern University, and the University of Denver, and there are several state and local talent searches utilizing the Johns Hopkins model as well.

The SAT was designed to predict success in college among high school seniors. When used out-of-grade-level with 7th graders, this test is useful as an indicator of exceptional mathematical and/or verbal reasoning ability. The high ceiling on the more difficult SAT permits discrimination of ability among students who all perform well on in-grade achievement tests.

Although males were somewhat more represented in the early Johns Hopkins talent searches, the ratio has been approximately 50:50 since 1980 when CTY was created and the search expanded (see Figure 1). Talent searches held in 1991 and 1992, however, suggest a slight trend toward males outnumbering females again, with females in those searches representing 48.1% and 49.0% of the participants, respectively. CTY will continue to observe future searches to see whether this trend continues.

In spite of fairly equal participation by males and females, small but consistent gender differences in talent search mean scores on the SAT-M have been observed, with males

outperforming females on this test. Table 1 shows the mean scores of CTY talent search participants since 1980. Differences between the mean scores of males and females range from a low of 19 points (1991) to a high of 36 points (1984), always favoring males. This difference has been less in recent years than in earlier talent searches, however.

Table 1: Mean SAT Scores of Talent Search Participants

Year	SAT-M		SAT-V		TSWE	
	Female	Male	Female	Male	Female	Male
1980	390	421	377	373	40	38
1981	390	420	362	369	39	37
1982	380	410	361	361	39	37
1983	377	408	359	361	38	35
1984	375	411	352	358	38	36
1985	383	417	353	363	38	37
1986	384	416	354	359	39	36
1987	388	421	358	358	38	36
1988	384	415	349	355	38	36
1989	380	404	355	356	38	35
1990	394	422	354	353	39	37
1991	388	407	360	356	38	35
1992	400	423	354	350	38	36

In contrast to the gender differences in performance on the SAT-M, gender differences on the verbal portion of the SAT among talent search participants have been very small or non-existent, with the slight differences fluctuating between favoring males and females. Differences have also been very small on the Test of Standard Written English, a test of writing skills and English usage, though they favor females. Essentially, however, no meaningful gender differences in verbal ability have been observed in the CTY talent search population.

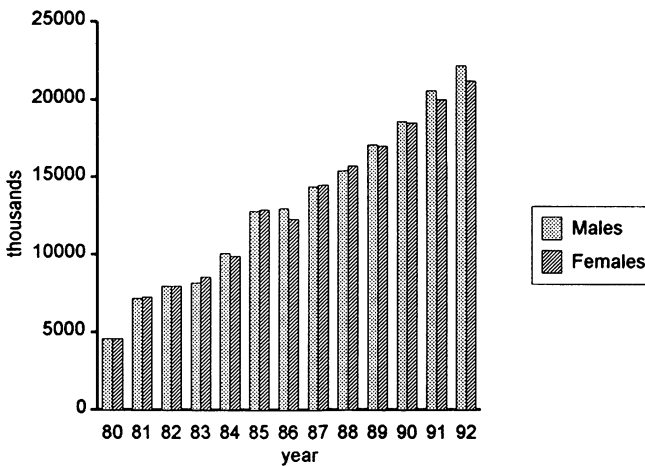


Figure 1: Total Participants (Talent search 1980-1992)

Gender Differences Among the Highest Scorers on SAT-M. Benbow and Stanley attracted considerable attention in 1983 when they published the ratios of male to female high scorers on SAT-M among 7th graders in the Johns Hopkins talent searches in 1980, 1981, and 1982. They reported ratios of approximately two males to every female scoring 500 or more, four males to every female scoring 600 or more, and 13 males to every female scoring 700 or more (Benbow & Stanley, 1983; see Table 2). CTY's more recent talent searches show considerable improvement in these male/female ratios since those early years; these results are also shown in Table 2. An analysis of gender differences on SAT-M from the talent searches held by CTY between 1984 and 1991 found that the ratio of males to females scoring 500 or above during those years was still almost 2:1. There was, however, a slight improvement at the 600 or above level; this ratio decreased from the previously reported 4 males to every female to a ratio of 3.4:1.

Table 2: Gender Differences Among High Scorers on SAT-M in Johns Hopkins Talent Searches

Score	1980 - 1982 ^{1,3}			1984 - 1991 ^{2,4}		
	Males	Females	M/F Ratio ⁵	Males	Females	M/F Ratio ⁵
500 or above	3,618	1,707	2.1:1	20,569	10,528	1.9:1
600 or above	648	158	4.1:1	4,647	1,292	3.4:1
700 or above	113	9	12.6:1	622	108	5.7:1

¹Data from Benbow and Stanley, 1983.

²Data from Barnett and Corazza, 1992.

³Total tested: 19,883 males, 19,937 females. Additional students tested for 700 or above distinction.

⁴Total tested: 122,185 males, 121,063 females.

⁵The M/F ratio was adjusted to compensate for the total number of males and females tested except for the 1980-82 700 or above ratio where total tested was unknown.

An even more dramatic change took place, however, during the years 1984 through 1991 at the 700 or above level; 5.7 males scored 700 or above for every female that reached that level, one-half the number reported by Benbow and Stanley in 1983. Of course, the proportion of total talent search participants who score at this level is very small, since these are extremely high scores. Nonetheless, it is encouraging to note that the proportion of students who score 700 or above on SAT-M before age 13 that is female is higher than was previously thought.

Young Students' Search. In 1992, CTY initiated a talent search for 5th and 6th graders using the Upper Level form of the Secondary School Admissions Test (SSAT). As in the 7th grade talent search, the purpose of choosing an above-grade-level form of the test was to discriminate among students who all perform well on in-grade tests. Norms for 8th and 9th grade students were used for comparison purposes. Of the 7,944 students who participated, males were somewhat more represented than females (54% compared to 46%). This contrasts with the more equal representation in the 7th grade search.

As in the 7th grade search, males outperformed females on the quantitative part of the test, though differences were small. Among 5th graders, the mean scores were 279 for females and 284 for males out of a possible total score of 350; among 6th graders they were 289 and 296, respectively. No gender differences were found on the verbal portion of the SSAT. Since this was the first year of this talent search, it will be important to observe trends over time. CTY also plans to observe the relationship between scores earned in the young students' talent search and later SAT scores obtained by the same students.

The School and College Abilities Test. In an attempt to identify precocious reasoning ability among students younger than 7th grade, CTY has also used the School and College Ability Test (SCAT). A study of gender differences among students in the 2nd through 6th grades in performance on an above-grade-level form of the SCAT found significant differences in mathematical ability favoring males ($p \leq .001$). At every grade level, the mean difference was at least one-third of a standard deviation. A closer examination of responses to items on the SCAT suggested gender differences according to mathematical subskills. Comparison of factor scores revealed no differences between males and females on tasks requiring students to identify whether enough information was provided in order to solve the problem. However, males outperformed females on problems that required students to apply algebraic rules or algorithms, as well as tasks where the understanding of mathematical concepts and number relationships was required (Mills, Ablard, & Stumpf, 1993).

Other Standardized Tests

In an attempt to characterize the magnitude and pattern of gender differences in performance on a variety of standardized tests, Julian Stanley and colleagues analyzed 86 nationally standardized aptitude and achievement tests (Stanley, Benbow, Brody, Dauber, & Lupkowski, 1991). The tests included the Differential Aptitude Tests (DAT) taken by students in the 8th through 12th grades, achievement and aptitude tests taken by high school students (including the SAT, Preliminary Scholastic Aptitude Test, American College Testing Program examination, Advanced Placement examinations, and College Board achievement tests), and the tests taken by college students in the United States for admission to the nation's graduate, medical, business, and law schools.

Except for the DAT, the results of which were based on a normative sample, all of the tests investigated the results for the total national population of test-takers during the years investigated; thus, sample sizes were generally exceptionally large. Except for the DAT again, most of the tests are optional and are taken for purposes of admission or earning credit for coursework completed. Students taking these tests are a fairly selective group of students who expect to perform reasonably well.

Males excelled most in mechanical reasoning, females in spelling; women were slightly ahead in language usage, clerical speed and accuracy, English composition, and knowledge of some foreign languages; men were higher in quantitative reasoning, as well as in political science, physics, European history, computer science, and chemistry. Thus, higher test performance by males than females was not limited to quantitative fields, as most previous studies had implied. Gender differences were consistent across tests and grade levels and appeared on achievement as well as aptitude tests. The pattern of greater differences at the upper levels of ability found in the talent searches was upheld on many of these tests, and differences in some areas were great enough to affect admission to selective colleges and universities.

CTY Academic Programs

Enrollment in Summer Programs. CTY conducts rigorous academic summer programs for highly capable students in grades 7 through 10. A separate program was offered for the first time during the summer of 1992 for high scorers from the young students' talent search and is now held every summer.

Eligibility requirements to attend the program for 7th graders and above are: for a math or science course a minimum score of 500 on SAT-M and a composite of SAT-M + SAT-V of at least 930; to enroll in a humanities course, students must score at least 430 on SAT-V and 35

on the Test of Standard Written English. Gender differences in performance on the SAT-M obviously result in gender differences in eligibility for summer programs.

For example, of 42,734 students who took the SAT in CTY's 1992 talent search, only slightly more males than females were eligible to enroll in CTY's summer program (10.6% versus 9.2%, respectively). However, the difference is more significant when one considers students eligible to enroll in a mathematics or science course; 6.8% of the males tested compared to only 3.9% of the females tested met CTY's eligibility requirements for these courses. Thus, gender differences on standardized tests may lead to additional differences in opportunities to participate in special educational programs. Differential participation in such programs by males and females may contribute to greater gender differences in behavior and achievement.

Choice of Programs. In addition to gender differences in the opportunity to enroll in a CTY mathematics or science course as a result of differences in performance on the SAT-M, differing interests may be contributing to gender differences in mathematics and science achievement. The students whose scores made them eligible to choose to take either a mathematics or science course or a humanities course in the 1989, 1990, and 1991 summer program were studied. Of the eligible males, 58% elected a math or science course compared to only 40% of the eligible females. Females were more likely to choose a humanities course (60% compared to 42% of the males; Mills, 1992a).

It is certainly appropriate for students to select a humanities course for which they are eligible. However, when we study gender differences in mathematics and science, it is important to note that any differences in achievement due to gender differences in aptitude and/or opportunity may be intensified by males and females preferring and choosing different learning experiences.

Achievement in Summer Programs. Gender differences have been assessed in terms of achievement in the mathematics courses in the CTY summer program. On entrance placement tests, females appear to be equally prepared. However, given an opportunity to proceed at their own pace, the males are more likely to move at a faster pace through the curriculum.

An analysis of mathematics achievement among the students who attended the CTY program in 1989, 1990, and 1991 found that the majority of students completed one course at a high level, including 65% of the females and 63% of the males. However, females were slightly more likely not to complete a full course (19% of females versus 14% of males), and the students who completed two or more courses were somewhat more likely to be male (22% of males versus 16% of females) (Mills, 1992a). Thus, there were subtle differences in mathematics achievement in the program. While one cannot rule out differences in ability and/or mathematics background as contributing factors, it is likely that motivation and/or self-confidence may be contributing to the amount of mathematics students complete in the three week summer program.

In CTY science classes, gender differences favoring males were found in post-test scores in CTY Physics classes. However, this was not the case in the biology or chemistry classes (Gustin & Corazza, in press).

Math/Science Credit/Placement. Studies have also been conducted on students' success in receiving credit and/or placement for courses taken in the CTY summer program when they return to school. In terms of requesting appropriate credit and placement: in math an equal percentage of males (80%) and females (83%) requested credit or placement, but in science there was a gender difference with 72% of males and only 59% of females initiating discussion about credit or placement. This discrepancy may relate to males' greater self confidence in their science abilities and willingness to accelerate into more advanced science courses.

With regard to receiving credit or placement: Of those who requested credit or placement in science, there were no statistically significant gender differences in terms of those who were granted it. Over 70% of science students (regardless of gender) who requested placement

received it, and 40% received credit. In math, however, although approximately 70% of each gender was awarded placement upon request, there was a gender difference in those awarded credit for math courses: Only 30% of females versus 40% of males who requested credit for math courses taken during the summer actually received it (Mills & Ablard, 1992).

Gender Differences in Personality Traits and Attitudes

Personality Studies. Mills (1992ab) studied gender differences in personality variables among CTY summer program participants and found that either a "thinking" or "feeling" cognitive/psychological style as measured by the Myers-Briggs Type Indicator (MBTI) was related to differences in ability and achievement. Academically talented males were more likely to be "thinking" types, more goal directed, and less concerned with the needs of others than academically talented females. "Thinking" females, however, like their male counterparts, had higher SAT-M scores, chose math/science courses in larger numbers, and achieved at higher levels once enrolled in a flexibly paced mathematics class than "feeling" females. Thus, "thinking" males and females were similar in aptitude and achievement, as well as on other personality variables. These findings suggest the possibility that temperament may contribute to one's developed abilities, and that personality, in particular a thinking or feeling cognitive style, may influence educational and career choices and one's persistence in pursuing goals. If so, it is possible that gender differences in the thinking-feeling domain may influence gender differences in behavioral outcomes. Additional studies are underway at CTY to clarify this relationship further.

Attitudes Toward Mathematics. Studies conducted at Johns Hopkins in the late 70's and early 80's found talent search females less confident in their mathematical ability than males, even when SAT-M scores were comparable. Males also responded more stereotypically to categorizing mathematics as a male domain. Among the females, those with high aptitude but low interest in mathematics exhibited less confidence in their mathematical abilities, depicted mathematics more stereotypically as male, and viewed math as less useful than those with greater mathematics interest (Fox, Brody & Tobin, 1982, 1985).

Recently, a study was conducted to investigate whether such differences still persist. Similar results were found among students who attended a CTY summer program during the summers of 1989 or 1990, all of whom had scored a minimum of 500 on the Scholastic Aptitude Test-Mathematics and a total of 930 on the verbal and mathematical portions combined. Males exhibited greater confidence in their mathematics ability, and reported math as more useful and more stereotypically a male domain than females. A subgroup of students who had selected a math or science course at CTY for at least two summers was studied as a high-math-interest group for gender differences. No differences were found for usefulness or confidence, suggesting that girls who chose to take math or science in the program are likely to exhibit as much confidence in their mathematical abilities and were as likely to view math as useful as their male counterparts (Mills, Brody, & Krug, in preparation). It is possible that a lack of confidence inhibits female participation in mathematics and science at advanced levels, and that females who have this confidence are more likely to persevere in the study of advanced mathematics and science.

Conclusion

Studies of talented adolescents conducted by researchers at Johns Hopkins document consistent gender differences on standardized tests of quantitative reasoning ability, as well as in other cognitive areas. Although such differences have not emerged on verbal reasoning tests, they were found in non-quantitative areas such as history and political science.

In measures of quantitative ability, males outperformed females on tests taken by students as young as 2nd grade through college students applying to graduate school. In the CTY talent search, some improvement in females' performance on the SAT-M compared to males' has been noted in recent years. In particular, among the highest scorers on SAT-M in the CTY talent searches, the ratio of males to females scoring at this level is considerably less than was evident in the talent searches conducted in 1980-82.

In addition to gender differences in test performance, the research summarized here suggests differences between males and females in educational opportunities, interest, motivation, self confidence, and personality traits that may contribute to differential achievement by males and females in mathematics and science. More work is needed to help us understand the interaction effect of these variables in determining the attitudes and behaviors of talented individuals.

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VI. SPECIAL GROUPS

Introduction

Betts and Neihart (1988) and many others have pointed out that there is a group of gifted children who are underserved because they wear a "double label". Three contributions of this part "Special Groups" deal with the case of such children, and they focus on different kinds of handicaps. Nava Butler-Por describes the situation of underachieving children in Israel who have grown up in a culture different from their origin. Diane Montgomery illuminates the case of gifted dyslexics, that is children of severe difficulties in learning language but of high general intelligence. Ernst A. Hany summarizes a workshop on gifted individuals with physical disabilities. All these groups suffer from their talents not being recognized by the relevant people around them, or by these people being unable to provide substantial help both for overcoming the handicap and for fulfilling one's potential. A special case is made of children with an unbalanced structure of intelligence whose problems arise from the inner source of unequal levels of skill.

Groups of different restraints need different treatment. Nava Butler-Por presents a program which aims at integrating differently cultured students into the dominating culture by stimulating contacts through a two-level tutoring system. Gifted underachieving fifth graders, the target group of the intervention program, are tutored by gifted eighth graders. Social activities and learning projects are the topics of the cooperative work which seems to be very effective as can be seen from subjective statements. The tutors are supervised by school counselors who advise them how to carry out the activities of the program. Another program which is presented by Nava Butler-Por aims at intensifying the student-teacher contacts in order to facilitate the enculturation of the underachieving students. Diane Montgomery deals with the case of gifted

dyslexics who need a completely different treatment. These children have specific learning difficulties in reading, spelling and writing. Therefore, the perceptual and cognitive processes which underly the process of acquiring and using language have to be assisted by a process-orientated intervention. Careful diagnostic analysis precedes and controls the individual design of intervention the principles of which are presented by the author.

Quantitative data on highly able children of an unbalanced structure of intelligence are presented by Maria Herskovits. Her analyses focus on students who showed large discrepancies on the two parts of the Wechsler Scales of Intelligence. A remarkably large group of gifted pupils had a much higher global score on practical tasks than on verbal tasks and at the same time indicated several problems in terms of school achievement and personality structure. On the other hand, lower but significant differences between the two parts of the Wechsler test did not hold the test author's promise of diagnostic relevance, at least not in the case of data Maria Herskovits has collected in Hungary.

Gifted individuals who suffer from physical handicaps have not received much attention from the public. A special Foundation, located in the Duchy of Liechtenstein, aims at making public aware of the substantial mental potential physically handicapped persons may have. A full-day workshop of the Third ECHA Conference dealt with the question of providing appropriate support to this special group and attracted a big audience. Ernst A. Hany summarizes the contributions to that workshop which have been published in German language elsewhere. It turned out that physically handicapped gifted individuals need an incredibly high level of energy and mental and physical strength for convincing institutions of higher education and companies to give them a fair chance.

If anyone still has had doubts that special efforts for educating the gifted is necessary, the case material presented in these contributions would convince him or her that it is.

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Gifted differently cultured underachievers in Israel

Nava Butler-Por

University of Haifa, Haifa, Israel

The professional interest in the question of the realization of human potential which is expressed in modern educational ideology that believes in the right of every child to fully develop his/her unique talents, has increased the awareness of the need to cater for the special needs of gifted children and provide appropriate educational programmes in order to fulfill their specific needs. While increased world recognition of the needs of highly able children has resulted in the development of diverse programmes for these children in many countries, it also highlighted the problem of hidden, undetected and unrealized talents of differently cultured children (Karnes & Johnson, 1991; Khatena, 1992; Passow, 1982).

The seriousness of the problem of cultural underachievement in Israel is emphasized by the findings that despite the efforts invested in the last four decades in "bridging the educational gap" between the differently cultured and Western child population, very few culturally different children participate in programmes for gifted children in general and in the special classes for highly gifted children in particular. While it is impossible to determine the full scope of cultural underachievement, since children may for reasons which will be discussed later, choose not to reveal their true abilities. There is ample evidence that the problem is widespread (Butler-Por, 1993; Karnes & Johnson, 1991; Richert, 1985; The Thomas and Hargreaves Report, 1984). The problem is highlighted by the professional literature's findings of the recent 1991 and 1992 diagnostic tests in Israel. These tests aimed to obtain a general and comprehensive picture of the school achievement of the entire elementary school population in Israel in arithmetic and comprehension. The results indicated that the highest proportion of failure was among the differently cultured Jewish and Arab students. It is pertinent to ask why in spite of the efforts invested in "bridging the gap," in Israel and the awareness that what is needed is: "A real commitment on the part of educator's and society at large to the concept that talent is not the prerogative of any racial or ethnic group, any social class or any residential areas. It may lie untapped in some situations under some conditions, but no population has either a monopoly on or absence of talents" (Passow, 1972, p. 31), the proportion of identified ability in differently cultured children in Israel is still very small. The answer to the question of cultural underachievement and the possibilities of alleviation of the problem should be directed to the following areas:

1. Historical factors
2. Cultural values and socialization practices
3. Diversification of identification criteria
4. School related factors

Historical Factors

At the onset of the state of Israel in 1948 and the opening of its gates to immigrants from diverse cultures, the school population became very heterogeneous. A high proportion of the immigrant child population came from Middle Eastern countries whose norms of socialization, values, expectations and cognitive experiences differed from the pre-state dominant Western culture. The motivation to merge the different ethnic groups into a more cohesive entity has

given impetus to formulating educational and social objectives aimed at "bridging the educational gap" between the oriental children believed to be disadvantaged and the advantaged school population. Much of the thrust of the developments in educational theory and practice has been directed towards understanding the cultural differences in socialization and the specific characteristics and needs of its children in order to develop provisions for educational experiences believed to be conducive to the cognitive and social development of differently cultured children and contribute to the process of narrowing the gap in scholastic achievements. The ideology resulted in the educational "reform" which involved the organizational changes in the school system: (1) The elementary education was conducted in neighbourhood schools; (2) The secondary education was conducted in integrated large schools, involving "bussing" of children.

However, this system while stimulating new developments in the curriculum, has also highlighted the problems of erosion among the differently cultured children as a result of the encounter of children who were considered highly able in their neighbourhood elementary school with the advantaged secondary school pupils. Their high motivation and expectations inspired by their previous scholastic successes gave way to helplessness and adoption of underachievement patterns of behaviour. Moreover, since insufficient knowledge of their specific characteristics and needs was available at the time, teachers were unable to identify high ability when manifested in behaviour products which differed from those with which they were familiar. Similar problems arose later among the Ethiopian immigration for the Ethiopian children. The transition from their home culture to Israel constituted a "cultural shock." The extreme differences in their socialization and learning experiences has placed them at the lower end of the scale in scholastic achievements. However, empirical experience has shown that the Ethiopian children have motivation and respect for learning, characteristics that serve as productive starting points for the process of fulfillment of their potential.

Cultural Values and Socialization Practices

While it is understandable that it is difficult as Getzels has argued, to identify high intellectual abilities in children who have been socialized in cultures and subcultures whose values and cognitive experiences differ from those of the dominant culture (Getzels, 1969), Passow (1982) identified three environmental factors which contribute to cultural underachievement: (a) Experimental deprivation; (b) limited language development; (c) socioeconomic or racial isolation.

Socialization factors and cultural characteristics have an important role in enhancing the child's ability to develop his potential. Frankenstein (1970, 1984) for example, maintained that Middle Eastern disadvantaged children are characterized by concrete dichotomized associative and affective thinking. Since these characterize their culture, he postulated that their parents socialization patterns could not provide the learning experiences that are conducive to developing abstract and critical thinking. He concluded that since the parents are unable to assume the educative role of providers of cognitive and social stimulus, teachers should fulfill this role. Based on these principles, Frankenstein devised special programs designed to develop abstract and cognitive abilities in differently cultured children. His theory and programs are studied in the Universities and are implemented by schools in Israel.

Diversification of Identification Criteria

Current professional literature indicates that accurate assessment of abilities requires the collection and evaluation of data from different sources (Frasier, 1991). The need to expand the identification practices is of particular significance for the identification of talent in culturally different students, in view of the recent research on intelligence and the assessment of intellectual capacity, indicating that an intelligence test provides an incomplete and narrow

picture of abilities (Gardner, 1983; Sternberg, 1988). Furthermore, it is important to emphasize that while the criteria for identification of talents in differently cultured children should include non-test data such as observations and individual reports (Khatena, 1992), and non-verbal creative measures (Khatena & Torrance, 1990ab; Torrance, 1974), the findings of a research aimed at finding means of identification of talents in differently cultured children in Israel, indicated that by using the top quartile of the creative students on the Torrance Non-Verbal Tests of Creative Thinking (1974), 60% of the high achievers among the Middle Eastern differently cultured elementary school students were identified (Butler-Por & Lancer, 1981). In addition, identification should consider the impact of cross-cultural experience and intercultural interaction which have been found significant in contributing to the development of creative abilities in Arab children in Israel (Mari, 1979).

School Related Factors

The problem of detecting high potential in differently cultured children has been shown to be affected by the following inter-related educational factors: (a) Absence of Differentiation; (b) Labelling and Low Teacher Expectations; (c) Incompatibility Between Learning Experiences and Educational Needs.

(a) *Absence of Differentiation*. Generally, the educational programs aimed to enhance the scholastic development of differently cultured children tend to perceive them as a homogeneous population resulting in stereotyping their characteristics, focussing on the variables in which they differ from those of the dominant culture. Most of the programs were based on enrichment for the entire differently cultured population in the class and thus generally failed to cater for the needs of the talented students to help them reach higher levels of cognitive thinking.

(b) *Labelling and Low Teacher Expectations*. While the need to "bridge the educational gap" between the student population of the differently cultured and dominant culture was recognized, the undifferentiated approach to the differently cultured school population resulted in the need to "label" them in order to implement the educational policies adopted. However, studies investigating the efficacy of programs for differently cultured children in Israel, for example (Smilansky, 1981), indicated that the labelling process leads to lowering the expectations of the teacher which lowers the child's scholastic expectations, a process which inevitably results in underachievement (Butler-Por, 1992; Rutter *et al.*, 1979).

(c) *Incompatibility Between Learning Experiences and Education Needs*. The teachers' low expectations from their differently cultured pupils constituted the basis for their pedagogical thinking which determines the kinds of curricula experiences provided and teaching methods utilized for their pupils.

Since the programmes were not designed to discover and develop potential, they were not appropriate for developing the abilities of the gifted differently cultured children. Thus these gifted children, considered as "the most disadvantaged within this already disadvantaged community" (Smilansky, 1981, p. 273) are deprived of the learning experiences and the intellectual stimuli needed in order to fulfil their educational needs and contribute to enhancing their motivation for learning at a higher level and thus bring about significant improvement in their scholastic achievements. Thus, these children were not only deprived in early childhood of the learning experience needed for concept formation, language and intellectual development, they were also deprived at school. Hence, these deficiencies prevented the teachers from recognizing their potential and from providing them with the appropriate learning experiences which would enable them to develop their "hidden" abilities. When we consider the accumulated effects of these processes it is not surprising that gifted differently cultured children are not found eligible for special gifted programmes in schools.

Since the effects of scholastic failure are cumulative it is important to identify the gifted

culturally different underachievers as early as possible during their primary school education. Early detection of potential should be followed by meaningful learning experiences which should enable these children to reach maximum development and benefit from the educational opportunities provided at the secondary and higher levels of education.

The question that must be asked: which educational experiences are significant for gifted culturally different underachieving children who are not realizing their potential since they lack the knowledge, learning habits and skills needed to fulfil effectively the role of the pupil? In addition, it is important to ask what motivational needs have to be fulfilled in order to help overcome underachievement behaviour and maintain scholastic progress?

It seems that learning the "Role of the pupil" could be achieved through close interaction with a tutor, who is an older achieving gifted pupil, with whom the younger gifted differently cultured underachiever can identify and from whom she can learn the behaviours and skills which should help her to make progress in school and develop according to her ability. The work with the tutor should be accompanied by teacher intervention work aimed to cater for the motivational needs of the individual child. These needs served as a basis for creating the following model of intervention.

Intervention Model for Overcoming Scholastic Underachievement in Gifted Differently Cultured Children

Rationale

The aims of this model are derived from the educational and psychological needs of differently cultured gifted underachievers which were discussed in the previous sections, and on my research and experience of working with gifted children in general and gifted underachievers in particular (Butler-Por, 1987). The specific objectives were formulated on the assumptions expressed in the professional literature that the differences in the scholastic achievements of primary school differently cultured gifted children and those of the majority culture are mainly expressed at the starting point (Gallagher & Kinney, 1975). For example, findings of a longitudinal study of the effects of integration of differently cultured children of Western origin in a primary school in Israel, indicated that differences in arithmetic achievements, for example, were solely quantitative (Klein & Eshel, 1980). The objectives for development of the differently cultured gifted should also aspire to meet special cultural needs and develop specific talents. It is important to note that some of the specific characteristics of differently cultured children, such as focus on interest learning, and problem solving orientation, are also attributed to creative children.

It seemed that the objectives formulated for the special classes for the gifted, which aimed to cater for the development of children of both convergent and divergent thinking styles would be meaningful for developing the potential abilities of gifted differently cultured underachievers (Butler-Por, 1976, 1987).

Objectives

Developing formal thinking and intellectual depth. While intellectual development is important for all children it is an essential educational goal for differently cultured children in view of their specific characteristics. Highly intelligent children learn quickly, have excellent memories, usually read extensively, and have a vast store of general knowledge. These characteristics lead them to believe that they completely understand the concepts and ideas that they have read about. The lack of sufficient experiences and practice in formal thinking skills, often leads to the reluctance to engage in thinking processes which involve greater depth, and may result, as in the case of gifted underachievers, in mental laziness. These characteristics

mislead the teacher of the gifted, who assume that the knowledgeable responses express comprehension, and they may not be aware that they should direct attention and invest effort in creating learning experiences that involve their pupils in thinking processes demanding greater depth. This objective is vital for the differently cultured gifted children. These pupils, for the reasons discussed above, do not receive the intellectual stimuli that enable them to develop adequate cognitive skills.

Furthermore when they enter neighbourhood elementary schools, further development is hampered as a result of the low expectations teachers have from differently cultured pupils, which in turn, determine the selection of contents and teaching methods which are inappropriate for developing formal thinking skills (Chasin, 1975; Rosenthal & Jacobson, 1968; Rutter *et al.*, 1979). Thus it is most important that teachers should be aware of the need to work towards fulfilling this objective with differently cultured gifted underachievers.

Providing tools for learning by self discovery and research methods. This objective is most relevant for the differently cultured underachiever since it enables her to utilize specific talents and thus contribute to the development of her self confidence. These learning processes enable acceptance of non judgemental feedback which also serves to raise the level of intrinsic motivation (Nisan & Butler, 1979). Learning by discovery methods enables the gifted differently cultured child to determine the rate of his individual progress by selecting assignments that he believes that he is able to cope with and complete. Consistent use of such methods improves processes of concept formation and the acquisition of self motivated learning habits which should contribute toward improving scholastic achievements and thus reducing underachievement.

Developing creative thinking and creativity. Although the development of creativity is important for all children, it should constitute an integral part of intervention programmes for gifted differently cultured underachievers. The characteristics which are typical of the differently cultured child's thinking style are content centered rather than form centered, oriented externally, problem-centered instead of abstract centered, slow, patient and persevering when interested, rather than quick and clever. It is the formal language deficiencies, which Riessman believes, constitutes the differently cultured child's "Achilles heel" in the school (Riessman, 1962). These traits also characterize creative children and as such they serve to reinforce the low expectation of their teachers who may not recognize the expressions of creative thinking and the creative products in different domains as indicators of high potential. Since the child's abilities are not recognized, the teacher also does not reinforce them. The gifted differently cultured child is not only deprived of support and encouragement, but also of the appropriate learning experiences in the areas in which he needs to improve - mainly in the cognitive formal thinking skills.

Educating Towards Social Involvement. Educating towards social involvement in school and community is important for all gifted children who tend to be more individualistic, preferring to work alone on the topics that interest them (Butler, 1976). It is particularly relevant for the gifted differently cultured underachievers, since success in assuming responsibility for experiences which contribute to the school and the community should help them to overcome their feelings of deprivation and to acquire a sense of belonging, which should contribute to their feelings of social acceptance, well being and self confidence.

Initiation and Implementation

The intervention model consists of two interrelated separate programmes which should be conducted simultaneously. The gifted tutors are responsible for one programme, the class teacher is in charge of the second one.

Programme A: The tutorial sessions

The educational team

One of the attractive features of launching a new educational model is the creative opportunity it offers those who are involved with its beginning. In this particular case it was important to create a supportive educational climate which constitutes an essential pre-requisite for the successful initiation and implementation of the project. For this purpose several meetings were planned for the participants of all the educationists involved with the programme:

A local representative of the Ministry of Education, the two principals of the schools involved in the programme - the head teacher and the counsellor of the secondary school in which the gifted tutors study, the head teacher of the primary school where the differently cultured gifted underachievers studied, the class teachers of both schools and the educational adviser for the special classes in Haifa who was responsible for creating the model (the author). During the meetings the conceptualization and aims were discussed and formulated and the different aspects of the implementation were finalized.

The tutors

The following activities were conducted in order to help the tutors to understand their role and prepare them for their work:

Workshop with the educational team - in this meeting the tutors discussed the different aspects of the model with the educational adviser to the special class for the gifted. The primary school principle described her school and the needs of her gifted differently cultured underachieving pupils, and the tutor's school counselor presented the activities in which they would be involved.

Personal meeting between the tutor and the school counselor - in this meeting the specific objectives and activities for the first meeting with their "child" were discussed, emphasizing the responsibility of the tutor for planning the activities. In addition the tutor was advised how to write a personal diary which would include the objectives, contents, activities and personal description and evaluation for each meeting.

The population

The tutors: 28 8th grade pupils participating in the special classes gifted programme in Haifa.

The tutored - 28 5th grade differently cultured gifted underachievers, which were selected for the intervention programme on the basis of observations of behavior in class, motivational needs and evaluation of potential conducted by the professional staff of their school.

Structure and contents

Personal relationships: The tutorship will be conducted on a one-to-one basis involving the tutor and the tutored. Sixteen weekly meetings will take place between the tutor - the secondary school gifted pupil and the differently cultured gifted underachiever. Each meeting lasting two hours.

Personal project: The tutor and "her" underachiever will select a personal project for their cooperative learning. The criteria for choice of topic: a) personal interest of the differently cultured underachiever in the topic. b) Motivation for learning more about the topic. c) Practical possibilities of developing and completing the project. The tutor and "her child" will share their learning experiences, study from different sources, and present their findings in writing and in creative products. The tutor will thus be able to stimulate curiosity, improve learning skills, tools and methods which she herself has learned in the gifted programme. It was hypothesized that these activities would provide intellectual stimulus, developing thinking skills and learning habits which should help towards making better progress in school. It was believed that the tutorial sessions which incorporated cognitive and social experiences would constitute a dynamic process providing continued feedback, positive reinforcement and affective support, factors

which should contribute to the development of intrinsic motivation which should enable the gifted differently cultured child to sustain the progress he has made in school. Creativity was encouraged by diverse creative methods of presenting the projects.

Creative experiences: The tutor and "his child" would create games in different areas aimed to develop and clarify concepts utilizing unconventional methods capable of developing and expressing creativity.

Social activities: Jointly, tutor and underachiever will plan and organize group activities aimed to involve the participants of this programme in contributing to the school and their community. It was believed that social development, just as moral growth (Piaget, 1966) can only take place through active participation in meaningful and productive social experiences.

It was assumed that participation in the social activities would provide the differently cultured gifted underachievers with the sense of belonging which is particularly important for these children. Since the development of social responsibility constitutes one of the objectives of the gifted programme of special classes with the regular school, it was hoped that the satisfaction experienced from the successful completion of the social projects would motivate both partners - the tutors and the tutored to continue with social oriented activities later on.

All the meetings were conducted at the primary school in which the gifted underachieving differently cultured children study. The tutors' school counselor was present in all the meetings in order to help the tutors with possible difficulties or problems which might arise.

Follow up and evaluation: The following methods were utilized: (a) Regular meetings of the project's educational team were convened in order to discuss the evolving processes. (b) Meetings between tutors and the school counselor. Weekly meetings between the tutor and the counselor responsible for the project were conducted, in which the previous meeting of the tutor with the underachiever was discussed and evaluated, and the subsequent meeting was planned, after they both read the tutor's account in his diary and discussed the problems which arose. (c) Final evaluation meeting between the gifted differently cultured children who participate in the programme, their class teachers and the school's principal. The meeting was devoted to the evaluation of the different aspects of the programmes and suggestion for further programmes planned for the following school years.

Evaluation and conclusions

In order to evaluate the efficacy of the tutorial programme, a final meeting was convened, in which all the tutors and the educational team responsible for the programme participated. The tutors were asked to assess (1) what their pupils have learned, (2) what they themselves have learned. It is interesting to note that the tutors have discovered some of the characteristics and the problems associated in the literature with differently cultured children (Frankenstein, 1984; Passow, 1972) as well as some of the behavioral characteristics of gifted underachievers (Butler-Por, 1987). All tutors agreed on the following characteristics:

- The tutored children had difficulties with concentration, and were not capable of persevering in completing tasks. With time their concentration and task commitment improved.
- They tended to become distracted, wanting to know what their friends who sat next to us did. They were inclined to think that their friends were doing better things. They felt deprived.
- They seemed curious and interested but did not know how to go about learning the things they were interested in. In later meetings, they learned how to find out things, and achieved much better achievements than we expected.
- They seem to lack a sense of belonging and were reluctant to talk about their families.
- They need support and encouragement. They are very loveable.
- They made good progress in the following areas: They enjoyed reading about different topics

in addition to those related to their personal project. They learned to analyse and summarize the material they read, to ask relevant questions and seek the answers to their questions. They improved their ability to pose and solve problems. Their spelling and writing improved. They learned to create original games, capable of revealing the correct answers to the questions they posed. They discovered that learning is fun and that presenting their findings in attractive ways and methods is enjoyable. They learned how rewarding it is to work with others and contribute to their friends and school.

When asked what they, as tutors, have learned, they agreed on the following aspects:

- We discovered that differently cultured children are like all children of their age who need to learn the things they do not know in order to make good progress at school.
- They are different from our brothers and sisters in responding with greater enthusiasm to new experiences. It seems to us that they missed these stimulating experiences at home.
- We found out that they did not receive the same help and attention from their parents that we get at home. We know how important it is.
- We know that all children can improve their school achievements and enjoy learning when they are provided with help and encouragement.
- We have discovered that we have learned as much as they did by working together and their successes made us very happy.

The tutored gifted differently cultured evaluation of the tutorial programme.

At the end of the programme, personal meetings between the children who participated in the tutorial sessions, their class teacher and the school principal were conducted in order to evaluate the efficacy of the programme. The assessment was based on (a) the completed personal projects (b) individual discussion with each child.

The evaluation of the personal projects indicated that all children improved their writing skills, spelling, ability to organize, plan and complete assignments. Improvement was also noted in thinking skills, processing of written material, question asking and problem solving. In addition it was noted that the personal projects revealed specific talents which the teachers were not aware of.

During the personal meetings the underachievers agreed on the following points:

- The meetings with our tutors encouraged us to read and find material for our project.
- The work with our tutors was very interesting. We would like to continue to learn about our topic and we asked our teachers to help us.
- We enjoyed discussing many things with our tutors and we learned that it is fun to learn with somebody else.
- We now do our homework without help at home, and we enjoy showing our work to our tutor, teacher and our headmistress.
- We are happy with our progress at school and hope to do even better next year.
- We like doing things together with our friends for our teacher and our school.

Evaluation of the teachers and school principal

Generally it was felt that despite the limited duration of the tutorial programme, it was possible to note the changes that occurred in the following aspects:

- The participation in lessons increased.
- Quantative and qualitative improvements in questions asked in class were noted.
- Writing, spelling and thinking skills improved.
- Productive ideas and outcomes of creative work in different areas increased.

- Social involvement improved differentially: some children offered to help other children with their school work, others initiated and organized social activities for the class, some children suggested to the headmistress that they would like to assume responsibilities for various school activities and functions. A few children did not volunteer!

Since the model was designed to provide teachers with a practical intervention programme that can be conducted in school, it is suggested that this model should be used by teachers for their gifted differently cultured underachieving pupils in parallel with the tutorial programmes described above.

Programme B: Teacher Intervention Model

Rationale

The intervention was based on Glasser's theory which suggested that in order to break the cycle of failure, the teacher should attempt to change the scholastic behavior of the child through a process involving three basic principles: (a) Acceptance of the child. (b) Recognition of the need for changing the child's school situation. (c) Assuming personal responsibility for bringing about the desired changes. The aim of this programme is to offer a structured educational plan; appropriate for fulfilling the individual needs of gifted differently cultured underachievers (Butler-Por, 1987).

Procedure

Identification processes should utilize unconventional measures appropriate for detecting the potential and specific abilities of differently cultured children. These processes should include observations in formal and nonformal class situations, evaluation of creative expressions and activities and personal meetings with each child.

Building a diagnostic profile of each underachieving child with the assistance of the school counselor, or the school psychologist. The personal file would facilitate acceptance of the child's potential and guide the teacher in helping the child to recognize his capabilities and the need for changing undesirable behavior and improving scholastic achievements.

A preliminary meeting between teacher and pupil in which need for change is recognized and joint responsibilities for effecting change are accepted. During this meeting the teacher conveys to the child that she believes that he is bright and that she thinks that he could do much better in school. She asks him whether he agreed with her, and discusses with him the reasons and problems that he believes prevent him from attaining better achievements in school. At the end of the meeting these intentions were operationalized in the form of a contract by which the pupil sets the assignments he has selected for the coming week and chosen those rewards which would serve as reinforcers. Tasks and rewards would focus on one or more of the following problematic domains which are associated with underachievement:

- Learning - e.g. preparation of homework, preparation of creative work, models, paintings, and visual aids for topics learnt at school or at home, projects, talks on subjects of special interest.
- Social - e.g. organizing a social event, making a contribution to the class with a friend, perhaps on cultural traditions, etc.
- Behavioral - e.g. reducing disruptive behavior in class or in the playground, trying to stop interfering with other children's work, reducing truancy, etc.
- Subsequent weekly meetings devoted to discussion, evaluation and reinforcement of assignments accepted in the previous week and selecting new tasks and rewards for the coming week. The rewards requested by the child from the teacher enable the teacher to

provide the child with help from other teachers or peers, to overcome difficulties and specific problems and to provide assurance that the teacher "is on his side" - most important for creating emotional security, which constitutes an essential condition for overcoming underachievement. In addition, the personal weekly meeting provides opportunities for discussing the child's tutorial sessions and providing feedback, reinforcement and encouragement.

- A final meeting at the end of the school year in which teacher and child evaluate the success of their joint efforts and agree that progress can be maintained without structured meetings. The child accepts responsibility for maintaining progress, while the teacher accepts responsibility to help, support and encourage the child within the class.

Conclusions and Educational Implications

In this paper we have discussed some of the issues, causes, problems and programmes related to underachievement among gifted differently cultured children. We have stressed the need to adopt non-conventional methods for the identification of cultural underachievement and suggested remediation programmes which have proved effective in helping children to improve their behavior and school achievements.

Furthermore, the evaluation of the processes and outcomes of the intervention programmes which were conducted, support Wilgosh's statement (Wilgosh, 1990, p. 14) that:

To attain the ultimate goal of identification of differently cultured underachieving gifted children...and development of their full potential, models and practice must reflect dynamic assessment using culturally and academically appropriate procedures, coupled with relevant appropriate strategies for remediating underachievement and maximizing potential.

Finally, our findings have great relevance for educational practice. The initiation and implementation of both the tutorial programme and teacher's intervention's model should contribute to the understanding of the specific educational and motivational needs of gifted differently cultured children. In addition, it is evident that given appropriate tools to initiate an intervention programme and ongoing support from peers, tutors and teachers, it is possible to bring about significant changes in the differently cultured gifted underachiever's school performance and behavior. Furthermore, the two-fold approach described in this chapter can be introduced fairly simply into educational school frameworks and can be implemented by gifted tutors attending gifted programmes and teachers helped by the professional personnel of the school.

To conclude, it seems most important to develop diverse programmes and evaluate the programmes with gifted underachievers in different cultures and investigate further the possible effects of the intervention on the teachers, a line of research which may be of great significance for educational practice in general and the education of gifted differently cultured underachievers in particular.

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Underfunctioning: The problems of dyslexics and their remediation

Diane Montgomery

Middlesex University, London, United Kingdom

Abstract

Diane Montgomery has been researching this area since 1979. Her case analysis, experiments and teaching studies have shown that the core difficulty which needs to be addressed is student spelling problems. When this is done by a specialist remedial programme refined over the last forty years by many world-renowned remediators, the problems of dyslexia can be overcome.

Her research has identified an articulatory awareness problem which prevents the learning of spelling during the early years of schooling in reading and writing lessons. Her training methods have been incorporated into the remediation programmes and are called "multisensory mouth training".

Older dyslexics are helped by the Alphabetic-Phonic-Syllabic-Linguistic programme and College and University students are helped by her Cognitive Process Strategies for Spelling.

Able dyslexics are found in all schools and can make up more than 5 per cent of the population. Sadly parents and teachers often regard these pupils as dull or stupid because they are slow to learn to read and spell. This is often far from the truth. Students with IQs of 150 or more can have this difficulty just as easily as children of very low IQ. All of them can be helped to overcome the problem.

Introduction

Different attitudes and terminologies exist in the areas of dyslexia and giftedness in different countries. In England the term developmental dyslexia is used to describe those individuals who have failed to learn to read and spell adequately for their age and ability. This distinguishes them from those with acquired dyslexia who have learned to read and spell more or less adequately but by reason of accident or brain injury have lost these abilities to a greater or lesser extent. However, the term developmental dyslexia is only to be seen in clinical, cognitive, experimental and neuro-psychological literature. In educational psychology, administration and teacher education it is much more likely that this problem is described as 'specific learning difficulties in reading, spelling and writing'. This distinguishes it from similar difficulties arising in children who are generally slow to learn including slower in learning to read and spell. Their difficulties are called 'general learning difficulties'. Specific learning difficulties in North American literature are described as 'learning disabilities'. In Eastern European countries this area of study is included as one of the Defectologies. The reason why 'specific learning difficulties in reading and spelling' is a preferred term in education in the United Kingdom is because it removes the location of the problem from ownership by the student. It also suggests that it is not a permanent handicap and that attention should be directed to some kind of educational remediation. In other words something can be done to help and the problem is not the child's fault. This illustrates an attitudinal change that came with the publication of the Warnock Report (1978) and develop-

ments in the field of special educational needs moving the concepts and models from the medical frame to a contextual one.

The term dyslexia created concern because it arose in the clinical field and people, particularly parents, tended to think of it as a form of medical disease or disorder. Mittler (1990) sums up the current approach as an 'ecological' model. In this form of analysis the child does not 'own' the problem, instead a range of external and internal factors which intermingle are considered to interact to create a specific learning difficulty. This can respond to appropriate educational intervention so that it is not allowed to become a handicap to the individual. The words 'disorder', 'diagnosis' and 'treatment' are therefore medical in content and not appropriate for use in the context of learning difficulties, instead 'assessment' of individual needs and differences lead to the development of 'intervention' programmes and 'learning strategies.'

The word 'dyslexia' itself means 'dys' - bad, or difficulty with; 'lexis' - word, particularly the written word. It is not the rubella of reading, as some parents seem to think. In the majority of cases no known pathology or neurological difficulty can be uncovered, EEGs are normal and BEAM analysis merely records the changes which occur as processing transfers during remediation from right to left and right hemisphere processing typifying the developmental changes in the reading and spelling progress.

Hereafter the reading and spelling problems experienced by the able pupils will be referred to as 'dyslexia' for brevity but must be taken to mean the specific learning difficulties in reading and spelling which these students suffer. The term 'dysorthographia' will be used to refer to those with spelling difficulties alone.

'Dyslexia' is just one of many of the specific language difficulties that have been particularly researched because of their profound effect upon learning in school. A range of 'left' hemisphere organised learning difficulties is listed below bearing in mind that there are a much smaller percentage, about 5%, who are left handed and right hemisphere dominated in language functions (Annett & Kilshaw, 1983; Deutsch & Springer, 1986).

Developmental dyslexia

Pupils with dyslexia have both reading *and* spelling problems. However, it has been rare for their difficulties in spelling to have been as thoroughly investigated as their problems with reading. The spelling problems are most often much more severe and in need of more attention than the reading difficulties. The incidence of the severest forms of the difficulty is thought to be an average 4% of the British School Population (Rutter, Tizard *et al.*, 1970). Pupils are reckoned to have 'dyslexia' if their reading (and spelling) is unaccountably low in relation to their intellectual abilities. It is therefore feasible for dyslexia to be found throughout the ability range. In practice dyslexia is generally only associated with students of higher academic ability because researchers set minimum thresholds of 90 or 100 IQ for their research populations to avoid the influence of other secondary variables in understanding and remembering instructions for example. The IQ threshold of 100 is also often set by remediators for entry of dyslexics into specialist fast-tracking programmes for obvious reasons. Slower learners are found to gain more benefit from developmental programmes (Montgomery, 1990) introduced across the curriculum than short term remedial programmes for 2 to 3 hours per week.

Developmental dysorthographia

Pupils with severe spelling problems and without signs of severely delayed reading are included in this term. Some such pupils originally had a reading difficulty which has cleared up, others may have learned to read very early and very easily but have somehow never mastered spelling and writing to the same standard. Some never really master spelling at all without very specific

help. It is easier for these pupils to bump along in the bottom streams or groups in schools and conceal their difficulties to a large extent for the same demands are never made upon their spelling as their reading (Peters & Smith, 1986). Spelling is basically a total recall activity and is therefore much more difficult to achieve with total accuracy than reading which is a recognition skill. Hence recovered dyslexics show signs of their problems whenever they are confronted with a new subject or new terminology as in the early stages of degree programmes.

Developmental dysgraphia

There are a considerable number of pupils, at least 10 per cent of the population (Gubbay, 1976; Laszlo, 1989), who have difficulties in the free coordination required in handwriting. Their difficulties may bear no relationship to reading and spelling difficulties but the current methods of primary teaching in Britain using print script and copy writing severely disadvantages children with these problems. As they find writing so difficult and time-consuming it leaves little available cognitive processing for spelling and writing and they write very little, usually in a stereotypic form. Lack of practice in spelling and writing to which their difficulty leads can be shown to have a direct impact on spelling development and so most pupils end up with both handwriting and spelling difficulties. In order to overcome these it is essential that a cursive handwriting training programme is introduced from the first days in school.

Complex Specific Learning Difficulties

The difficulties already described may be found not only singly but in combination. My researches and those of Peters (1970) show, for example, that at least 30 per cent of all dyslexics have some form of handwriting difficulties. In addition similar proportions may be found with subtle to severe language difficulties. Pupils with the severest forms of such communication disorders are said to have *developmental dysphasia* and this is in itself a whole branch of specialist enquiry. *Developmental dyscalculia*, a problem in the understanding and manipulation of numbers has a more equivocal research base. The largest majority of the problems in this area can be associated with the same *fundamental and underlying deficit or difficulty* as seen in dyslexia. This is a *verbal processing difficulty* (Miles, 1992). In reading and spelling it manifests itself as a 'phonological disability' underlying the establishment of verbal codes (Frith, 1985; Miles & Miles, 1990; Vellutino, 1979). What is therefore crucial in research is to uncover the causes of such a phonological disability if this is possible and to trace the effects of it upon the learner so as to be able to plan remedial intervention strategies which might obviate it or at least overcome some of its more severe manifestations. This way all stricken children might learn to be more successful in school and the highly able might overcome what for them is a totally disastrous and career-destroying problem which consigns their intelligence and high ability to more devious manifestations such as disruption, disaffection from school and mental distress.

The broad outlines of my research in the area of dyslexia follow. The focus of this research has been upon spelling difficulties of 288 dyslexics compared with 94 control subjects and with a large range of case analyses of individual spellers from kindergarten to higher education.

Early abilities in reading and spelling

If we examine the early work of children encouraged to write 'from inside their own heads' using any spelling skills they can muster, we can see a marked difference between their work and older dyslexics. For example:

The work of Kelly and Faye who are in their first month in school and are both five years old, shows students who have 'cracked the alphabetic code' and are using it creatively in their

spelling. Emma is 6 years old and illustrates the kind of progress they can be expected to make. If they had been taught cursive writing their progress would be even more marked. Cursive writing is only now being reintroduced into kindergarten and year 1 in schools in Britain. It was phased out for a print script in the years after the 1914-1918 war on the basis that it was simpler and easier for infants to learn. It failed to take account of the needs of learning and motor programming concentrating as it did upon the visual appearance of the print.

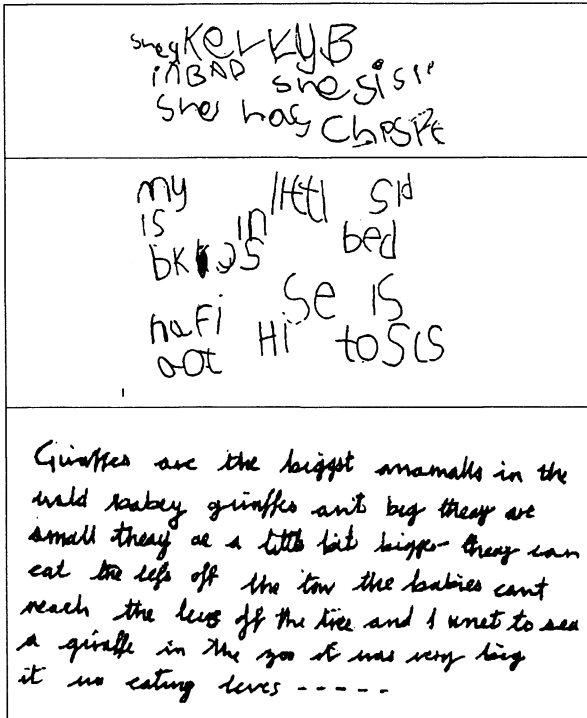


Figure 1: Beginning spellers creative spelling. Upper part: Kelly (5 years, 1 month: "Kelly is in bed. She is sick. She has chicken pox."); middle part: Faye (5 years, 1 month: "My little sister is in bed because she is having her tonsils out."); lower part: Emma (6 years: "Giraffes are the biggest animals in the world ...")

The writing of dyslexics shows very different patterns from these. James is 7 1/2 years old and well above average in ability but he has only just begun to crack the alphabetic code and he has been 'over phonicked' rather than taught appropriate syllable rules and structures as he learns. He can only just 'spell' two words, 'mummy' and 'James'.

David is 8 and has an IQ well over 140 on WISC-R and can use good visual memory to help him spell but mainly refuses to write anything at all. He has little symbol to sound correspondence.

Caroline is 7 1/2 years old and has learned little about spelling and reading. She has an idea about words being divided by spaces and knows they are made up of letters. She illustrates the extent of her knowledge by using some of the letters of her name to spell her story and preserves a syllable structure with vowel type structures in the medial positions.

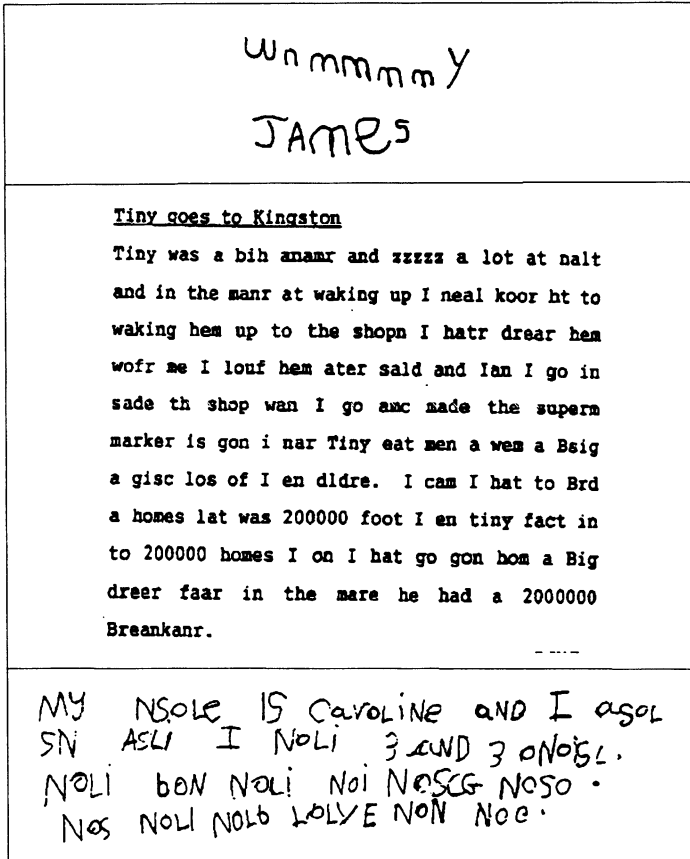


Figure 2: The beginning spelling of dyslexic subjects. Upper part: James (7 years); middle part: David (8 years); lower part: Caroline (7 years)

Her ability in conversation and practical tasks shows she is well above average and at least at the high average ability level. She has been receiving weekly in-class support for her learning but after six months has made little progress. This is typical of the findings for several remediation strategies used by non-specialists. The experiences of these children raise questions about why they have failed to learn what other less able children find easy.

Patterns of difficulty

A wide scale analysis of dyslexic difficulties by Liberman *et al.* (1975), Golinkoff (1978), Frith (1980), and Marcel (1980) has identified a set of core of difficulties in pre-school and the early years of school. These early predictors of dyslexia were:

- inability to appreciate rhyme
- poor knowledge of alphabet names
- poor symbol-to-sound correspondence
- poor phonological abilities, e. g.
 - poor ability to blend sounds
 - poor analysis of words for reading
 - poor synthesis of words for spelling
 - inability to segment phonemes.

For example, pupils may know that c often has to sound (k), they may well be unable to say the word 'cat' and remove the (k) and say (k)-(at) in reading or recombine them for spelling. These are called phoneme segmentation and phoneme reassembly tasks. Research shows (Montgomery, 1990) that these are fundamental sub-skills of spelling which 'dyslexics' can only perform if they have learned to spell that particular word. Normal subjects can use other strategies to give them the ability to segment and reassemble sounds for spelling. This suggests that particular avenues for learning may be unavailable to 'dyslexics'.

Research suggests that there are two routes which adult readers may use in reading and spelling (Baron & Strawson, 1978). There is no reason to suggest that they are not also open to beginning readers and spellers and so we can view the Logographic Route as open to 'Look and Say' methods of teaching and the Phonological Route as representing Phonics based methods.

However, although there are only two input routes identified by these researchers it is possible to propose that human intellect is such that it can input from its own resources and thus creates a third route to reading which is cognitive in origin. It can link the logographic and phonological and create data from these combined as well as from cognitive processes. Flavell (1978) and others might refer to these as metacognitive events when they are made to become explicit. The present trend to use mixed methods and treat reading and spelling learning as a 'psycholinguistic guessing game' (Smith, 1973) enables both routes to be used rather than one or the other and because of cognitive interplay the whole becomes more than the sum of its parts.

Table 1: To show mean quotients for intelligence, reading and spelling

numbers	WISC-R VQ	WISC-R PQ	full Q	reading Q (D&D)	spelling Q (D&D)	chron age	male/ female
high able dyslexic 30	125.3	124.9	126.8	82.8	82.9	10.2	5:1
dyslexic 288	110.2	108.7	109.6	77.5	73.4	10.1	5:1
NORMAL 94	108.7	108.6	107.9			8.0	1:1

D&D stands for Daniels & Diack Reading test 12 and D&D Spelling test.

How can dyslexic difficulties be analysed and understood?

An inspection of the typical spellings of five year olds and older dyslexics clearly shows the inability of the dyslexics to crack the alphabetic code. Even when some alphabetic knowledge is available the dyslexics seem incapable of using it to build into their writing and reading. Ordinary 5 year olds seem perfectly capable of acquiring this knowledge without being directly taught (as in Look and Say methods of teaching). However, phonic methods alone do not prevent dyslexic difficulties occurring (Chall, 1967). In addition no amount of remedial phonics sessions seem to improve the dyslexic condition (Gittelman *et al.*, 1983).

As Table 1 shows, high ability does not protect individuals from dyslexia. The highly able group was selected on the basis of having one WISC-R score at 130 or above either in verbal or performance areas. This group can also be said to be underfunctioning on the intelligence test too. They will show more variability among sub-scores particularly in areas which depend upon verbal abilities or require verbal mediation during processing even of pictorial items. Some will show particular deficiencies in arithmetic because of the need for verbal mediation during number processing. Thomson (1984) amongst others has pointed to these difficulties in assessment of dyslexics.

The reading and spelling scores of the dyslexics who as a group were the same chronological age as the rest of the dyslexic groups showed that there was an intelligence factor at play in reading and spelling development. The highly able dyslexics were quite clearly using their superior intellectual skills to good effect and show significantly better scores to the extent of 5 points in reading and approximately 10 points in spelling. Their reading and spelling scores were comparable whilst those of other dyslexics showed significantly greater retardation in spelling.

In addition to these differences between high able and other dyslexics there was another within the age band. There was much greater variability in the ages of referral in the high able group. All the six and seven year olds referred were in the high able group as were all the fifteen year olds returning to remediation centre for top-up of spelling help. When these individual's scores were removed from the group, the age of referral of high able dyslexics was later than the rest of the dyslexic group. This is to be expected because, perhaps, their higher scores were tending to mask their difficulties. In education authority areas which do not include assessment of intelligence in the profile, these pupils might be missed and be thought to be functioning at a slower than average level but not seriously so. Highly able pupils may be so successful at coping in ordinary classrooms with dyslexic difficulties that they may be thought to be just about average in ability and achievement. Once again pupils with the potential for high achievement can be overlooked. The total group of children from whom these dyslexics were drawn was 20,000. These results indicate that approximately 1.5 per cent of pupils are found with dyslexic difficulties. One in ten dyslexic pupils were in the high able category. This might suggest that there were more high able in the 'dyslexic' group but this was in fact a function of pre-selection processes in which pupils with WISC-R scores below 100 who may also be 'dyslexic' were not referred for specialist teaching, it is undertaken in their own schools. The dyslexics identified entered the TRTS programme (Cowdery, Montgomery *et al.*, 1983) at the Reading Centre and received specialist remedial tutorials 2 to 3 times per week for an hour per session. It was felt by the Centre teachers that slower learners did not profit from the rapid top-up remediation technique they used. However they found that highly able very young pupils could very quickly learn what they needed from the programme and so attempts were made to bring them in at 6 years. The earlier they could be identified the more success with the programme was found for there was so much less for them to unlearn and there were several years of infant education left for them to practise the skills they had learnt. They quickly reached grade level in six months and maintained that progress.

What can possibly cause 'dyslexic' pupils early difficulties?

The key problem identified by researchers (Vellutino, 1979) in the field is the inability to assign appropriate graphemes to separate phonemes and to learn the alphabet names. Stripping beginning phonemes from syllables also poses a problem to dyslexics just as it does to illiterate peoples (Marcel, 1980).

In the English language there are just 44 different phonemes or sounds which make up words and 26 alphabet letters. For example, c - a - t is made of three phonemes: consonants 'c' (k) and 't' and short vowel sound 'á'. The word 'phone' consists of three phonemes (ph is a consonant digraph or two graphemes making one sound f, 'o' is a long vowel sound or a vowel which 'says its name', 'n' is a nasal consonant and 'e' is silent. With so few sounds and letters to learn it seems absurd that clever children cannot grasp them instantly but the fact remains they cannot. Even in languages such as Turkish and Italian where the relationships between sounds and their symbols are quite regular there are still some dyslexics. English is more removed from a simple phonetic structure and so even when mastery of the system eventually comes, for most 'dyslexics' do learn to read and spell a little, there are many more hurdles to overcome and the dyslexics are more widely spread in attainment and more obviously incapacitated than in phonetic languages.

Researches with cohorts of dyslexics in the group of 288 compared with the normal or regular school subjects matched for reading and spelling ages rather than chronological ages have revealed a number of interesting insights into 'dyslexic' difficulties.

The studies included research into the alphabet and two significant features were found. The alphabet *appears only to have been invented once* whereas other forms of writing were invented in many different cultures (Diringer, 1962). It was thought to be invented by the Phoenicians in the context of their rather special *consonantal language*. They invented 22 different and to us arbitrary symbols, for the 22 consonants. The Greeks borrowed their system, added vowels and so the basis of our system was established and passed on to the Romans and the rest of the world.

In this we learn the clues to the resolution of a problem. For example, could a dyslexic have invented the alphabet system so unique and neat? Why was the system thought only to have been invented once? What might be the significance of a consonantal language on the alphabet's invention? What is the significance of consonants as opposed to the vowels?

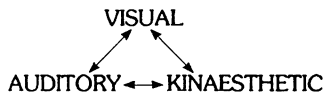


Figure 3: The multisensory triangle

Responses to these questions have led to a better understanding of dyslexic difficulties and how to overcome them. For example consonants are sounds which appear to have a distinct feel in the mouth in which articulators make contacts in different key patterns. It would seem inevitable if this is so that the alphabet could easily be invented in a consonantal language. Vowels are not so easily felt depending for their identification more upon openness of mouth

and shape together with place and position in the open mouth from which the sound is made. If we hypothesise that the dyslexic's problem is that he or she is not *aware* of the feel of the articulators when making a particular sound then it would be much more difficult to remember the sound of a particular phoneme and its grapheme connection. An alternative interpretation might be that dyslexics are unable to use articulatory information to put into the multisensory triangle.

This would deny beginning spellers and readers the one set of concrete clues for making consistent decisions about the connections between the sounds they hear and make and the symbols they read and write. Ehri (1978) for example has suggested that the phoneme is an abstract perceptual unit. At five years or beginning school what the child needs most is some concrete experience to support and structure learning. The articulatory feel pattern of phonemes and syllables can provide this concrete and systematic link to phonemic and visual abstract and arbitrary symbols which are outside stimuli. This would enable a child taught by phonics or Look and Say methods to pick up skeletal phonics during early learning and use it in "creative" spelling as Francis (1982) and Read (1986) describe. The beginning speller may be seen mouthing and feeling the articulators during early spelling. The dyslexic remains puzzled by it all and if he or she learns to write it is mainly copied work or a few simple spellings learned "by eye". If the child has a very good visual memory then for a while the difficulties may be masked. When the articulatory awareness difficulty is accompanied by any other difficulty such as a handwriting problem, poor visualising ability, poor memory, indistinct speech, poor language ability, the child becomes at risk from the dyslexia for compensatory routes are not so freely available. There might only be a few months delay in establishing awareness of articulatory patterns but the pupil can quickly become confused and muddle graphemes and phonemes and then becomes anxious which can inhibit further learning. A potential dyslexic with good visualising and good memory abilities can perhaps easily remember the form of useful words in the early reading and writing books. However clues will be that letters in the middle of words may be in the wrong order showing a visual rather than auditory and kinaesthetic base has been used to guide the construction of words. A facility for rapid sight reading may be observed with a much more limited output in the written mode. This will be disappointing to the teacher and the tendency may then be to think this pupil is withholding good work and not trying or is lazy rather than having a specific learning difficulty which needs special help. The condition is disabling for the pupil, and extremely frustrating. At the extreme of this continuum of disability or difficulty there may be a small minority in whom there are distinct neurological difficulties in the area of the angular gyrus (Geschwind, 1979) where the three types of information appear to be integrated. At the opposite extreme we find a few cases such as Peter who was given four twenty minute sessions of 'multisensory mouth training' to 'feel' and use articulations in reading and spelling and who suddenly improved his reading and spelling skills by two years on the Daniels and Diack tests. The school was astounded and Peter never looked back. Between such extremes are the large group of dyslexics for whom there is no such magic formula but who can be helped in a structured 6 month to 2 year programme. Research by Clemmens and Schiffman (1972) showed that if remediation was introduced before the age of 8 years it was likely that in over 80 per cent of the cases the skills could be brought back up to grade level by the end of the programme. In our Learning Difficulties Research Project set up in 1981 and in which teachers and researchers have followed pupils through their remedial programmes, these results have been confirmed. In addition to this the brightest 'dyslexic' children, if identified at 5 and 6 years old, can be given sufficient training such that in a term to 6 months they are functioning as well as peers and often better and do not need to return to the programme. The younger all the children are the better the results for they have less to unlearn and their motivation has less time to have been spoiled. However, administration is such that the problems are not allowed to be analysed and referred until at least 7 years. Referral

procedures may then take a further 18 months. The pupils remain on the waiting list for another year so that finally at 10 1/2 they obtain some help to bail them out before they enter secondary school where they may be submerged and fall quickly behind in all subjects in an unsupported environment. Table 2 shows the improvement in reading and spelling of dyslexics on an APSL programme after an average of 60 one-hour lessons.

Table 2: Reading and Spelling test results on Entry to and Exit from the Reading Centre using the TRTS Programme

1989 N=38	CA	RA	SA
ENTRY	10.10	7.50	7.33
EXIT	10.78	10.72	10.00
Difference terms	1.4	2.44	1.77

Evaluation of most of the programmes in use have shown that they are ineffective (Transley & Pankhurst, 1981). During the 1980s however an effective style of programme the Alphabetic-Phonetic-Syllabic-Linguistic A P S L (Gillingham & Stillman, 1956) was introduced from the USA Scottish Rites Hospital by Hickey (1973-1977). Hornsby and Shear (1976) also found the programme effective and developed their version of it. My colleagues, the remedial teachers in the project were trained by Hickey in 1973 and developed their version of the basic scheme and together we wrote it down as the Teaching Reading through Spelling (TRTS) programme and published it in seven stages of 1983-1987. The programme is highly structured, sequential and logical. First alphabet sequencing training is undertaken whilst simple sound and symbol correspondences are taught visually, auditorily and now kinaesthetically and in addition the grapheme is written in cursive form. These multisensory connections are trained together one sound at a time until recognition and recall are automatic and then the next sound is learned and the two are used in combination The initial order follows Hickey and results from the frequencies of use in words.

i t p n s

Figure 4: Writing exercises following Hickey's recommendations

Simple, regular words and sequences can be built up phonetically. As this happens the concept of syllables as beats in words is introduced and that all syllables must have a vowel. First short vowel sounds are learnt and used. Later long vowel sounds and the affixing rules add, double drop, change, are taught at appropriate points in the 7 levels of the programme.

The TRTS and similar programmes operate best in tutorial withdrawal settings in which intensive training can be given by a teacher to not more than two pupils. Class teachers of infants do need to learn the principles of it to use with pupils who show early difficulties. Parts

of the phonic and linguistic structures can be incorporated into mainstream language learning as individually appropriate but for teachers whose own knowledge of linguistic structure is hazy, a different but related system of *Cognitive Process Strategies* has been developed. These strategies were first developed and evaluated with dyslexic students in higher education (Montgomery, 1990) and then with their help and the help of teachers on inservice courses, were evaluated with pupils throughout the age ranges in schools. It was found that teaching the strategies to correct misspellings as the teacher moved round the class looking at individual children's work, as well as incorporating phonic, syllabic and linguistic material as appropriate to small groups and in classwork enabled the dyslexic and non 'dyslexic' children to reduce their spelling errors by 50 per cent over the five weeks of the trials. Comparison with age mates in parallel classes showed that the controls had made no such improvement. Children with reading and spelling difficulties in normal or regular classrooms also improved but at a slower rate. Results on standardised tests of spelling also showed improvements. The students and pupils enjoyed the strategies and all reported happily moving from a state of learned helplessness actively to improving their own spelling.

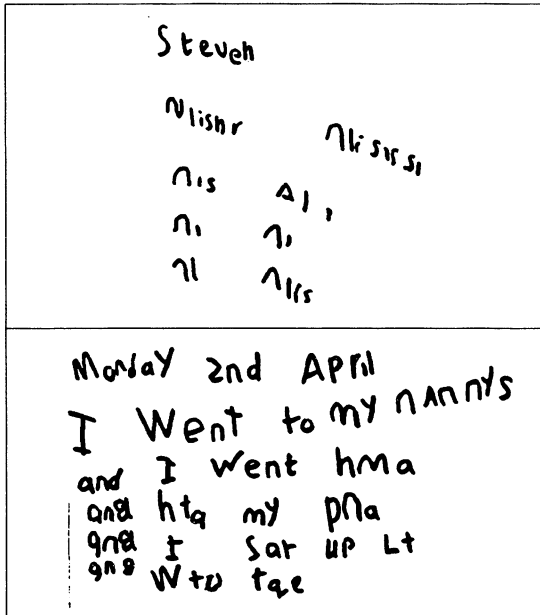


Figure 5: Stephen's (6 1/2 years) skills before (upper part) and progress after six lessons on TRTS (lower part)

The tuition always began by showing the pupils how good their spelling really was when they would get most letters in a word correct. They learnt to put a circle round the error letter or omission and then apply two of the cognitive strategies to correct the misspelling. Each then

checked their own accuracy by using Stillman's (1932) Simultaneous Oral Spelling technique. The pupils' writing became more extensive and higher in quality as they dared to try new and unusual vocabulary. Spelling became an exciting problem-solving activity with great willingness between the pupils to share their 'secret' strategies.

Summary

Seven key principles in helping pupils with 'dyslexia' have been outlined. These are

- identification of problems at the reception stage or in first grade and as soon as possible;
- to implement a remediation strategy;
- to use an APSL remediation programme with those who are two and three times failures in the regular classroom;
- to support this programme with 'multisensory training';
- to use a developmental cursive writing system with beginning readers and spellers and those older pupils in remedial programmes;
- to use cognitive process sets of strategies for spelling to support reading in early and later developmental stages;
- to link the support systems for dyslexic pupils and students and adopt a *problem-solving and positive approach to learning*.

In these ways it has been found possible to remove the reading and spelling barriers to learning of dyslexic students and so enable them not to underfunction and underachieve in the academic subjects. Gifted students have thus been able to reveal their full potential and in written examinations have produced spelling error free first class degree papers.

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The problems of highly able children with an unbalanced intelligence structure

Maria Herskovits

Institute for Psychology, Hungarian Academy of Sciences, Budapest, Hungary

Abstract

In our 6-year longitudinal study aiming at the early identification of high ability, a total of 118 children were tested using the Wechsler Adult Intelligence Scale at the age of 12. There were 95 children with IQ over 110. Unlike the 35% incidence proposed by Kaufman (1979), we found significant, i. e. more than 12 scores difference between VQ and PQ, in remarkably more children (58%), and this value was over 24 (max. 48 scores) in further 25% of the cases. The direction of discrepancies considerably shifts from the balanced values found by Kaufman in favor of the performance side, and also the rate of sexes is shifted in favor of the girls. A part of these children were underachievers, but the majority of them were excellent pupils.

Our present study focused on children - 55 persons - whose IQ was at least 110, with a difference of 12 points or more between the VQ and the PQ, with either value being higher than 120 (V+, P+), with particular focus on those with a difference of 24 points or more (PP+). The Control Group (C) included children with IQ over 110, but with less than 9 scores difference between VQ and PQ (33 children). More detailed breakdown was calculated according to sex. Some of the more than 90 indices of our longitudinal follow-up study are discussed in this paper.

It proved to be very useful to distinguish the PP+ group which showed extreme differences. The reason for the extreme differences was the relatively very low VQ while the PQ value was hardly higher than the score in the P+ group. The most favorable picture, considering creativity, leisure time activity, or even the opinion of teachers and the mathematics schoolmarks, was seen in the P+ group where VQ in the good average or even in higher zones was associated with very high PQ. While differences of groups with high but not extreme discrepancies from both each other and the control group appeared only occasionally and had little effect on achievement, the PP+ group - and within this particularly the boys - showed less success in both school and other achievement, and their personality was less balanced.

Suggesting that highly unbalanced intelligence structure in highly able children, without resulting in unavoidable difficulties in school achievement or adaptability, is even more frequent than is proposed in literature, our results require further targeted studies regarding cognitive styles, task solving strategies and professional orientation.

Problem

In our follow-up study (N=1,033) we had 95 twelve years old children who scored 110 or more at the WECHSLER Adult Intelligence Scale. 55 of them - 58% - showed a discrepancy of 12 or more points between VQ and PQ - regardless the direction.

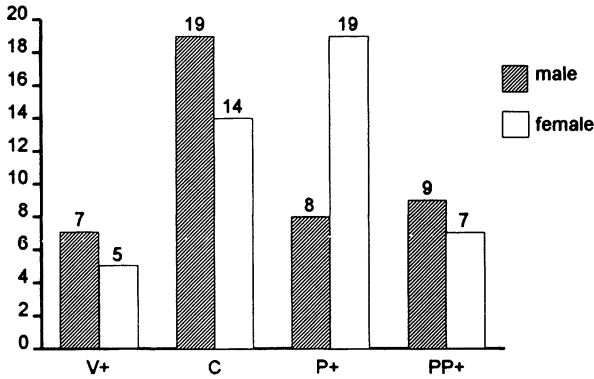


Figure 2: Distribution of subjects according to sex

Our results suggested that the extreme group PP+ was the problematic one, and within this particularly the boys.

Questions and Methods

Our present study is a by-product of a large-volume longitudinal study on the early identification of high intellectual ability. A total of 118 "suspects to be gifted" were selected from 1,033 children followed from the age of 9, and were tested among others using the Wechsler Adult Intelligence Scale at the age of 12. (The children are now 14 years old, their follow-up is in progress.) On the base of preliminary literature (Kaufman, 1979) and our own experience, we expected that in the normal population the significant VQ-PQ difference relatively often reaches high values (35% rate). Kaufman calls attention to controversies and insufficiencies of studies and interpretations regarding the meaning of this difference. We found no references to studies on the degree and importance of differences in the high IQ zone. Kaufman's data suggest that the frequency of differences within the IQ increases with ever higher educational level of the parents, and this indirectly means that considerable differences are more frequent in the high IQ zone.

Nevertheless it was surprising that the data of the Wechsler IQs showed that

- differences exceeding 12 points were seen between VQ and PQ in more than half of the sample (58%);
- the frequency of extremely high differences (24-48) was the manifold of that reported by Kaufman;
- the direction of differences was markedly shifted towards performance (12:43);
- the rate of girls was higher than that of the boys in the P+ group.

Since we have a large amount of both individual and group data on the children, taken at ages of 9, 12 and 14 (not to be reported here due to the limited space available), we put the question whether we can find a meaningful explanation for these differences, or we can identify certain factors in the school career of the children which can be related to these differences; i. e. how these groups can be characterized. Besides the partial data of the Wechsler test, the following data is interpreted here:

- at age 9: Raven Progressive Matrices
Intellectual Achievement Responsibility Scale
Teachers' Rating Scale
Creative Leisure Time Scale (Torrance)
- at age 12: Raven Progressive Matrices
School Marks
Intellectual Achievement Responsibility Scale
Level of Aspiration
- at age 14: Advanced Raven
Tel-Aviv Inventory of Creative Performance (Milgram)
California Psychological Inventory (shortened form, 300 items)

The data were processed by the BMDP program pack, using t-tests and ANOVAs (two-way analysis of variance).

Explanation of the Wechsler data

The most important result here (Table 1, Figures 3a and 3b) was that P+ and PP+ groups were distinguished by the VQ, but not by the PQ. While ranging in the average zone VQ in the PP+ group (mean=104, s.d.=7.5), the VQ means fell into the higher-than-average zone (just like PQ in the V+ group) in the P+ group. That is, with one side in the extreme high zone and the other in the weak average one, the latter is assumed to determine school performance, and the resulting discrepancy experienced by the child may affect his or her self-esteem and may lead to a labile personality.

Table 1: Distribution of the Wechsler IQs and Subscales
(the data of boys and girls are not presented separately)

	V+	C	P+	PP+
IQ	125	127	129	122
VQ	135	125	116	104
PQ	112	125	135	136
SUBSCALES				
Information	11	11	10	10
Comprehension	12	11	10	9
Digit Span	15	15	13	11
Arithmetic	13	12	11	9
Similarities	13	12	11	10
Coding	12	13	14	14
Picture				
Arrangement	11	12	13	13
Picture				
Completion	10	13	14	14
Block Design	12	13	14	14
Object Assembly	7	11	12	13

As to the subscales, the most surprising result was that the *Information* subscale was the only one where no difference was seen between the groups. Further surprising results were that in the V+ and C groups the highest value was the *Digit Span* subscale, while in the PP+ group

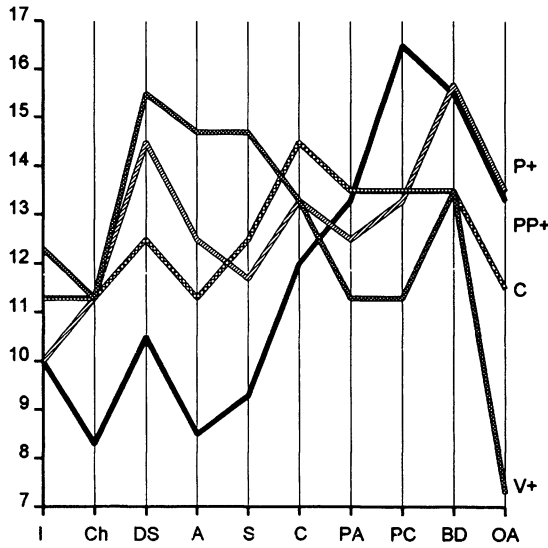


Figure 3a: Distribution of the Wechsler subscales - males (Legend see Figure 3b)

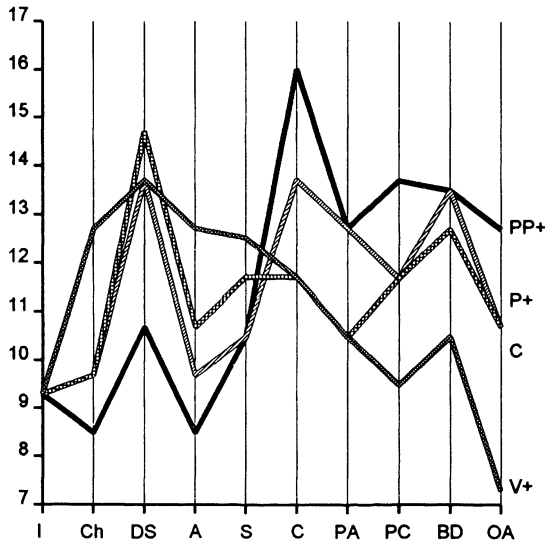


Figure 3b: Distribution of the Wechsler subscales - females (Legend: I = Information; Ch = Comprehension; DS = Digit Span; A = Arithmetics; S = Similarities; C = Coding; PA = Picture Arrangement; PC = Picture Completion; BD = Block design; OA = Object Assembly)

the deepest points were the *Arithmetic* and the *Reasoning* subscales which may indicate both learning and orientation problems. In the Performance side the *Coding* subscale (whose non-consistence with the other subscales was pointed out by Kaufman as well) showed interaction. A striking result was the very low value of the V+ group in the *Comprehension* subscale which indicates that the *Hand Assembly* which lacks conceptual support was an unsolvable task for many children.

The Raven test - which is usually regarded as an index of fluid intelligence, and therefore our hypothesis was that it would correlate with the performance side -, however, did not show results which were easily interpretable (Table 2). It was noteworthy that in boys, its value decreased instead of the expected elevation within three years in the P+ and PP+ groups, and increased considerably in the V+ group. We do not have an explanation for this phenomenon, since the Advanced Raven taken at 14 years of age showed no differences at all between the extreme groups.

Table 2: Means of dependent variables

	V+		C		P+		PP+	
	male	female	m	f	m	f	m	f
Raven at age 9	48	47	47	48	46	47	47	47
Raven at age 12	53	48	49	50	45	49	45	50
Advanced Raven at age 14	25	25	27	23	24	25	25	25
Teacher Rating	83	63	75	75	85	78	73	81
Leisure time at age 9	56	47	64	62	65	68	61	61
Leisure time at age 14	19	15	21	12	22	22	24	20

Legend: m=male, f=female

Teacher Ratings and Creative Leisure Time Activity Scales showed less favorable evaluation and a less colorful - perhaps more learning-centered - world in V+ group girls, and more comprehensible leisure time activities and higher appreciation by teachers in the P dominance groups, but mostly in the P+, i. e. in the non-extreme children.

Table 3: School marks at age 12

	V+		C		P+		PP+	
	m	f	m	f	m	f	m	f
Behaviour	4.5	5.0	4.1	4.9	4.0	4.7	3.9	4.6
Diligence	4.8	4.5	4.3	4.9	4.4	4.7	3.9	4.6
Hungarian grammatics	4.5	4.5	4.1	4.8	4.0	4.8	3.2	4.4
Hungarian literature	4.7	4.5	4.5	4.8	4.4	4.8	3.7	4.4
Russian	4.7	5.0	4.2	4.9	4.4	4.9	3.1	4.6
Science	4.8	4.5	3.9	4.5	4.3	4.6	3.8	4.3
History	4.7	4.0	4.1	4.8	4.4	4.7	4.1	4.4
Math	4.5	4.5	4.6	4.5	4.7	4.8	3.6	3.8

Note: Data evaluation for the 14-year-old group is in progress.

Success at School

The distribution of data was mostly in accordance with our expectations, i. e., the children performed well at school (Table 3).

In the boys, the V+ group was the only one where schoolmarks for behavior and diligence were equal to those of the girls, otherwise, as usual, the girls had better marks in each subject except mathematics. School achievement was best in the V+ group, *except* mathematics where the best results were obtained by the P+ group. It is all the more striking that the mathematics marks of the PP+ group were so low. Kaufman’s factor analysis suggests that the *Arithmetic* subscale does not belong to either of the verbal or the performance groups, still we have to think that poor mathematics schoolmarks are closely related to the low performance of these children in the *Arithmetics* subscale. School achievement of girls - *except* mathematics - is not considerably worse, whereas the boys in the PP+ group are generally underachievers, and their marks for behavior and diligence are also remarkable lower, and this indicates that a disbalanced structure of abilities - as a rule, or as a consequence? - is associated with behavioral problems as well.

Table 4: Means of Intellectual Achievement Responsibility Scale (Crandall-Katkowsky) and indices of the Level of Aspiration Test (Robaye-Herskovits)

	V+		C		P+		PP+	
	m	f	m	f	m	f	m	f
IARS								
Locus of success at age 9	15	14	13	14	14	15	13	12
Locus of failure at age 9	14	13	11	14	11	13	10	13
Locus of success at age 12	14	12	12	13	14	13	12	13
Locus of failure at age 12	11	8	8	10	9	9	8	8
LEVEL OF ASPIRATION								
first performance	20	9	18	16	20	21	22	12
goal discrepancy	1.6	-4.8	1.9	2.8	2.5	2.6	5	2.1
achievement increase	1.6	1.8	3.1	2.5	1.9	1.4	0.9	0.3

Personality Characteristics

Both methods (as depicted in Table 4) equally focus on the children’s relation to their own achievement. IARS refers to the intellectual achievement, and asks for the children’s attitude experience in imaginary situations of success and failure. The Level of Aspiration Test is a model-reaction task, the children put together nuts and bolts, and have to guess their next performance, they act in real success and failure situations.

The IARS suggests that in the PP+ groups the internal control is lower, especially in failure situations; though it is noteworthy, and does not throw good light on the schools, that responsibility taking for success and failure showed remarkable decrease in the whole population within three years.

The analysis of the level of aspiration offers a more differentiated picture. First Performance shows self-esteem, ambitions and often the sense of reality. Here we can see that girls in the extreme group are more cautious, while the boys are braver in each case. In the Goal

Discrepancy, which is the classic index of the level aspiration, striking results were the extremely low (-4.8) value of the girls in the V+ group, the constantly high value of the P+ group, and high values, approaching rigidity, irreality, in the boys in the PP+ group. These results are of particular importance if we consider that the Increase of Achievement (which is an index of effectivity and ability to perform) is very low in the PP+ group, while the best increase of achievement was seen in the "cautiously ambitious" Control group which scored somewhere in the middle of the previous two indices.

Characterizing the groups,

- V+: the self-confidence of the girls is very low, they are afraid of failure;
- C: there is no discrepancy between the sexes, both the girls and the boys are high achievers, ambitious;
- P+: no discrepancy between the sexes, high ambition;
- PP+: non-effective; their self-esteem sometimes slides to irreality.

Table 5: California Psychological Inventory (CPI)
(Means of subscales and factors)

	V+		C		P+		PP+		Overall Mean
	m	f	m	f	m	f	m	f	
Do	49	49	31	51	36	49	34	52	44
Cs	51	57	42	56	46	50	30	56	48
Sy	48	61	40	61	51	53	37	56	50
Sp	51	56	43	57	43	52	38	52	49
Sq	51	50	31	51	35	56	40	47	46
Wb	34	49	46	50	49	42	42	41	44
An	54	49	55	42	48	51	59	47	50
Re	32	43	44	47	48	42	43	50	44
So	43	65	56	65	57	54	47	59	56
Sc	30	52	42	52	49	39	47	52	45
To	26	48	39	47	39	37	29	44	39
Es	33	46	36	52	45	44	31	49	42
Gi	18	47	35	41	50	37	39	53	39
Cm	51	48	50	53	55	55	43	45	51
Ac	41	47	43	48	53	44	50	46	46
Ai	41	52	46	51	44	47	40	48	47
Ie	44	55	41	52	46	53	32	54	48
Py	56	56	51	54	49	54	49	58	53
Em	50	54	45	59	49	50	39	53	50
Fx	59	60	50	61	49	54	52	53	54
Fe	41	54	54	44	37	48	50	43	48
FACTORS									
Stabil	28	48	41	49	52	40	40	50	43
Social	53	53	37	56	42	54	35	53	48
Superego	45	53	54	51	47	52	49	48	51
Independ	47	55	51	55	46	48	44	49	50

The interpretation of the CPI data (Table 5) is hindered by the fact that the difference between the sexes is significant in each group. Since it is normal at this age that boys and girls are on different levels of development, it is not surprising that the girls offer a fairly more balanced picture, and have very high values in the Sociability (Sy) and Degree of Socialization (So) scales.

An important result is that the boys' Dominance (Do) value reaches that of the girls only in the group of high verbality, whereas extremely low values are seen in the factor of Emotional Stability (I), and in the ability to elicit Good Impression (Gi). A further striking result was that the PP+ boys showed unfavourably low values in the Sociability factor (II) and also in scales indicating their attitude to achievement (Ai, Ie).

Social Background

It is often mentioned in the Wechsler literature that performance dominance - or verbal score significantly lower than the performance value - is a consequence of handicapped sociocultural background. Since our sample as a whole was characterized by the overrepresentation of highly educated parents (Table 6), this claim was only partially verified by our data. All but one children with fathers of low educational level (14 persons) belonged to the P+ and the PP+ groups. An interesting and well interpretable relationship was found, however, when the nature of the father's occupation was taken into consideration: there were markedly more fathers in the technical field, both engineers and skilled workers, in the P+ and PP+ groups. In addition there were relatively many artist fathers, and the only teacher father's subject was arts and painting. This seems to corroborate the explanation, proposed but not unambiguously proven by Kaufman that hemisphere dominance and the resulting cognitive style are in close connection with the verbal or performational dominance of the intelligence structure.

Table 6: Fathers Education and Occupation

field/education group	high		medium		low	
	V+,C	P+,PP+	V+,C	P+,PP+	V+,C	P+,PP+
technical	14	9	6	5	1	12
artist	1	4				
human	9	3	1			
others	6	2	4	8		2

Legend: V+: no father under medium-level education;

C: mostly graduated fathers, almost all the doctors;

P+,PP+: dominance of technical profession (engineers - skilled workers), artists, except of one case all the fathers with low educational level belong to this group

Conclusions

1. The major consequence that can be drawn from our study is that *more caution than ever before is needed when using VQ-PQ differences for diagnostic purposes*, particularly in case of children with high intelligence. Kaufman specified the rate of children with VQ-PQ differences larger than 12 to be 35-40% in the normal population. In our sample this rate was 58%, i. e., *the larger share of the sample*. The fact whether or not high VQ-PQ differences are characteristic to the extremely high intelligence zones must be clarified by further studies only.

2. Our knowledge up to now seems to be insufficient to explain *why VQ-PQ dominance has shifted to the side of PQ*; all the less because children of highly educated parents were overrepresented in our sample, and children from parents of low education amounted to one quarter of participants only. We have a single, only impression-based assumption, namely that the arrangement and evaluation of *Coding* and *Completion* subscales are outdated in their present form, and many can achieve maximal scores in these tasks. On the other hand, subscales

of *Information*, *Digit Span* and *Arithmetic* mean appear to be more difficult for the majority of children because of changes in the methodology of school education and the widespread use of calculators.

3. Our results suggest the conclusion that, as specified in literature, *the significant (12) difference between VQ and PQ is not to be accepted as a meaningful one in the high intelligence zone where even the lower values belong to the higher zone*. No kind of pathological indications were found either in the V+ (12-41 point differences) or in the P+ group (12-24 points) in our test series; school achievement of these children was as good as, or sometimes even better than that of the Control Group of well-balanced high intelligence. In our case the divergences in the direction of intelligence might influence the cognitive style, the fields of interest and then choosing of profession, so its study seems to be a task of educational psychology rather than a subject to clinical psychology.

4. *The extremely high difference between VQ and PQ (24-48 scores) in favour of PQ is a real challenge for several reasons*. First, as opposed to Kaufman's data of 6-7%, this occurred in 24% in our sample, i. e. in nearly a quarter of the cases. These children were partly underachievers, though belonged to the average zone even so. The problems came from the *relatively low VQ* and their school performance was in good accordance with this result. Manifested in many cases, the disbalance may result from the strong discrepancy and all its practical and emotional consequences, as well as from other factors to be clarified by further targeted, problem-centered individual studies. The incidence of the phenomenon can only partially be explained by the handicapping sociocultural background. *Implications of hemisphere dominance* may offer themselves as an explanatory principle but this again would need further targeted studies.

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Disability and the development of giftedness

The complicated relationship of two concepts which lays consider
to be opposites

Ernst A. Hany

Institute of Educational Psychology, University of Munich, Munich, Germany

Due to the great interest in the topic "Disabilities and the development of giftedness", a workshop was organized and sponsored by the Foundation for Nurturing the Physically Handicapped Gifted (Duchy of Liechtenstein). The most important contributions and results of the one day session have already been published in German (Foundation for Nurturing the Physically Handicapped Gifted, 1993). This English version represents a summary of the German publication.

In his introductory talk, Michael Jäger, workshop organizer and chair of the above-named foundation, spoke about predominant social prejudices. These prejudices make it difficult to combine the ideas of physical handicaps with giftedness. Even educators tend to view a physical handicap as a deficit and never as potential or a special opportunity. There are numerous individual examples that handicapped (e. g. hearing or visually impaired) have made high mental accomplishments. On the federal side, the academic and professional education of the handicapped must be supported by special financial measures. The handicapped need in addition to emotional support special aids in order to deal with daily life. If these are not provided, much mental potential goes to waste.

Following this, Ernst Schulte told about his experiences as the director of the Rhineland-Westfalia Vocational School for Hearing Impaired. It is quite possible for the hard of hearing today to achieve a professionally qualified school degree since there are numerous schools offering this in Germany. Those individuals who are deaf, however, face much more difficult barriers. Those young people who do finish a school degree are usually extremely motivated and possess very high communication abilities. This is also the most important prerequisite for successfully beginning a career. The speaker regretted the limited number of continuing education experiences for this group (e. g. technical schools for the hearing impaired).

Matthias Weström followed with a talk about the German Institute for the Blind in Marburg. This school offers approximately 260 students (50 per grade level) various degree opportunities. The students are provided with a support system in educational and practical/emotional things. In addition to the acquiring of knowledge, the focus of school work is on learning practical skills. The students live in small groups and gradually learn, by means of systematic directions, to better deal with their life situation. The mediation of perceptual and exploratory strategies is especially important in this educational system.

Uwe Koch, Martin Neher and Harald Messing reported about a research project for determining the life situation of visually and hearing impaired individuals who are attempting to or have acquired an academic degree (Koch & Neher, 1992). The great amount of data, collected mostly in interviews with approximately 150 persons in Germany, can be summarized as follows: "The results show that successful school and professional careers do not represent individual cases, but even extremely handicapped visually and hearing impaired persons can be successfully integrated into schools and professions given the right support." Prerequisite for

this is the development of certain special competencies (Braille or sign language) social skills (mobility, communication ability) and support through modern technical equipment (computers, transcribing telephone, etc.). Special vocational counseling and aids for beginning a career are also very important.

These talks were followed by self-reports of three physically handicapped individuals about their personal and professional development. All three (Maike Stein, Roland Zeh, and Julia Ellins-Haidukiewicz) have begun or successfully completed a university degree program. There was a consensus among the three that they were continually faced with prejudices by non-handicapped individuals. Very few people believed that they were capable of mental accomplishments; they had to frequently fight their way through schools for higher education. Parents, friends and well-meaning parents were always an important support. Without the personal support of the social network and their own, individual motivation to achieve, often inflamed by the barriers they faced, they would never have been able to realize their gifted potential.

The concluding discussion, led by Klaus Urban and Michael Jäger, included further experts and the audience. The discussions led to the following recognitions:

(1) Research is necessary to develop appropriate support measures for the gifted handicapped. This research should provide epidemiological data on handicaps and types of giftedness. In addition, possibilities for the early recognition of giftedness should be found. It would be advantageous, if we could develop methods of diagnosing giftedness in handicapped preschoolers.

(2) Even more important than carrying out research, it is important that scientific results are consistently put into practice by political measures. There has long been information available on which concrete measures handicapped individuals need in order to successfully complete school. This includes early intervention (e. g. language development support in hearing impaired), includes the individual support during education (e. g. through technical aids, translators, etc.) and is directed not only at the provision of specialized schools but also at the intensive education of later employers with regard to the handicapped.

(3) All those involved were in agreement that the daily life of the physically handicapped must be made less difficult. Schools, authorities, school dormitories and public transportation must be made accessible for the handicapped. The positive examples to be found in the United States were frequently referred to. The financial support of handicapped students must come from one source. Presently, the Office for Educational Support, the Public Health System and the Social Services Offices are all responsible, but all pass the responsibility on. There was no consensus about whether the responsibility should be given to local agencies or to specialized departments of cross-regional offices.

(4) The handicapped themselves must also be involved in the development of social and educational policies. They know best where their gifts and their involvement are being wasted at any given time. Generally they have to use a large part of their energies to tear down walls of misunderstanding about their gifts and lack of sensibility about their needs. The removal of social prejudices and political or environmental impediments is the most important step in this direction so the physical handicaps do not necessarily develop into "mental" handicaps (in the sense of limitations), especially in the gifted.

The discussion about the current educational policy is being continued in Germany. The "Arbeitskreis Begabungsforschung und Begabtenförderung" (Circle of Research on Giftedness and Nurturance of the Gifted) is holding a conference on this topic in fall of 1993 in Rostock.

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Workshop chair's address:

Foundation for Nurturing the Physically Handicapped Gifted
Michael Jäger
Im Quäderle 11
FL-9490 Vaduz
Liechtenstein

VII. IDENTIFICATION AND PSYCHOLOGICAL MEASUREMENT PROBLEMS

Introduction

In his keynote lecture, Ivan Koren addresses many of the current concerns of the discussion on the value of systematic identification of gifted children. He gives special attention to the emotional and social consequences of labeling processes and deals with the most popular criticisms against identification. His definitions and recommendations for designing the identification process attempt to avoid running into these criticisms. In his perspective, identification has to be a three-step approach starting from perceiving indicators of giftedness, then applying detailed diagnostics, and finally evaluating the diagnosis by assessing achievement and program outcomes. By using multiple sources of information and a method of continuously collecting information, decision errors and ever-lasting labeling of the students are avoided or at least reduced. Harald Wagner, by commenting Ivan Koren's thoughts, puts still more emphasis on the limitations of psychometric measures which call for an implementation of measures of cognitive processes and strategies, and he reminds us of the economical analysis and evaluation of the identification process from a decision-theoretical perspective.

This comprehensive theoretical discussion is then enriched by reports on concrete procedures and instruments used for the identification of gifted and talented persons. Günter Trost and Ingemar Wedman first summarize contributions made to their workshop on identification. Despite advanced theoretical concepts and practical instruments being available in most countries, there still remain substantial debate on central issues as the nature of giftedness, the role of identification in the whole process of program design, and the amount of effort which has to be put to the diagnosis of individual pre-requisites of learning.

Individual papers of full length follow this summarizing report. Nail Şahin and Ekrem Düzen describe their system of identifying a very small group of children to be educated in a special school from a very large population of students. They use a sequential procedure of selecting students by applying stages of teacher recommendation, group and individual tests, and assessment centers.

Heinrich Stumpf opens a series of contributions which present instruments currently under development. His battery of scales for measuring spatial abilities will fill a substantial gap of the collection of standardized instruments available now. The same will hold true for a complex instrument Hermann Rüppell reports of. He has developed this instrument which attempts to measure the learning and effective use of analogical reasoning, on the basis of remarkably sophisticated theorizing which other instruments often lack. Some first empirical data is provided by Seokee Cho for her instruments which aim at measuring cognitive processes and thinking skills. These instruments are intended to improve the prognostic validity of the identification procedure used in programs for the gifted by including further pre-requisites of learning progress in the statistical models of prognosis and selection. Zuzana Tomášková finally presents some clever tasks she has developed for use with secondary school students in order to collect evidence on their mathematical reasoning skills. However, when she compared the test results with indicators of school achievement, she received only low values of correlation. Other authors, including Herman Rüppell and Heinrich Stumpf, have struggled with low validity coefficients as well. However, this fact does not de-value the instruments or tasks they have developed. Instead, these results question the validity of easily available indicators (e. g., of school grades and teachers' judgements) for representing subtle differences of basic learning abilities and creative talent.

Identification of the gifted

Ivan Koren

Faculty of Philosophy, University of Zagreb, Croatia

Abstract

Four topics are selected from the plethora of issues related to the identification of the gifted: (a) stratification of the concept of identification (recognition, determination, verification); (b) cybernetic modelling of identification (identification as process diagnostics); (c) methodological problems of identification (especially the value of teachers' and parents' assessment); and (d) individual and social consequences of labelling (positive and negative experience).

A synthetic account of each of the selected topics was made on the basis of recent relevant literature, the attitudes of competent experts were reviewed, controversies of the empirical data were outlined, and answers to some disharmonious issues were suggested. The discussion is summarized into the conclusions of both theoretical and practical relevance.

Introduction

Having received a kind invitation from the Third European Conference organizers to give the keynote lecture related to the identification of the gifted, I found several issues to be self-imposed.

First, is it at all possible to encompass so complex and comprehensive a subject-matter in such a short an address without excessive reduction and simplification, which would create an impression of superficiality? Second, is it more profitable to approach the issue in an extensive manner, by addressing a whole range of the themes related to the area, or to select a few key themes and then to elaborate them more intensively? Third, should the paper represent a general review of the classification and systematization of the concepts related to the area, or should it contain the most recent empirical knowledge obtained through research? Finally, should the content be addressed from a positivistic viewpoint, based on the prevailing concepts of the established scientific authorities, or give a critical and anticipatory intonation, and how much, if any at all, should one's own experience and attitudes be represented, etc.?

These, and many similar questions seem to be well justified. Namely, there is hardly a book on giftedness and the gifted that contains no chapter on identification. Furthermore, there isn't any professional or scientific meeting on the gifted in which the identification issues are omitted. All the reports of any research project review the identification procedures administered to the subjects participating in it. Finally, the discussion of the issues of identification and confirmation of gifted individuals has a long tradition.

The first conceptualizations of the identification procedures are found in the discussions of the Greek philosophers Socrates (470 to 399 B.C.) and Plato (427 to 347 B.C.) on the nature and the structure of giftedness, and the first practical procedures in the organized selection of "the handsomest, strongest and the most clever youth" for the education of social leaders by a Mohammadan ruler at the beginning of XVI century (according to Witty, 1977, p. 1). However, the first scientific approach to the identification of the gifted certainly must be attributed to

Lewis M. Terman and his collaborators, and to their famous follow-up study of the gifted children in California from 1920 on (Terman, 1968).

Concurrently with Terman, as well as later, and especially from the mid-century, numerous studies have been initiated, and based upon quite different identification programs. It is quite clear that they cannot be hereby enumerated, let alone described. However, the examples can be given through two of those classic studies. One of them is "Project Talent" (Flannagan *et al.*, 1962), which covered 400,000 subjects from high schools throughout the USA, and employed a respectable battery of 23 tests, 3 personality inventories, a preference test, and two written tests. The second example is the Munich study of giftedness (Heller & Hany, 1986; Heller, 1990), which employed a two-level identification procedure covering the areas of intellectual, creative, social, psychomotor and musical abilities with numerous instruments for each of these domains, and also on the large number of subjects. Both projects are of a longitudinal design, and are characterized by a segmental strategy of differential identification of the highly gifted young people, and by the control over a large number of relevant variables.

The large quantity of references on the identification of the gifted may be well illustrated by a selective bibliography on the identification of the intellectually gifted compiled by B. Feger on the occasion of the VI World Conference on Gifted Children (Hamburg, 1985), listing 355 references for just this single area of study of the gifted. The symposium "Identification of the Gifted" was held at the same Conference, a dozen of quite informative papers were presented, and later published in the book edited by K. A. Heller & J. F. Feldhusen "Identifying and Nurturing the Gifted: An International Perspective" (Toronto: Huber, 1986). The Gifted Child Quarterly periodical often publishes papers related to the issues of identification as well, and its special issue (vol. 28 (4), 1984) was dedicated to the subject area. The similar stands for other periodicals, as well as for special editions in Europe, America and Asia.

All those considerations influenced my decision not to make this paper a general review of the identification-related issues, i.e., not to represent a reasonably successful compilation of the similar reviews already published, but rather to elaborate in it several issues, to examine them, and to try to provide plausible solutions. Those issues are, as follows: the analysis of the concept of identification, conceptualization of identification as of process diagnostics, some methodological difficulties of identification procedures, and practical effects of identification on the identified individuals and on their social environment.

Let us now consider each of the above mentioned issues.

The stratification of the concept of identification

The aim of every identification procedure in the area of giftedness is certainly the *diagnosis* of the individual status of a potential candidate related to some relevant characteristics, and the *prognosis* of the development of those characteristics in terms of the quantity and quality of their scope. Obviously, the practical goal of identification is the provision of the optimal educational and other support to the transformation of an individual's high-quality potentials into the concrete manifest abilities. Namely, the identification procedures are usually applied to be able to intervene in the most favourable time of life (usually in the early youth) and to provide both the internal and external conditions necessary for the transformation of the dispositions into the productive mechanisms designated by various terms, such as manifest giftedness, productive giftedness, talent, etc.

The identification itself, as a set of methods and procedures for the detection and confirmation of gifted individuals, is prevalingly determined by two factors. The first determining factor is the *conception of giftedness*, and the other the *particular purpose* of the identification, i.e., the content of the intervention (educational program, vocational choice, research selection, school selection, etc.), or the purpose of its initiation.

The conceptualization of the phenomenon of giftedness has developed through the process of the gradual accumulation of knowledge within the framework of pertinent sciences, and on the basis of theoretical explanation of the empirically gathered data. In simplified terms, the process departed from a monolithic conception of giftedness, usually expressed as a high IQ (Terman, 1969) towards the conception of giftedness as a multi-area system, encompassing smaller or greater number of types of giftedness (Kathena, 1979; Wagner *et al.*, 1991). The most recent accounts of the field usually mention six areas, based on the general intellectual, specific-academic, creative, leadership, artistic (expressive), and psychomotor abilities (Galagher, 1976).

The other direction in the conceptualization of giftedness departed from the first conceptions of giftedness as a particular really existing property of an individual, which one can have or have not, to the contemporary viewpoint of giftedness as a developing process related to some conditions (Cudina-Obradovic, 1990). A typical example of a developmental concept of giftedness is the well-known Renzulli's interactive model of above-average abilities, high creativity and motivation, from which the later componential model of talent (Wagner *et al.*, 1984) has been developed.

The accepted conception of giftedness is the basis for its operational definition, on which, in turn, the concrete identification procedures are based, in the sense of the definition of the variables to serve as the tools of identification and of the methods to be applied in it.

On the other hand, the compositions of the identification procedures are substantially influenced by the purpose of the procedure itself. It is well known that the identification of the gifted is organized in view of various goals. The identification procedures may be roughly divided by purpose into two domains: the domain of pragmatic goals (provision of the educational support, selection to elite schools, vocational guidance, competition for scholarships, etc.) and the domain of theoretical and research purposes (accumulation of knowledge on the phenomenon of giftedness, testing of the efficacy of the detection and promotion of giftedness, studies of the pertinent environmental factors, etc.). Naturally, these goals are found combined in various ratios in all the practical purposes.

The conception and the purpose of the identification, therefore, determine its methodological structure, i.e., the procedures and the instruments. However, different procedures and instruments are characterized by different levels of validity, reliability and objectivity. This means that the identification procedures differ substantially both by the content that is the subject-matter of any particular diagnosis, and by the level of the diagnostic-prognostic validity of the results of the identification itself.

We have, therefore, reached the fundamental issue on whether the concept of the *identification of the gifted* represents a *unitary entity*, as usually deemed in the lay circles, and sometimes in professional discussions as well, or every identification procedure should encompass also an attribute to denote it more clearly. It is certain that the concept of identification is a stratified one, that it includes various degrees of identification procedures from which stem the outputs of various value levels, and that it includes the denotation mark of the specific field of giftedness to which the identification itself relates. The differentiation of at least three levels of identification is, therefore, recommended in any given area of giftedness (Koren, 1989), as represented in Figure 1.

Recognition of the gifted represents the disclosure of the signs of giftedness. It is an initial phase of identification, in which certain symptoms are recognized in particular individuals that set them apart from their relative populations, in the sense of their ability to perform certain activities significantly quicker, better or with more success in comparison to their peers. The disclosure of such symptoms may come about spontaneously (from parents, teachers, club leaders, and other individuals in position to observe the reaction of the potentially gifted), or

through an organized effort of particular institutions, social and professional associations.

Determination of the gifted represents the definition of the type and the level of giftedness. This is the phase in the identification in which the identity of the gifted individual is recognized, i.e., in which the set of abilities that constitute his/her giftedness is determined. The determination process is applied to the already recognized gifted individuals, but can be used in the population as a whole. Prerequisite for this phase is the involvement of the competent professionals (psychologists, educators, physicians, etc.), and the use of the standardized measuring instruments, or the evaluation by teams of experts (juries).

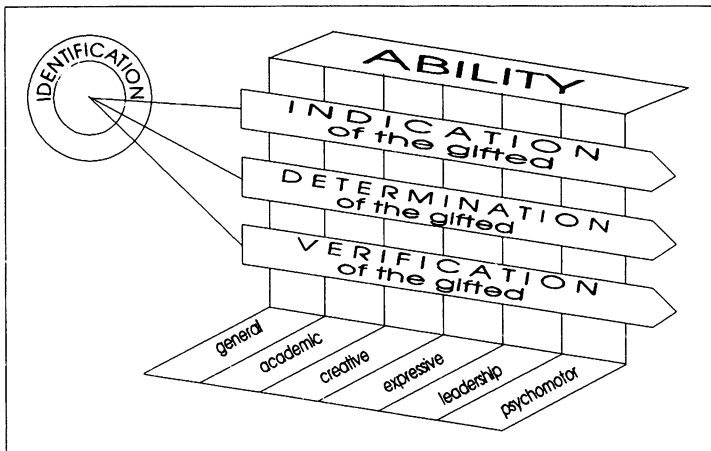


Figure 1: Segmental stratification of the concept of identification

Verification of the gifted represents the highest level and the final stage of the identification process, in which the individual's actual giftedness is evaluated, either through its manifestation in a particular outstanding product, or in a product whose potential is proven with high probability. The verification procedures may be organized in different ways; the practice has established the verification by specially formed official committees. The identification, therefore, may be considered a broader concept that includes the diagnostic and prognostic procedures of various scopes and breadth, with a whole range of methodological forms: from the least complex and least reliable activities, such as self-evaluation or peer ratings, to the most complex ones accompanied by the application of instruments of established metric characteristics. This surely justifies calling for, besides the claim of somebody's identification as of the gifted, the specification of the level of the identification procedure as well. Similarly, the level of the applied identification procedures is to be taken into account at the interpretation of the results of a research program.

Cybernetic model of the identification process

Many criticisms of identification are found in the professional literature. The American psychologist J. W. Birch (1984) has entitled one of his papers "Is any identification procedure

necessary?". The answer to the question is presented in the conclusion of the paper: "Identification of gifted students, as generally practiced in the United States, is neither desirable nor necessary." He, therefore, had in mind a particular type of the procedures for the identification of the gifted, as well as the other authors who criticized the actually practiced identification procedures, and found them in many ways deficient.

Such criticisms are most frequently based on the fact that the identification is usually programmed as a single-term procedure, that the diagnoses are made on the basis of a limited inventory of diagnostic means, that the measuring instruments applied possess poor prognostic properties, that a psychometric approach is favoured in contrast to the holistic one, and that those procedures usually neglect the multi-dimensionality of the phenomenon of giftedness. The direct outcomes of these and similar pitfalls of the majority of identification procedures represented the great mistakes of identification, both in the sense that many actually gifted individuals failed to be recognized, and in the sense that some quite average individuals were diagnosed as the gifted.

The creators of identification methodology are aware of the objective difficulties in the organization of the practical activities in the identification of the gifted, and consequently endeavour to remedy, if not totally eliminate many of the actual setbacks. These efforts may be formulated in terms of particular principles to be respected in the planning phases of the identification procedures:

a) *The concept of identification comprises a series of specific procedures.* As no universal giftedness exists, there is neither a universal identification procedure to be applied in all the instances. The type of giftedness and the purpose of the identification procedure determine the actual methods and procedures of the process.

b) *The identification represents a continuing process.* The human characteristics constituting the concept of giftedness are dynamic categories, so the single-term diagnoses on their developmental level are always risky. A continuing evaluation of the obtained diagnoses is, therefore, necessary, thus making the identification a process activity.

c) *The optimal age for identification is not determined unequivocally.* In relation to the chronological age, the identification should not be attempted too early, when the organic structures are not yet mature enough for the reliable determination of their potential, nor too late, when the optimal period of development, and the possibility of influencing it, is terminated. From this viewpoint, the optimal age for identification is dependent on the type of ability to be identified, and on the individual developmental rate of the gifted individual.

d) *The identification procedures are population-oriented.* Starting from the principle of democracy, each member of the population must have an equal opportunity to have the type and the level of his/her giftedness determined in any phase of his/her development, should the relevant indications appear. This makes the identification an open process with all the members of a particular population as permanent candidates.

e) *Careful use of verbal labels of the identification results.* Because of the possibility of failure of the identified gifted individuals to realize their potential, as well as for the possibility of the adverse reactions of the (usually ill-prepared) environment, the indiscriminate and abundant use of the direct labels for the identified individuals is quite dangerous (e.g., "gifted", "talented", "highly above-average", etc.).

Even these few conceptual remarks indicate the complexity of the identification process, and the necessity of careful planning of all its components. Several authors have elaborated such plans, as illustrate hence by the model by which the identification process encompasses five steps (Feldhusen, 1984): (1) definition of the programmatic goals and types of giftedness (those abilities and characteristics that represent the subject of identification); (2) application of the

nomination procedures (various pre-selection procedures generating a broader circle of the potentially involved in special treatment); (3) application of the individual identification procedures (a more precise determination of types of giftedness and the extraction of those to enter special programs); (4) application of the individual differentiation programs (determination of specific characteristics of the gifted aimed at clear individualization of educational programs); and (5) validation of the identification process (determination of the efficacy of the applied procedures aimed at their affirmation or possible future modification).

These, and similar components may, in various combinations, be found in the proposals by other constructors of the identification procedures' plans (Renzulli, 1977; Khatena, 1978; Rimm, 1984, and others). However, they all lead towards a pragmatic model based upon the mutual permeation of identification procedures and various educational programs on one side, and specific content and specific forms of their elaboration on the other. These programs for the gifted differ from regular school programs not only in content, but by far more by instructional techniques. They are oriented towards self-reliance, individual freedom, initiative, scientific and creative work, productive cooperation, and self-control.

A larger number of subjects is initially included into a particular educational program, which consists of less complex task, on the basis of certain pre-selection procedures (sometimes they can be based just on self-perception and interest). On the basis of performance in programmatic activities, a differentiation of those who have manifested their abilities in a productive manner is carried out, and they are subsequently admitted to programmatic activities of increasing complexity, so the process continues as a spiral by reduction of the number of subjects and by the increment of complexity of relevant programmatic activities. The criteria for admission into particular more specific programs are, besides the demonstrated success in previous tasks, the results of psychological and educational exploration including, naturally, testing by use of adequate measurement instruments.

It is quite obvious that some of the admitted individuals drop out in the course of such a combined process (Renzulli, 1984), but other individuals can also join in any phase, regardless of the reasons for their previous omission, if the relevant indications appear (various nominations, test results, etc.). This sort of identification, based on repeated determination of abilities and characteristics accompanied by the evaluation of manifested performance, is usually named PROCESS DIAGNOSTICS. Consequently, the final diagnosis (not in the absolute sense of the word) is the result of the evaluation of all the previous diagnostic/prognostic procedures.

Elements of process diagnostics may be found in many models and programs aimed at the identification and the development of the gifted. Only several examples will be mentioned here, all of which are reviewed in a comprehensive account of such models (Renzulli (Ed.), 1986): SMPY-Model for identification and education of the mathematically gifted students (Benbow); S-O-I Model for identification of the gifted and training of individual intellectual abilities (Meeker & Meeker); PURDUE THREE-PHASE MODEL for the identification of gifted children and training of their thinking skills (Feldhusen & Kolloff), Triad/Revolving Door Model (TRDM), which starts from a population, through pre-selection and three subsequent "enrichment programs", to include 5-10% of the pupils in the most complex phase (J. S. Renzulli & S. M. Reis), etc.] The Moscow Young Physicists' Tournament-YPT (Korneeva *et al.*, 1991) can also be included in this group. These, and numerous other similar models, are characterized by the mutual permeation of identification and educational treatment of the potentially gifted.

In consequence to the all reviewed above, it may be concluded that the population-based process diagnostics can be explained by a "sift-down" model (Treffinger, 1986), in which the population of the "officially designated" is reached through a multi-level screening. The individual-based process diagnostics can be represented by a cybernetic model (Figure 2).

The stepwise diagnostic process is based on feedback, and the route from recognition to verification leads through a series of steps, where the admission into a higher level is stipulated by the success at previous ones. Every potential candidate must be given a chance of multiple testing of his capacities at every diagnostic level. Certainly, the call for the utmost flexibility of such a model is self-evident.

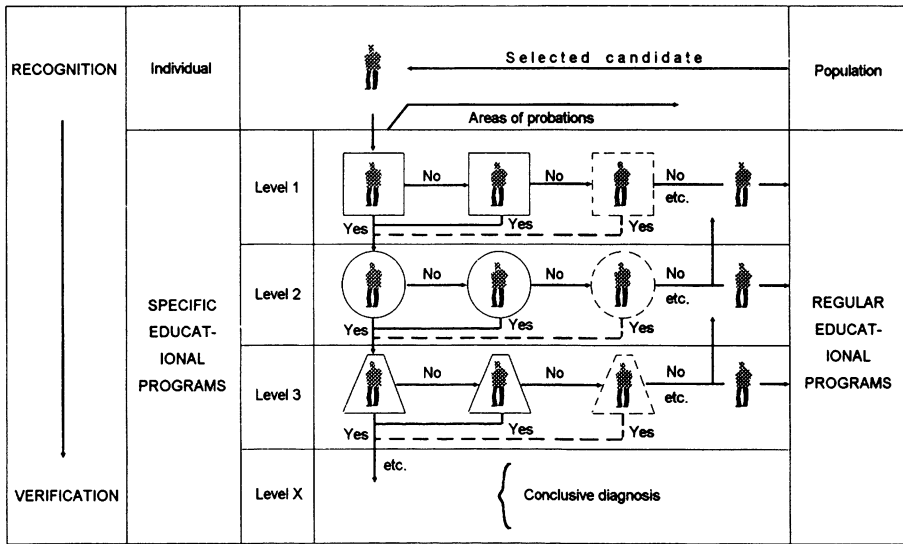


Figure 2: Process of identification of a gifted individual (cybernetic pattern)

Methodological problems of identification procedures

Many different methodological forms and procedures are used in the identification of the gifted in accordance with the operational definition of giftedness and the purpose of the particular identification activity. The abundance and variety of the existing methodological forms may be illustrated by the book "Successful Programs" (Juntune, 1986), which reviews over 120 educational programs for gifted and talented children and youth of USA and Canada. Dozens of types of individual and group tests of general and specific intellectual abilities were employed in their identification, along with a variety of creativity tests, personality tests, attainment tests, teachers' and parents' nominations, check-lists, questionnaires, interviews, peer ratings, self-ratings, and other identification techniques.

The attempts at the systematization of the procedures used in contemporary practice for the identification of the gifted could lead to their classification into two groups of methods: assessment methods and testing methods, as shown in Figure 3 (Koren, 1991).

The basic feature of all *assessment methods* is a direct determination of particular characteristics by men. The assessment is, consequently, always subjective and vulnerable to

well-known subjective errors. There are two forms of assessment: assessment of the *developmental level* of subject's relevant *characteristics* (abilities, personality traits, interest, motivation, etc.), and assessment of the value of *subject's spiritual and material products* (scientific work, technical patent, poem, painting, musical interpretation, acting performance, etc.).

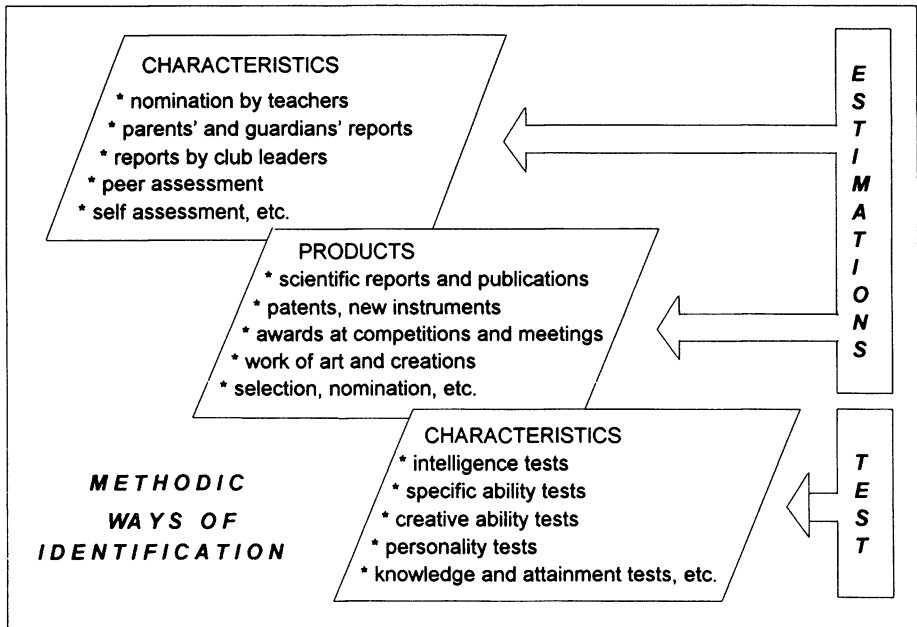


Figure 3: Assessment and measurement in the process of identification

The assessment is most frequently done by teachers, parents, club leaders, and less frequently by peers and acquaintances, while self-assessment is used just occasionally.

The basic feature of all the testing methods is the use of standardized measuring instruments, of known metric characteristics, that can be applied by trained professionals. The instruments are calibrated i.e., they possess the norms that allow for the placement of any particular individual's result on the appropriate spot of the continuum of a measurement scale (usually percentile scale), and thus for the determination of the proportion of his population above or below him by the results obtained through that particular diagnostic instrument.

The methodology of identification, from both general and specific viewpoints, was discussed by many authors in the field. R. Strang (1967), for instance, points out the phenomenon of so-called pseudo-giftedness, where some lively and talkative children, especially those of ambitious parents, may convey a false impression of giftedness, in contrast to the withdrawn, but actually gifted ones. E. P. Torrance (1971) emphasizes the importance of harmony between the identification criteria, which includes the use of instruments, and the aims of programs for the treatment of the gifted. Ph. Vernon (Vernon *et al.*, 1977) points out that, regardless of the

identification technique we choose to employ, there is no single all-valid assessment. D. Sisk (1987) discusses the list of the most frequently used identification procedures, reviews specific instruments for the handicapped, and stresses the importance of case study technique. C. L. Hollinger and S. Kosek (1989), and N. S. Leites (1988) speak of the possibilities, as well as of the numerous difficulties related to the prediction of the later development of the early identified gifted children. A. Kleverlaan (1991) elaborates (on the example of The Hague) the difficulties in the identification of gifted children of ethnic minorities, etc.

Moreover, numerous designers of research programs aimed at the support to the gifted of general and specific abilities report on the variety of methodological approaches to the identification in those areas. Different combinations of trait assessment, product assessment, and characteristic's measurement are present there, too. The representative sample of papers to illustrate the scope of methodological issues related to specific areas of giftedness is extremely hard to compile. For instance, one could mention the finding (Freedman, 1986) that both artistic interest and musical production abilities are equally important predictors of artistic giftedness. The construction and development of valid measurement instruments could also be included, such as Clark's Drawing Abilities Test for screening and identification in visual and performing artistic abilities (Clark, 1989), Hamburger Test für Mathematische Begabung in the area of mathematical giftedness (Wagner & Zimmermann, 1986), and other similar tests. The dilemma on how and when to use the measures of general versus specific intellectual abilities (Stanley, 1984) could be mentioned, too, as well as the problem of differentiation of the gifted in terms of their academic potential within a particular identification model (Van Tassel-Baska, 1984), and so on.

These few randomly selected general and specific methodological issues cannot represent a systematic review of the field, but can present us with the illustration of both their diversity and complexity. There is, however, an issue that seems to deserve special consideration, and will be addressed separately. This is the issue of the value of various nominations (based upon assessment), especially by teachers, because they take the top rank on the list of generally used identification procedures (Marland, according to Sisk, 1987).

From a theoretical viewpoint, teachers do possess certain qualifications for valid detection of gifted students. Primarily, they are in the position to observe, on a long-term basis, the behaviour of children in various curricular and extra-curricular activities. Furthermore, they have the opportunity to compare the developmental levels of the characteristics of children of the same or similar chronological age. Moreover, they possess a psychological and educational training, which is prerequisite for understanding and recognition of individual children's reactions. They are also in constant communication with family environment, and are thus able to acquire the relevant information on a child. Finally, they are able to consult professionally with other teachers, and so on. However, many findings indicate the poor validity of their assessment. In a review of synthetic evidence from a number of studies, J. T. Webb *et al.* (1982) claim that the teachers' nominations identify less than a half of students subsequently identified as gifted by individual testing. At the same time, 10% of the students identified as gifted by them fail to be proven actually gifted, and even 25% of the highly gifted ones remain unnoticed by their teachers. Many prior and later papers corroborate these findings. Where does this paradox stem from?

There are two apparent reasons for this controversy. The first one is the evaluation *criterion* on which teachers' assessment is based. These assessments are usually compared with test results, and tests are a priori taken as valid diagnostic/prognostic instrument; this is a clear case of *circulus vitiosus*. Only the appropriate follow-up studies could, as the matter of fact, provide us with the possibility of evaluation of real validity of teachers' nominations. The second reason stems from the fact that teacher is considered to be "a completed *instrument*". For, as J. Whitmore (1985, p. 112) puts it, "most teachers and other school professionals have not been

prepared to identify accurately the gifted children who are not high achievers and to provide for their special needs". If the teachers received a systematic methodical education (e.g., in the area of analytical discrimination), and were provided with appropriate apparatus (manuals, evaluation scales, etc.), than their assessment would prove to be of a greater use in the identification of the gifted, as demonstrated by some recent studies (Hany, 1991).

Due attention should be paid to other forms of nominations in identification procedures. The important role is played by parents. The advantage of parents' evaluation is that they have the opportunity to observe the continuous development of child's behaviour in a great variety of situations, and the shortcomings stem from the lack of possibility of adequate comparison of one's own child with his peers, the lack of methodological training, and the emotional involvement that usually leads to over-rating of child's characteristics. Some authors, such as J. Alvino (1985), claim that parents should acquire reliance on their evaluation skills, because it seems that they do possess an intuitive knowledge of their children, and are aware, although usually unable to explain how, of their children's unusual ability. Despite such viewpoints, much research on the possibilities of professional help in the efficient appraisal of the characteristics of one's own children is certainly to be expected, for the knowledge in this area is very restricted, especially concerning the construction of appropriate instruments. This, of course, stands for all the other potential nominators, such as peers (Gagne, 1989).

Because we are unable to further elaborate neither the discussion of the already mentioned methodical issues of identification, nor to extend it by inclusion of additional issues, we shall conclude this chapter with a general statement. The diagnostic methods of identification of the gifted are studied and evaluated extensively, especially regarding the tests of individual simple and complex abilities. The relevant knowledge is much less abundant in the area of the so-called inter-diagnostics. i.e. on the combination of various common diagnostic measures, and in diagnosis of the process characteristics of gifted individuals (Hany, 1987). It is very likely that the further developments in the area of diagnostic/prognostic procedures for identification of the gifted will be directed towards the disclosure of the relation between the interaction of cognitive and non-cognitive characteristics of gifted individuals with their social and cultural environment, and their projection on certain criterion variables (Heller, 1987), leading to the affirmation of non-parametric methods of identification of the gifted. This remains, however, a separate issue.

Individual and social outcomes of the publication of identification results

The feature inherent to identification procedures is a certain statement of the results (output) of these procedures. Regardless of the form of their publication - in descriptive categories, in statistical terms, or in some other manner - they always relate to actual individuals. There is no anonymous identification, at least for the identified and for those who are to support their development, for such activities would then be senseless. Consequently, a question on the individual and social outcomes of identification and their publicized results seems to be quite relevant.

From a theoretical viewpoint, as shown in Figure 4, not only the extremely polarized results are to be expected, but also a full scale of different outcomes, such as, for instance: the absence of specific outcomes, exclusively (or prevalingly) positive outcomes, exclusively (or prevalingly) negative outcomes, positive effects in one area, and negative in the other, positive outcomes for the identified, and negative for their environment (siblings, peers, etc.), varying outcomes for different individuals in the same situation with no possibility of generalization, etc.

The above mentioned theoretical assumptions are present in the views of particular authors, but also substantiated by various empirical results, which in some instances disclose smaller or greater positive effects, while in the others smaller or greater negative consequences were

observed, either for the individual or for his environment. These discordant and indeed contradictory results will be illustrated by several examples.

The close relation of the publication (labelling) of the gifted with the conceptualization of the concept of giftedness is pointed out by J. Freeman and K. K. Urban (1983). The authors claim that giftedness is not just an individual/psychological, but also a social/cultural phenomenon, and that the expectations from the labelled individuals are dependent on the social definition of the concept of giftedness. By reference to the findings of a number of researchers, they emphasize the positive effects of identification on the motivation of both subjects themselves, and of those who are engaged in their education and support, but warn, at the same time, against the negative effects of segregation, especially in small children, proposing the inner differentiation of the curriculum, i.e., the individualization of the procedures within a normal educational environment.

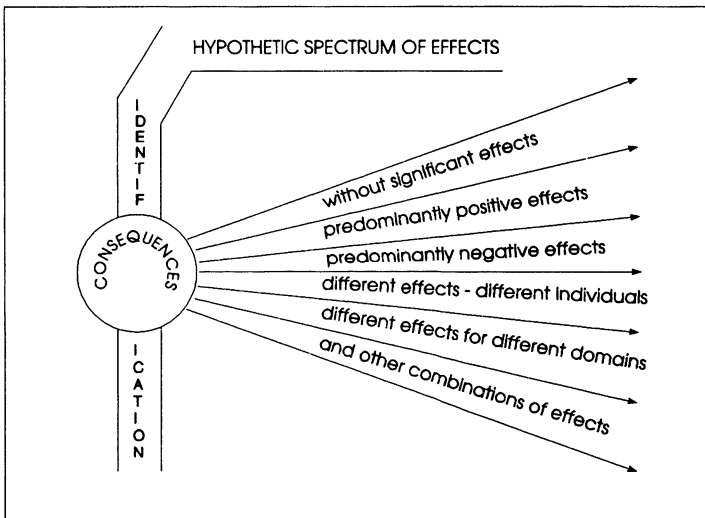


Figure 4: Theoretical consequences of the publication of the results of the identification process

A synthetic overview of the relatively controversial findings on the effects of publication of the gifted was compiled by A. Robinson (1986). It is reported that the publicized gifted adolescents tend to have a positive attitude towards themselves, and are not rejected by their peers (S. L. Guskin); that the school environment doesn't necessarily perceive the publicized gifted negatively (A. J. Tannenbaum and H. J. Morgan); that the direct approach of teachers to the gifted individuals is an affirmative one (A. Robinson); but, on the other hand, that the labeling of the children as gifted produces negative outcomes in families with several children, both for the gifted and for other children (E. Fisher and D. G. Cornell); that some teachers tend to rate the identified gifted children lower (B. Clark and J. C. Jacobs); that some psychologists and counselors react negatively to the labeling of the gifted (J. L. Weiner and J. A. Deulio), and so on. These findings have brought Ann Robinson to the following conclusion: "The effects

of labelling children gifted are, at present, unclear.... In either case, the issue of identifying and subsequently labelling children as gifted continues to be an interesting and controversial area of investigation" (1986, p. 108).

J. Freeman includes the issues of the effects of identification and labelling of the children as gifted into the area of emotional aspects of giftedness, speaks of the stereotypes of the gifted, and points out the differences between the American and the European stereotypes. While the former, based on Terman's and many other subsequent results, are of prevalingly positive connotations, the latter are mostly negative, and associate giftedness with various difficulties, especially with emotional problems. The author substantiates this claim by the results of Gulbenkian's English project for gifted children, which demonstrate the statistically significant larger presence of emotional behaviour disorders in the labeled gifted group, as compared with the control.

The diversity of the findings is well evident from several other studies. Guskin and Zimmermann (1986) report on the results of their study of 295 gifted students, and conclude that they demonstrate highly positive attitudes towards giftedness, but consider themselves no different from the others, and are, with few exceptions, well accepted by the other students. Colangelo and Brown (1987) have disclosed the difference between the short-term and the long-term family effects of the identification and the publication of the gifted, and determined that the immediate adverse effects tend to disappear over the time, although the gifted themselves express some doubt about the presence of completely positive attitude of their family members towards their abilities. Cornell (1989) has carried out a study investigating the effects of the use of term "the gifted" by the parents on the adaptation of their children as expressed through self-concept, anxiety and social status. He has concluded that the children of those parents who use this label tend to display significantly lesser adaptation in some of these variables than the children of the parents who refrain from the use of the term.

Our study (Kolesaric & Koren, 1991), organized as a two-year longitudinal study that included the experimental and control group of elementary school students (sixth and eighth grade), had demonstrated that the public labeling of the gifted students produced no statistically significant adverse effects on the attitudes of students, their parents and teachers on the onset of giftedness and on the gifted. However, the consistency of attitudes of the gifted and their parents proved not to be stronger than the one of the attitudes of other students and their parents. Moreover, the publicly labelled students, in comparison to all the other students as well as to the other gifted students (who were not informed on their giftedness), believe to the significantly lesser extent that the identification leads to the development of negative character features.

Even these few randomly chosen studies confirm the initial assumptions on the equivocality of the effects of the public labeling and differential treatment of gifted individuals. This also means that the identification itself does not automatically produce positive or negative outcomes, but that these outcomes are rather dependent on the actual organization of the identification procedures in varying objective circumstances.

Namely, every person involved in the organization of identification procedures tends to believe that the outcomes of these procedures will produce positive effects both on the identified individuals and on their environment, and that the potential adverse outcomes may be prevented or significantly suppressed by preventive action. In other case, no one would ever get involved in these activities. The issue, consequently, arises on the identity of the critical factors of identification that may generate the adverse effects. They are indeed numerous, but the most prominent seem to be the ones related to the inadequate psychological preparation of the identification candidates, as well as of those involved in the process immediately or remotely, such as family members, peers, teachers, co-members in various clubs, associations, organizations, etc.

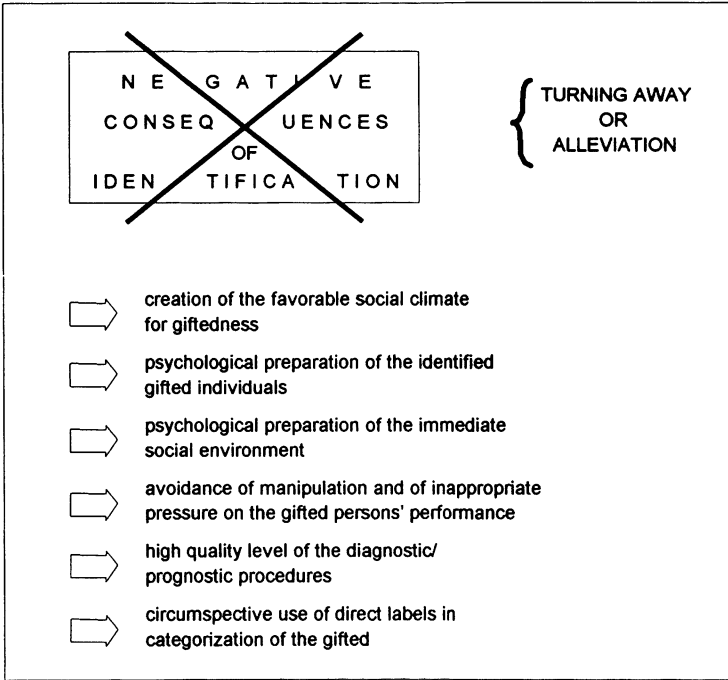


Figure 5: Preventive activities aimed at alleviation of the negative consequences of identification

The psychological preparation of the candidates to be potentially categorized as gifted includes their education on the relation of their natural potentials and the realization of these potentials, as well as on all the possible reactions of the social environment to their distinction, which can range from understanding and unconditional support, through ignoring and envy to total rejection. The preparation of the social environment encompasses the educational and other procedures aimed at the natural and tolerant acceptance of individual differences within the particular social group, and on the manner of communication respecting those differences. Naturally, the forms of such an educational preparation are specific for particular categories of subjects, such as parents, siblings, peers, etc.

Many other factors may significantly influence the effects of the publication of the identification results. The general social climate, as expressed in the attitudes of authorities, legal regulations, and in the media, is of great significance. The existence of the tradition of identification activities will be of some influence, too (the first attempts at identification of the gifted in a society will produce different effects than those which are already become the usual practice). Furthermore, the manner of use of identification results' labels, especially the exaggerated and indiscriminated use of direct labels as "gifted", "talented", "highly above-average", etc., may produce negative outcomes, especially if some of the labelled individuals fail to manifest their potentials. Similarly, the seriousness of the approach, as well as the methodological level of the procedures and their organization, represents the significant regulators of their positive or negative outcomes.

All the above mentioned, as well as many other factors that may prove harmful to the gifted individual's personality and/or his environment in the course of publication of the identification results must be taken into account in the phase of identification programming, so that various corrective procedures may be applied to check their potential adverse effects.

Concluding statements

The present paper refers to, defines and discusses just a few out of a large inventory of issues related to the identification of the gifted: first it discusses the very concept of identification concerning its complexity and layered structure, then attempts to present identification of the gifted in a form of process diagnostics and to represent it by a cybernetic model, then analyzes some methodological difficulties and concerns present in the organization of identification procedures, and, finally, draws attention to the potential individual and social outcomes of the publication of the results of identification activities. Such an elaboration of the issue allows for the synthesis of the following concluding statements:

(a) The issue of identification represents a crucial component of every system of organized care for the development and support of the gifted. Moreover, the quality of individual educational and other supportive programs is to a significant extent dependent on the quality of identification procedures themselves.

(b) Every identification procedure is determined by the present conception of giftedness and its operational definition on one hand, and by the purpose and goals to be achieved by that particular identification activity on the other.

(c) The very concept of *identification of the gifted* includes several procedural levels. These levels differ both in concept and in methodology, and the most prominent of them are, as follows: *recognition* (perception of relevant signals of giftedness), *determination* (definition of the type and the level of giftedness), and *verification* (evaluation of the manifested giftedness).

(d) Identification, as a set of specific methodological procedures, represents a continuing process. These procedures interchange with various programs of educational support to the gifted. The interrelation of identification and educational processes produces the actual diagnosis for each particular gifted individual. These procedures are, therefore, justly named *process diagnostics*.

(e) Every single diagnosis at each level of identification process must be verified or falsified by feedback on the actual manifestation of the diagnosed characteristics, for it represents the basis for the following steps of process diagnostics; all the relevant identification activities take place following a cybernetic model.

(f) Numerous procedures of assessment and testing are employed in practical identification activities. There are continuous efforts towards the construction and the development of new measurement instruments, and the improvement of the diagnostic/prognostic validity of the existing ones, especially for specific areas of giftedness.

(g) The reported discrepancy between poor validity of teachers' nominations and their realistic potential for more successful assessment of their students' giftedness is highlighted. The reasons for this paradox seem to be the inadequate criterion used for the validation of their nominations (test results), and their lack of appropriate training in the methodology of assessment.

(h) The most frequent formal output of identification procedures is labelling of the identified gifted. As the available studies failed to present us with conclusive evidence on the individual and social effects of identification, so the whole range of outcomes, from positive through neutral to negative, is theoretically to be expected, preventive action aimed at the elimination or suppression of the possible adverse effects is called for.

(i) The organizational measures accompanying identification procedures to prevent the adverse effects of identification are, on one hand, the appropriate psychological preparation of the identified gifted individuals and of their immediate and remote environment, and, on the other, the quality of diagnostic/prognostic procedures themselves.

It can be stated, in conclusion, that some other authors reviewing this particular field would probably select some other present issues of identification, or would view and discuss these ones in a different manner. This confirms the notion of the discussion of identification as of a continuing process itself, a never completed pattern of knowledge on the subject. I would be happy if my present paper succeeded in adding a small contribution to that pattern.

Summary

Four topics are selected and discussed out of the broad range of subject-matter related to the identification of the gifted: stratification of the concept of giftedness, cybernetic model of the identification process, methodological problems related to identification procedures, and individual and social outcomes of publication of the identification results.

Starting from a presupposition that the purpose of every identification procedure in the area of giftedness is *diagnosis* of individual status in relevant characteristics of a particular potential candidate and the *prognosis* of the development of those characteristics, as well as from the fact that identification is determined by the conception of giftedness and the concrete purpose, the concept of identification is analyzed. It has been argued that this concept is not a unitary entity, but rather consists of at least three levels: *recognition* (acknowledgment of the signs of giftedness), *determination* (appraisal of the type and level of giftedness), and *validation* (evaluation of the manifested giftedness). Such a stratification has its methodological consequences, for every phase of the identification requires specific methodological procedures.

Identification, viewed as a set of specific methodological procedures, represents a *continuing process*. These procedures are mutually permeated with various programs of educational support, and the inter-relation of identification and educational processes produces the actual diagnosis of every gifted subject. For this reason these procedures are named *process diagnostics*. Because every individual diagnosis at every level of identification process must be verified or falsified by feedback information on the actual manifestation of the diagnosed characteristics, all the relevant identification activities may be described in terms of a *cybernetic model*.

In the practical identification activities numerous procedures are used, both from the group of assessment methods, and from the group of measurement (testing) methods. The discrepancy between teachers' nominations and their realistic potentials for successful assessment of level of giftedness of their students (substantiated by the results of many studies) represents a separate methodological problem. A more detailed analysis of this problem discloses that its reasons stem from the existence of the *questionable criterion* for the evaluation of their nominations (mostly test results) and from their *inadequate methodological training* in assessment procedures.

The most frequent formal output of identification procedures is labelling of the identified gifted individuals. The results up to date failed to produce unequivocal accounts on the individual and social outcomes of identification, so, as all the options remain theoretically possible, from positive through neutral to negative, it is advisable to carry out preventive activities aimed at the elimination or at least diminution of the possible negative outcomes. The advised preventive activities encompass the *psychological preparation* of the identified gifted individuals and their immediate and distant environment at one side, and the *highest possible standard of diagnostic/prognostic procedures* on the other.

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Commentary on "Identification of the gifted"

Harald Wagner

Bildung & Begabung e. V., Bonn, Germany

The identification of the gifted is without doubt one of the most controversial issues in research on giftedness as it is closely related to an equally controversial issue: the definition or concept of giftedness itself.

Ivan Koren's impressive presentation made it totally obvious that we cannot expect simple answers to difficult questions and that we have to develop individual strategies of identification with respect to specific abilities or talents, the age and the social background of the person to be diagnosed, the purpose of the identification and the possible consequences.

I think it was a wise decision that Ivan Koren, for the purpose of this conference, chose to concentrate on some highly important aspects of identification rather than to attempt a comprehensive overview. And this was very friendly towards the discussant as well, as it leaves ample space for me to add some thoughts on identification from a rather pragmatic point of view.

(1) When Ivan Koren talked about *process diagnostics* he referred to an identification procedure which combines diagnostic elements with elements of educational support in a sense of *formative evaluation*. Just for the sake of clarity, I would like to add that the term *process diagnostics* is used as well with a different meaning: namely the *assessment of cognitive processes*. Most achievement tests yield nothing but a product, a result of cognitive and metacognitive activities. Little or nothing do we learn about *how* a result - whether right or wrong - was achieved. As we fairly well know that intellectually highly able people not only differ in quantitative aspects of cognitive functions - for instance speed of processing, capacity of information input and storage - but also in qualitative aspects - they *think* differently - it would be highly desirable to possess diagnostic tools to evaluate thinking and problem solving processes. Steps in this direction have been undertaken in Germany for instance by Facaorau (1985) and by Rüttzell et al. (1986). It seems to be doubtful, however, whether we will ever end up with tests that could be as easily administered as traditional intelligence tests.

(2) Most of our current ability and achievement tests are poorly suited to reliably measure high performance. They are made to differentiate optimally in a medium range of ability but they usually have a ceiling which is too low to allow a differentiation within the upper 3 or 5 percent. There are at least two solutions for this problem: (a) apply a modern, differential aptitude test that provides several levels of difficulty well beyond the age of the child to be tested; (b) apply aptitude and achievement tests that are standardised for older populations. This latter approach was successfully introduced by Julian Stanley when he developed the talent search for mathematically precocious youths in the US (Benbow & Stanley 1983). Those 12-year-olds who belonged to the top 3-5 percent on in-grade (age appropriate) achievement tests were allowed to take the Scholastic Aptitude Test, which is designed for 16 to 18-year-old senior high school students. This procedure is suitable for discovering extremely accelerated children (figure 1). For most identification purposes it is not important to end up with a precise age-oriented percentile rank or IQ but to have an estimate of the intellectual potential or a rank order of the tested persons.

(3) One of the least developed areas in educational and psychological endeavours about gifted children - at least in Europe - is the identification of the gifted among disadvantaged groups - cultural and ethnic minorities from low socio-economic backgrounds and poorly educated parents and the identification of handicapped gifted children. When it is said that about 50% of the gifted are not identified in schools, it has to be assumed that the percentage of not identified gifted from the groups just mentioned is much higher. Very recently John Feldhusen recommended not to look for generally or broadly gifted persons in disadvantaged groups but "to assess youth's *special* talents, aptitudes, or abilities ... the need is particularly acute when we are assessing youths from special populations, who might have suffered severe restrictions in their development of general, allround giftedness" (Feldhusen, 1992, p. 123). With the growing number of immigrants into Western Europe, the question of talent identification and development for the disadvantaged becomes increasingly pressing.

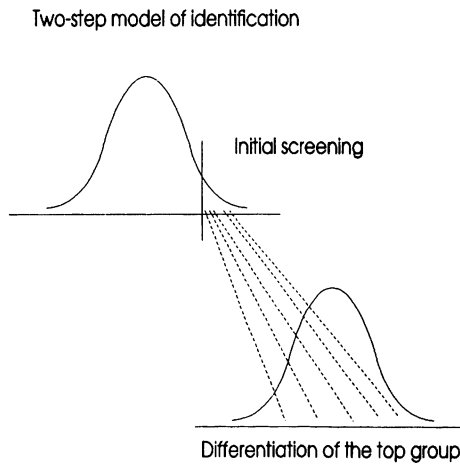


Figure 1: Two-step model of identification as used in Stanley's talent search

(4) Identification of giftedness must never be an end in itself. There is no point in searching for highly able just to label them and leave them as they are or ask them what they want. A more sensible approach would be *first* to develop educational programmes and opportunities which can be realised with the available resources and which meet the special needs of highly able learners in distinct areas and *second* to select those who are likely to benefit most from the programme. Such programmes can be of diverse character like early entrance to school, high school or university, acceleration to higher level classes, Saturday or afternoon classes, specialised clubs or organisations, residential summer programmes, mentor programmes, special classes or even special schools.

(5) My last point deals with economic aspects of the identification procedure. I assume that most of you are familiar with this model that represents the relation between a certain ability, for instance, "mathematical reasoning" and a test procedure designed to assess this ability. As we have no means of directly measuring ability, we usually take one or a combination of several

tests as a more or less accurate estimate of the true ability. We assume that the different levels of ability form a continuum on which we can locate a point which separates the "highly able" or "gifted" from the "above average" or "normal". This point can be qualitatively or quantitatively defined. The ideal case would be that the test score accurately represents the true level of ability in 100% of all cases. In this case all persons would be just on one line. This, however, is never the case. Instead they will usually gather in a ellipse like this - a little bit idealised.

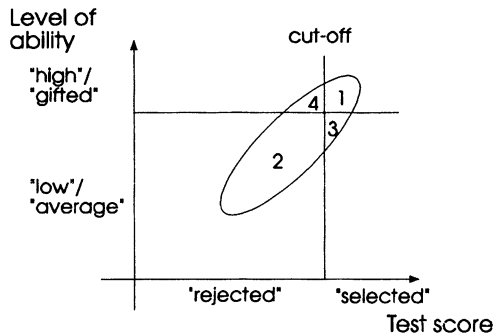


Figure 2: Correlation between "true" ability and test score. Identification of the gifted by means of a cut-off point.

To determine the highly able, we use a cut-off point which is chosen arbitrarily according to the purpose of the identification procedure. The result is four groups of subjects: (1) The correctly identified gifted, (2) the correctly identified non-gifted, (3) the "false positives" (Type I or alpha-error), (4) the "false negatives" (Type II or beta-error). By raising the cut-off score we can reduce the number of false positives but automatically increase the number of false negatives. By lowering the cut-off score we can reduce the number of false negatives but vice versa increase the number of false positives.

The false classifications bear differential benefits for the individual and the selecting institution. The institution often seeks to minimise the false positives, especially in those cases where a costly educational programme is to follow (e. g. pilot's training, national scholarship programme). On the other hand the benefit for the individual is obviously rather low if he/she has been erroneously rejected. A possible solution for this dilemma is, as Ivan Koren pointed out, 1) a multilevel identification strategy of educational units followed by further diagnostic testing to reduce the number of false positives and 2) subsequent opportunities for the false negatives to enter the educational programme after their true abilities have been discovered.

The effort and expense for the diagnostic procedures are to be seen in relation to personal and financial consequences and to how easily an erroneous decision can be corrected. Just think of two extremes: the selection of a manager for a top industrial position and the admittance of a pupil to an afternoon maths class for able and motivated children. Time does not permit me to deal with other interesting topics like the importance of non-cognitive factors for the prognosis of talent development or the negative consequences of *not* identifying gifted children. But I am confident that there will be ample opportunity for it in the course of this conference.

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The workshop "Identification of gifted students"

Summarizing paper

Günter Trost and Ingemar Wedman

*Institute for Test Development and Talent Research, Germany,
and Department of Education, University of Umeå, Sweden*

The eight contributions to the full-day workshop on the identification of gifted students covered both a wide age span and a great number of aspects. The age groups involved in the analyses ranged from age six or seven (beginners of elementary school) to the late twenties (graduates from university and students completing their doctoral dissertation). The authors' attention was focussed on the characteristics of different kinds of giftedness, for instance in mathematics and in sports, and on the possibilities for identifying students endowed with special features of giftedness. Furthermore, the contributions dealt with large-scale schemes for the identification of gifted students across special fields of talent in the context of both research projects and scholarship or special educational programs. Nine researchers from seven European countries participated in the workshop.

Irina S. Averina from the Institute of General and Pedagogical Psychology in Moscow, Russia, presented the concept and some of the results of the *"Moscow-Munich Longitudinal Study of Giftedness: Identification of Different Types of Giftedness at Various Age Levels"*. This research project is designed as a cross-cultural study analyzing, on samples of Russian students, the same variables that have been investigated by Kurt Heller and his co-workers in the Munich study of giftedness on West German students, and using the same instruments of assessment.

The variables to be assessed were:

- intelligence,
- creativity,
- achievement motivation,
- quest for knowledge,
- working styles,
- other non-cognitive characteristics and
- indicators of achievement in different areas.

The project started in 1990 with the construction and evaluation of a Russian version of the German intelligence test "Kognitiver Fähigkeitstest" (KFT) which had been used successfully in the Munich study. The results of the pilot study indicated that the German and the Russian versions corresponded well in terms of reliability, distribution of scores, and some aspects of validity.

In a two-step procedure gifted children were identified: by teacher checklists on the one hand and by test scores in the KFT and in tests of creative thinking on the other hand. Five age cohorts were included in the study: students of grades 1, 3, 5, 7 and 9. Out of 600 students of each age cohort about 70 students were selected respectively.

From the analyses that have been carried out so far it can be concluded that

- intelligence and creativity are independent dimensions of giftedness,

- there are clear differences between various types of giftedness, and multiple giftedness occurs relatively seldom,
- teachers do fairly well in identifying the intellectual abilities of their students,
- teacher ratings on creativity do not correspond with the results of creativity tests.

Many of the findings of the Moscow study are in line with the findings of the Munich group on German students.

An ambitious project has been launched in Turkey; it aims at a nation-wide program for the identification of children of extremely high ability levels for special education. Since the first step of the selection procedure will be teacher nomination, a logical starting point was an investigation into the concepts of gifted individuals formed by the teachers as well as by university students in the psychology and education departments. In their report titled *"The 'Gifted Child' Stereotype Among University Students and Elementary School Teachers"*, Nail Şahin and Ekrem Düzen from the Department of Psychology at the Middle East Technical University in Ankara, Turkey, presented the results of their investigation.

Out of a large pool of traits which are used both in the research literature and in various selection programs to characterize gifted individuals, 45 statements were chosen describing five dimensions ("academic achievement", "comprehension", "curiosity/creativity", "perseverance" and "social relations/self-expression"). 232 students at four universities and 303 fifth grader teachers at 25 schools with a long teaching experience were asked to rate each of these 45 statements as to the degree to which they describe a highly gifted child.

The intercorrelations between the five dimensions were rather high with coefficients ranging from .40 to .76. There are marked differences between the mean ratings given by teachers and those given by students. Teachers placed the greatest emphasis upon "academic achievement", closely followed by "comprehension"; third in the rank order was "curiosity/creativity"; statements about "social relations" were considered least descriptive of high giftedness. An exploratory factor analysis yielded five stable and interpretable factors. They differ considerably from the a priori dimensions described above. A core factor explaining 63 per cent of the common variance consisted of statements related to comprehension and problem solving. The second factor was labelled "task persistence and involvement" (14 per cent). The remaining factors were labelled "maturity-persistence" (12 per cent), "responsibility-leadership" (6 per cent) and "communicative-interactive abilities" (5 per cent of the common variance). On the basis of these results, a shorter version of the checklist is being developed as a nomination form for the first nation-wide selection campaign that will be run in 1993.

The features of this *"Multi-Step Selection Process for the High-Ability Children"* were outlined by Nail Şahin and Ekrem Düzen in a second contribution to the workshop. The procedure aims at the selection of a small number of 35 extremely gifted children out of approximately 600,000 fifth graders in nine Turkish provinces for participation in a special education program offered by a newly founded special school for the gifted.

The first step involves teacher nomination. With the help of a nomination form teachers are asked to nominate any child who shows signs of very high ability, to rate each candidate on the 20 traits that emerged from the abovementioned study and to document the child's achievements.

To all nominated children (probably 10,000 to 12,000) two tests of general intelligence and general academic ability will be administered in regional test centers: Raven's Progressive Matrices and a locally developed Test of Academic Reasoning. In this second step, a maximum of 500 candidates will be selected for the next stage on the basis of a composite test score.

The third step includes individual testing and interviews with the children and their families. The Wechsler intelligence test (WISC-R) will be used in combination with tests of divergent

thinking and creativity. The interviews will focus on the child's previous achievements and family environment. As a result of this selection stage, 60 to 70 children will be admitted to the last step.

Step four is a 20 day summer camp offering various forms of challenging activities and entertainment. The children's social interactions, cooperation, planning and coping skills, and adaptability will be observed and judged by trained supervisors. The final decision on the admission to the special school will be based on all of the available data on the children.

Intense research is in progress to ensure the validity of the selection instruments to be used.

The goal of identifying the gifted students has also guided research activities and the development of assessment instruments in Slovenia for many years. The results of these endeavours were presented by Jan Makarovič, member of the Faculty of Social Sciences of the University of Ljubljana, Slovenia, in his paper on *"The System of Talent Identification in Slovenia"*. For the present system of selecting gifted students for a scholarship program, out of a great variety of tools, those individual measures have been retained "that proved to be the most satisfactory metrically, the most predictive and the least redundant" (Makarovič).

In the first step for identification, the screening phase, a broad net of separate indicators of talent is taken into account. Among the criteria are

- extremely high scores in a battery of psychological tests of mental abilities that are applied to the total age cohort of pupils in the last grade of elementary school;
- pupils' answers to a Questionnaire about the Vocational Choice yielding information on family environment, curricular and extracurricular interests and activities, vocational interests and aspirations, as well as the children's self-ratings of their abilities to perform 21 different kinds of work;
- teacher ratings of each pupil's academic ability, his or her diligence at school work, a description of the pupil's personality and problems, and data about school marks in the main subjects.

The second step in the identification process demands more refined methods which take into account the complex interrelation of the various indicators of giftedness. The diagnostic instruments used in this stage are:

- the Questionnaire about the Possibilities of Realizing the Vocational Wish; it contains scales of intellectual interests, of attitudes toward school work, of creativity in extracurricular domain-oriented activities and of social creativity, of the pupils' values, and finally, of participation and success in contests;
- a test named "Uses of Things" measuring the abilities needed for divergent production;
- interviews.

A systematic identification of the talented has been performed in Slovenia since 1986. On the basis of the results of concurrent control studies, the instruments used in the program have been revised several times. The present system aims at identifying the top ten per cent of an age cohort in terms of intellectual abilities by the first step and at selecting approximately one quarter of these pupils by the second step for scholarship programs.

While the identification programs reported so far are of a general, comprehensive type and address themselves to younger age groups, the program for the *"Identification of Mathematically Gifted Students"* presented by Zuzana Tomášková from the Pedagogical Faculty of Charles University, Prague, Czech Republic, is focussed on the identification of a special talent, and the reference group are students in the first four grades of secondary school.

Two versions of an algebraic test and two versions of a geometric test were developed, the final versions containing eight problems each. Unusual and challenging problems which are not

part of the regular mathematics curriculum were chosen for the tests. The stress was laid on provoking creative thinking and elegant, fast solutions.

The algebraic test is designed to assess the abilities of

- logical judgement,
- selection of relevant information,
- combination of information,
- mathematizing real-life situations,
- recording reasoning procedures in mathematic symbols,
- handling numbers imaginatively.

The geometric test aims at assessing the abilities of

- spatial visualization,
- transformation of geometric information into the language of algebra,
- combination and reasoning.

The entire tests take 50 minutes. Participation is voluntary. The tests serve as instruments for the identification of mathematically gifted students who can then be offered special programs.

Statistical analyses with the first set of tests on a sample of 150 students in the first grade of secondary school yielded very high reliability coefficients and almost optimum difficulty indices for the algebraic test (data on the geometric test are not reported). The coefficients for the correlation of the test scores with school marks in mathematics were very low indicating that the tests do require qualities of thinking (particularly problem-solving abilities) that are different from those required in the regular mathematics courses.

Quite another special field of talent has been studied by Jacques van Rossum from the Department of Psychology of the Free University, Amsterdam, Netherlands. His contribution dealt with *"Talent in Sport: Characteristics of Top-Level Athletes According to their Coaches"*. Questionnaires were sent to members of the guidance teams of the Dutch national squad in six olympic sports inquiring into the experts' opinions about the relevance of a variety of characteristics for success at top-level sport.

In the first study, eight general characteristics that had been chosen from the literature were rank-ordered according to their importance for success as a top-level athlete by 50 coaches in judo, speed skating, table tennis and swimming. Although the rank-orders differed across disciplines, "natural endowment" held the highest rank in three of the four sports. Only in table tennis was "technical ability" ranked highest. "Natural endowment" means, in this context, appropriate body configuration (e. g. long arms for judo and swimming, long legs for speed skating). "Quantity of training" was generally judged to be of minor importance.

In the second study, 27 field hockey and 19 track and field coaches were asked to rate the importance of an enlarged list of ten general characteristics for success as top-level athlete. For field hockey, "mental fitness" was rated highest, for track and field "physical fitness" obtained the highest ratings. The author demonstrated the findings on the examples of international top athletes and interpreted them in the light of concepts of giftedness.

Competition is stiff not only among top-level athletes but also among school or college graduates applying for highly attractive positions. Whenever personnel selection takes place in multi-cultural and multi-lingual societies, there is a need for culture-fair assessment instruments that, at the same time, reflect some central requirements of the jobs in question in terms of aptitudes needed to perform well. A new approach to meet this demand was reported by Ali Baykal from the Department of Science Education of Bogazici University, Istanbul, Turkey: the development and analysis of *"Tangram and Tetris Items in the Measurement of Ability"*. He has transformed problems of the old Chinese game Tangram (a variety of complete and closed

figures drawn by others have to be replicated by a set of rectangles, triangles and parallelograms) into multiple-choice items. Tetris is a popular computer game in which the computer randomly releases, at small time intervals, different kinds of objects which are all made up of four small squares. The player has to combine all objects by making them adjacent to each other without any blank space between them. Ali Baykal has designed a multiple-choice test presenting five Tetris-like objects which consist of six small squares each. The test items are more complex figures, each one made up of four of the objects; the candidate has to identify the missing fifth object.

The new subtests, among other tests, were tried out on a sample of 675 graduates of the top four universities in Turkey. The results indicated optimum difficulty for the Tangram and too high difficulty for the Tetris subtest; furthermore, satisfactory coefficients of internal consistency were obtained for the Tangram items and high coefficients for the Tetris items. Finally, low intercorrelations were found both between the two subtests and between each of them and the other cognitive subtests in the battery. These findings give reason to assume that the new item types might also be useful additional instruments for the identification of gifted students.

In the last contribution to the workshop, Günter Trost from the Institute for Test Development and Talent Research, Bonn, Germany, gave an overview on concepts and programs for the "*Identification of Gifted University Students for Scholarships in Germany*". There are nine organisations offering scholarships for gifted students in higher education. Eight of them are affiliated with the major political parties, the major confessions, and the Trade-Union Congress respectively. One organisation (the largest one) is neutral with respect to political, social or confessional orientation. The total number of German scholars of all the scholarship foundations amounts to approximately 10,500 students and 2,400 doctorands, which is equal to less than one per cent of the total student population.

The general goal of all organisations is to further, in an individual way, the development of the abilities, the development of the total personality and especially the development of their scholars' particular commitment toward society. The scholarship programs include three types of assistance: (a) financial support - largely depending on family income, (b) individual guidance both in academic and personal matters, and (c) enrichment programs such as summer schools, weekend seminars, foreign language courses, one year of study abroad, practical experience and excursions.

Seven of the nine organisations accept applications submitted by the candidates themselves; two organisations only accept nominations of gifted persons by school teachers, university professors, alumni or other persons.

All organisations demand academic achievement at least well above average as a necessary but not sufficient condition for admission; however, they differ considerably in the degree of selectivity. A second criterion applied by all organisations is a sense of responsibility as a citizen and active participation in social, political, religious or cultural life. Other personality traits such as task commitment, initiative, open-mindedness, breadth of interest and social competence are frequently mentioned as further criteria of selection.

All scholarship foundations reach their selection decisions in two steps: (1) selection on the basis of written material: school-reports, nomination forms, certificates, testimonials, curriculum vitae etc.; (2) selection by means of more individualized assessment techniques either in selection seminars or on individual appointments: extended interviews, group discussions (three organisations), essays (two organisations), intelligence test (one organisation), and presentation of papers (one organisation).

Most organisations conduct follow-up studies on the academic and professional careers of their former scholars. The results indicate that, in general, the scholars do very well in their academic studies and that, later on, many of them gain positions of high responsibility and

influence. However, without including control groups (same abilities, no scholarships) into the longitudinal studies, it is not possible to separate the effects of the selection procedures and the effects of the scholarship programs.

All of the contributions to the workshop stimulated intense discussion with a large and active audience involved. The variety of perspectives represented in the papers evoked comments, questions and disputes covering a correspondingly wide range of topics connected with the identification of gifted students. The discussion was centered around

- the concepts of giftedness underlying the various identification programs and research studies presented in the workshop,
- the appropriateness and effectiveness of different strategies and instruments used for the identification of the gifted, and
- the implications of the reported research findings for practical programs for the gifted.

As a result of both the papers and the discussion, it became evident that easy solutions to some of the central problems in this field are not at hand: Among these problems are the everlasting difficulty of defining and operationalizing the criteria of giftedness (and finding consensus about it), and the dilemma of conflicting goals of including large numbers of potentially gifted persons into the identification programs and carrying out time-consuming "in-depth analyses" with individualized assessment techniques which must be reserved to small numbers.

Notwithstanding the problems that remained unsolved, the workshop offered a good opportunity to exchange results, experiences and opinions and to learn about interesting concepts of giftedness, systems and techniques of talent search as well as research designs that have been developed and evaluated in other countries.

A multi-step selection process for the high-ability children

Nail Şahin and Ekrem Düzen

Department of Psychology, Middle East Technical University, Ankara, Turkey

Abstract

In this paper, the selection process for a unique and pioneer project in the identification of gifted children between 11 and 13 years of age will be described. In Turkey, there are 1.5 million 5th graders expecting to graduate at the end of the 1992 school year, and approximately out of the 600.000 of these students, only 35 will be selected for a newly-founded school for the gifted. This extreme selectivity in the project necessitated a multi-step selection process.

The first step will involve the nation-wide distribution of the teacher nomination forms. Teachers of the fifth graders will be asked to nominate any child who shows signs of very high ability in their classrooms. The nomination forms will contain the necessary details to guide the teachers' decisions. For those children who are nominated, the second step will involve the application of group tests on reasoning with verbal and spatial problems, and general intellectual ability (Raven's SPM). Testing will be conducted in regional centers to facilitate the participation of candidates from rural areas. The third step will include individual testing and interviews. In this step, the IQ measures as well as tasks emphasizing creativity and problem solving abilities will be emphasized. The final step will involve a 20-day summer camp, where learning of totally unfamiliar material will be introduced and observation records will be kept about the child's performance in various social activities. The final decision will be based upon all of the available evidence about a child. Separate norms and cutting scores are being contemplated for males and females, as well as for children from urban and rural backgrounds. Concurrent validities of the group and individual tests are being studied. Intense research activity is in progress to establish the validity of the tests to be used in the selection process.

Introduction

The selection/identification process to be described in this report is envisaged within the objectives set by Inanç Foundation, a private organization dedicated for the education of gifted children, especially for those in families with a limited income. The Inanç foundation will finance a specialized school for this purpose which is expected to begin instruction in the 1993-94 academic year. The preparations for the selection of students have already begun. There will be about 1.5 million primary school graduates at the end of the academic year 1992-1993. A noteworthy aspect in the recruitment policy of the Inanç Foundation school is that, in the first year, at the end of a nationally representative survey which will include approximately 600,000 fifth graders, only 35 children will be accepted. In addition, half of these children live in small villages or hamlets scattered in a vast geographical area. This small number makes the project extremely selective and will probably challenge all the known identification procedures. The selection process to be described in this paper was outlined in a series of meetings with the representatives of Inanç Foundation and experts in various fields.

The selection committee cannot rely upon the records of schools for initial screening, simply because school psychological services, or routine testing and record keeping do not exist. The scores in the state and private school entrance examinations are not reliable criteria either. Children identified by their teachers and encouraged by the family may participate in these nation-wide competitive examinations and may be recruited into the state-supported boarding schools or private schools. Among those recruited into these schools a considerable number of gifted children can undoubtedly be found. However, this selection procedure is based upon material taught at schools and to a large extent on encyclopedic knowledge, and some problem solving abilities which can be boosted by special training. A new chain of private courses have been rapidly expanding in the cities for this purpose. These courses emphasize the test taking skills, review the school content (especially in mathematics and natural sciences), expose their students to shortcuts, and administer frequent multiple-choice examinations to familiarize the students with the actual test-taking situation. Consequently, the scores in these nation-wide examinations are expected to be heavily biased toward the school material, and the child's skill in taking the multiple-choice tests.

Because of the relativity of the grading system in the schools and its heavy emphasis upon rote memorization, rating children according to their school achievement is not a reliable measure either. Certainly, for some children, the scores in the entrance examinations or school grades will be correlated with mental ability. The challenge in the selection procedure is to reduce the contribution of the memorized school material, but to capture the components of mental potential that will preferably be independent of such biases.

Any selection/identification process of giftedness must rely upon an explicit definition of this concept. In our case we have defined it as high "general academic ability", excluding specific artistic talents. A multi-step selection model has been outlined involving four major steps. It begins with the collection of teacher nominations, followed by the group administration of the general ability and academic reasoning tests. Individual testing and interviews make up the third step. A summer camp including further observations and testing is the fourth step. The first phase, the call for teacher nominations, has already been initiated as of December 1992.

Steps of the selection process

Teacher Nominations

In some programs teacher nominations constitute the sole source of identification or acceptance criterion for gifted education (Borland, 1978). In the Turkish case, teacher nominations will be obtained to identify those eligible for inclusion into the "group testing stage". Although the nominations will not be restricted to teachers alone, the teachers' opinions will, nevertheless, constitute the essential source of information about the candidates during the first year. With the cooperation of the Ministry of Education, which presides over a large centralized educational system, the nomination forms will be distributed throughout the country. For the first year, 9 provinces with largest populations are selected in seven representative geographical regions. These centers contain approximately 600,000 fifth graders.

Teacher nomination forms emphasize extremely high ability, and invite teachers to document the achievements of the child they nominated. The teachers are also asked to rate each candidate on the 20 traits which emerged in a previous study as the core characteristics of gifted children (Şahin & Düzen, 1992a). If a teacher nominates more than one child, he/she is asked to rank order these candidates and rate the first candidate on the 20 traits. The teacher nomination forms will be used for the initial screening, and in principle, all children nominated by the teachers will be included in the group testing. The impression we gained during the pilot studies and interviews with the teachers is that, they will be receptive and eager to cooperate

on such an issue. The potential number of candidates is still expected to be very high. Approximately 16.000 teachers will be contacted during this phase of the project and nominations in the range of 10.000 to 12.000 students are expected.

Group Testing

The step after nominations will involve the administration of group tests which will be carried out in the regional centers mentioned above. Group intelligence tests (Raven's SPM and some subscales of the APM) and a locally-developed General Ability (Academic Reasoning) Test will be the two instruments to be used during this phase of the project. It is expected that these tests can be administered in the same day, during the morning and afternoon sessions. Group testing will be carried out simultaneously in all centers.

a) Test of Academic Reasoning. A test of general academic ability, prepared by experts in educational testing, consists of verbal, spatial, quantitative ability sections, and reasoning on natural science and social science problems. The initial 340 items were given in two parallel forms to 669 children in the 6th grade. Items with highest discriminative validity were retained resulting in a 120-item scale (Özçelik & Eski, 1992). The items do not require the specific knowledge of the school content but rather give the necessary information and ask for a reasonable solution. The administration is expected to take about 90 to 120 minutes. The concurrent validity of this test is currently being studied in different samples (Düzen & Şahin, 1992).

b) Raven's SPM Test: This test will be used as a measure of general intelligence (Raven, Court, Raven, 1983). Considerable evidence exists for its cross-cultural suitability (Nehring & Court, 1992; Raven, 1989) and appropriateness in the selection for gifted education programs. A series of studies were initiated to obtain the local norms for the target age group (10 to 12). Additional data collection is also in progress for younger and older age groups. To obtain validity information, the SPM is being administered together with other tests planned to be used in the selection process. Percentile ranks and the IQ equivalents are now being computed in the samples and comparisons are being carried out with the data reported in the published literature. Alternative versions of the RPM are being experimented upon, to adjust the required level of difficulty. The set A of the Advanced Progressive Matrices Test was also included in the pilot studies. The administration of the SPM is expected to take 40 to 60 minutes. An information sheet will also be included to collect more detailed information about the child's background and family characteristics.

It should be emphasized that the most significant reduction in the number of children will take place during this phase of testing. From a total of 10,000 children expected to participate in the group testing, a maximum of 500 will be selected for the next stage, i. e. the individual testing. This means a selection ratio of approximately 1 over 20 children. Therefore, the discussion of the inclusion and exclusion errors comes most pointedly at this stage. The challenge is to reduce these numbers with a minimum error possible and still keep in the sample, those children with an IQ above 140.

It is hoped that a composite index, including the ART and the SPM scores or any subset of items from both tests, will be developed to be the most sensitive predictor combination for the selection of high ability children (Govindarajulu, 1988). Final decision about the best method of composite derivation is not yet taken, we are currently experimenting with various alternatives. Among the candidate procedures are regression equations, involving test, subtest or item information and teacher evaluations.

Individual testing, interviews with the child and the family

A more detailed evaluation is expected to be achieved during the individual testing stage. For

the assessment of ability, the WISC-R will be the main measure on which locally-developed norms are available (Savaşır & Şahin, 1988). The WISC-R may be sensitive enough to this ability range, as was borne out in our pilot studies (Şahin & Düzen, 1992b). In addition, supplementary measures, like problem posing, tests of divergent thinking and creativity might also be included at this phase. Presently, there is some concern over the predictive validity of the creativity tests. Validation studies of the creativity tests are being carried out by independent teams. Their findings will be critically evaluated before a final decision is made for the inclusion of these tests in the individual testing stage. This step will also include a detailed interview about the family, the child's previous achievements, academic and personal status of siblings, parents etc. The administration of the tests and the interviews will be conducted by senior psychologists with over 20 years of experience in working with children of this age.

The number of children to be accepted to the final stage of the selection process (summer camp) will be reduced to 60 or 70, a number twice as large as the final acceptance which is set to be 35 students for the first year.

Summer camp

The candidates selected after the individual testing will be invited for a 20-day summer camp in a convenient setting. In this relaxed, holiday atmosphere, they will be observed in various social interactions, their cooperation, planning and coping skills, and adaptability will be recorded. Various forms of entertainment and new, challenging activities will be introduced. The purpose of this step is to observe and collect information about the personal characteristics of the child, aspects that are not adequately tapped by the instruments in the previous steps. A detailed "observation form" will be kept daily for each child by their supervisors. The ratio of supervisor to child will be very low, allowing for intensive attention for each child.

The agenda for the cognitive activities in the camp is not yet finalized. Although one of the defining characteristics of intelligence has been the "speed in learning the new material", this characteristic may not be captured adequately by the intelligence tests. We would like to include some measures of dynamic testing and learning speed, and tasks that are likely to be correlated with high ability such as learning a new (or exotic) language. Tasks such as analogical reasoning (Stone & Day, 1984), learning complicated chess-like games are mentioned but not yet finalized.

The final decision will be based upon a composite index employing all available evidence about a child. The selection committee is not particularly and fanatically interested to rely upon the test scores. We wish we had other more objective and precise instruments to be used in such a venture. The hard reality is that there will be a critical public, questioning the validity of each step in our selection process and an over-attentive press to publicise - and of course criticize - such an ambitious and pioneer project. Being in charge of a unique experience in our country, we feel obliged to produce objective data, commensurable with the experience in the international practice in the identification of gifted children.

Problems, Questions, Discussion

In the national standardization of WISC-R there were no gender differences among children with a total IQ of 130 and above (Şahin, 1992). Similarly, the preliminary figures from the ongoing Raven' SPM standardization indicate no gender difference among the highest scorers. There seems to be no gender bias in the nominations of teachers either, although there were more males in the highest ability group studied (Şahin & Düzen, 1992b). Our selection criteria will emphasize the general academic ability which is expected to be related to mathematical thinking. In the nation-wide sample, it is possible to expect a male bias, as reported by other researchers (Stanley, 1988). Use of special quotas and separate norms for females as a strategy is suspended until the final gender composition of the sample is obtained. Similarly, special

adjustments might become necessary for the evaluation of children from rural and urban backgrounds, a practice similar to that followed in the evaluation of lower vs. higher SES children in the WISC-R standardization (Savaşır & Şahin, 1988). Similar adjustments may be required in the Raven's SPM and the Academic Reasoning Test.

In the general reviews of the gifted identification process, the hazards of relying upon a single test score are being frequently voiced. Although the multi-step selection process has the advantage of reducing the errors associated with decisions based upon a single criterion, it has the disadvantage of being very costly and time-consuming, and requiring a continuous organization. Studies are needed to develop a shorter, yet equally effective selection model.

The present model provides for opportunities to refine the identification process. In addition to the accumulation of evidence for testing the validity of the decisions, there will be a longitudinal database to fine-tune the instruments used in the selection procedure. Contacts will be maintained with high-ability children not selected. Some of the planned activities include the referral of these children to other institutions, feedback to their family and teachers, keeping them on the mailing list for creative activities, book sharing and periodic visits. Ways are sought to reward teachers who were successful in the identification of gifted children. For the coming years, standardization of some alternative instruments is being planned. Among these, the dynamic testing procedures will have a priority. Work has already begun by another team on the standardization of the Leiter Battery. Work is also planned on the PPVT-R for the initial screening, and the Woodcock-Johnson battery for the subsequent stages.

The real validity of the identification model, of course, is the life-long productivity of the children selected (Renzulli, 1990; Sternberg, 1987). The validity to be obtained through school achievements is only the first wave, and many more waves of data have to be collected in the future.

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Author notes

1. Correspondence concerning this paper should be addressed to:

Nail Şahin
Professor of Developmental Psychology
Middle East Technical University
Department of Psychology
Ankara 06535 Türkiye

2. Comments about the selection process may also be sent to:

İnanç Foundation
Attention of Dr. Füsün Akarsu
Educational Coordinator
Sarayardı Caddesi, No 24
Acıbadem, İstanbul
Türkiye

Subskills of spatial ability and their relationships to success in accelerated mathematics courses

Heinrich Stumpf

Center for Talented Youth, The Johns Hopkins University, Baltimore, USA

Abstract

The study explored what subskills of spatial ability make a contribution to the prediction of success in accelerated mathematics courses. We compiled a battery of 14 types of spatial tests that broadly sample the ways in which spatial ability has been operationally defined in terms of tests so far.

Two forms of this battery were administered to large samples of students taking courses offered by the Center for Talented Youth. Many of the 28 subtests examined had an appropriate level of difficulty for the population under study; some turned out to be too easy. The reliability estimates for most of the tests were at least adequate and in some cases very high. A subset of the complex tasks requiring spatial visualization in three dimensions (pattern assembly, paper folding, surface development, and perspectives tasks) turned out to be the most valid predictors of success in mathematics courses. The correlations of these tasks with the criterion (success in mathematics education) compared very well with the predictive validity of the mathematical section of the SAT. Most of the tests requiring the perception, retention, and transformation of visual forms within a plane showed low correlations with the criterion, as did three-dimensional mental rotation tasks. We expect that a revised version of the battery will enable us to improve our present instruments for predicting success in learning mathematics at the advanced high school level.

Subskills of spatial ability and their relationships to success in accelerated mathematics courses

This paper deals with the problem of predicting success in accelerated mathematics education by measures of spatial ability. Spatial ability will be broadly defined here as the ability to understand the spatial relationships among objects, and a large range of spatial tasks will be considered as possible predictors of success.

There is no doubt that tests of mathematical and, possibly, verbal reasoning ability should play the most important role in predicting success in studying mathematics. The merits of such tests have been highlighted in many publications, such as Stanley's (1977) work on the Study of Mathematically Precocious Youth (SMPY). Yet a number of theoretical and empirical studies suggest that spatial ability might make an additional contribution to predicting success and thus help to improve the validity of our present talent identification procedures.

Reasoning tests (especially indicators of mathematical reasoning such as the mathematical section of the Scholastic Aptitude Test) are likely to set the standards against which measures

of spatial ability are to be compared, but there are several reasons to expect that spatial tests might be useful in predicting success. Four of these arguments will be mentioned here.

First is the observation that many problems in mathematics have spatial implications. This is most evident in geometry, but it is also true for many other areas of mathematics. The mathematician imagining the relationships among different sets of numbers or the graph of a complex function also uses spatial concepts. These observations have been convincing enough for psychometricians to include spatial tests in batteries designed to predict the success of students in mathematics and science. A prominent example of such a battery is the collection of Study Field Oriented Tests developed in Germany (Blum, Hensgen, & Trost, 1985). The Study Field Oriented Test for Mathematics, for instance, includes intersection tasks as a spatial subtest.

The second reason is that observations in cognitive psychology point out the use of spatial problem solving strategies in everyday life, mathematics, and the sciences. This literature has recently been summarized by West, Morris, and Nichol (1985). A typical view of how spatial strategies are used in mathematical problem solving is expressed by Hermelin and O'Connor (1986, p. 155): "Those who are gifted for mathematics can convert verbal codes into spatial images, are able to operate on these images, and can retranslate their solution into verbal form."

The third reason is that a number of theoretical models of mathematical ability and of talent in fields where mathematics is important explicitly postulate spatial abilities as important components. An example of such a model is Ruppell's (1991) theory of technological innovative talent, where this component is called "structuring flexibility."

The fourth and most important reason that spatial tests might be useful in predicting success in mathematics courses is that many empirical studies link spatial ability to mathematical talent and talent in fields where mathematics is important. Most of these studies are correlational. Tests of spatial ability have been related to success in mathematics (e. g., Bishop, 1980; Fennema, 1974; Fennema & Sherman, 1977; Guay & McDaniel, 1977; Hermelin & O'Connor, 1986; Hills, 1957; Kovac, 1989; Lean & Clements, 1981; Sherman, 1980; Smith, 1964; Tartre, 1990; Weiner & Robinson, 1986), natural sciences (Baker & Talley, 1974; Bennett, Seashore, & Wesman, 1973; Tracy, 1990), and engineering (Heinrich, d'Costa, & Blankenbaker, 1988; Poole & Stanley, 1972).

This body of research also includes factor analytic studies in which spatial ability was found to be a component of mathematical talent (McCallum, Smith, & Eliot, 1979; Vernon, 1950). Although most of these studies reported substantial correlations between spatial ability tests and performance in mathematics and science, their results are not entirely consistent, because there are a number of counter-examples (Lean & Clements, 1981; Weiner & Robinson, 1986).

Despite widespread support for the view that spatial ability is important in mathematical and scientific problem solving, spatial ability tests have not played a prominent part in most of the large programs in which tests are used operationally to identify mathematical and scientific talent. Psychometricians at the Educational Testing Service, for example, developed a large series of spatial tests (some of which will be mentioned below), but did not include a single one in a large-scale program like the Scholastic Aptitude Test. As one of a few large-scale programs, the Test for Medical Studies (Institut für Test- und Begabungsforschung, 1990) used in Germany does have a spatial subtest, but the predictive validity of this test proved to be much lower than the validity of the mathematical reasoning tests also included in the battery (Stumpf & Nauels, 1990).

The inconsistency of research results and the mixed success of practical applications of spatial tests might be due to the facts that the various studies used different spatial tests and that most of them employed only a small number of them, in many cases only one. But according to theories of spatial ability - to mention only the most recent ones by Lohman (1988) as well as

by Guttman, Epstein, Amir, and Guttman (1990) and Carroll (1993) - the construct of spatial ability is multifaceted and involves several relatively independent components or subskills.

It appears that only certain subskills make substantial contributions to the prediction of the criterion (success in mathematics education), but it is not clear which skills these are. If we look at two components that are distinguished by most theories, spatial visualization and spatial orientation, most researchers and theorists would agree that visualization is the more salient factor, but an empirical study by Hills (1957) pointed to the opposite.

The purpose of the present study was to find out which subskills of spatial ability make a contribution to predicting success in an area of accelerated mathematical education.

Specifically, summer courses offered by the Center for Talented Youth (CTY) at The Johns Hopkins University in Baltimore were evaluated. We tried to assess spatial ability as broadly as possible and to examine what components of this ability can make a contribution to predicting success. A large number of potential measures of spatial ability for such an assessment exist. Eliot and Smith (1983) attempted to survey and collect all existing figural tests of spatial ability and found several hundred of them. It might appear hopeless to try a comprehensive assessment of the construct as it has so far been operationally defined in terms of figural tests, but in collecting the tests, Eliot (1980, 1983; see also Eliot, Stumpf, and Tissot, 1992) made an important observation: He found that the existing tests (with very few exceptions) can each be classified into one of 16 categories.

These categories, listed in Table 1, can be grouped, in turn, into two divisions - a recognition and a manipulation division.

In terms of Kelley's (1928) definition of spatial ability, the tasks of the recognition division require the perception, retention, and transformation of visual forms within a two-dimensional plane, whereas the manipulation tasks require the mental manipulation of visual shapes across a plane (Eliot, 1983, p. 11). More detailed information on the rationale of the classification is presented in two of Eliot's publications (Eliot, 1980, 1983).

Table 1: The Categories of Eliot's Classification of Figural Spatial Tasks

Recognition Division:	
Category 1	Perceptual Speed Tasks
Category 2	Copying Tasks
Category 3	Maze Tasks
Category 4	Figure-Ground Tasks
Category 5	Visual Memory Tasks
Category 6	Gestalt Resolution Tasks
Category 7	Paper Formboard Tasks
Category 8	Figural Rotation Tasks
Manipulation Division:	
Category 9	Block Tasks
Category 10	Intersection Tasks
Category 11	Block Rotation: External
Category 12	Block Rotation: Internal
Category 13	Paper Folding Tasks
Category 14	Pattern Assembly Tasks
Category 15	Surface Development Tasks
Category 16	Perspectives Tasks

Note: Adapted from Eliot *et al.*, 1992, p. 6.

Table 2: Subtests of the CTY Spatial Test Battery, Form AA, Recognition Division

No.	Name	Category	Author(s)
10	Comparative Guidance and Placement Program: Form QPG, Book 3: Path Finding Test	Copying and Maze Tasks	Educational Testing Service (1959)
3	Kit of Reference Tests for Cognitive Factors: Hidden Figures Test, CF-1	Figure-Ground Tasks	French, Ekstrom, & Price (1963)
6	Learning Figures Test	Visual Memory Tasks	Institute for Test Development & Talent Research (1986)
11	Kit of Factor-Referenced Cognitive Tests, Gestalt Completion Test: Cs-1	Gestalt Resolution Tasks	Ekstrom, French, Harman & Dermen (1976)
8	Senior Aptitude Test for Indian South African: Form B (Paper Formboard Test)	Paper Formboard Tasks	DeVilliers, Oosthuizen, & Kruger (1977)
12	Senior Aptitude Tests: Subtest 7: Spatial 2D (Figural Rotation Test)	Figural Rotation Tasks	Fouche & Alberts (1978)

Note: The number in the left column indicates the position of the subtest in the battery.

Table 3: Subtests of the CTY Spatial Test Battery, Form BB, Recognition Division

No.	Name	Category	Author(s)
10	Kit of Reference Tests for Cognitive Factors, Copying Test: CF-3	Copying Tasks	French, Ekstrom & Price (1963)
3	Special Aptitude - Spatial Relations: Hidden Figures Test	Figure-Ground Tasks	College Entrance Examination Board (1951)
6	Visual Memory Test	Visual Memory Tasks	Stumpf (1992)
13	Street Gestalt Completion Test	Gestalt Resolution Tasks	Street (1931)
8	Kit of Reference Tests for Cognitive Factors, Paper Formboard Test, Vz-1	Paper Formboard Tasks	French, Ekstrom & Price (1963)
12	Kit of Reference Tests for Cognitive Factors, Card Rotations Test, S-1	Figural Rotation Tasks	French, Ekstrom, & Price (1963)

Note: The number in the left column indicates the position of the subtest in the battery.

Relying on this classification, one should be able to represent most of the major ways in which spatial ability has been operationally defined so far in terms of figural tests in one test battery, if a very large one.

Method

The CTY Spatial Test Battery (STB)

In 1991 and 1992, an experimental version of such a battery, the CTY Spatial Test Battery (STB; Eliot & Stumpf, 1992) was developed at the Center for Talented Youth. This battery has 14 subtests and three Forms, AA, BB, and CC. The present paper will deal with Forms AA and BB only. The number of subtests in each Form was limited to 14 in order to make the administration of the battery feasible. In compiling the battery, we deleted the category of Perceptual Speed Tasks and combined the Copying and Maze categories into one. Twenty-seven of the 28 subtests in the two Forms had been published and used before; the remaining one - the Visual Memory Test of Form BB - was developed at CTY.

Tables 2 through 5 give an overview of the tests included in Forms AA and BB of the STB. In the tables, the subtests appear in the order of the categories they are designed to cover. The numbers of the subtests in the test booklets are specified in the first column. Both Forms have two Parts, the first of which contains the subtests 1 through 6, the second, the subtests 7 through 14. The administration of each Part takes about one hour and a half. Sample items for most of the subtests are given in the directory of spatial tests by Eliot and Smith (1983).

Procedure

The Battery was administered to a sample of students taking CTY summer courses, including courses in mathematics and natural sciences. The courses are open to students who have reached at least the seventh grade and attained qualifying scores on the Scholastic Aptitude Test. To qualify for courses in mathematics, the youngest applicants (up to 13 years and six months) needed scores of at least 500 on the mathematical section of the SAT and at least 930 on the whole SAT. The oldest students (16 years and six months to 17 years) needed scores of at least 670 on the mathematical section of the SAT and of 1270 on the SAT as a whole.

CTY mathematics courses are demanding and fast paced. They last approximately three weeks. Topics covered include pre-calculus mathematics, linear algebra, mathematical logic, history of number theory, and calculus. The classes are small - usually 16 students or less in one class. At the end of every course, the CTY teacher writes a detailed evaluation of the success of every student in the class. Such an evaluation summarizes the observations made by the teacher on each student, appraises his or her performance, makes statements on strengths and weaknesses, and gives recommendations for the further education of the student. These evaluations provided the criterion against which the subtests of the STB were validated in the present study. The evaluations, usually about one page long, were rated by two experts on a five point scale. The reliability of these ratings proved to be rather high, with a correlation of .91 between the ratings of the two experts. Therefore, the two ratings were combined into one criterion measure by averaging them. This composite had a split-half reliability of .95.

Clearly, this criterion score is difficult to predict because the time of observation is short and the score incorporates arbitrary elements, not only from the teachers but also from the raters. It was expected, however, that the validity of the primary predictor, the mathematical section of the SAT, would set a standard against which the validity of the STB could be compared.

Subjects

The STB was administered at one site where the CTY courses were being offered to about 950 students and where the students lived for three weeks. All students at the site were invited to take the STB; participation was voluntary. The test was administered in large classrooms by CTY teachers.

Table 4: Subtests of the CTY Spatial Test Battery, Form AA, Manipulation Division

No.	Name	Category	Author(s)
7	Thurstone's Primary Mental Abilities Tests: Subtest 17 (Block Counting Test)	Block Tasks	Thurstone (1937)
4	Special Aptitude - Spatial Relations: Subtest 1, (Intersections Test)	Intersection Tasks	College Entrance Examination Board (1951)
2	Eliot-Price Mental Rotations Test	Block Rotation Tasks (External)	Eliot & Price (1976)
14	Special Aptitude - Spatial Relations: Subtest 4 (Identical Blocks Test)	Block Rotation Tasks (Internal)	College Entrance Examination Board (1951)
5	Kit of Reference Tests for Cognitive Factors: Paper Folding Test, Vz-2	Paper Folding Tasks	French, Ekstrom, & Price (1963)
9	Three Dimensional Test: RBH-0125 Subtest (Pattern Assembly Test)	Pattern Assembly Tasks	Richardson, Bellows, & Henry Staff (1950)
13	Special Aptitude - Spatial Relations: Subtest 3, (Surface Development Test)	Surface Development Tasks	College Entrance Examination Board (1951)
1	Guay's Visualization of Views Test	Perspectives Tasks	Guay (1976)

Note: The number in the left column indicates the position of the subtest in the battery.

Part I of Form AA was taken by 355 students. The number of students completing Part II of Form AA was 218. As for Form BB, a total of 279 students took Part I of the test; 187 took Part II. The age of the students in all four samples ranged from 12 to 17 years. The data of the samples mentioned so far were used in the tests analyses reported in the following section. Not all of these students, however, took mathematics courses. The correlations of the STB subtests with the criterion score reported refer to students for whom both STB data and criterion scores were available. The numbers of students included in the correlation analyses are specified in the results section.

Table 5: Subtests of the CTY Spatial Test Battery, Form BB, Manipulation Division

No.	Name	Category	Author(s)
7	Factored Aptitude Series: Subtest 12: Blocks Test	Block Tasks	King (1956)
4	Special Aptitude - Spatial Relations Tests, Form M: Intersections Test	Intersection Tasks	College Entrance Examination Board (1938)
2	Mental Rotations Test	Block Rotation Tasks (External)	Vandenberg & Kuse (1978)
14	Guay's Visualization of Rotations Test	Block Rotation Tasks (Internal)	Guay (1976)
5	Structure of Intellect Tests: Paper Folding Test	Paper Folding Tasks	Guilford (1968)
9	Special Aptitude - Spatial Relations Subtest 3 (Pattern Assembly Test)	Pattern Assembly Tasks	College Entrance Examination Board (1951)
11	Kit of Reference Tests for Cognitive Factors: Surface Development Test, Vz-3	Surface Development Tasks	French, Ekstrom, & Price (1963)
1	Cube Perspectives Test	Perspectives Tasks	Stumpf & Fay (1983)

Note: The number in the left column indicates the position of the subtest in the battery.

Results

As documented in Tables 2 through 5, the various subtests of the STB were developed in largely differing contexts. Therefore, their appropriateness for the present population had to be examined before considering their validity coefficients. Thus, some of the basic psychometric properties of the subtests will be described before the validity of the battery is discussed.

Basic information on the psychometric properties of the STB in the population specified above is given in Tables 6 and 7. Most of the tests showed an appropriate amount of reliability for the present population, although some proved to be rather easy.

In Form AA (see Table 6), five of the subtests had average p -values in the range of .40 to .60, which is considered to be optimal for a study like the present one. The Hidden Figures Test turned out to be slightly too difficult in our sample. The Path Finding, Gestalt Completion, Paper Formboard, Figural Rotations, Eliot-Price Mental Rotations, Identical Blocks, Paper Folding, and Pattern Assembly tests were too easy for our population, but despite this, most of these tests showed rather high levels of reliability. The Cronbach Alpha coefficients for 13 of the 14 tests are larger than .70, the minimum level of reliability considered to be adequate in a research like ours. It should be noted, however, that 10 of these tests had Alpha- coefficients in excess of .80, which is very encouraging. The test that showed a deficit in internal consistency is the Gestalt Completion Task.

In Form BB (see Table 7), the average p -values for 10 of the 14 subtests are within the range of .40 to .60. In the recognition division, the Hidden Figures Test proved to be too difficult

Table 6: Psychometric Properties of the CTY Spatial Test Battery, Form AA

Subtest Name	N of Items	Time Limit	Mean	SD	Avg. p	Cronbach Alpha
Path Finding Test	25	4	19.6	4.2	.78	.84
Hidden Figures Test	20	12	7.4	3.8	.37	.75
Learning Figures	20	5/5	8.3	3.8	.41	.71
Gestalt Completion	20	4	12.8	2.9	.64	.69
Paper Formboard Test	25	12	18.6	5.9	.74	.91
Figural Rotations	30	6	25.0	4.9	.83	.88
Block Counting Test	80	8	41.1	14.5	.51	.95
Intersections Test	25	10	12.2	5.3	.49	.83
EP Mental Rotations	20	12	14.2	4.4	.71	.84
Identical Blocks	20	10	13.5	5.1	.68	.88
Paper Folding Test	20	12	16.1	2.9	.81	.75
Pattern Assembly	50	15	32.7	12.6	.65	.96
Surface Development	30	12	14.6	7.9	.49	.93
Guay's Visualization of Views Test	21	12	11.6	4.7	.55	.84

Note: The first time specified for the Visual Memory Test refers to the memorization period, the second to the reproduction period.

Table 7: Psychometric Properties of the CTY Spatial Test Battery, Form BB

Subtest Name	N of Items	Time Limit	Mean	SD	Avg. p	Cronbach Alpha
Copying Test CF-3	64	6	32.5	11.1	.51	.95
Hidden Figures	16	10	5.5	3.1	.34	.70
Visual Memory	20	5/5	8.4	4.3	.42	.79
Gestalt Completion Test Cs-1	24	4	12.8	2.9	.53	.53
Formboard	24	12	11.3	4.3	.47	.80
Card Rotations S-1	224	6	110.8	40.3	.50	.98
Block Counting	30	8	21.1	4.0	.70	.72
Intersections	25	10	12.0	4.5	.48	.77
Mental Rotations	20	10	10.0	5.1	.50	.88
Visualization of Rotations	25	12	15.6	5.6	.62	.86
Paper Folding	30	10	13.2	5.9	.44	.85
Pattern Assembly	25	15	10.0	4.1	.40	.82
Surface Development	60	12	44.7	13.8	.75	.96
Cube Perspectives	21	12	11.7	3.9	.56	.73

Note: The first time specified for the Visual Memory Test refers to the memorization period, the second to the reproduction period.

under the present time allowance. In the manipulation division, the Block Counting and Surface Development Tests and, fractionally, the Visualization of Rotations Test turned out to be too easy. As far as the Cronbach-Alpha coefficients are concerned, eight tests showed high levels of internal consistency (Alpha > .79). The Hidden Figures and the newly developed Visual Memory Test, as well as the Block Counting, Intersections and Cube Perspectives Tests also proved to have adequate degrees of reliability. The Gestalt Completion Test, however, did not turn out to be internally consistent enough for routine application in this population.

After acceptable levels of difficulty and reliability for the majority of the tests had been established, we addressed the question of whether the tests can predict success in the CTY summer courses in mathematics.

The correlations of the scores on the subtests of the STB and on the two parts of the Scholastic Aptitude Test (SAT) and the criterion scores are displayed in Table 8.

Table 8: Correlations of the Scores on the Scholastic Aptitude Test and the CTY Spatial Test Battery with the Average Course Success Rating

SAT, Mathematical Section	.31	
SAT, Verbal Section	.32	
<hr/>		
CTY Spatial Test Battery:	Form AA	Form BB
Copying/Maze Tasks	.01	.02
Figure-Ground Tasks	.09	.34
Visual Memory Tasks	.13	.34
Gestalt Resolution Tasks	.09	.16
Paper Formboard Tasks	.19	.10
Figural Rotation Tasks	.09	.05
Block Tasks	.20	.08
Intersection Tasks	.17	.20
Block Rotation: External	.16	.06
Block Rotation: Internal	.07	.25
Paper Folding Tasks	.36	.38
Pattern Assembly Tasks	.37	.45
Surface Development Tasks	.38	.20
Perspectives Tasks	.23	.45

In the present study, each subtest of the STB represents one of the item types specified above. Since the key question of the study was what item types predict success in mathematics courses, irrespective of the reliability of the specific test, the correlations of the STB subtests with the criterion score of success in the mathematics classes were corrected for attenuation. The correlations reported in Table 8 rely on 108 students for Part I of Form AA, 68 subjects for Part II of the same Form, 83 students for Part I of Form BB, and 49 students for Part II of Form BB.

The SAT had been used to select the students for the courses. Thus, there was a restriction of range on the distribution of the SAT scores. This restriction turned out to be smaller than expected: The standard deviations of the mathematical and verbal sections were 85.69 and 69.48, respectively, as compared to standard deviations of 100 in the overall SAT population. Nevertheless, the correlations of the SAT scores with the ratings were not only corrected for unreliability, but also for restriction of range using Thorndike's (1950) formula.

The correlations with the criterion differ widely across the predictors. Surprisingly, the correlation of the verbal section of the SAT with the criterion was about the same as the predictive validity of the mathematical section. These validity coefficients, in turn, proved to be

lower than the validity of some of the STB subtests. In the two Forms of the STB, the Copying and Maze Tasks and the Figural Rotation Tasks showed essentially zero correlations with the average ratings, as did the Figure-Ground, Gestalt Resolution, Figural Rotation and Internal Block Rotation Tasks in Form AA and the Figural Rotation, Block Counting and External Block Rotation Tasks in Form BB. The Visual Memory, Paper Formboard, Block Counting, Intersections, External Block Rotation, and Perspectives Tests in Form AA, as well as the Closure, Paper Formboard, Intersections, and Surface Development Test in Form BB also showed low correlations ($.10 < r < .25$) with the criterion measure. The validity coefficients of the Figure-Ground, Visual Memory, and Internal Block Rotation Tests in Form BB proved to be higher than the coefficients just mentioned; some of these correlations slightly exceeded the predictive validity coefficients of the two sections of the SAT, but for these item types, the validity coefficients were not consistent across the two Forms of the STB. The most valid subtests across the two Forms were the Paper Folding and Pattern Assembly Tasks, but the Surface Development Test in Form AA and the Perspectives Test in Form BB also showed high validity coefficients as compared to the two sections of the SAT.

Discussion

The difficulty level of many of the subtests in the CTY Spatial Test Battery was found to be appropriate for the population tested. In addition, the internal consistency of most subtests was at least acceptable and, in many cases, high.

In assessing the predictive validity coefficients of the subtests, one should keep in mind that the criterion is difficult to predict, as mentioned above and documented by the relatively low correlation of the mathematical section of the SAT with the average rating.

The differences among the validity coefficients for the various subtests of the STB demonstrate that not all subskills of spatial ability are good predictors of success in learning mathematics. For example, many of the subtests in the recognition division of Eliot's classification proved to be essentially uncorrelated with success in the accelerated mathematics courses. Several of the more complex proficiencies assessed by the subtests of the manipulation division, however, showed closer relationships with the criterion than did the mathematical section of the SAT, whose validity coefficient was originally expected to be an upper limit for the correlations of the STB subtests with the criterion. Not all of the tasks in the manipulation division, however, turned out to be predictively valid. In particular, the mental rotation tasks, which are often believed to measure a core component of spatial ability, proved to have only trivial or low correlations with success in the mathematics courses. The core of the predictive validity of spatial ability with respect to mathematics learning, therefore, appears to rely on the complex visualization skills assessed by the Pattern Assembly and Paper Folding tasks and, probably, also by Surface Development and Perspectives tests. In the latter two cases, however, the results obtained here are not entirely consistent across the two Forms of the STB.

As mentioned above, the findings of the earlier studies on the prediction of success in mathematics education are inconsistent to some extent, although most of these studies found positive correlations between scores on spatial tests and the various criteria studied. Given the results of our study, a major part of this inconsistency is likely to be due to the facts that different subskills of spatial ability were assessed and that not all of these abilities are essential for success in mathematics education. The predictive validity of those subskills of spatial ability that are related to success in the criterion performance, however, compares very well to the predictive power of well-established mathematical reasoning tests such as the quantitative section of the SAT. The validity coefficients of the subtests of the STB measuring these skills are certainly high enough to encourage further studies with a revised version of the CTY Spatial Test Battery. A revised (and abridged) version of the STB might well become an economical instrument that

can be used to improve our present methods for identifying mathematical talent in young students.

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The DANTE test

Hermann Ruppell

Seminar for Education, Department of Educational Psychology, University of Cologne,
Cologne, Germany

DANTE is a process-oriented, computer-guided testing procedure. The computer presents complex thought problems and microstructurally monitors, guides and analyzes long term thought processes that sometimes last hours. This is made possible by the analysis of solution steps, mistakes, and particularly answer sensitive assistance. With the help of the underlying theory of information processing it is possible to analyze thought processes in detail.

DANTE does not belong to the field of traditional intelligence diagnostics, but rather to that of experimental psychology. Methodically and diagnostically DANTE represents a new kind of test that is characterized by the attempt to register the qualities of inventive thinking, i. e. *Analogy Sensibility (AS)*, *Selective Elaboration (SE)*, *Coordination Capacity (CC)*, *Structuring Flexibility (SF)* and *Synergetical Thinking (ST)*. This is made possible by presenting a complex thought problem within a limited time span and employing diagnostic evaluation scales. The thought problem is characterized by a long lasting composition process and a coherent succession of thought challenges. Their successful management calls for gradually more complex thought processes. Finally a coherent *problem space* develops similar to the real process of inventing:

- at first you learn all the relevant facts and represent them coherently,
- then you infer further by combining different thought processes
- and finally you integrate everything within a flexible representation.

The DANTE test, trying to maximize its logical validity, also consists of three analogical, succeeding phases:

- a phase of preactivation and gradual immersion,
- a phase of gradually more complex deliberations
- and an integration phase, in which the different problem situations have to be related to one another in order to construct an image of the whole situation.

By monitoring the thought behavior of a DANTE candidate, the relative performance of the qualities of inventive thinking can be deduced. The performance of

- *Structural Analogy Sensibility* can be deduced from structural transfers the candidate uses when confronted with structure analogical objects and situations,
- *Procedural Analogy Sensibility* can be deduced from the recognition of analogical problem solving patterns within the framework of transfer hierarchy,
- *Selective Elaboration* can be deduced from bridge-head constructions, i.e. the development of cognitive nets while drawing apparent conclusions,
- *Coordination Capacity* can be deduced from conditional compilations, i.e. the combination of several conclusions,
- *Structuring Flexibility* can be deduced from varying visualization complexes and
- *Synergetical Thinking* can be deduced from the aggressive use of pictures, statements and analogies that support each other.

In view of the DANTE development these diverging challenges had to be merged in a way that a homogeneous, well rounded problem solving situation was created. This situation is supposed to present a long lasting, exciting challenge of the limits of creative information processing as used by inventive thinkers. Thus, the development of DANTE became an inventive problem itself. Its creators had to step into the shoes of inventors themselves while keeping in mind the DANTE goals. After a number of revisions that are characteristic for inventions, the DANTE activities, i.e. the *Logical Combinations of Spatial Structures* (see below), were created. They make up the DANTE test in the form of a succession of exercises, which the candidate has to interrelate.

After a casual phase of visual preactivation, an orientation phase of gradual immersion follows, employing simple *Logical Combinations of Spatial Structures*. These combinations gradually become more complex making use of transfer effects and soon reach their full complexity. The ultimate challenge of inventive thinking, i.e. the recognition of analogical conclusive patterns becomes more and more important. Those patterns also include structures that fulfill the prerequisite of a conditional premise but negate its consequence.

Logical Combinations of Spatial Structures

The Logical Combinations of Spatial Structures call for the holistic visualization of spatial structures using familiar, analogically structured images of every day situations. Moreover, they challenge a flexible, three dimensional combination of the different logical patterns. DANTE candidates have to decide which structures can coexist within a defined cubic lattice without displacing one another; which ones fit well together and which do not.

Configurations made up of colored cubes are used as spatial structures and a 3 by 3 by 3 cubic lattice serves as the space in which different figures are supposed to be combined. The candidate is presented with various pictures of structures at the very beginning of the test, even before he gets to read the instructions or knows what the test is all about. The pictures appear as a kind of slide show; they are preactivated as the experimental psychologist would say. During the actual test the candidate merely gets to read descriptions of the structure pictures and does not get to see them again.

These propositional complexes represent premises that serve as starting points for the Logical Combinations of Spatial Structures. One premise after the other is presented and the candidate has to visualize the specific structure and decide whether the different structures fit into the limited cubic lattice without displacing each other. If they do not fit because parts of the different structures displace each other, then the premises cannot be valid simultaneously. It is the candidate's task to determine whether there is a contradiction between the premises or not. A contradiction exists if one cube inside the cubic lattice is required to be of two different colors simultaneously.

An added difficulty is that the candidate can only see the last premise for making his decision, because only that one is visible on the monitor. Each premise disappears as soon as the next one is presented. In order to combine the different premises the candidate has to constantly hold in his mind all previous ones. In view of the limited capacity of the working memory the combination of four, five or six premises is only possible if the appropriate structures are held as visual entities. This process is supported by analogically structured images of every day situations. The premises are not presented by themselves but always in connection with analogical objects or situations.

With the help of the analogies the defined structures can be derived by structural transfer and if the *Analogy Sensibility* is high they can be swiftly reconstructed at all times. In case this does not work, modified assistance is offered. If a structure of a former, at the moment not visible, premise cannot be visualized, then the candidate may look up its analogy. If this is still not

enough, he can also look up the premise itself. Logical conclusions become more important, the more conditional premises are included, i.e. those that make their existence of the defined structures dependent upon the existence of other conditions.

Conditionally defined structures come alive only if their prerequisites exist. As long as this is not clear, the different possibilities and potential structure combinations have to be handled flexibly. Here, the DANTE qualities play an important role.

The *Coordination Capacity* is challenged because conditional premises do not offer fixed starting points in contrast to factual ones. In case of the more complex combinations, which introduce four or five conditional premises, the candidate has to begin by positioning all possible structures in the cubic lattice temporarily. He may be able to combine different structures that do not have a fixed position in the cubic lattice by using tentative conclusions. If the succession of premises becomes longer and longer, some of these tentative conclusions have to be put aside for a while, so that they do not use up the whole capacity of the working memory but still stay on hand. This is the only way to ensure that they can initiate the necessary chain of conclusions as soon as the factual premise is presented.

As the number of premises that are supposed to be put together increases, Coordination Capacity can become very taxed and the combination of conditionally defined structures can be compared to artistic juggling. The candidate has to find out whether a structure together with others fulfills the prerequisite of a conditional premise thereby activating another structure, which in turn may fulfill the prerequisite of yet another conditional premise and so forth.

These irritating thought games sometimes call for the consideration of four, five, or even six different statements. The test creator, who is well aware of this, can challenge the Coordination Capacity to its limits by cleverly compiling statements that condition one another.

Analogical Inference Patterns

The transfer of *Analogical Inference Patterns* between superficially totally different combinations, i.e. between those that do not have one premise in common, presents the most difficult synergetical challenge of the DANTE qualities. It is the ultimate challenge of inventive thinking. Just like the great analogies used for inventing, discovering or creating, so does this transfer call for spotting deeply rooted similarities between knowledge areas that do not seem to have anything in common and for using this cognition for further deliberations.

Those who accept this challenge of the DANTE test, deal with it aggressively or even have fun with it are prone to get to the highest level of human information processing. There, the boundaries between knowledge areas start floating and the structures become transparent. One after the other appears as just another case of the same, identical in principle but still different.

Inspection of the problem space

In order to catch hold of the *problem space*, which has developed in the mind of the candidate while solving the task, the candidate is confronted with half a dozen statements right after thinking. He has to decide whether the individual statement is true, false or whether he cannot make up his mind. There is no time limit but no assistance is offered either and there is no feedback.

In the DANTE test the statements not only test the candidate, but also give him a number of solution cues, hint at more general thought strategies and systematically reconstruct the problem solving process for those who lost track. Thus, the statements are not only decisive for diagnostic reasons but also constitute a learning component. In this way the DANTE test harmonically connects process orientation with the concept of a learning framework.

The DANTE thought hierarchy

The Logical Combinations of Spatial Structures are embedded within a *transfer hierarchy*, i. e. the solution of the more simple exercises facilitates that of the more complex ones by analogical transfer. The DANTE qualities can fully develop by following this thought hierarchy:

- starting with the solution of simple combinations and gradually increasing the use of the DANTE qualities,
- then fully challenging them by introducing the more complex combinations
- and finally requiring a cognitive powerplay with Analogical Inference Patterns.

By gradually increasing the use of the DANTE qualities the first phase is designed in a way that for those whose qualities of inventive thinking are low, it becomes hell. The DANTE test saves those candidates more trouble and after this phase lets them know that their monitored thought behavior did not indicate any exceptional talent for visual-analogical, inductive-innovative problem solving.

The survivors of this first phase are directly sent to purgatory and confronted with the more complex tasks. This is where they can really make use of their DANTE qualities. Those who playfully succeed in this second phase are sent to the third one, the ideal place for proving their DANTE qualities. In this last phase the recognition of analogical inference patterns is mainly tested.

Evaluation

DANTE's evaluation applies to

- the quantification of the DANTE profile,
- the calculation of the QI (Qualities of Information processing),
- the record of the performance of the DANTE qualities on a time scale and
- the concluding interpretation of these data.

The DANTE profile is a quantitative presentation of the performance intensity of the DANTE qualities during the thought process. The record of the qualities on a time scale describes the changes that occurred during the candidate's thought process and the concluding interpretation presents a qualitative description of the whole thought process. This last one can be used in a diagnostic written report on the performance of the candidate's abilities.

The DANTE test places the candidates in four hierarchical groups, which are made up of

- those who are less suited for innovative-inventive problem solving and have trouble with visual-analogical thinking,
- those who tend to think in a visual-analogical way and only falter when the Logical Combinations of Spatial Structures become too complex,
- those who tend to think in a visual-analogical way and even succeed when confronted with more complex Logical Combinations of Spatial Structures, but fail when it comes to the analogical inference patterns and
- those who accept the ultimate challenge of inventive thinking, i.e. the Analogical Inference Patterns.

Science Process Skills Tests and Logical Thinking Test for identifying the scientifically gifted in Korea

Seokee Cho

*Division of Gifted and Talented Education and Research,
Korean Educational Development Institute, Seoul, Korea*

Introduction

The scientifically gifted are the main resources that the Republic of Korea can count on to develop advanced science and technology. The Korean government has recognized the necessity of developing the full potential of the scientifically gifted since the late 1970's; nevertheless only 12% of the scientifically gifted senior high school students have been provided with special programs at 11 Science high schools. Those schools are self-contained special schools for the scientifically gifted established since 1983.

Considering the importance of early identification and development of the gifted's potential, it is necessary to develop instruments for identifying the scientifically gifted as early as the elementary school level.

This study aims at evaluating the possibility and appropriateness of using Logical Thinking Test for identifying the scientifically gifted at the elementary school level in Korea. Coefficients of validity and reliability with the scientifically gifted in Grades 5 and 6 were analyzed on the basis of classical test theory.

However, classical test theory does not yield information about the appropriateness of the test and items on the test for identifying the gifted, who are superior to most other students. In addition, all the statistics regarding reliability, validity, or item difficulty, and discrimination measured according to classical test theory are influenced by the sample size of examinees. And estimates of students' ability vary directly with the difficulty of the test items. If test items are difficult, examinees' ability will be estimated as low. In contrast, examinees' ability will be estimated as high when test items are not difficult. In addition, the classical test theory does not allow the probability of an examinee getting the right answer for a certain item simply by chance. Classical test theory assumes an equal measurement error to all subjects. However, consistency of test score is determined by the examinee's ability. Excellent examinees are more consistent in dealing with test items than inferior examinees are. For these reasons, the effectiveness of tests in identifying the scientifically gifted in Grades 5 and 6 is analyzed on the basis of item response theory.

Theoretical Background of Science Process Skills Tests and Logical Thinking Test

The scientifically gifted are defined as "those who are, compared to their age group, at the upper 85th percentile in all and above the 98th percentile in any one of the following psychological traits: mathematical and science language ability, creativity, and task commitment. In addition, they should show strong interest and positive attitude toward science and

scientific activities" (Cho, 1989). A multi-stage identification model was adopted, where identification was based first on parental, self and/or teacher recommendation, next on group testing using with various psychological tests, and finally on individual performance test given by professionals.

The Logical Thinking Test can be used for the second stage of identification of the scientifically gifted. The Logical Thinking Test was chosen because it assesses students' logical operations which correspond to students' ability to acquire science concepts and use scientific thought processes (Raven, 1974). To facilitate students' learning, it is essential to match instruction and curriculum materials to students' cognitive development level. To do this, the assessment of the developmental reasoning capabilities of the students is necessary. The results from the assessment can be used not only to modify strategies used in the teaching of science, but also to help teachers to better understand the level of gifted students' intellectual development.

Logical operations have long been studied by Piaget and his colleagues. Piaget's theory of cognitive development postulates four stages in the process of development which include a final stage of concrete and formal operations. Inhelder and Piaget (1958) administered several different clinical interview tasks which illustrated the change from concrete to formal operations. Their tasks measured, among others, controlling variables, explaining physical phenomena, enumeration of all the combinations or permutations of a set of objects, using proportional reasoning, explaining compensations, and separating variables.

However, the clinical method has the following problems. The interview can be a source of variance; is time-consuming; and requires trained interviewers to ensure consistent scoring. In an attempt to avoid these problems posed by clinical interviews, some researchers have developed reliable and valid classroom tests of cognitive development. Some of them are totally paper-and-pencil tests (Bart, 1972; Burney, 1974; Longeot, 1965; Raven, 1973; Tobin & Capie, 1980); the others deal with some form of demonstration of manipulation of Piagetian theory based apparatus within a paper-and-pencil test format (Lawson, 1978; Rowell & Hoffman, 1975). Roadrangka, Yeany, and Padilla (1983) developed the Group Assessment of Logical Thinking (GALT), which uses a multiple-choice format to present options for answers as well as the justification or reason for those answers and employs pictorial representations of real objects.

Along with logical thinking ability, science educators and scientists have stressed the importance of the set of skills scientists use to solve problems. At various times, these skills have been labeled as critical thinking, problem solving, scientific thinking, and, most recently, as the science process skills.

While it is difficult to identify the precise genesis of the term, science process skills, its present day usage stems in large part from two sources. First, Jerome Bruner wrote *The Process of Education* (1961). In this book he stressed the need for curricula which allow for "solving problems on one's own" and advocated devoting the first two years of school to exercises in manipulating, classifying and ordering objects. In short, Bruner saw "those processes as educational ends in themselves..." (Shulman & Tamir, 1973).

Secondly, the new elementary curriculum, *Science - A Process Approach (SAPA)* focused its entire program on skills that scientists use to solve problems. SAPA defined the process skills as a set of broadly transferrable abilities, appropriate to many science disciplines and reflective of the true behavior of scientists. SAPA divided process skills into two types - basic and integrated. The basic science process skills were observing, classifying, communicating, measuring, using space/time relations, using numbers, inferring, and predicting. These skills provided a foundation for learning the more complex integrated skills. The integrated science process skills were controlling variables, interpreting data, formulating hypotheses, defining operationally, and experimenting.

SAPA fulfilled a need for standardization of terminology within science education by distilling a group of highly complex intellectual activities into a set of relatively well defined skills. Other new curricula of the era quickly adopted the SAPA list of skills and definitions, including the Biological Sciences Curriculum Study and the Science Curriculum Improvement Study. This agreement on terminology allowed science educators to focus on developing and evaluating the effectiveness of curriculum materials for teaching these thinking skills.

While the focus of science process skills has produced a consensus of terminology and many process skill-oriented curricular efforts, measurement of these skills has lagged far behind. Most existing instruments focus on measuring all science process skills and were created for use with teachers. In addition, a few integrated process skills tests that do exist, such as the integrated process skills test developed by Dillashaw and Copie (1981), are geared primarily for upper level secondary school students. There is also a test of integrated process skills which has been developed for middle school students, the Middle Grades Integrated Process Skills Test (Cronin & Padilla, 1986). These existing integrated process skills tests contain items which require specific knowledge, even though some other authors insist that their tests be content free.

Procedures used to construct and validate identification instruments

Item selection and modification

Test items that had been employed in logical operations tests were used as a basis for developing the Logical Thinking Test. The justification for basing the test on items from prior research was that these items have high reliability and validity.

Sentence lengths and word complexities were adjusted to produce a written test suitable for students with fifth and sixth grade reading level. A pool of ninety-seven items was assembled. This item pool consisted of 32 items measuring logical thinking.

Pilot testing and test characteristics

In pilot draft form, the Logical Thinking Test was administered to 818 teacher-recommended gifted students in Grades 5 and 6. The emphasis in this phase was to determine the goodness of test items. Teachers recommended students in each school based on criteria such as following: (1) IQ score over 120; (2) overall school achievement ranking in the top ten percent; and (3) score above A on a school-administered math and science test; or (4) exceptionally strong interest and active participation in science programs. Results of item analyses were used to select 21 items for the Logical Thinking Skills Test before drawing a final version. The number of items of the test is shown in Table 1.

After determining the content of the final version, the test was administered to 360 teacher-recommended gifted students in Grades 5 and 6 to estimate the test's validity and reliability. The next year, to estimate the predictive validity of the test, 278 students were followed up and given the Science Achievement Test and Logical Thinking Test. For examination of concurrent validity, the Science Aptitude Test, a non-verbal test of Level G and H of The Kuhlman-Anderson Test (Scholastic Testing Service, 1982) was also administered.

To estimate test-retest reliability, the same tests were administered to the original 360 gifted students one month after the initial implementation of the test.

The final version of the Logical Thinking Test possesses the following characteristics:

(1) The measurement of six logical operations: conservation, proportional reasoning, controlling variables, combinatorial reasoning, probabilistic reasoning, and correlational reasoning.

(2) A multiple-choice format for presenting options for answers as well as the justification or reason for that answer.

- (3) A pictorial representation of real objects in all test items.
- (4) A reading level appropriate for the fifth and sixth grades.
- (5) A test length that permits administration of the test by individuals who simply serve as proctors to a large group and completion within one test period.

Table 1: Number of items of the Science Process Skills Test and the Logical Thinking Test

Science Process Skills Test		Logical Thinking Test	
Factor	Number of items	Factor	Number of items
Defining operationally	6	Conservation	4
Formulating hypotheses	6	Proportional reasoning	6
Finding variables	8	Variable control	4
Designing experiments	6	Probabilistic reasoning	2
Making tables	4	Correlational reasoning	2
Drawing graphs	4	Combinatorial reasoning	3
Drawing conclusions	6		
total	40	total	21

Validity and reliability of the tests

First, descriptive statistics show that items measuring science process skills are easy enough to show negative skewness for both Grades 5 and 6 (see Table 2). Items measuring logical thinking skills are difficult for Grade 5 students and just appropriate for Grade 6. The kurtosis of Science Process Skills Test shows it has more variance than normal distribution, while scores of Logical Thinking Test have less variance than normal distribution.

Second, reliabilities were checked by computing several coefficients. Internal consistency coefficients were estimated by Cronbach’s alpha. It ranged from .62 to .71 for Science Process Skills Test and .72 to .78 for Logical Thinking Test. Reliability coefficients estimated by K-R 21 ranged from .49 to .61 for Science Process Skills Test and from .50 to .66 for Logical Thinking Test. These internal consistency coefficients of Logical Thinking Test were higher than those of Science Process Skills Test, even though they are generally high enough to be used for identifying the scientifically gifted. Generalizability coefficients estimated by norm-referenced approach ranged from .62 to .71 and .72 to .78 for Science Process Skills Test and Logical Thinking Test, respectively. Test-retest reliability implemented one month after the first implementation of the two tests ranged from .65 to .71 and from .72 to .79 for Science Process Skills Test and Logical Thinking Test, respectively. All of these reliability coefficients is presented in Table 3. Reliability measured by norm-referenced measurement approach are evaluated to be generally high.

Table 2: Descriptive statistics of SPST and LTT

Test	Mean	S.D.	Kurtosis	Skewness
SPST G5	24.95	4.73	-0.19	0.00
G6	28.45	3.96	-0.51	-0.19
Total	26.70	4.69	-0.29	-0.23
LTT G5	7.14	3.00	0.45	0.86
G6	10.29	3.70	-0.86	0.26
Total	8.72	3.71	-0.48	0.57

Fourth, predictive validity, concurrent validity, and intercorrelations between the two tests were estimated. Even though the Logical Thinking Test showed higher coefficients than Science Process Skills Test, both were generally found to be valid tests.

Table 3: Reliability coefficients of SPST and LTT

Reliability Test	SPST			LTT		
	G5	G6	Total	G5	G6	Total
Cronbach's alpha	.70	.62	.71	.72	.75	.78
K-R 21	.59	.49	.61	.50	.65	.66
Generalizability	.70	.62	.71	.72	.75	.78
Test-retest	.65	.66	.71	.76	.72	.79

Table 4: Validity coefficients of SPST and LTT

Validity Test	SPST			LTT		
	G5	G6	Total	G5	G6	Total
Concurrent Validity	.26	.31	.38	.37	.45	.51
Predictive Validity	.39	.28	.42	.49	.42	.53

Analysis of Logical Thinking Test by Item Response Theory

The two tests, SPST and LTT, were analyzed to find out whether the two tests satisfied the two basic assumptions of item response theory. Item response theory assumes the unidimensionality of latent space and local independence. Unidimensionality of latent space means that, even though it is true that several abilities can influence examinees in responding to tests, only one ability exerts influence on examinees' test scores dominantly. Local independence means that test item scores are independent statistically. These two assumptions are almost identical.

By carrying out analyses on goodness-of-fit of the item response model for each test, it was found that the Logical Thinking Test was satisfying the basic assumption. However, the Science Process Skills Test was not satisfying the assumption of unidimensionality of latent space. Therefore, only the Logical Thinking Test was analyzed further on the basis of item response theory. Goodness of items was examined by computing the test and item information, discrimination parameter, and difficulty parameter estimates and standard error. Appropriateness of using the test for identifying the scientifically gifted was tested by analyzing the test information.

Two parameter logistic model was selected for analyzing the test items and convergence criterion of EM and Newton iteration was .01. The test was implemented to 1,915 random sampled Grades 5 and 6 students. BILOG computer program for PC (Misley & Bock, 1990) was used for item analyses. Test information for ability levels was analyzed by using computer programs developed by Park (1989).

A. *Analyses of testing materials on satisfaction of basic assumptions of item response theory.* Factor analyses were carried out to find out whether the Logical Thinking Test satisfied the basic assumption of unidimensionality of latent space. The result showed that the first factor explained 42.0% of the total variance of test and the ratio of eigenvalues of the first factor and the second factor was 2.59. The Logical Thinking Test satisfied the criteria suggested by Reckase (1979, p. 228), which is that the least variance of test scores explained by the first factor should be more than 20%. In conclusion, it can be said that the Logical Thinking Test satisfies the assumption of the unidimensionality of latent space.

Item response theory assumes an item characteristic curve defined by probability function of examinee's ability and item parameters. In this analysis, two parameter model was assumed, which considers item discrimination parameter and item difficulty parameter. Guessing parameter was not considered because the Logical Thinking Test does not allow examinee to guess answers, by having four options format for answers and justification or reasons of selecting the answer and by giving a credit only when they get both right. When X^2 were computed by BILOG program, the result showed that only 3 items were found to satisfy the two parameter model of the goodness-of-fit test with Grades 5 and 6 random sampled examinees. As previous studies suggest, when the size of sampling is more than 1,000, the number of test items which satisfy the goodness of fit test increases. Since the number of examinees is more than 1,000 in this study, X^2 is not an appropriate statistics for goodness-of-fit test.

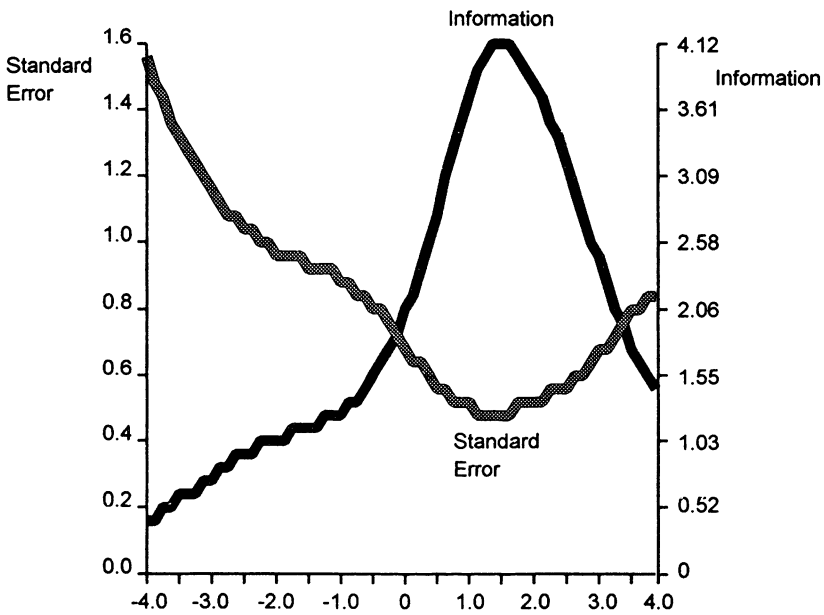


Figure 1: Test information curve and curve of standard error of estimates of ability parameter of Logical Thinking Test

B. Test information analysis. Both test information and item information were analyzed. However, only the result of test information analyses are presented here because the author was interested in the appropriateness of the test as a whole instead of individual items for identifying the scientifically gifted.

To find out whether the Logical Thinking Test is appropriate for identifying the scientifically gifted of Grades 5 and 6 students, test information function curve and curve of standard error of estimates of ability parameter were analyzed. For the Logical Thinking Test to identify the students above the 85th percentile test, information should become maximum at the 1.03652 of examinees' ability, since ability parameter is standard normal distribution with mean equal to 0 and standard deviation equal to 1.

As shown in Figure 1, test information of 21 items showed the maximum information at the 1.5 of ability level and standard error of estimates of ability parameter became the minimum. Therefore, it can be said that the Logical Thinking Test is most appropriate for identifying students who are above 93.92 percentile of Grades 5 and 6. Even though the Logical Thinking Test is a little difficult for gifted students in Grades 5 and 6, it can still be said that the test is quite appropriate for identifying the scientifically gifted in Grades 5 and 6, because test information shows the maximum value between the ability levels of 1.0 (84th percentile) and 2.0 (98th percentile) and the test information steeply decreases for the ability levels of less than 1.0 and more than 2.0.

Conclusion and suggestions for use

This study aimed to find out whether Logical Thinking Test and Science Process Skills Test are appropriate for identifying the scientifically gifted in Grade 5 and 6. Reliability and validity coefficients were examined on the basis of classical test theory; and item parameter and test information were analyzed to decide their appropriateness on the basis of item response theory.

The instruments can be supported as reliable and valid instruments to identify science talent both by classical test theory and item response theory. The result produced by classical test theory with 240 scientifically gifted students shows that Science Process Skills Test and Logical Thinking Test can be used as reliable and valid means to identify science talent out of large number of students at Grades 5 and 6. Even though the Logical Thinking Test and Science Process Skills Test were all found to be reliable and valid enough for identifying the scientifically gifted at Grades 5 and 6, Logical Thinking Test is recommended more for an independent use. It is because all the statistics of Logical Thinking Test regarding reliability and validity are consistently higher than those of the Science Process Skills Test. It is reasoned that Science Process Skills Test requires students to have enough content knowledge in science to solve them consistently, while the Logical Thinking Test requires only logical operations.

Considering that the validity and the reliability might have been underestimated because of homogeneity and limited number of students involved in the study, they are quite high enough to be used for identifying the scientifically gifted. However, all these statistics computed are a function of examinee's ability level and sampling. To avoid such dependency, its appropriateness for identifying the scientifically gifted were examined with 1,915 randomly selected examinees on the basis of item response theory. The results confirmed that the Logical Thinking Test, even though it is a little difficult for Grades 5 and 6 students, is a very appropriate test for identifying the gifted in Grades 5 and 6. It was because the test information became the maximum at the ability level between 1.0 and 2.0 which is above 84th percentile and below 98th percentile and the test information decreased steeply at other ability levels.

In this study, the test information for each grade was not analyzed. Since there must be difference in the ability level between grades, the appropriateness of using the Logical Thinking

Test for identifying the scientifically gifted in each grade should be further investigated. The test information gives enough information about appropriateness of the test for using it on identifying the scientifically gifted. Furthermore, it is necessary to analyze item biases in relation to sex. In a male dominant society, the Logical Thinking Test can be biased against the female students.

The test results can also be used by teachers to better understand the science talent of their students and to tailor their instruction and teaching materials accordingly.

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Identification of mathematically gifted students

Zuzana Tomášková

Faculty of Education, Charles University, Prague, Czechoslovakia

I'm a member of teaching staff of the Department of Mathematics at the Pedagogical Faculty of Charles University in Prague teaching mathematics and computer science. At the same time I have been reading distance postgraduate studies at the Department of Didactics of Mathematics at the Faculty of Mathematics and Physics of Charles University in Prague since September 1990.

My research is focused on identification and fostering of gifted students in mathematics at the secondary schools.

Why shall we be engaged in the problem of mathematically gifted students?

The fostering of mathematical giftedness isn't meaningful only for the education of the future mathematical specialists because the mathematics teaches students to sort and to word accurately their ideas, to distinguish more important data from unsubstantial, the algorithm and logical thinking and what is main - it encourages the students' creative mind. All these activities are very useful and necessary for the other great numbers of scientific branches and directions. For example to be able to work with computers is needful for each of us and the mathematics is the basic branch for the computer science and I could enumerate the series of other liberal, technical and natural historical branches.

Gifted students will have a great deal on contribution to the future prosperity of society and at the same time each student needs such education that is adequate to his or her abilities.

On other side there was a wide-spread tendency to underestimate the achievement of all groups of children especially the able or that it is the question of an elitist activity.

But the result of this interesting and important work very often depends on the teachers - on their approach to these problems and on the atmosphere without routine and repetitive work he or she is able to form in the classroom.

The curriculum for gifted students has to be sufficiently challenging and adequately demanding.

Towards the mathematical talent

It is difficult to elucidate the nature of mathematical talent or giftedness exactly by one simple definition. It may appear in several different guises. Many researchers have been attempting to describe its characteristics but there has been no fixed definition of mathematical ability.

I would like to mention three quite different definitions in my paper.

Mathematician and psychologist Hamley wrote in his book "The Testing of Intelligence" in 1935: "Mathematical ability is probably a compound of general intelligence, visual imagery, ability to perceive number and space configurations, and to retain such configurations as mental patterns".

In 1976, Krutetski defined mathematical ability differently in his work "The Psychology of Mathematical Abilities in School Children". He contended that particular individuals possess a

mathematical cast of mind - a tendency to see the world through mathematical eyes - which can be seen clearly in pupils who are specially gifted in mathematics. He suggested that this feature may be present at birth, but that it can also be developed by a favourable environment. Three basic types of mathematical mind were identified by him:

- (1) the "Analytic" who tend to think in verbal, logical terms,
- (2) the "Geometric" who tend to think in visual, pictorial terms,
- (3) the "Harmonic" who combine characteristics of the other two.

Krutetskii's conclusion is that pupils with the harmonic type of mind are the most likely to have mathematical aptitude.

The last definition of mathematical giftedness, in my paper, is given by Kießwetter, 1985: "Mathematical giftedness is a set of testable abilities, there is a high probability of successful creative work later on in the mathematical field and related areas. These abilities are defined by the mathematical parts of SAT and by a new test for mathematical giftedness (Hamburger Test für Mathematische Begabung - HTMB), stressing the following complex mathematical activities:

- organizing material,
- recognizing patterns or rules,
- changing the representation of the problem and recognizing patterns and rules in this new area,
- comprehending very complex structures and working within these structures,
- reversing processes,
- finding (constructing) related problems".

Some characteristics of mathematically gifted students

Before attempting to identify the gifted students it is useful to take into consideration their characteristics that they could have. At the beginning of this part it is necessary to mention that although there may not be very many gifted students so their characteristics are rather varied among the students mutually. What is possible to say about some student need not be true about the other one. That is why the characteristics of gifted students will not be generalized easily.

Teachers describe mathematically gifted students in the following way:

- they are better able to understand the essence of a problem at once or relate one problem to another,
- they are able to work for a long time with persistence and total absorption especially in a search for the best and simplest solution to a problem,
- they are better in their vocabulary, but not always keen to write with this is connected brief quite laconic expression of thought. This may show itself in mathematics where there may be a dislike of writing own solutions of problems that can be solved by heart,
- some of them are conceited, the others are reserved, shy and unassertive,
- they strive after an elegant solution,
- they like use numbers in text and stories and they like to pose a problem to themselves during lessons and free time at home like: "How many seconds does a man live in a lifetime?" and so on,
- they very often use logical connectives: "if", "then", "so", "because", "either", "or" in the text and speaking,
- they try to find own interesting solutions of problem different from teacher's one,
- they can generalize mathematical material rapidly and easily,

- they tend to skip over intermediate steps in a logical argument,
- they have self-confidence in a new mathematical situation, some of them are very initiative in it (they use sentences like: "I know, that"; "No, it can't be right because"; "I think, that it is possible to solve in this way ..."; "Look, I can show you, that" and so on),
- they tend to remember the relationships in a problem and the principles of a solution,
- they like the discussion to some problem or mathematical theory inclusive of a evidence,
- they tend to use the mathematical methods in subjects where it is possible like physics, descriptive geometry, chemistry, biology, geography, art lessons.

Gifted students want to find an elegant solution to a problem fast, they make skips during their thinking and thanks to these factors they often make mistakes in mechanical calculation.

We can find in work "Mathematics for Gifted Pupils" by Anita Straker published in 1983: "It is easy to confuse the ability to perform calculations with mathematical ability. Whilst skill at computation is of considerable value, and may be the first indicator of future mathematical giftedness, a distinction should be made between this more limited talent and a facility for handling abstract numbers imaginatively and with pleasure" (Straker, 1983, p. 12ff.).

An experienced teacher can recognize true mathematical talent but it is impossible to generalize this fact. Sometimes gifted children may not present themselves, their abilities thanks owing to fear of teachers, parents or friends. In this case the identification of their talent is more difficult. On the other hand, gifted students must get the opportunity to demonstrate their abilities. Therefore teachers must prepare appropriate and challenging mathematical material and problems for students. Bad teacher's approach may make the great irreparably damage and loss of student's interest and then mathematics can become a "critical" subject for some students and raise fear in them.

Some teachers have special point of view, that only problemless students can be potential mathematical talent but right opposite is often truth. Because gifted students may feel that they are different from their schoolmates, it may happen, that they don't fit into the collective of class or they become reserved in themselves and so they can become problematic and unsuccessful students. Then the identification of their real abilities is very hard. The problem of identification must be considered like the one of the areas in the complex fostering about the talented population.

Aim of my work

At the beginning I gave myself a question: "What does mathematical talent inhere?" I try to look at this problem with eyes of teacher of mathematics. If I want to set test for identification of mathematically gifted students at secondary school so which sort of problem then I shall use. It was needful to find the types of mathematical problem for these tests, but the features of mathematically talented students, enumerated in chapter above or in other literature, seems to be in more common form and more useful for teachers in practical lessons at school. I felt that it would be necessary to pass on lower level with finer and more detailed description. There is a requirement to find out the basic characteristics, which gifted students apply during the solution of mathematical problem. It means such typical features and abilities which represent the inevitable substance of mathematical talent and at the same time to support and to develop these abilities of gifted students, especially in lower grades of secondary schools.

Methods

Two versions of an algebraic test and two versions of a geometric tests (with problems for geometry in the plane and in the space used simultaneously in one version) have been set so far for the first grade of the secondary school. For these tests such an unusual interesting and

challenging problem was chosen which is not taught in normal mathematical lessons laying stress on creative thinking in these tests to encourage students to use their own reason and ideas during solution of such problem. Teacher can recognize by using of algebraic and geometric tests the following features:

Algebraic test

- abilities of logical judgment,
- combination abilities,
- abilities to select and to sort important information,
- abilities to mathematize the real-life situations,
- abilities to record the procedures in mathematical symbols,
- abilities of handling numbers imaginatively based on knowledge of their characteristics.

Geometric test

- abilities of the spatial visualization (in the plane and in the space),
- abilities of the transformation of geometric information into the language of algebra,
- combination and logical abilities.

Elegant and fast solutions of some problem are very useful pointer for identification of mathematical talent. The development of creative and logical thinking of mathematically gifted students is the main target of mathematical education and it is necessary to aim at this.

But I know that the stage-fright and the fear, caused by taking a written test, can play an unfavourable role. That is why I named these tests "Enjoyable Mathematics" and "Enjoyable Geometry". It is said at the beginning of each test, that it is no examination and students can only try what they are able to solve. The entire tests take 50 minutes.

Each test must correspond to the requirement of objectivity, reliability and validity. Thanks to the type of problems there is ensured the independence of student's result on the level and the volume of mathematical material taught in common lessons at school because then the result would be rather distorted and tests would be more suitable for the testing of ability of students to learn some material. Each of first work versions of algebraic tests contained 14 problem and the final versions have 8 problems after the elimination of the problems with the highest and lowest quotient of solvability.

None of these tests contains "answer only" or "multi-choice" questions. Because these types of question preclude the possibility of detection of the way of solution and depth of ideas used by the students. Some students can only guess the right answer or on another hand some students can be inattentive and then they are able to indicate a wrong answer. "Freedom" was given to students at this tests because the way of solution can tell teacher a lot of interesting and useful information about the level of giftedness. Four sample problem from algebraic and geometric tests will be given here for better elucidation of type of problem.

Problem 1:

Two friends have met:

P1:why are you carrying so many parcels?

P2: I'm carrying the presents for my three sons, all of them have a birthday tomorrow.

P1: How old are your sons?

P2: If you were an everyman I would tell you but because you are a mathematician, you must calculate it. If you multiply their ages that they will reach tomorrow, you will get number 36.

P1: You have told me rather little, haven't you? It isn't enough for me!

P2: Well, do you see this house in front of which we are standing? The number of its windows

is the same as the sum of the ages of my sons they will reach tomorrow!

P1: Excuse me, but as I'm looking at this house so it still isn't enough for me!

P2: It is all very well, then my oldest son's name is Adalbert, but it is really all, what I say about them to you.

P1: But that is really just what I missed for the full satisfaction! As if you have told me the age of your three sons by this.

How old will the boys be tomorrow?

Problem 2:

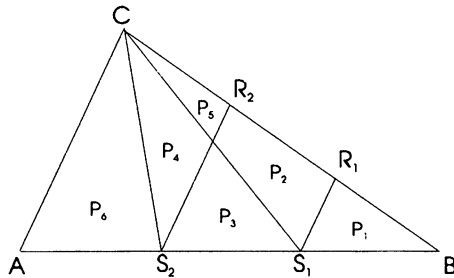
Let us denote the natural numbers 1, 2, 3, ..., n, written in certain order, as $a_1, a_2, a_3, \dots, a_n$. If n is odd number then the product $(a_1 - 1)(a_2 - 2)(a_3 - 3)\dots(a_n - n)$ is divisible by 2.

Prove this proposition.

Problem 3:

The triangle ABC is given. The points R_1, R_2 divide the side BC into the thirds, let us draw parallel lines with the side AC through them. Denote their consecutive intersections with the side AB as S_1, S_2 and construct the line segments S_1C and S_2C . The triangle ABC falls into six pieces in this way (see the picture below).

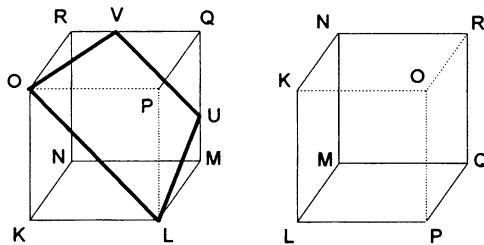
Find their areas if you know that the area of the triangle ABC is 18 cm^2 .



Problem 4:

The opaque quadrilateral is placed in the wire cube.

Draw it in the rotated position on the neighbouring cube.



I got after the using of statistics methods that the reliability of both algebraic tests is equal to 1. But when I tried to compare the students' results in the test with their school mark in

mathematics so I got very low values of correlation coefficient. These two quantities aren't in correlation to each other. I often discussed this problem with teachers of all tested classes and I found out that they lay stress more on student's approach to the studies than on the talent, it means a student with higher study morale is assessed with better marks and gifted students are very often "problem students" and that is the consequence.

The other statistics quantities are following:

Algebraic Test							
Type of Class	Test 1			Test 2			
	Meanscore	Deviation	Median	Meanscore	Deviation	Median	
M-Class	28.17	7.62	28.00	26.83	8.39	27.00	
MF-Class	21.52	7.76	21.00	16.78	6.68	18.00	
N-Class	16.13	6.80	16.00	7.92	5.12	7.00	

Number of all classes tested: 5

Number of all students tested: 150

Maximum score: 40

M-Class: class with an enhanced mathematics education

MF-Class: class with an enhanced education of mathematics and physics

N-Class: class with a normal curriculum

On the other side I was glad that I got such results, because these tests can help teachers to aim their attention at students although having bad marks in mathematics but having higher score in test because their talent has had no chance to show so far. The reasons can be various and teachers should notice just such students especially.

Final consideration

At the end of my contribution allow me this little consideration. Teacher must be not only a good expert but also a good actor. The relation to the teaching is very similar to the musical ear. It must already be given somewhere in genes and then the influences can start, that enrich and lead it. Both can be passive or active. Somebody has passive musical ear, i. e. he can recognize when somebody sings out of tune, but he isn't able to sing himself. It is the same with pedagogical abilities. Teaching of gifted students is much more difficult, demanding and time-consuming then work with average students.

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VIII. GIFTED EDUCATION AND PROGRAM EVALUATION

Introduction

Research on the cognitive processes of highly able individuals, on their cognitive and social development, or on the characteristics of instruments used for identification mostly aims at designing education of highly able children and students in an appropriate way. In Europe, most educational provision for gifted students is part of the regular instruction for all students or is modeled after experiences made in other countries. Therefore, this part of the book does not contain European reports on concrete programs, classes, or projects especially and originally designed for gifted children. We have received several reports on such endeavours but none of them satisfied our standards of providing careful description, an acceptable rationale, and convincing data of evaluation except some which better fitted into another part of this book. This part concentrates more on theoretical reflections and methodological considerations as the basis for program design.

In her keynote address, Diane Montgomery clarifies basic issues of promoting gifted learners through education and instruction. According to her experience, process oriented instruction which focusses on methods and strategies of solving real problems not only improves the acquisition of knowledge and process but also enhances student motivation substantially. Her teaching model has been successfully implemented in classes and in teacher education. Its effectiveness is demonstrated by references made to teacher examination scores and to participants' subjective course evaluation. By commenting on Diane Montgomery's contribution, Heinz Neber points out that her program fits nicely into recent developments of instructional psychology. He is curious about further proofs of effectivity of Montgomery's program and reminds on other teaching models of education which have been designed to meet the special needs of gifted students.

In a similar way as these authors do, Joan Freeman adopts a mainly cognitive view on learning, problem solving, and creativity. Her comprehensive contribution deals with the ingredients and pre-conditions of creative accomplishment and real-life problem solving. She points out the relevance of thinking skills, of a sound knowledge base, of strategies for problem transfer, and of a positive self-concept and stable inter-personal relationships for making valuable creative contributions to the progress of society. By including evidence from her own empirical data collected longitudinally on gifted children, Joan Freeman is able to precisely describe the steps of development of expertise in various fields and to define the developmental catalysts which contribute to a child's reaching the proximal zone of his or her development. The author draws conclusions for an adaptation of the school curriculum in order to improve education not only for gifted children.

The next two contributions focus on methodological aspects of evaluating gifted programs. Michael C. Pyryt and Ron Moroz describe their work of evaluating an accelerated mathematics program, which was presented as part of a workshop on evaluation. The contributions to that workshop are summarized by Ernst A. Hany who first gives a short introduction to the research on evaluation. The papers presented in the workshop demonstrate the variety of goals and methods which are used for evaluation purposes and call for a better exchange of conceptual and practical work between researchers in this area.

The promotion of high ability and talent through education and instruction

Diane Montgomery

Middlesex University, London, United Kingdom

Introduction

Researchers in the area of high ability and talent seem to agree that intelligence is a multi-layered and multifactorial concept (Necka, 1991). As the century ends the broadest view of intelligence has been adopted. It began with a narrow test-defined conception and has ended with an acceptance that high achievement or potential in any area of endeavour with at least average ability on tests of intelligence may signify a person with potential high ability or talent. Research and general experience of educators has shown that intelligence tests and scholastic achievements in schools may not identify able individuals.

Intelligence itself has come to be regarded as not only the capacity to acquire knowledge and concepts but also the ability to use these flexibly in a range of cognitive and intellectual processes. McClelland's (1958) work was widely influential in teacher education in Britain in the 1960s and 70s. He argued that intelligence was a widespread characteristic transformed into talented performance by various of the *right sorts of education*. Even at that stage he said we should stop refining tests and concentrate more upon defining learning environments which link learning opportunities with identification.

In 1965, having reviewed 176 research studies on gifted education, Goldberg (1965) came to the conclusion that there were two great research needs. To find (1) what would stimulate a love of learning among able children; and (2) what kinds of assignment would most effectively develop independence of thinking and independence of effort. The one thing Goldberg was really sure about was that we did *not* need more tests. What was less clear was whether able children needed acceleration through some programmes or depth in others.

Twenty-five years after Goldberg's research Passow (1990, p. 17) in his review of research on Gifted Education was able to state that the two major areas for research and development were still (1) what kinds of educational and social opportunities are needed to promote high ability? and (2) how can we identify and nurture giftedness in disadvantaged populations? These key questions have remained the same for the whole of this century. How much we have achieved remains to be determined.

Goldberg (1965) was unsure whether *Acceleration* through studies or study in *Depth* was appropriate for able learners. *Differentiation* of some kind was considered to be a priority. These three - Acceleration, Depth and Differentiation have become major issues in education in England over the last few years.

Acceleration: Evidence has been accumulating which shows it is often appropriate for highly able individuals to proceed through easy and lower levels of subjects when they have the knowledge and ability to do so. This appears to be particularly important for gifted mathematicians and musicians. In some school systems "skipping" grades can be beneficial. It is not at all clear that acceleration is essential across other curriculum areas and may prove unnecessary if the teaching and learning environment is flexible. One key concern is that acceleration should

not just be accelerated content where five year olds learn the curriculum of twelve year olds. It is much more important for them to learn to use their knowledge and be developing their intellectual skills instead of just learning more information. Accelerated content for able learners is however the most common provision observed.

Depth: Goldberg suggested that some aspects of the curriculum should be followed in depth whilst others could be followed at a more superficial level. As there is limited learning time this is reasonable but care needs to be taken that what is learned in depth is not merely in terms of quantity and at superficial or surface levels (Gibbs, 1990). It needs also to be absorbed at deep levels so that it can be used in real problem solving at a later date if and when required.

Differentiation: The issues in differentiation are critical. If we set work for different levels of ability - *differentiation by inputs* (a) then we have to decide at the outset who is able and who is not with all the attendant problems of identification. Teachers often differentiate without test information and can of course choose wrongly (Painter, 1983). If they give the same work and *differentiate by outputs* (b) then the work may fail to be sufficiently challenging for the able pupils and they may underfunction. This method is a variant of teaching to the middle and using tests and assessment questions to stretch the able upon which the rest perform poorly. In my view neither strategy is adequate for meeting able or slow learners' needs and a different form of differentiation is proposed in the following (c).

Differentiation

a) "The setting of different tasks at different levels of difficulty suitable for different levels of achievement."

b) "The setting of common tasks that can be responded to in a positive way by all pupils/students."

c) "The setting of common tasks to which all pupils/students can contribute their own knowledge and understanding in collaborative activities and so structure their experiences and progress from surface to deep learning and thus be enabled to achieve more advanced learning outcomes."

It is believed by many people that if we segregate able and highly able pupils in separate schools or through curriculum differentiation in the same school and classroom, this is socially and politically divisive (Barton & Tomlinson, 1984). It sets the pupils and the outside world to think that they are an élite. As they are only likely ever to be a small proportion of an intellectual élite, this is unfair and also unwise for most will not fulfil their potential in any case. The fact of putting them in a special school for the able may have far more to do with later success than their actual ability. We see this in the "Public School" (fee paying schools in England). Their pupils make up 7% of the school population and they hold over 45% of all the highest paid jobs. Ability to pay rather than intellectual ability is the criterion for entry to the Public School system.

If we could provide a differentiated curriculum and a flexible approach we might learn how to teach better. If we could share this with all teachers in schools and higher education we could improve the quality of education of all our students.

What constitutes good teaching? In my view (Montgomery, 1988) "good" teaching is occurring where

"Students want to learn rather than have to be made to, where they continue discussing and thinking about the subject long after the lesson ends".

The key question is how do we motivate students to learn? We know able students can learn easily and more quickly but that they can also become bored equally as easily and quickly by

the pace of learning in the ordinary classroom. Learning information is on the whole easy for able students but learning large quantities of information does not seem to promote their intelligence. When University undergraduates were asked how they had behaved at school and if they were model students few had been attentive and well behaved. The following is a list typically produced from a class:

What did you do at school today?

Day-dreamed	Nothing
Propelled things	Displacement activities
Damaged property	Absented self
Distracted teacher	Sat resentfully
Discredited others or subject	Recruited others
Exited to loo	Wandered
Volunteered	Avoided
Kept head down and chatted	Clowned
Continuously talked	Disrupted
Continuously queued	Persistently refused to work

Our present methods were patently not working. These students were obviously not motivated by their earlier classroom experiences suggesting they had been exposed to much poor teaching. In addressing the problem of how to promote intelligence and ability in able students through good teaching and make quite sure that underfunctioning and disadvantaged able are stimulated to achieve higher levels of functioning, we have to consider what can possibly be the "right sorts" not only of curriculum but also of pedagogy. How can these styles of activity have remained hidden for all these decades? Presumably good practice is also widespread. Perhaps what has been lacking is definition and research to underpin it. This may have arisen because so often there is a separation of research from educational practice in that expert practitioners do not have the opportunity or the training to engage in research and researchers do not always have the practical experience in the profession to inform their methodologies. A significant number of studies have shown success in promoting the abilities and scholastic achievements of disadvantaged groups (Feuerstein, 1985; Weinstein, Goetz, & Alexander, 1988) but there would seem to be insufficient attention paid to promoting the abilities of able samples.

This report presents a summary of results of twelve years work with undergraduate teacher education students defining teaching strategies to try to promote learning and to enable them to unlock their own abilities and talents as well as those of their able pupils. A research grant has just been obtained to enable more rigorous testing to take place in a controlled experimental design of the various hypotheses put forward. The research has developed at two levels - developing a theory and practice of teaching and learning to use with able students in schools and developing a set of strategies from this same theory and practice for enabling teachers in training to promote their students' learning. These new teachers in their classroom observation sessions were very much aware that many of the more able children were bored and were not being stimulated to achieve at a consistently high level even with experienced teachers. Despite all their personal attempts to stimulate these pupils there was insufficient information and teaching resources to enable them to do this on a consistent basis. At the ECHA conference in Zurich in 1988 teachers of able children were still able to complain that everyone recommended that they should be "teaching their students to think" but no one would explain to them how to do this. In fact, it was quite common in our studies to find teachers believed that they were stimulating their students to think in fact when they were not.

The researches began with the development of materials for use with able students in small groups within the ordinary primary school classroom. The teachers were asked to identify their most able students. Naturally they identified some but also included those who were difficult and others who were clearly not able. Research studies of Painter (1983) showed that secondary school teachers often nominated only one third of students who were gifted and included a third who were not. These studies showed a similar but not quite such an extreme trend in primary teachers' nominations. In a number of symposia at this conference we have heard how teacher selection of able students puts them into gifted programmes. This can be shown to produce a particular type of biased sample and may leave out many who are able but not functioning as expected by their teachers. Teachers views of high ability were often narrow and unsupportive to the students. In the early studies (Montgomery, 1985) it was found that although the materials had been prepared for highly able groups, the other students in the class wanted to join in. When they did so with a small amount of extra support from the teachers, they began to achieve very good results too. As their abilities became manifest the teachers began to adopt new and favourable attitudes towards them. These were often students who had previously been considered to be "slower learners" or lazy and a nuisance. These experiences made me change my strategies in identifying and teaching able students and consider a different approach with their education. The hypothesis presented to the teacher education students ran thus:

"Just suppose that we are all born brilliant but it is the environment which conspires to dull and blunt us and make us underfunction, in particular the classroom environment."

Although Bernstein (1970) argued that education cannot compensate for society, more recent evidence (Rutter, Maughan, Mortimore, & Ouston, 1979) has shown that school ethos contributed to by many factors including academic ones can improve the performance of all pupils. In 1992 the HMI review of the education of very able children in schools showed that if good provision was organised for able students, all the students benefited and overall standards were raised. The consequences of these studies and this viewpoint are that schools should adopt a very positive attitude to the learning and abilities of *all* the children and not make prior judgements which lead to the identification and special provision for the few. The teacher education students were taught that if children fail at a task then it becomes the teacher's fault for not presenting it in a sufficiently interesting and appropriately structured fashion. The teacher's task was to structure the experience so that the student learnt. Teacher education students had to be moved from the notion that their job was to teach "their subject", to the attitude that their job was to *enable* children to *learn* the subject. They taught children not subjects. To help them clarify their thinking, teaching was defined as a *process* by which the teacher ensured that the students were learning or had learnt more or less what it was intended they should learn.

If we teach, this carries with it the implication that during the process the learner learns (Hirst, 1968). Lecturing carries with it no such implications. The lecturer tells the students information or demonstrates skills but the students do not automatically learn them as a result. Teachers therefore do not teach subjects, they teach students to learn subjects. Teaching is thus a more complex activity than dictionary definitions can lead us to suppose.

As the children set about the learning task, the teachers were shown how to observe them and note the developmental levels of cognitive processing elicited by the tasks. Thus Curriculum Identification and Assessment (CIA) strategies were formulated to replace test identification for as Passow (1990, p. 16) has stated in relation to such procedures:

Despite the acknowledged critical significance of identification and selection processes in the school's efforts to nurture potential to performance, there is little research to ascertain the effectiveness of our procedures or more important, whether we are diagnosing the right characteristics and behaviour.

The teachers were encouraged to deal with a class of relatively unknown individuals by treating them all as potentially able even though the students themselves might not show it. They were instructed to "C.B.C." the students, that is, to *Catch them Being Clever*. This was not so absurd as it might sound for Rosenthal and Jacobsen (1968) and Good and Brophy (1982) have shown that students regarded as able by their teachers somehow begin to become so. The teacher's attitude appears to result in a self-fulfilling prophecy with some individuals scoring 20 points more on IQ tests than previously. Although criticisms have been levelled at the methodology of the Rosenthal research, the benefits of adopting a positive attitude to pupils and their behaviour has been widely evidenced (Becker, Madsen *et al.*, 1969; MacDonald, 1971; Wheldall & Merritt, 1984, 1991). This has resulted in the advocacy of the C.B.G. strategy, which stands for "Catch them Being Good", in classroom management strategies (Montgomery, 1989). Both C.B.C. and C.B.G. are found to have a powerful effect on students' behaviour and school work and are part of the process of setting the "right kinds" of classroom climate for learning and in improving the ethos of the School.

The C.I.A. and C.B.C. strategies enabled the identification of ability and high ability to be linked directly to the learning opportunities of the students. It was observed that good teaching resulted in secure learning by the students and was a process by which the learner was *motivated* to learn. Without motivation we know little learning will take place, thus the best teaching will be that which is highly motivating. During observations of over one thousand lessons (Montgomery & Hadfield, 1989), good teaching resulted in the students pursuing their learning long after the lesson ended. They continued to be motivated by their learning experiences so that the teacher found it difficult to stop them and switch to the next task. Although it is believed that human beings are born to be curious and with an investigative frame of mind (Kelly, 1955), it seems that in Britain at least much of our school system conspires to iron this out of even the most able as soon as possible (Roberts, 1986) and at least by the end of the first year in Secondary school (Rutter *et al.*, 1979). When the students enter University it has been found that at least 50 per cent lack adequate higher order reading skills to deal with the textual materials which they will meet in degree studies (Thomas & Harri-Augstein, 1984). In teaching undergraduates for many years on a range of degree programmes, it soon becomes clear that most of them enter our higher education system ill-equipped for the demands of the studies they have to undertake. However, at this stage it is assumed that they do have these skills and so no-one teaches them. Where it is recognised that help may be needed, study skills programmes are offered but these tend to be of a bolt-on or generalist variety which do not appear to have sufficient transfer value to specific subject areas. Thus there has in the past been a long and somewhat disappointing history in the teaching of learning and study skills (Lockhead & Clement, 1979; Meek & Thomson, 1987; Reynolds & Shirey, 1988), what is new however is that the current interest in learning strategies can be based upon an emerging cognitive theory of human learning and thus has greater potential for being effective.

For the purposes of transmission of teaching methodology to the teacher education students, *two central objectives in teaching* were defined as:

- (1) *to enable pupils to think efficiently, and*
- (2) *to communicate those thoughts succinctly through a variety of modes and media (Montgomery 1981, 1982).*

These two objectives were to override all concern for subjects and skills which were to be secondary or subordinate. Students preoccupied with subject or content learning found this hard to follow. They too often confused strategies geared to memorising with those geared to developing thinking or cognitive skills which would result in the remembering of content.

By a process of grounded research a set of six *Cognitive-Process Pedagogies* (Montgomery, 1990) were defined by which students' thinking processes could be engaged during learning

whether they were children in school or undergraduates at university.

Cognitive-Process Pedagogies

(1) Investigative and Problem solving and resolving strategies particularly in *Real* problem solving situations

(2) Cognitive Study Skills (requiring higher order reading and study skills)

(3) Collaborative Learning in which pairs and small group discussion was an integral part of the student learning activity

(4) Experiential Learning (not *experimental* learning but *experience-based* learning)

(5) Language experience methods in which students' own experience is used as a major part of the study and resource material for learning

(6) Games and simulations

The teacher students were taught to design their lesson strategies and contents so that there was an element of the unknown, a puzzle for their pupils to think about, resolve and make closure upon. By these means natural curiosity and motivation were to be harnessed and used in the learning process.

The learning process was also the subject of study and the following aspects were incorporated into the theoretical framework for developing teaching and learning strategies - the Piagetian (1952) framework describing intellectual development and Vigotsky's (1968) and Donaldson's (1978) critiques together with more recent perspectives from Kolb (1984) and Gibbs (1990). It was emphasised that in order for secure or deep learning (Gibbs, 1990) to occur, the learner should be an active participant in the learning process not just as a child but throughout life. Gibbs contrasts *deep learning* (accommodation in Piagetian terms) with what he describes as *surface* or superficial learning.

The characteristics of surface learning are said to be:

- a heavy workload;
- relatively high class contact hours;
- an excessive amount of course material;
- a lack of opportunity to pursue subjects in depth;
- a lack of choice over subjects;
- a lack of choice over methods of study;
- a threatening and anxiety-provoking assessment system.

Fostering a deep learning approach:

This rests on the obverse of surface approaches (Gibbs, 1990):

- relatively low class contact hours;
- intrinsic interest in the subject;
- freedom in learning in content and method or scope for intellectual independence;
- experience perceived as "good" teaching.

Kolb's (1984) contribution was on the value of *active* participation in the learning process and his proposal of a learning cycle in effective learning. His research showed that active participation by the learner in itself was not enough but that it must be followed by reflection upon the activity if learning was to take place.

"Learning occurs not in the doing but in the reflection and conceptualisation that takes place during and after the event" (Kolb, 1984).

It was felt however that this definition needed some elaboration if it was successfully to meet the needs of learners engaged in higher cognitive activities and so the learning process became described as a *Cognitive Process Learning Spiral* to provide a model for the processes which the teacher needed to allow the students to go through if, for example, they were to be able to operate at the higher levels of intellectual processing described in Bloom's (1956) Taxonomy of Educational Objectives such as analysis, synthesis and evaluation.

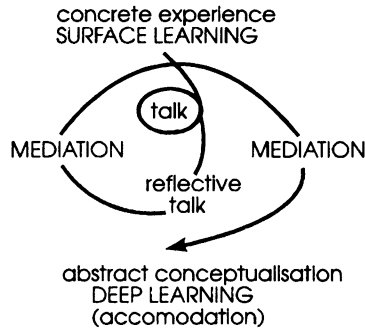


Figure 1: Cognitive Process Learning Spiral

The model indicates that learners can progress from Surface to Deep Learning by a variety of experiential learning methods mediated by the teacher and encouraged by reflective talk. This process of learning does not return them to the same position as before. Through the learning process cognitive structures and strategies are developed and changed. In this paper *two* cycles of reflective talk are proposed as necessary for full cognitive growth which the teacher can enhance through judicious questioning indicated by the term *mediation*. The first cycle of reflective talk should centre on that which has been or is being learned so that an appropriate structure for understanding is developed. The second cycle which may at times interact or overlay the first is that in which the students reflect upon the process of learning itself or *how* they learned the material, the metacognitive level. Metacognition is regarded as a highly important contribution to higher order learning. It is defined as "the processes whereby we think about our cognitive machinery and processing mechanisms" (Flavell, 1979).

Metacognitive activities contribute to the development of self-regulatory and self-management skills as well as a sense of personal agency. Self monitoring in particular has been found by Wang and Lindvall (1984) to contribute not only to improved acquisition but also to improved generalisation and transfer of knowledge and skills. Brown, Bransford, Ferrara, and Campione (1983) have defined self-regulatory activities as including planning (predicting outcomes, scheduling time and resources), monitoring (testing, revising, rescheduling), and checking (evaluating outcomes). These were not only included in our studies but also reflective talk upon how each of these processes had been undertaken or achieved with the emphasis upon learning from mistakes, how to reschedule, reconstruct, replace and re-evaluate the learning outcomes.

How the student teachers were helped to develop the abilities of able students

The student teachers were encouraged to focus upon the learners rather than the subject contents. They learned how to structure the contents and the learning experiences to evoke

learning responses. In designing a lesson plan, the teachers were urged to consider at each stage what it was the students were actively engaged in doing. Were they listening, thinking, reading, writing, talking, operating or doing? The plan should include a series of these changes in activity to form a "tactical lesson" plan (Montgomery, 1989) rather than a content dominated plan. It was emphasised that very few people, particularly children, know what they think until they try to explain their thoughts to someone else. Although our primary school education offered some opportunities for children to talk about their learning experiences, secondary schools offered little. A range of Her Majesty's Inspectorate reports had indicated weaknesses in this area over a considerable period of time (HMI, 1981, 1986, 1989).

For key phases of the lessons, teachers were shown how the curriculum task should be designed so that it promoted talk about the work in hand. This was in contrast to the observations made by Bennett (1986) who showed that most talk in "collaborative" groups in classrooms was of a social nature and rarely about the work in progress.

An example of a problem-solving type lesson is exemplified in the following. The purpose was for the students to understand a History topic about why castles were built and the type of site which would be likely to be chosen. Students at the ages of 12-13 years would be likely already to have a range of experiences and knowledge about castles which could usefully be drawn upon before new information was presented. An exercise similar to that described would use their knowledge but also help them organise and share it with each other. Their group discussions would be the first subject input with the second round led by the teacher amounting to the reflective talk stage.

A pictorial map of an area with mountains, marshes, villages, woods, rivers and so on was given to each group of five students. Six sites were identified on the map, some with good castle building potential, others with varied attributes. Each group was assigned a site and told to produce a site agent's selling brief focusing on the advantages to the potential lord and lady if the castle were built on their site. The six groups were given 10-15 minutes to prepare their brief and asked to discuss this in independent leaderless groups. At the end of the preparation period, the teacher asked one or two representatives from each group to make their presentation. Great fun and humour resulted as the groups vied with each other. At the end of the presentations the class was asked to decide which would really be the best site and to identify the pros and cons for each of the six (Analysis). The class were then asked to select castles of their own choosing from pictures; books and other resources were also made available. They were asked to use these to write an introduction to a class book on why that castle was built where it was and what was its purpose (Application and Analysis). It might be thought that it would be quicker for the teacher to question the pupils at the outset and elicit the information from them shaping it into pros and cons and the written introduction. It would be marginally quicker but would be a far less powerful strategy for student learning. Such learning by expository and didactic methods may result in only superficial levels of learning for even the able students and far less motivation would be evident. The able can easily become bored and the less able fail to grasp even the main ideas in didactic approaches. This collaborative problem-solving approach resembles "real" problem-solving which is so essential for highly able students according to Freeman (1991). Didactic and expository methods offer a low level of learning for all students.

How the teacher education students' abilities were promoted

In order to produce teachers capable of generating real problem-solving approaches in all curriculum areas which they were going to teach, it was found necessary to give them learning experiences which paralleled those they needed to develop for school children. These learning experiences needed to be developed within their graduate programmes. It was found that unless

this was done, the majority would be incapable of escaping from, or regressing to the methods by which they themselves were taught. This information was obtained through the in-service training network which was developed with teachers attending in-service courses who were being introduced to the same pedagogical approaches.

The teacher education students represented those in the top twenty per cent of the ability range in the population. Although intellectually able their secondary/high school 'A' level grades were sometimes lower than other students. In other words some were often lower attainers in the able group. Some of them were creatively intelligent with poorer memorising abilities. Thirty per cent were married women returners and mature students who had left school sometimes before 'A' levels. A few had had dyslexic difficulties in school. Each cohort seemed to be made up of a large proportion of underfunctioning able who, despite all the advantages of higher education, remained disappointed by their achievements or disappointing to their tutors as their initial motivation declined.

In order to try to break this cycle of disadvantage and unrealised potential the whole teaching programme in the psychology/special needs area was redesigned. The emphasis was moved from expository teaching and lecturing to learner orientated independent study methods. The course was scheduled to occupy four hours 'contact' teaching time per week for the final year. The typical schedule consisted of a one hour lecture followed by a 1 1/2 hour tutor led workshop and a 1 1/2 hour seminar. The new plan had to cater for a 50 per cent reduction in staff because of cuts in teacher education as well as the development of the new learning structure. The concept of structured student learning time was developed in which the programme ran as follows - a 1 hour lecture followed by a 2 hour student organised workshop and feedback session and a 1 hour seminar with the tutor on alternate weeks. The seminars on alternate weeks and student led workshops enabled the reduction in staff time to be accommodated in the programme without increasing the size of the seminar groups (12-15 students per member of staff). In another part of the B.Ed Course where tutors maintained their original type of programme and incorporated staff cuts by doubling seminar group sizes, deleterious examination results were obtained. In addition there were numerous complaints from students about the programme and its lack of relevance to their perceived needs, especially where seminars deteriorated into mini lectures related to the main lecture content. In our new programme reports became increasingly favourable.

The first thing which was discovered under the new régime of training was that most of the students lacked any form of self organising strategy and study skills. For example, after a lecture on test construction, test standardisation and norming including details of testing for reliability and validity, they were given the workshop brief, to "Determine if test X is a 'Good' test for use by the classroom teacher. Examine the three attainment tests set out and select one to study in detail and upon which to write a brief report."

The in-service teachers were given the same lecture and given the brief "Your head teacher has been to a conference where the virtues of test X were promoted. Examine the test carefully and write a brief report clarifying whether or not it is a good test".

In both cases the problem set was "Real". It was not an easy task to do and 1 1/2 hours was set aside for completion. It was with some amazement that tutors saw many of the undergraduates leaving the workshops after 20 minutes quite sure they had completed the task. After questioning about what they had done they were asked to hand in their report and were permitted to leave. Each seminar following the workshop had been designed so that the first half hour was for feedback from and on the workshop. The following hour was for discussion of the relevant research papers. It will not be surprising to find that none of the undergraduates gained more than C-grades for their test evaluations. Most of the practising teachers gained at least C. The more effective undergraduates had formed working groups of two and three

persons to discuss and plan their evaluation. Others worked individually or in loose association and at a superficial level. They made no systematic analysis of the lecture content and its application to test evaluation. The feedback session took an hour since the first half was spent in the students showering blame on the task, the tutors and the poor quality of the instruction, in coming to terms with their failure. Their dignity was upset. They listened to and reflected upon their strategies or lack of them and began to see how they might easily have accomplished the task. They also learnt that they had to enter into a detailed and concentrated interaction with each other and the material. They needed to interrogate text, tests, learning strategies and solutions. They would then begin the process of operating at higher order intellectual levels. It was agreed they should repeat the whole workshop again the following week not as a punishment but to prove to themselves they could actually do the work. The repetition was the subject of some discussion by the tutors, several of whom thought that the feedback on the failure would be enough. However, in the long term the complete repetition of the whole event was of both immediate and long term benefit. The students could complete the task successfully and gain satisfaction and closure. In the process they learned the need to link lecture content and theory, with the workshop activities and practice. In the process they learned to plan, organise and evaluate learning and the contents of their own learning in relation to external and internal criteria, all highly useful cognitive and metacognitive skills. A full cognitive learning spiral had been completed and they had operated at Bloom's (1956) highest level - *evaluation*. Each student could exit at the point where they were satisfied they had successfully completed the tasks.

These experiences for staff and students alike confirmed that we learn most from having to repeat a task we have already completed unsuccessfully when we have to reflect upon the process of learning as well as the contents of that learning.

"It is only after one has solved a problem that one can learn most effectively how one should have solved it" (Larkin et al., 1980).

On the second occasion all the groups worked systematically throughout the workshop period unsupervised and many stayed during the lunch period practising their new found appraisal techniques on several other tests. None of the groups scored lower than B+ for their analysis and the grasp of the concepts of norming, reliability, validity and correlation were remarkably sound. From that period they were able to give a professional and succinct evaluation of any test within twenty minutes. Their success was accompanied by a new feeling of vigour. From that moment they became alert for any new challenge the tutors might issue. Each group would discuss tactics and tutors' designs and motives as part of their task organisation strategies. At examination time little revision was required and a high standard of answer was achieved. In lectures a higher level of attention was observed for they continually expected to be asked to apply what had been explained to some new area.

The *seminar* which accompanied the lecture and workshop was to discuss a research paper on Early Screening Techniques by Leach (1983). Ten copies of the paper were held in the library complying with copyright conditions. The 80 students could make their own copy for study, use the library copy in the library or consult the journal article itself. They had to organise and complete their review within a week. The task set was that the article should be read and the flow chart of key concepts should be completed and handed in at the start of the seminar.

It was explained that the top box should hold the key concept which was central to and underpinned the rest of the sense of the paper. The other boxes should reflect the major concepts and issues which were discussed in the paper and followed from the key concept, the subordinate concepts. An introduction to flow charting and other cognitive study skills had already been part of an earlier study programme based upon the work of Thomas and Harri-Augstein (1975), Royce-Adams (1977) and Schools Council (1981). Whereas previously

reading a research paper and making notes for the seminar might take an hour or so, the problem posed by the empty boxes in the flow chart caused much lengthier independent study and preparation periods. Each student took time according to individual need. The constant searching of the text for deeper structures complied with the demands of complex written material for *reflective* reading (Schools Council, 1981) as opposed to *receptive* reading which most had engaged in previously. The capacity to remember the papers' structure and contents and give an accurate summary of them was very good and continued for a very long period. Seminar strategy was also modified to promote the development and use of cognitive processes. In traditional seminars groups of 12-15 students are assigned to a tutor. The students read and prepare notes on one or two of several research papers and then two of them are asked to present each paper to the rest of the group. Quite often only those who present the papers read them and their presentation is in the lecture form. It was realised early on that very little learning could be taking place through this strategy. The students who had presented the papers were the ones for whom the learning had been successful and this was evidenced in their examination papers. It was therefore essential to replicate the conditions under which they had worked with all the students.

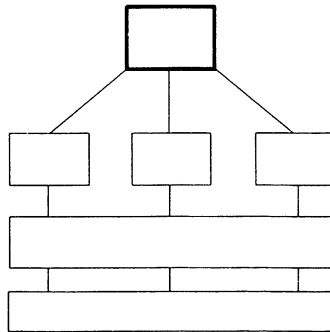


Figure 2: To show flow chart for seminar on Early Screening Paper (Leach 1983)

To assist in this, concept mapping tasks were frequently used for introductory sessions. To illustrate this method in relation to the Cognitive Learning Spiral the following was undertaken.

Concept mapping task

(1) The students were shown how to draw a concept map which would illustrate their thoughts about a particular topic. The concept **RUN** was used as the example (Figure 3a).

(2) The students then took the key concept Giftedness (Talent or High Ability) and before reading or studying anything were asked to draw a concept map expressing the knowledge, links and concepts which came to mind when thinking of the key concept (Figure 3b).

(3) The students were then given readings or lectures and practicals around the topic and were asked to complete another concept map on the same subject. This would take them through the first cycle of reflection upon the area.

(4) The final stage however was to ask them to write ten ways in which their pre and post readings concepts maps were different. This moves them through the second round of reflection in the Learning Spiral and is not only difficult for them to do but brings their cognitive processing to a higher level of awareness and operation.

A range of techniques such as these were used to bring the students to a higher level of cognitive functioning. Other examples were to set them to write a book review of a text they had just read according to review criteria, to design a short answer examination paper based upon the contents of those research papers and so on.

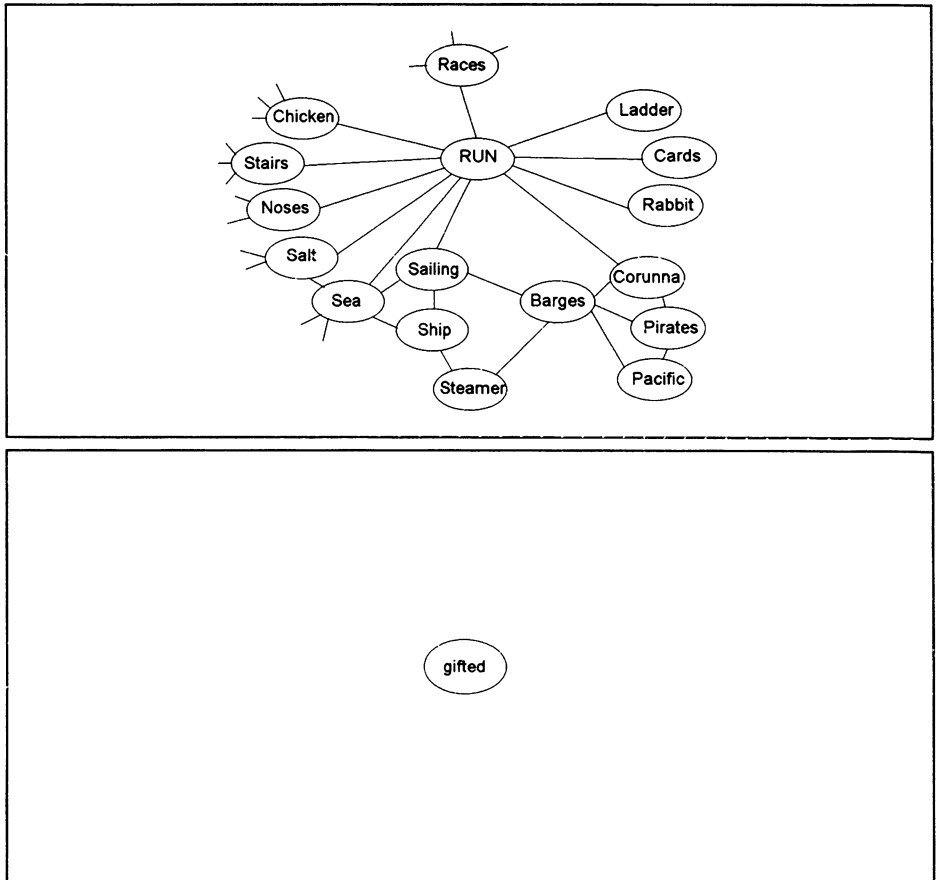


Figure 3: Example of the concept map for "RUN" (a) and work sheet for the concept map for "gifted" (b)

The research of Race (1992) later showed the extent of undergraduate learning through different methods and materials as follows:

Lecture	5%,
Books	10%,
Audio-visual presentation	20%,
Dramatic lecture with audio-visual presentation	30%,
Discussing	50%,
Explaining	75%,
Teaching	90%,
Assessing	95%.

As can be seen the lecture is the least effective method whereas students teaching the material to students is one of the most effective. Assessing the outcomes of learning was the most powerful pedagogical strategy of all. Although in the period when these developments took place Race's quantification of effectiveness were not available, nevertheless the grounded research showed that *Discussing, Explaining, Teaching* and *Assessing* were the strategies which most enhanced student learning and motivation. It was these which were incorporated into the programmes of study.

The following two histograms show post hoc the results of cohorts of teacher education students following a psychology/special needs programme leading to a 3 hour examination paper as part of their final fourth year assessment programme.

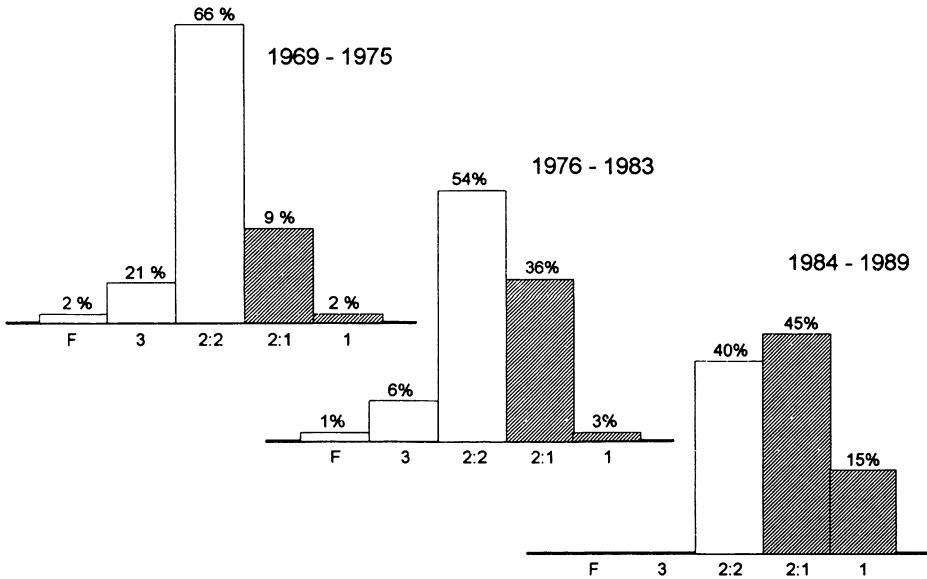


Figure 4: General distributions of examination grade results in terms of degree classifications

There is a distinct improvement in examination grades appearing after 1984. Prior to this period the grades had been more normally distributed. The negative skew seen after 1984 appeared on a consistent basis, the pattern shown is a typical one. Year cohorts increased from 20 to 85 students over the period. There are of course a number of factors which might bear upon the changes seen in the two histograms. For example, questions set in the examinations might have become easier; intake ability might have increased; the range of topics might have been set within narrower limits; tutors might have fed more clues to the examinees. For those engaged in the work there was a constant change in the programmes over a 15 year period but the students' scores on the final examination tended to be distributed normally until there was a critical change in delivery of the programme in the "class of '84".

The students were also asked to write their own reports on their learning in lectures, seminars and workshops. These reports were most detailed, reflective and informative and helped keep the programme on course in its new form. This was important for the tutors often became the ones who felt insecure. They became worried that they were not feeding out information in lectures to the students and had constantly to be weaned from not providing the answers, crib sheets and summaries. Immediately they did provide answers many students felt more secure and regressed to waiting to be told the correct answers and strategies. It was a continual battle to keep some of the students thinking. Their reflective reports however showed that important changes had taken place. An excerpt from one of these follows in the final section of the paper.

Summary

The subject of this paper is the Promotion of High Ability and Talent through Education and Instruction. The strategies and contents of process method teaching programmes for students in schools and their teachers in training have been outlined. The general results of their programmes have been reported. Direct statements from the learners were common, such as:

"It was interesting and made you think"	- 10 year old
"Much better than the usual boring stuff we get"	- 11 year old
"At last we are being treated as adults"	- 18 year old
"We feel like real students at last"	- 24 year old
"I know I have really developed intellectually in the last year"	- 29 year old
"It's the first time since I've been here I have really had to use my brain. It's quite hard, thinking"	- 25 year old
"This has been real 'engage brain' stuff".	- 40 year old

Course evaluations were very positive and the marked increase in the number of examination grades in the B+, A-, A, range was noted as well as the general improvement through the grades. What has been lacking until now is an opportunity to provide hard evidence that these strategies have promoted high ability and talent. In the next two years there will be the opportunity to produce this evidence with research funding from the University.

The cognitive-process pedagogies programmes have now been transferred from the previous traditional undergraduate programme to Middlesex University and developed as a series of Distance Learning MA programmes in Special Needs, Specific Learning Difficulties and the Education of the Highly Able.

The following list shows some of the Cognitive-Process Strategies from the original programme which have been redeveloped and added to and which are now part of the Distance Learning programmes.

Examples of Cognitive-Process Assignments

Flow Charting *	Concept mapping *
Main points	Naming and connecting
Write a short answer test paper *	Write a book review *
Evaluate a reading test *	Design and evaluate a Whole Book game *
Make a problem solving lesson *	Structure a collaborative task *
Mark an essay *	Evaluate a computer package *

(* According to given criteria or structures, e. g. criterion referenced assignments.)

Examples of Cognitive-Process Study Skills: In relation to textual, visual and performance material

- * Locating the main point and subordinate ones
- * Flow charting
- * Deletion
- * Tabulating
- * Classifying
- * Diagramming
- * Sequencing
- * Comprehension
 - factual
 - inferential
 - abstract
 - recognition of intent, bias, attitude, propaganda
 - critical appreciation
- * Labelling
- * Categorising
- * Comparing
- * Contrasting
- * Drafting
- * Perceptuo-cognitive strategies
 - skimming, scanning, locating information

Thus far the results from the programmes have shown that a love of learning can be rekindled in able students in classrooms and universities. It has also been shown that it is possible to design assignments which will most effectively develop independence of thinking and effort based upon cognitive-process principles.

Teachers and tutors however need help to move them from their traditional lecture mode strategies to become managers of learning, facilitators and collaborators with students.

Examples of student self assessment, reflective reports

Julie C. Yr 4:

Lectures: My note-taking is more effective than in earlier years. I have more confidence to write my own interpretation of the information received, rather than attempting to form copious notes of everything mentioned. I feel I have acquired a basic understanding of the content of the lectures so far, but need to read much more to enhance my superficial understanding.

Workshop: I like the design of the day's programme in the sense that the workshop sessions enable me to internalize the content of the lectures; to discuss with other people apparent uncertainties. The intensity of the whole day, during which we explore an aspect of the course, means that I have time to consolidate ideas and, consequently generally leave the college feeling that I have learnt something.

Seminars: I feel I participate far more in these seminars than I have done in those during previous years. However, I am still often reluctant to offer verbal comment, despite my good intentions! The seminars clarify and extend my understanding of the papers we are required to read. Listening to other people's ideas and experiences makes the papers appear more relevant and meaningful. I am very aware of the fact that the more I put into this course the more I will receive from it. Thus, greater reading on my part is necessary. I question my ability in terms of identifying children with learning difficulties and implementing suggested intervention techniques. Yet I am (happily) aware of my interest in the subject, e. g. when I go into school and definitely sense 'problem areas' and feel myself wanting to respond to them."

Kerry O, Yr 4:

"*Course Evaluation:* I find the course particularly useful and relevant for work in school. We are provided with strategies for dealing with and identifying children with learning difficulties and gifted/able pupils and we have been given useful schemes, addresses etc which can be referred to in future years. The seminars and workshops are of great use.

Self-Evaluation: I am particularly interested in this course and wish that what I have learnt, I had learnt earlier as it would have been very useful for past experiences in school. I need to read up on the issues more frequently rather than leaving it to the end of the year! (Hopefully this will be done over Christmas.) I also enjoy the readings, believe it or not, and find the ensuing discussions stimulating; I feel I need to jot down more notes on the papers whilst reading them, trying to pick out main and subsidiary points rather than taking an overall view. However, I do find that I am applying ideas and skills into my teaching which I have gained from this course, which I feel shows I am interested and also understand. I need to contribute more to discussions as I tend to listen to other ideas but do not share my own!"

Attendance: One 1-hour seminar missed.

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Commentary on: The promotion of high ability and talent through education and instruction

Heinz Neber

Institute of Educational Psychology, University of Munich, Munich, Germany

Diane Montgomery's contribution deals with some important questions in gifted education and reflects the growing interest in talent development (Mönks, 1990). In order to answer such questions, her starting point is characteristic, selective assumptions about determinants of high ability and talent. These determinants are located solely in the area of instruction, or the academic learning environment. This corresponds to an extreme environmental perspective with no discussion of the role of biological prerequisites (Plomin, 1989). All non-academic environmental determinants other than at school are also left out, such as family background or the community (Azmitia & Perlmutter, 1989). This contribution thus concerns itself with the optimization of academic instruction.

This, too, takes place in a characteristic perspective. The promotion of high ability is not achieved through additional training, special course content or classes, but rather through improving regular curricula for all students. This completely neglects the questions of admittance to and the identification problem for programs of the gifted (Feldhusen & Heller, 1986). This presentation, thus, does not deal with gifted individuals as a subpopulation of students but rather is directed at the general improvement of instruction, at the promotion of all students.

The starting point is the determination that motivation of students and their higher thought processes are inadequately promoted in the regular classroom. This leads to intelligence being left unchallenged, underdeveloped. This intellectual potential of learners is left unused and even education students could be considered to be gifted underachievers. This could be shown in a retrospective questionnaire of students and their experiences at school.

Good teaching should eliminate these deficits in scholastic learning. The author developed a program for training education students which is described here. It is continuously modified and improved. The goal of this program is to create the individual setting for motivating and thought-promoting instruction so that all students can use their full intellectual potential. This contributes to the battle against the newly recognized problem of underachievement (McCall, Evahn, & Kratzer, 1992; Butler-Por, 1987).

The attempt to do so through an adequate teacher preparation can be incorporated into a number of educational programs, especially within the American departments of special education and educational psychology (Maker, 1976). A total of two goals are strived for,

- an improvement in grade school education;
- a more effective degree program for students studying education.

The contribution is concerned almost solely with the second goal. In order to achieve more effective learning in the degree program, the author evaluated years of her personal teaching experience, some very general teaching models and as a specific approach: Bloom's taxonomy of learning objectives in the cognitive domain. Unfortunately, the broad spectrum of more

relevant teaching models are not considered which have already been developed and tested in gifted education on the basis of Bloom's taxonomies (Maker, 1982).

The method employed here can be more closely related to the current educational developments. This is true of the attempted more effective study of education students which is organized around problem-oriented instruction, learning in real-life situations, cooperation with other students and the metacognitive support of study skills. All of these methods can be related to contemporary developments in the educational domain. These are primarily the problem-oriented curricula, situated learning (Lave & Wenger, 1991) and cooperative work forms (Resnick, Levine, & Teasley, 1991). Diane Montgomery's work thus contributes without doubt to the progress in these areas and represent the important interface between practical education and research on giftedness.

Further integration of the results in the areas mentioned should be used to increase this interface. This demand also holds true of the data in this contribution for evaluating this described program. The criteria should include not only grades in exam and students' self-reports about the study techniques used but also measurements of changes in the students' educational expertise. The ability to design and execute motivating and thought-provoking curricula are a declared goal of the program. It is decisive for the challenging of high ability and talent in primary school students and should be evaluated.

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Thinking in the head and in the world

Joan Freeman

Institute of Education, University of London, London, United Kingdom

Abstract

I am concerned here with examining ways in which highly able children can develop their talents for real-life circumstances, rather than just reproducing information for examinations, or solving sterile intellectual puzzles. Clear and effective thinking can be seen in the way people deal with information, such as the flexibility and speed with which they can command their intellectual powers for a variety of purposes. Yet however potentially able they are, children need help to process and use information in an adaptable way, to the best of their innate ability; in this, a primary aim is to guide them towards effective abstraction and storage of impressions which are more and more complex. The very earliest learning and ways of storing that information in memory are important steps towards future high-level performance.

The integration of new learning depends on a solid and growing knowledge-base, while the value of this learning depends on the child's ability to apply it in new situations, i. e. transfer. The extent of a person's knowledge is so important in learning that it can even overwhelm some differences in IQ, but efficient use of the available mental resources shows up best in a novel situation. Which thinking strategies children will choose depends on how valuable these strategies appear to be in certain situations, though those which are very well practiced can turn into habits which may then be used in unsuitable circumstances. For example, some people who have been highly successful at school examinations proceed through life showing how much they have learned - as though they were still at that stage - rather than exploring new directions and ideas in the wider world.

Competent creative thinking involves choosing suitably from a range of possible thinking strategies. To do that requires the confidence to take an overview of both the subject under consideration and of one's own mental approach (metacognition). My own research (Freeman, 1991) found that those who were highly able intellectually often had an advanced degree of such awareness, and that they could function nearer to their best for longer than the others in the sample. If all children could become more aware of their thought processes and learning strategies, they could not only widen their thinking repertoire, but know when to select and apply different procedures. Neither development nor performance can be looked at separately from the context in which they function - good performance in one context may be poor in another. Yet adaptable thinkers can operate appropriately in a wide variety of contexts.

Good inter-personal relationships begin at birth, and are important for the development of both intellect and a sense of responsibility. The reciprocity of interactions between adults and children, as well as the variety and meaningfulness of these interactions are important aspects of education. Developmental research has also shown that social and economic influences strongly affect not only the quality of thinking and consequent levels of performance, but also an individual's aims in life (Freeman, 1992). The more complex a society, the more intellectually competent its people must be to exploit their opportunities in it and accept responsibility for their actions.

People can act positively when they have enough self-confidence and courage to use experience in new ways: formal education is not the only route for developing the highest levels of expertise. If the education of exceptional skills and talents is limited to selected groups, however good the selection procedure, there will inevitably be talented individuals whose potential contributions to society are not developed. What is more, it is not possible to predict the kinds of talents that will be most needed in the future.

The promotion of versatile thinking comes from acquiring knowledge in a manner which is meaningful to the learner, and which can be used in many situations. Individuals also have to learn to work with others - a skill which they can practice at school, leading to greater interpersonal understanding. Flexibility in teaching, concern for the individual child, the provision of free, high-quality education, as well as non-school educational provision for those who want it - are the facilities which enable excellence to develop in people from all walks of life.

This is a strange title, and you may be wondering what I mean by it. My concern in this presentation today is to explore ways of moving away from the kind of limited learning and thinking which stays mostly in the head, and which the highly able are so often pushed into at school, because it is very useful in examinations. Instead, I would like to see all children helped to keep their minds open, so that they can think in a flexible, creative way, and behave with competence and responsibility - the theme of this conference. This implies that their that emotional development is well balanced, which would benefit both their classroom work and their activities in the world outside, for the rest of their lives.

Flexible thinking can be seen in the ability to deal competently both with information, and with other people. But it does not develop spontaneously to a high level, even though in its more positive form of creative thinking, it is part of every-day problem solving. No matter how potentially highly able children are, they need support and teaching to develop their thinking flexibly and creatively to its highest levels. If we could teach *all* children how to keep their minds open and ready for competent action, then we would be able to increase the numbers who would be considered highly able.

I have spent many years of my life investigating the development of human abilities to their highest levels. During my researches, I have come across the problem of bright children who are keen to learn, and who's parents and teachers are keen for them to learn, but whose sometimes emerge from their years in education with their curiosity dimmed and their outlooks narrowed. They may, however, have superb examinations results.

I believe that in the past, we have seriously underestimated the human potential for learning and creative thinking, although genetic inheritance does set upper limits. The decoding and learning of language, for example, is a brilliant feat that is accomplished by just about everyone, including slow-learners. Tiny babies have to learn to make sense of what adults say, not only to understand the direct meanings of their words, but also to interpret the unspoken implications of their gestures and body movements. Reading is another example of a common high-level thinking skill which demands some creativity. In trying to understand what an author had in mind, the reader has to check the new ideas, and then organise and compare them with what he or she already knows. Even beginners select from the text, leaving out details that do not seem central to the message, and adding extra information from memory that is needed to make it intelligible.

Research findings from psychology, the social sciences, neurobiology, and medicine, show that the way people think and behave is directly related both to their experiences and to the way they perceive these. Although there is considerable overlap between the environmental

influences which promote creative thinking on the one hand and high academic achievement on the other, they are not always exactly the same, and can even be contradictory. For instance, one can predict academic achievement quite well from the IQ score, but not creative accomplishment (Milgram, 1990). Creative thinking, because it draws on emotional and personality factors, needs emotional freedom to flower, whereas successful academic achievement is more dependent on controlling the emotions.

The arts may only account for a small percentage of the world economy, but in their different forms they permeate every aspect of life, whether as music, dance, literature, or the visual arts. Life can be lived on a basic level with no sustenance for the spirit, but that is not one which anyone would choose to experience. Aesthetic productions are not a luxury, but a necessity, the dynamic of human society, and they depend on flexible creative thinking.

Research in music and fine-art

The first indications of a possible split between academic learning and creative thought came to me when I was working on the development of aesthetic talent in primary school children; specifically, with fine art and music (Freeman, 1984). I had started out with the idea that since cultural differences are effective in determining children's school achievement, the same was probably also true for their aesthetic development.

Because tests of aesthetic ability are not entirely reliable, I decided to start my investigations with children who were clearly outstanding in those areas. This meant combing the primary schools of the industrial city of Manchester for talented children. To find the young fine-artists, I took armfuls of pictures out of dusty school cupboards and off classroom walls, to be judged for quality by practising artists and teachers. For the young musicians, I asked the school music teachers and the Saturday morning orchestra leaders for names, while some had already passed the audition for entry to the famous Chetham's school of music.

Eventually, my sample contained 72 children divided into four groups - 12 talented young fine-artists, 12 talented young musicians, and for each of them, a control child matched for everything but talent, who was taken at random from the same class. I gave them all a wide battery of tests of intelligence, personality, and aesthetic ability, and also devised some myself for this unusual project. For these, I used aspects of short-term memory, as being an accessible function of developed perceptual abilities in these areas. The children worked with new problems in music and fine-art. Three aspects of memory were used, (1) recognition of individual colours or sounds, (2) discrimination of style in painting or musical composition, (3) practical manipulation of the relationships of the elements of drawing or music.

These proved to be highly discriminating. The children who had had knowledge and practice in these areas were able to remember and use it flexibly. But there was some overlap between the two sets of talented children on all the aesthetic tests, so that they were more alike in their scores than their two control groups. An aesthetic factor seemed to be operating. But there was more to their talent than just knowledge and practice.

I went to each child's home, where I interviewed the parents about the children's early development, and the family way of life. Clear and statistically significant differences emerged between home backgrounds of the groups of children. All the children - both talented and control - had had access to the same school influences, provided free by the local education authority. But the talented lived in homes where they were given generous parental encouragement and equipment, and where parents generally had a musical or artistic life-style.

Most of the 12 schools in the sample had made considerable efforts to help the children in these areas, but whether a child's talent actually blossomed seemed to depend on cooperation from home. It appeared that children were unlikely to develop their talents to an exceptional

level unless the adults with whom they lived were prepared to make the effort to support them. And yet, while some schools in the sample took advantage of local authority provision to produce a fine collection young musicians or excellent art work, others of similar socio-economic status could not produce even one child who played the recorder and the school walls displayed few paintings.

The musical families also were different from the fine-art families in their daily living, for example, the musical parents brought up their children more strictly, including making them practice regularly. The artistic families, though, were much more given to family discussions, and their children had the broadest cultural interests in the whole sample. This broader cultural base included proportionately more musical activity than the young musicians had in fine-art. These artistic children from their liberal lively-minded homes also had the greatest flexibility in thinking in the sample.

Although I found the superior creative thinking of the young artists interesting, it was not my main research goal at that time, but I did record it. Looking back honestly, I may even have put it into a mental compartment as being part of the myth of the Bohemian artist - which in truth did not fit very well with the lives of these school-children, many of whom lived in the mean streets of the industrial revolution. But later, the question of influences on the development of creative thinking came back to me with force during my longitudinal study, because it is only that kind of study which can provide an extended view of children growing up. This time, I was able to watch some of the children change from being open-minded and curious to become limited and sad young adults with dull eyes and little concern for what was going on in the world.

These impressions, however, were not part of the original research hypotheses for the longitudinal investigation: they emerged over time. Fortunately, having accumulated a great deal of data on most aspects of the young people's development, I was able to identify this syndrome, and analyse what had happened across the years to find how it had come about. Before describing what emerged from that work, though, I'd to look at what is known about how flexible and creative thinking develops.

Creative Thinking

There are two essential foundations for creative thinking - emotional support and education.

Emotional support. Feelings of being worthwhile affect children's belief in what they are capable of doing. Those who feel good about themselves and confident about aiming high are psychologically much better placed for the development of creative thinking. Emotional support includes the increasing degree of control that children are allowed to assume over their own working and living environments. For any achievement, such matters as self-confidence and satisfactory personal relationships can be as important as the mastery of skills and knowledge. Good self-esteem brings with it one particular ability which is vital for creative production - that is to delay reward. This ability was investigated in 4 year-olds (Mischel *et al.*, 1989), and the researchers found, as they had expected, that it increased with age. But they also discovered that the ability to delay gratification correlated positively both with intelligence and with thinking ahead for others - social responsibility.

Education. The major goals of good education are generally recognised as having spread beyond the mere accumulation of knowledge, to include helping children develop curiosity, problem-solving attitudes, and a love of learning which will last them for the rest of their lives. However, these beneficial teaching aims have to be encouraged by specifically directed teaching, with provision of materials to learn with. But they can be obstructed by the children's lack of self-confidence as well as by cultural prohibitions.

In order to find ways of improving the flexibility of thinking for competence and responsibility, it is essential to look at how the process begins, and what influences its development. The context of learning is extremely important in the development of thinking.

The importance of context

Thinking is social. From birth, individuals adjust their behaviour according to the people they live amongst. Assessing the capacities and predicting the behaviour of other people is an important part of intellectual growth. Freud used the term *Menschenkenner* for people who were notably good at the perception of others. The ways in which we behave can be seen as ongoing 'experiments', their results providing feedback from the environment which determine future behaviour. You can see the effects of the social context in the ways an individual deals with a problem, which may change radically in different situations. For example, a child may think more creatively at home, but conform at school; or he may fail with the problems set at school, but be highly successful in the demands of the street gang.

Neither development nor performance can be looked at separately from the circumstances in which they operate, because good performance in one place may be inappropriate in another (Wertsch, 1990; Nisbet, 1991). But competent people should be able to operate in a great variety of situations, for which flexible thinking is crucial, especially in complex situations.

In my role as President of ECHA, I have been privileged to see children of all abilities growing up and being educated in widely varying circumstances throughout the world. Some of these conditions offer them only very limited possibilities of teaching, and few resources to develop their thinking. In the ex-communist countries of Europe, for example, not only do schools still face severe shortages of materials, but the teachers also have to overcome the training they received to think and teach in specifically structured ways. In the favela slums of Brazil, where children have to earn money to live, teachers are obliged to use their ingenuity, such as offering food to children to entice them into school. In South Africa, children in the shanty towns are struggling with the break-up of the system of education based on apartheid.

The more complex a society, the better educated people must be to exploit their opportunities, and to adjust their own behaviour to others in it. Right now in Britain, a country of 60 million people, we are putting all the social welfare data onto a massive computer system. This means that the thousands of managers and clerks in welfare offices must be sufficiently competent to access this information quickly and accurately, because the claimant's next week's rent may depend on it. This is also happening with all German published works; the original training of the librarians who will handle the data will probably provide the basis of their competence in dealing with it.

The roots of thinking skills

Once a baby is in the world, every sense is active, though usually with a bias towards vision and hearing. Even in the first days of life, infants are curious and look around for what interests them, staring at some objects and events more than others. The refinement of their earliest perceptions is very rapid, and what they are learning then provides a very important foundation for their future thinking.

Even in babies, intellectual development can be thought of in terms of problem-solving skills (Mayer, 1992). By a few weeks old, they begin to use their own experiences for simple problem-solving, and so must have begun to store them in memory - however fragile and unreliable. But the human brain is never passive; we always try to make sense of our experiences by transforming them into simplified, coded, versions. Adults have thousands of these short-cut codes in memory, such as judging distance by using perspective cues learned from experiences.

The earliest coding starts with coordinating sensory impressions, such as the way a ball feels round and watching it roll. But good perceptual skills do not just happen, they must be learned through experience. Improved performance requires practice, and so the best children's toys are those which provide physical characteristics to be explored, problems to be solved, and the possibility of classifying things.

Culturally disadvantaged children, though, find it more difficult to practice and increase the complexity of their early perceptual learning. This deficiency can be seen in little children who are below average in recognising objects and situations, and are also less able to describe them (Siegler, 1991). Children from unstimulating homes where play-material is scarce, have been measured as falling significantly behind others by the time they reach five years-old (Mascie-Taylor, 1989).

In many if not most societies, mothers provide a baby's introduction to the prevailing culture by mediating or filtering experiences of the world. The mother's own emotions play a role in this mediation, which can significantly affect the intellectual growth of the baby. Even infants of ten weeks can recognise the difference between happiness, sadness, or anger in the mother (Collins & Gunnar, 1990). Her happiness encourages the infant to explore, her sadness producing sadness or anger, whereas her distress causes the infant to withdraw.

Any condition that causes stress to infants increases their need for their mothers, and decreases their urge to explore. What is more, the ill-effects of anxiety-arousing experiences are cumulative. Consequently, children raised in a stable happy home are more likely to be curious and to persist with their own explorations, especially when the tasks become more complex. In a comparison study, three and a half year-olds, who had been classified as securely attached when they were babies, thought of new ideas and participated more in nursery activities, and they also attracted more friends than the less secure children. Their teachers rated them as more curious, eager to learn, self-directed, and effective (Waters *et al.*, 1979). The strongest early indicator of a future lively mind is the ability to communicate, which is traceable from the age of three months, (Bryant, 1992). Vigotsky (1978), in his 'socio-historical' approach, described how while children are learning their language they are also taking in 'ready made' parcels of culture to use in thinking. In addition, almost all words carry emotional meanings from the situation in which they were learned, although this can change. Language also influences thought by firming-up perceptions, and children with poor verbal ability can also have poor perceptual and other intellectual abilities.

Things that parents do together with their child have a far-reaching effect on the child's understanding and thinking. Games, conversation, stories, walks in the park, even arguments, positively foster the child's intellectual growth. The problem for research is how to establish which factors result in what characteristics, because the interaction works both ways. For example, a highly verbal and demanding child can affect parents' behaviour by stimulating them to offer more conversation and read more stories. On the other hand, those parents who do talk to children a lot were probably verbal people before they had a family.

The effects of children's experiences and the way they approach new ones can be seen in the development of their personal way of thinking - their 'cognitive style'. This can partly be seen in terms of how much they use either side of the brain, or more generally as how much 'divergent' and 'convergent' thinking they do. A convergent thinker goes by the rules, will probably reach conclusions quite logically, and generally does well in scientific or mathematical activities. Divergent thinkers are more creative, coming up with new ideas and approaches, and often prefer more artistic activities. At school, convergent-minded pupils do better with straightforward question-and-answer type tests, whereas divergent pupils prefer essays, where they can use their imaginations. Traditional teaching in schools usually over-emphasises the convergent style.

Sorting perceptions

For every baby, the 'bits' of unconnected information they perceive have to be sorted, coded, and put into a developing mental structure to make some sense of them. In time, these bits are clustered into active ideas or 'schemas', which are used to compare and interpret new perceptions. One could also call them 'operational models'. These models of personal causes and consequences normally develop in an unregulated and unreviewed way. Nevertheless, they are complex and subtle, underlying underlying the personal ability to anticipate and control the situation.

The variety and the flexibility of these schematic models depends on what has been experienced. For example, little children, with their limited experiences, will have the idea that all women are like their mothers. Obedience is an emotional schema, which may be useful in some childhood situations. But if it becomes fixed, because children are not allowed to practice making decisions for themselves, they are likely to continue to accept others deciding for them. Any independent questioning, thinking, and stepping out of line can then be difficult.

Schemas are further combined into a sequence directed towards a goal - a 'strategy'. A simple strategy would be the allocation of the right amount of time in the day for different tasks. This takes some practice before it runs smoothly, for which children can be helped to plan and check what they are doing. Of course, teaching children how to make strategies does not mean that they will use them regularly, either in the original situation or transferred to other situations. Yet children *will* use the strategies they have learned, more often and in more sophisticated ways, when they can see the benefits to themselves, such as by earning praise or money.

The most valuable and sophisticated 'super' strategy is 'metacognition' - the awareness of one's intellectual activities, such as thought processes, concentration, and memory, so that they can be employed most effectively. It is a well established fact that individuals who employ effective planning and self-monitoring will perform better than those who do not regulate their actions (English, 1992). They can become self-organised and are free to learn from experience. They can use themselves as a reference 'test' for validating new experiences, both to negotiate what they need and carry it over into future learning. For expert performance, it includes a comprehensive knowledge of a given domain, so as to outperform others with a more limited knowledge (e. g. Chi, Glaser, & Farr, 1998). Hence, to be at their most effective, it is important for children to be familiar with strategies adaptable to the area in which they are working, for both novel and routine problems.

Highly able children do seem to have better capacity for metacognitive processing (Freeman, 1991; Swanson, 1992). But all children can be helped to improve this overview ability, for example, by keeping personal records of how they work, and discussing what they find. They can be taught to develop the habit of metacognitive behaviour in their learning, such as by checking their understanding of the principles, monitoring for consistency, and consciously relating new material to old.

In all analyses of complex task performances the prime characteristic to appear is smoothly working metacognition. This is found much less frequently in younger or less experienced individuals. The experienced car mechanic, for example, reasoning about breakdowns and repairs, does not work unthinkingly through a routine checklist, but makes good use of the 'mental models' she has acquired of the behaviour of engines.

However, the ability to think strategically can begin early. Lehwald (1990), working with children of between 4 and 6 years, found that the more intelligent and curious among them were better at exploring things systematically, using their metacognitive resources more skilfully. He hypothesised that the parents of these young children used metacognitive hints, in a mediating way, when solving problems together with their children during play, instead of simply providing the solutions.

The flexibility and efficiency with which one uses available mental resources show up best in novel situations. Sternberg and Davidson (1986) believe that this is the main difference between the intellectually gifted and other children, ie. in the way each gets hold of a new task and carries it out. Indeed, that is where the highly able are most likely to show themselves: firstly in their capacity to take a speedy overview; secondly in their ability to form effective strategies to carry it out, and thirdly, in their ability to monitor their own performance. I would suggest, however, that even though a task may be carried out perfectly using good strategies and monitoring, if there is no possibility of flexibility, such as in a mathematics problem with a fixed answer, then the outcome cannot be considered as being at the highest levels of thinking.

The creative cost of high academic achievement

Teachers know that the style and efficiency of children's learning and thinking is fairly well set by the time they reach the classroom. All long-term studies have shown the cumulative effects of family attitudes in the development of talent (Bloom, 1985; Czeschlik & Rost, 1988; Freeman, 1991; Heller, 1991; Oden, 1968). They have also shown that the highly able in stable homes are at least as well adjusted as other children. In a historical case-study of outstanding individuals such as Darwin and Piaget, Gruber (1981) found a similar combination of events and potential. The most impressive evidence I have found for the artificial division between academic and creative thinking came from the longitudinal research which I carried out in Great Britain over a period of 14 years. I will not go into the details of the research here, it is published in *Gifted Children Growing Up* (Freeman, 1991), but simply provide an overview picture.

The research took a wide view of the development of a group of recognised gifted children on the one hand, and matched but unrecognised gifted children on the other, as well as a random control group, all from the same school class. The follow-up investigated 81% of the original sample - 169 young people aged between 14 and 23. The methodology involved deep, counselling-style interviews with all the young people, their families and teachers, and provided a holistic perspective on their development. My overall intention was to look for the often subtle matters which could affect the development of the children's abilities and happiness.

At this point, I will pick out an aspect of the work which threw some light on the theme of this address - the development of flexible, creative thinking. Most particularly, I was moved to search the collected data to find out how some of the bright and lively children that I started with had become unquestioning and unresponsive young adults.

What gives you the greatest pleasure?

At times, academic research can be hard tiresome work. But then a revelation, which was quite unexpected, can light up a whole new area. The question - "What gives you the greatest pleasure?" - had been designed simply as a relaxing way of rounding off an interview of some hours. But, in fact, some of the responses were so distinct that it was possible to make a comparative study between those who chose measurable achievement as their greatest pleasure - the Achievers - and those who found their greatest pleasure in creative activities - the Creatives. Others in the sample found their pleasure in wider variety.

This question about pleasure proved to be an important indicator of the young people's outlooks, which could be measured against my collection of the varied influences in their lives. Whether it was in measurable achievement or creativity, the pleasure which the young people described was not passive, but was usually put into action. The sad overall finding was that although almost all the sample had enjoyed some steady satisfaction in some creative activity as they grew up, only the Achievers had changed radically. When they were children they had enjoyed their creative endeavour, but it began to diminish in their early teens, hitting a very low

level by the age of 18, and by 20, only a few of them claimed any creative leisure activity at all.

Statistically however, although many of the comparisons were highly significant (at 5% or 1%), the results can only be taken as indicators, because the numbers became rather small - 41 Achievers and 11 Creatives. Of the 169 young people, only 6.5% had found their major satisfaction in creativity. However, the size of the sample was somewhat moderated by the case-study manner of investigation.

The two profiles

Analysis of the data showed up distinct characteristics of each of these two groups. Most notably, most of the Achievers were boys (93%) and most of the Creatives (73%) were girls. Their respective outlooks appeared to have made a difference to their school-leaving examination results. Though the Creatives had acquired more passes, they were distinctly lower in grade average - the Achievers obtained twice as many A grades.

Emotionally, there was a great distance between the two groups. On a British test of adjustment (Stott, 1976), the Achievers had far higher hostility scores than any others in the whole sample - but of the 11 Creatives, only one managed a single hostility score. The Achievers also had by far the highest peer-maladaptiveness scores - whereas the Creatives did not manage a single one between them. It was clear both from the test results and the interviews that the Achievers had real difficulty in coping with emotions and relationships. This sometimes brought them depression. Not only did their sense of their own value often appear to depend on their academic successes, but also their deeper sense of self in the sense of - If I cannot demonstrate my success, then who am I? A few were explicit about this fear.

Both the Achievers and the Creatives had absolutely identical, very high IQ scores, but regarded them quite differently. The Achievers often saw their exceptional intellects as an aspect of themselves which was unattractive to other people, while the Creatives could either disregard theirs or take pride in it, but either way they said it made little difference to their friendships. Thus, it was not the high IQ itself which affected the young people's relationships, but their self-concepts. The Creatives also felt themselves to be more empathetic - twice as frequently as the Achievers, and to me, the interviewer, they seemed much more communicative, livelier, and more fun to be with.

However, life was not entirely smooth for the Creatives because they had far more problems with their teachers. They seemed to have more difficulty in fitting in with the system - or the system was not flexible enough to accommodate them.

The Achievers were not altogether responsible for their psychological situation, though. They were often under considerable academic pressure, being at high-powered schools where the arts subjects were given low status, and their attempts at creativity had sometimes been blunted by teachers. There were also significant differences in the home backgrounds of the young people. In the Achiever's homes, the admiration of achievement, especially in science, often took precedence over artistic appreciation and practice. The Creatives' homes were more artistic; they had more pictures on the walls, a wider range of books, and parents were more serious in their attitudes to music. The families often listened together, rarely used music as background, and they more frequently played instruments themselves.

Characteristic profiles of each group could be described. The Achiever accepted the goals and authority of his academic institution, which were reinforced by higher esteem from the teachers and support for his high-level work. He carried this acceptance of authority over into non-school systems, such as in his leisure activities. Some saw university as a rather nicer form of school, where they worked very hard, were occasionally inspired by the teaching, but were

usually unaffected by the wider opportunities there. Most of the Achievers had chosen to study science. They had few, if any, friends. They were decidedly short of imagination.

The Creatives were much less academically ambitious, and accordingly less successful in school and examination grades. Perhaps because of this, and the discomfort they often felt with the school system, they believed that their teachers underestimated their intellectual potential. Compared with the Achievers, they were much more lively-minded, more active in politics, and more interested in what was going on in the world, now and in the future.

In fact, Eysenck (1990) has provided some evidence which fits these patterns. He sees personality factors as being associated with academic success. The introvert, he says, suffers from anxiety, and works hard with good results, while the extravert socialises and neglects her studies.

The evidence provided by this study seems to encapsulate the wider findings of much other research. One could say that both the Achievers and the Creatives were influenced in their behaviour by their family attitudes and self-esteem. Teachers seemed to treat them in accord with the image they presented, the Achievers were not encouraged to be more creative, and the Creatives' academic potential was underestimated.

Conclusions

Having described just a little of the evidence which indicates how children's flexible thinking may be limited, it is time to look at what positive actions could be deduced from it. The possibility of making changes in parenting is beyond the scope of this presentation, other than what I have outlined earlier. But there are a variety of ways in which rigid teaching in schools can be loosened up. What is more, many human aptitudes are better developed outside the classroom than in it, such as through contact with professionals - artists, performers, farmers, scientists etc. Such changes, though, calls for a fresh outlook from administrators and teachers, and a willingness to alter routine - to think differently from before.

Although the bases of the changes I am now suggesting are not new (they were approved by both Socrates and Dewey), their practice is still uncommon. What is more, as pupils sit in their rows in the classroom, the information they are given is not always ordered in the most logical or easiest way for it to be absorbed and applied. I have chosen just four major areas:

(1) *Social learning.* The first change should be from concentration on each individual learning from the teacher, to socially based learning. This means encouraging a two-way interaction between pupils and teacher, as well as interaction between the pupils. For example, the teacher could talk aloud while working through a problem, so that the pupils can follow her more expert reasoning and then discuss it. Or it could be cooperative learning, in which pupils explain their reasoning to each other.

Teaching for flexible thinking involves the pupils in decisions and allows them some negotiation about how they approach a task. The teacher has to check, though, that children do progress in areas of weakness, and not simply reproduce earlier successes. In a normal mixed-ability classroom, it is impossible for a teacher to adapt to each pupil's cognitive style, but within reasonable limits, the pupils should have enough freedom to learn in their own way. This is encouraged if the learning environment includes the pupils' ideas and initiatives, and not only those of the teacher. The learner also needs some freedom to change direction and use different strategies, maybe even being allowed to move in or out of the classroom to work in different groups, or having access to different materials and equipment.

The lack of social learning between teacher and pupil begins to have negative effects from the first days at school. British research on young children in school found very few times when they were actively engaged in a real intellectual search (Tizard & Hughes, 1984). Compared

with their rate of questioning at home, they asked relatively few questions in school. The teacher, however, did ask questions, although she usually had an answer in mind - the 'Guess-what-I'm-thinking' style of teaching - and children's incorrect answers were often dismissed. This not only inhibits children from seeking information and ideas from their best resource - the teacher - but also from giving responses which may be different from hers.

(2) *Realistic problems.* The second suggested change is the increased use of realistic problems in the classroom. The best kind of learning can be transferred for use in other situations, which means being able to extract the key operations from one task and recognise how they can be used for others. This depends on flexible memory storage, so that knowledge can easily be found, adapted, and put to work. The most efficient way of doing this is to learn the material in a problem-solving way in the first place. There is evidence that learning taught in a realistic problem-solving way has built-in potential for transfer to other situations (Okuda *et al.*, 1991).

Finding and solving real-world problems provides excellent mental exercise. A real-world problem in mathematics, for example, would be working out the best way of spending the weekly classroom budget, an in-the-head type of problem would be working out how long it would take 3 men, each digging at the rate of 1 metre an hour, to make a trench 4.6 metres long. Bringing meaning into children's learning with individual projects and interests means replacing a rigid timetable with careful preparation for teaching, where possible guided by the child's individuality.

However, one cannot assume that children who are actually dealing with problems in the real-world use them with deep meaning. This warning is illustrated in studies of Brazilian street children selling food (Karraher *et al.*, 1985). Their work required them to do arithmetic in their heads - If one coconut costs x cruzeiros, how much will five coconuts cost? - which they did speedily and accurately with very little formal education. But the study found that the children had almost no insight or reflection about what they were doing, which made it difficult if not impossible for them to transfer their techniques to other mathematical situations. What they were really using were relatively simple coping skills with numbers, rather than exercising genuine competence in numeracy.

(3) *Flexing the curriculum.* A third change would be to the curriculum - integrating the teaching and learning of different subject areas. This approach provides opportunities for flexible, coordinated learning - just like in the world outside school. But it is rare, especially in secondary schools. Sometimes the lesson that pupils learn best is that maths is what happens in maths lessons, and science in science lessons, and that there is little connection between them, neither subject being relevant to languages or art.

It can be different in primary schools, where teachers often try to organise broad subject areas on integrated lines, in such a way that content and ideas can flow from one to another. They may, for example, take a central point for consideration, such as aspects of transport, bringing in history, geography, engineering, etc. There is no reason why this method cannot be used for older pupils. Another example would be when history and geography specialists coordinate their teaching about the Second World War, which would give a more rounded picture of events than either one working independently.

(4) *Enrichment.* A fourth change would be to increase educational enrichment. This is the deliberate rounding out of the basic curriculum with ideas and knowledge. It stimulates pupils to be aware of wider and more complex aspects of the study area, as well as opening up new areas of interest. Enrichment can be offered in the school classroom using extension learning materials, in the school or public library, in the community, or even through a correspondence course in which the student and the instructor never meet. It is not a supplementary diet which depends on whether there is enough money for 'extra' material and tuition, but should be an everyday part of school provision.

Overview

In the long run, the principal goal of education should be to enable people to continue learning and thinking when they are outside its direct influence. Even where provision is good, children only spend about ten per cent of their lives in school, which is really too short a time to provide them with all the preparation they might need for what lies ahead. The best we can do is to give them some experience and practice in using their creative thinking powers. For this, the professional competence of classroom teachers is paramount. It is they who can create a classroom atmosphere in which rational and reflective thinking can take place, which means that they too must be able to use those abilities.

It is important to recognise that the elements of both knowledge and emotion merge in creative thinking. Feelings help to select which knowledge is likely to be useful. But feelings are also a form of knowledge themselves, which is at the heart of the process, because they are a way of knowing - what one feels to be right. It is in the nature of creative thinking to express rather than repress impulses, so that the more open-ended the teacher's guidance, and the more free the pupils are to think creatively, the deeper and thus longer-lasting the effects of their education are likely to be.

There seems to be a plasticity in human imagination, which the rest of the animal world does not share. A child may pretend to be a horse, for example, but it does not happen the other way round. This playing imitating ability, a form of 'perceptual participation', brings the world within a child's mental grasp. The constant questioning and experimenting with the real world starts with early perceptual experiences, and at best continues throughout life.

The dilemma for educationalists is that when highly able children enter into intense, academic work because of their ability to pass examinations well, the development of a playful, creative approach to learning is likely to be discouraged. If they have a drive to be expressive and to think for themselves, they will not feel able to do their best where conformity is promoted. Alternatively, if high achievers are to prosper in a balanced, creative way, they may need to ease up on the academic side, and increase their social and leisure activities, for which they will need the support of both parents and teachers. For instance, they may need support and encouragement to overcome their own urges for hard learning. This should result, not in lower examination marks, but in higher ones, and certainly in their greater personal strength and happiness.

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Evaluating an accelerated mathematics program

A centre of inquiry approach

Michael C. Pyryt and Ron Moroz

The University of Calgary, and The Calgary Board of Education, Calgary, Canada

Overview

Research reviews on the effects of acceleration (Daurio, 1979; Getzels & Dillon, 1973; Gold, 1965; Goldberg, 1958; Gowan & Demos, 1964) have been exceedingly positive. Daurio's (1979) review of the literature, for example, indicates that accelerated students often outperform control students on both academic and non-academic measures. Gold (1965) wrote, "No paradox is more striking than the inconsistency between research findings on acceleration and the failure of our society to reduce the time spent by superior students in formal education" (p. 238).

The smorgasbord of accelerative opportunities model pioneered by the Study of Mathematically Precocious Youth (SMPY) at The Johns Hopkins University provides much evidence for the effectiveness of accelerative practices. After using a talent search approach (Stanley, 1976; 1977, 1979; Stanley & Benbow, 1986) to identify superior mathematical reasoners, SMPY encourages students to take advantage of numerous accelerative opportunities. Accelerative possibilities are limited only by the ability and motivation of the identified students. The more capable and motivated a student is, the more "radical" the accelerative possibilities. SMPY has pioneered the use of fast-paced mathematics classes, whereby students learn several years of mathematics in one year (Bartkovich & George, 1980; George & Denham, 1976). Benbow, Perkins and Stanley (1983) reported that participants in SMPY's first two fast-paced mathematics classes scored significantly higher in mathematics portion of the Scholastic Aptitude Tests (SAT-M), expressed greater interest in mathematics and science, and accelerated their education much more than nonparticipants. Fast-paced classes can be geared to Advanced Placement exams (Mezynski, Stanley, & McCoart, 1983).

SMPY has also pioneered the Diagnostic Testing-Prescriptive Instruction (DT-PI) approach to accelerate students (Stanley, 1978, 1986). This instructional approach, which can be used in both individual and group settings, involves: using standardized tests, analyzing content of items missed on a given test to determine educational needs, designing and implementing an instructional program to address these needs, retesting on a parallel form of the initial test to determine mastery, and proceeding to the next content level using the same approach (Benbow, 1986).

Brody and Benbow (1987) have examined the effectiveness of the smorgasbord of opportunities model. Students who made use of accelerative options had higher college GPAs, won more honors, attended more selective colleges, and had higher career aspirations than students who decided to make use of these accelerative options.

Despite the positive research results, accelerative practices are underutilized in North America. There is only one accelerated mathematics program at the junior high school level in the entire province of Alberta, Canada. The present report describes on-going research at that junior high school, F. E. Osborne Junior High School in Calgary. Two aspects of the study are unique. First, an integrated or unified approach to the teaching of mathematics is used in Alberta. This

report provides insights regarding the effectiveness of mathematics acceleration in this integrated context. Second, the results available for this evaluation are due to a unique collaborative venture called a centre of inquiry, in which partnerships are formed between university faculty and personnel for the purpose of conducting joint research and evaluation projects.

Description of the Alberta Curriculum

The mathematics curriculum at the junior high school level consists of six strands: problem solving; number systems and operations; ratio and proportion, measurement and geometry, data management and algebra. These strands are taught each year as components of the three-year junior high school mathematics curriculum (Alberta Education, 1988). At the senior high school level, the main mathematics curriculum is a sequence of three courses. Each course consists of concepts in Algebra, geometry, trigonometry, and statistics. Students aspiring to post-secondary education take a sequence labelled Math 10, Math 20, and Math 30. Concepts in calculus are taught in an optional course, entitled Math 31 (Alberta Education, 1992).

Description of the Accelerated Mathematics Program at F. E. Osborne Junior High School

F. E. Osborne Junior High School has a school population of approximately 500 students dispersed among Grades 7, 8, and 9. Since 1987, about 30 students enroll each year in an accelerated mathematics program, designed to teach the three-year junior high school mathematics curriculum and Math 10 while enrolled in junior high school. Acceleration is accomplished by teaching Grade 7 and Grade 8 Mathematics courses, while students are in Grade 7; Grade 9 Mathematics while students are in Grade 8; and Math 10 while students are in Grade 9. These students have been selected on the basis on standardized achievement performance in elementary, student interest, teacher recommendations, and parental permission. The program also has a flexible entrance policy to accommodate transfer and regular students, who demonstrate mathematics achievement.

Evaluation Methodology

Available data regarding end-of-the year achievement for various cohorts, beginning in 1987 were analyzed in terms of success in particular courses, correlates of achievement, and performance of accelerated students and older students on common examinations. Data were available for four cohorts of students (1987-1988, 1988-1989, 1989-1990, and 1990-1991).

Table 1: Percentage Success in Accelerated Mathematics Classes by Cohort

Cohort	Math 7/8	Math 9	Math 10	Math 20	Math 30
1987-1988			82%	78%	95%
1988-1989	100%	100%	82%	87%	
1989-1990	97%	100%	82%		
1990-1991	94%	100%			

Results of Longitudinal Follow-Ups

Using a final grade of 70% or better as a criterion for success in a given course, the success rates of students in various cohorts are shown in Table 1. Students were especially successful in Grade 9 mathematics, with all students in three cohorts, surpassing the criterion. Results appear reasonably consistent across cohorts.

Results of Path Analysis

A path analysis model was developed to predict success for each math course. This simple effects model proposes that achievement in each course in the mathematics sequence has only direct effects for the next course. Path coefficients predicting achievement in math courses for the four cohorts are shown in Figure 1. Results are strongly supportive of the proposed model. Since the path coefficients for this particular model are simply the bivariate correlation coefficients, squaring the coefficients provides an index of the variance accounted for by each predictor. For the eight predictors of mathematics achievement over the four cohorts, the median variance accounted for was 56 percent.

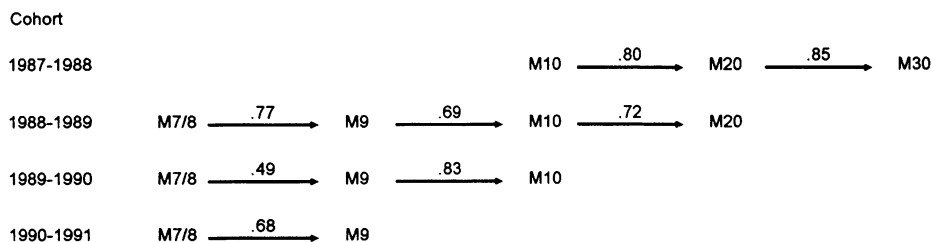


Figure 1: Path coefficients for predicting mathematics achievement

Performance on Common Examinations

Common mid-term examinations were administered to students in the accelerated mathematics program and students in the regular mathematics program to determine if there were skill differentials between accelerated and older regular program students. Analysis of variance results indicated no statistically significant differences between accelerated and older regular program students.

Summary/Future Directions

The evaluation data collected to this point generally supports the effectiveness of the accelerated mathematics program at F. E. Osborne Junior High School. These results provide evidence that accelerated programs do work even when an integrated approach to the mathematics curriculum is used. The progress of all cohorts are being continually monitored. Several pilot studies on the use of teacher-made tests and teacher rating forms as possible identification tools are currently being implemented.

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Evaluating programs for the gifted

Insights resulting from an international workshop

Ernst A. Hany

Institute of Educational Psychology, University of Munich, Munich, Germany

The idea of evaluation is increasing in educational systems, public health systems, in city management and everywhere, where a large amount of public funds or manpower are used. One speaks of educational evaluation when information about an educational measure is systematically collected and made public, when the original goals are compared with those actually achieved or when such measures are judged according to their value or merits (Attkisson & Broskowski, 1978; Nevo, 1991). Evaluation in educational systems is concerned with the individual learning, i. e. usually students, with school personnel (teachers and administrators), with instructional materials and curricula, with educational programs and measures or with educational institutions and organizations (Lewy & Nevo, 1981). The evaluation should either serve to continually optimize a program or an instructional unit (formative evaluation) or make it possible to evaluate a measure upon completion (summative evaluation; cf. Scriven, 1967; Bloom, Hastings, & Madaus, 1971). In some cases, however, the evaluation serves not to judge but rather to inform the public or to motivate the participants (Nevo, 1991).

When the gifted are nurtured in special institutions or with special curricula or materials, then these measures should be evaluated. The function of this evaluation is then to document the local needs for a nurturance program, to document how well the program selected meets the educational needs and to document the effects that carrying out the program has on the participants (Callahan, 1993). The examination of support of the gifted makes particular demands on the design and methods of evaluation studies. These demands make the completion of such studies more difficult, especially when one considers that evaluation studies in general need to meet high standards (Stufflebeam, 1991). Renzulli and Smith (1979) emphasize that programs for the gifted usually have to meet quite complex goals (e. g. the nurturance of problem-solving abilities) and that they necessitate a great individualization of instruction making a simple measurement of general effects of program participation rather pointless. Callahan (1993) points out that comparability is very difficult: Are gifted programs supposed to be judged on whether they are "better than nothing" or do they need to be compared with the next best available alternative? Comparative evaluations would seem to be called for in the study of effectivity of gifted programs, but is an expensive procedure (Davis & Rimm, 1985; Provus, 1971). It is also difficult to find an adequate control group when evaluating a program for the gifted (parallel to the experimental group: gifted student volunteers) and to find adequate instruments for determining effects which do not have a ceiling effect which would interfere with effect measurement (Carter, 1991).

Perhaps it is these difficulties and demands which lead to many programs for the gifted scarcely being evaluated or that the results of the studies are seldom published. Callahan (1993, p. 606) concluded soberly after an international survey: "The paucity of program evaluation internationally is striking." An intensive search at US schools including their state administrative agencies only provided 79 evaluation studies that could be examined (Hunsaker & Callahan, 1993). Internationally seen, there are few researchers who are involved in questions of program evaluation. Harry Passow organized a workshop on evaluation for the World Conference for

Gifted and Talented Children in The Hague (1991) and had difficulty finding enough speakers. The author of this presentation was faced with a similar situation. Initially, he wanted to bring together German-speaking evaluation researchers for a discussion group. In Germany, the evaluation of gifted programs is valued relatively highly. Several states (Baden-Württemberg, Bavaria, North Rhine-Westphalia, Rhineland-Pfalz) have given universities or state institutions the job of evaluating programs that they are carrying out. Unfortunately, most of the colleagues from these institutes were unable to attend the ECHA conference due to other engagements. Therefore, we turned this workshop into an international symposium. Nevertheless, it proved to be difficult to find enough contributors. This was only possible by bringing together contributions with very different goals and methods into one program.

In the following, the individual presentations are to be briefly presented. In summary, the discussion from the workshop will be described. Problems that made it difficult to exchange ideas and suggestions for a future meeting on the topic of evaluation will be provided as a conclusion of this report.

Michael Pyryt from the University of Calgary (Canada) made the first presentation "Evaluating an accelerated mathematics program: A centre of inquiry approach" (authors: M. C. Pyryt & R. Moroz). This contribution has been printed in full length in this volume. The evaluation was related to a junior high school, where a selected group of seventh graders completed the materials for the mathematics of the seventh and eighth grades. During their eighth grade, these students then completed the mathematics curricula for ninth graders, and in their ninth grade, they were presented with mathematics - in anticipation of the first year of high school - materials from the tenth grade. The study showed that, depending on the cohort and year 80-100% of the selected students had no difficulty whatsoever in completing the accelerated curricula. The criteria for this was the achievement of at least 70% correct in final test for the school year. In addition, there were no differences in achievement scores between the accelerated students and the older students viewed in comparison, who completed the same materials over a longer period of time (Pyryt & Moroz, 1992).

Following this, Arnim Kaiser from the Armed Forces University in Neubiberg (Germany) reported various research methods that he has employed to evaluate acceleration programs in German schools. The title of his talk was: "Support of gifted students at high school while reducing time spent at school". Six schools in Rhineland-Pfalz are trying out different measures for shortening the length of time spent at school (in each case a year reduction). Arnim Kaiser and his team studied how the parents and students decided to participate in the acceleration measures and the experiences that the students made in the special classes. Interviews and informal questionnaires were employed. In order to determine whether the accelerated students developed special achievement anxiety, standardized personality tests were used. For the question of whether the teachers employed particular instructional methods for the accelerated curriculum, the team developed their own procedure for analyzing the instructional course. This procedure is based on a list of categories for describing the teacher behavior and uses the methodology of sequential determination of instructional processes. This method was presented and discussed in greater detail in the workshop (Kaiser, 1992).

Whereas in the first two contributions, the effectivity of more global programs was studied, both of the following contributions were concerned with the quality of teacher judgements in the identification of gifted students.

Ekrem Düzen of the Middle East Technical University in Ankara (Turkey) reported on "A validation study on teacher nominations of gifted children" (Authors: N. Şahin & E. Düzen). The researchers worked on a procedure which was to sieve out as effectively as possible the very best students from ten thousands of students in all of Turkey. These students were then allowed to attend a special private school. For this purpose, an examination of whether teacher

nominations and group intelligence tests make it possible to accurately predict the results of the Wechsler Intelligence Test (WISC-R). It could be shown, that among the students nominated by 303 teachers in four Turkish provinces, many were only of average intelligence. It was also not possible to improve this selection process by employing the Standard Progressive Matrices (SPM by Raven). The authors also examined which WISC subtests were especially highly correlated with the WISC total score in the selected group of most intelligent students. They concluded that one could filter out a high percentage of above-average students but not highly gifted students when they included test for working memory capacity and for determining abstract spatial relationships in the group test phase. In this way, they were able to reject many unsuitable students before beginning with expensive individual testing (Şahin & Düzen, 1992).

The fourth contribution was by Ernst A. Hany from the University of Munich (Germany): "Do teachers identify gifted students on the basis of typical or of diagnostic characteristics?" This paper is to be published in a German language journal (Hany, submitted). The theoretical basis of this work is the application of recognitions in hypothesis testing by nonprofessionals in determining whether an object belongs to a psychological concept. In an empirical study, we examined how approximately 40 teachers - who select gifted students each year to participate in special courses for the gifted - make their selection decisions. It was demonstrated that the teachers, as lays in many instances, are subject to "confirmatory bias". This means that one makes a decision about whether a student is gifted based on properties that are particularly characteristic of the gifted (e. g. "completes his/her homework carefully"), instead of on characteristics which clearly distinguish the gifted from other students (e. g. "solves problems in an unusual manner"). Even if gifted students are less likely to exhibit the second characteristic than the first, the second is of higher diagnosticity since it enables us to more clearly separate the gifted from other students. The decision-making strategy that the teachers use can be explained as "base-rate fallacy": They fail to consider that there are many fewer gifted than other students (Hany, 1992).

The four individual presentations demonstrate the theoretical and methodological variety in studies on the evaluation of nurturance of the gifted. The first two contributions were concerned with the effects and side-effects of complete programs for the gifted. The last two contributions were, however, focussed on the selection of gifted students. Whereas Pyryt & Moroz and Şahin & Düzen used purely quantitative methods, Kaiser shows the value of qualitative methods (interviews) and Hany the value of simulation procedures. The approach used by Kaiser to evaluate the instructional process in detail is a good example of formative evaluation: If one compares various groups of learners with regard to the teaching processes and the success in learning, one can identify especially effective instructional methods and recommend them to teachers. The objects of evaluation were the teachers (in Hany and Şahin & Düzen), all participants (Kaiser), the methods of selection (Şahin & Düzen) and the learning-related program effects (Pyryt & Moroz).

With this variety of goals, starting positions and methods, it is not surprising that the discussion was not directed at basic questions but rather at methodology details and local conditions. Many of the comments from the audience were necessary in order to create an information basis for understanding one another. The international discussion about evaluation is made more difficult by the fact that most individuals are usually familiar only with the school systems in their own country and overlook the huge differences between European school systems and the systems in the USA and Canada. It is frequently true in Germany that measures for promoting giftedness are planned by an educational ministry and "prescribed" for the state schools (private schools are so few in number, that they do not need to be considered here). The teachers at these schools are not always pleased that they have to carry out a program for the gifted; they are even less pleased to be evaluated by psychologists during this. Thus, evaluation has to be carried out very carefully; the evaluation of an individual teacher's work is neither desirable nor

permissible. The teachers in the US seem to have a weaker relationship to their schools. Individual schools seem to vary greatly in their personnel and their achievement profiles, whereas the state school systems in Europe provide for a certain minimal standard and that a similar education is provided for each student. It is unthinkable in Germany, for example, that the admittance to a university could depend upon the location of the school one previously attended.

There are even greater differences between the school systems in terms of their practical realization of ideas (e. g. educational philosophy, curriculum, school types, teacher education, budgets, etc.). These cannot be presented here. Local measures for promoting giftedness must be guided by the conditions present. Studies evaluating gifted programs must by necessity also be flexibly constructed. There are frequently limitations in terms of budget, personnel, goals and data availability which cannot be overcome. Such studies often do not meet more rigid methodological criteria. Thus, they should be judged more on the degree to which they really contribute to improving gifted programs. This question can only be answered, however, when all of the details about the educational system concerned are known. It is therefore important when writing about evaluation studies for an international audience that one provides this background information.

It would also seem to be important to better support international activities for evaluating gifted programs. A "special interest group" for evaluation sponsored by an international organization could contribute to a coordination of the various projects all over the world. The data bank being developed in the United States on evaluation instruments (Callahan & Caldwell, 1993) and a growing number of methodologically oriented publications (e. g. Nielsen & Buchanan, 1991) will certainly contribute to improving the research level and the practice of evaluation.

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IX. TEACHERS OF THE GIFTED

Introduction

Research on teachers of the gifted has mainly focused on the characteristics of particularly competent teachers or on their skills for identifying gifted children. The two papers included in this part of the book lead to new areas of research. The first, written by Jan B. Hansen and John F. Feldhusen, investigates if training in gifted education helps to develop teaching competences of the participating teachers. Their study shows that trained teachers' classroom behavior is much more favourable than that of untrained teachers. A pretest-posttest design would be helpful to support the conclusion that differences in teaching behavior were not caused by pre-training differences between the groups of teachers. However, this study shows in a prototypical way how elements of effective teacher training could be isolated, and studies like this can contribute substantially to attempts of designing curriculum units for the education of teachers for the gifted.

Another path of research is demonstrated by the study of Şahin and Düzen on stereotypical views of the "gifted child" as held by university students and teachers. It can be safely assumed that the teachers' subjective decision strategies for identifying gifted students are based on their conceptual definition of the gifted child. These subjective conceptualizations have to be investigated if one wants to gain insight of the way how teachers perceive and identify gifted students. Şahin and Düzen's study is of course an exploratory one. The factor solution obtained must certainly be regarded as a preliminary one as is indicated by low eigenvalues of the factors, moderate scale consistencies and high scale intercorrelations. However, this work is of high value because it does not only combine theoretical models recently developed in social cognition research with practical questions of teacher behavior but it also enhances our understanding of the implicit theories held by teachers which have to be addressed by instructional units if a teacher training wants to be effective.

Comparing GT trained and GT untrained teachers

Jan B. Hansen and John F. Feldhusen
Purdue University, West Lafayette, Indiana, USA

Introduction

Do teachers who are trained in gifted education teach any better than teachers who have no training in gifted education? Does training lead to improved teaching skills? Does training improve classroom climates? These are important questions that are rarely addressed in gifted education. In spite of common agreement that teacher training programs in gifted education are necessary, teachers who lack such training are often hired to teach gifted students and/or are assigned to replace a GT trained teacher when schools reduce staff. It is important to test whether or not training in gifted education leads to more effective teaching. If teaching skills are improved by GT training, then it seems logical to assign teachers with those skills to teach gifted students.

Research Review

Does teacher training in gifted education help teachers develop important competencies? Previous research indicates that it does. Studies selected from a comprehensive literature search show that trained teachers are better than untrained teachers when identifying gifted students (Borland, 1978; Jacobs, 1972), are more supportive of gifted students and programs for gifted students while untrained teachers are apathetic and sometimes hostile (Wiener & O'Shea, 1968), and trained teachers use teaching methods they did not know before training began (Gallagher, Aschner, & Jenne, 1967; Martinson, 1972). The present study was designed to further the research comparing GT trained and GT untrained teachers and address the following:

- (1) compare the skills of teachers who receive training in gifted education to the skills of teachers who do not receive training;
- (2) compare the instructional climate in classrooms of teachers who receive training in gifted education with the instructional climate of teachers who do not receive training.

Method

A total of 82 teachers participated in the research. Trained teachers (GTT) had taken three to five graduate courses in gifted education and were teaching gifted students at various schools throughout Indiana. Untrained teachers (GTU) had an assignment to teach gifted students but no graduate coursework in gifted education.

GTT teachers (43 elementary and 11 secondary) and GTU teachers (11 elementary and 17 secondary) were compared on measures of teaching skill and classroom climate. Trained observers evaluated teachers in their classrooms using the Teacher Observation Form (TOF) (Feldhusen & Huffman, 1988). The TOF consists of 12 items that focus on critical skills in teaching gifted students: subject matter coverage, clarity of teaching, motivational techniques, pace of instruction, student-directed activities, variety of experiences, teacher-student interac-

tion, homework, higher-level thinking, creativity, teacher planning, and learning aids. (See Appendix; Editors' note: The form of the original instrument was changed to fit to the layout of this book).

Class climate was measured with the Class Activities Questionnaire (CAQ; Steele, 1981), completed by students. The Class Activities Questionnaire was designed to identify teaching behaviors that are especially relevant to gifted programs.

A total of 365 students were selected randomly for the study: 270 from the 54 GTT teachers' rosters and 95 from the GTU teachers' rosters. Students were identified as gifted and talented by their local school district according to guidelines established by the Indiana Office of Gifted and Talented.

Results and Discussion

Teaching Skills

Statistical analyses showed that GT trained teachers scored significantly higher ($p < .01$) than GT untrained teachers on all items of the TOF except the item related to homework. Specifically, results for the TOF showed that GTT teachers used more concept-based approaches to subjects and fostered more indepth study. GTU teachers tended to teach to the whole class at a normative level and focused much attention on children who were slow in learning. GTT teachers were clearer in their presentations and explanations, while GTU teachers gave directions for larger amounts of time. GTT teachers were more energetic and enthusiastic and provided more fast-paced instruction. Typical observer comments for GTU teachers included "very slow-paced", "too much review", and "[pace] not adjusted for fast learners". GTT teachers fostered student self-direction far more than GTU teachers. They presented information in a wider variety of ways and fostered more positive interactions with gifted students than GTU teachers. GTT teachers focused more on higher-level thinking skills by focusing classroom discussions on in-depth analysis, synthesis, and evaluation of information. GTU teachers often limited discussion to knowledge level questions. Similarly, GTT teachers emphasized creativity more, asked more open-ended questions, and encouraged more risk-taking than did GTU teachers. Observers noted that GTT teachers had clearer and more highly differentiated objectives, and selected more relevant instructional materials. GTU teachers used materials such as worksheets commonly used in regular classes. The results of this study clearly show that GTT teachers demonstrate greater skill teaching gifted students than GTU teachers.

Class Climates

Did students of GTT and GTU teachers perceive them in different ways? The results of this study indicate that the answer is "yes". Students rated GTT teachers significantly higher ($p < .01$) than GTU teachers on the CAQ. Specifically, student responses on the CAQ showed that GTT teachers lectured less, emphasized higher-level thinking, conducted more discussions, and placed less emphasis on grades than did GTU teachers of the gifted. In general, gifted students clearly perceived GTT teachers' classroom climates as more positive than the classroom climates of GTU teachers.

Conclusions

It is clear that teachers who had training in gifted education and who showed strong support for programs for gifted and talented students were more skilled in teaching gifted students and created more positive classroom climates than teachers who were not trained and did not show such support. The results from both professionally trained observers and from students in the

teachers' classes indicate that teachers who have been trained in gifted education are much more skillful in engaging gifted students in appropriate and effective learning activities than teachers who have not had such training.

Endorsement and certification requirements assure parents, students, and administrators that teachers meet minimal standards of training. It seems reasonable to suggest that if there are training requirements for teaching physical education, music, typing, auto mechanics, and for teaching handicapped students, there should be training requirements for teaching gifted learners. The arguments in favor of assigning teachers with special training in gifted education to teach gifted students have been found so persuasive that several legal disputes involving GT trained and GT untrained teachers, ended in decisions favoring the trained gifted education teachers. Karnes and Marquardt (1991) claim that these cases provide an unambiguous signal to other courts regarding hiring GT trained teachers even if the GT untrained teacher has seniority within the school district.

Based on this study and other research, it seems that the best practice is to hire/and or assign GT trained teachers to teach gifted learners.

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Appendix

Teacher Observation Form of the Purdue University Gifted Education Resource Institute

PURDUE UNIVERSITY GIFTED EDUCATION RESOURCE INSTITUTE

Teacher Observation Form

Teacher _____ Date _____
Time _____ to _____ Location _____
Course _____ Grade(s) or Age(s) _____

RATING SCALE

- 5 - Outstanding 4 - High 3 - Average
2 - Needs some improvement 1 - Not satisfactory N/O - Not Observed
Criteria observed/not observed

CATEGORY/CRITERIA: Ranking for each category is determined by observation of one or more of the criteria listed below it.

1. Subject matter coverage (A-C)
2. Clarity of teaching (A-F)
3. Motivational techniques (A-C)
4. Pace of instruction (A-C)
Rating scale: 5, 4, 3, 2, 1, N/O

	5	4	3	2	1	N/O
11. Lesson plans designed to meet program, course, and daily objectives						
___ A. Sense of planning with flexibility	_____					
___ B. Student-centered	_____					

	5	4	3	2	1	N/O
12. Use of teaching and learning aids						
___ A. Inclusion of audio-visual materials, models, demonstrations, etc.	_____					
___ B. Clearly printed and grammatically correct	_____					
___ C. Appropriate/necessary	_____					
___ D. Variety of materials/aids used	_____					

Activities were conducted in _____ small groups _____ large groups _____ individually.

Teacher's strenghts: _____

Suggestions for improvement: _____

Additional comments: _____

Observer's Signature: _____

Review by Teacher _____ Date _____

Would like conference regarding evaluation. Suggested time: _____

The "gifted child" stereotype among university students and elementary school teachers

Nail Şahin and Ekrem Düzen

Middle East Technical University, Department of Psychology, Ankara, Turkey

Abstract

On the basis of a review of the literature, over 100 statements were collected describing various traits of gifted children. Among these, 45 statements that seemed to be relevant for the fifth grade gifted children were chosen to represent 5 trait clusters (dimensions) most frequently found in the characterization of gifted children and adolescents. Nine statements - trait descriptions - were prepared for each dimension, each statement was arranged in a 5-point Likert-scale format. In the first phase of the research, a total of 232 university students in various departments of social sciences rated the importance of each trait for a "gifted child". In the second phase, a total of 303 elementary school teachers were included in the sample. The results were analyzed separately and jointly for the two samples.

The response patterns of both samples revealed that the traits were perceived to be highly interrelated, the internal consistency coefficients being over .90. The inspection of the strength of endorsement of individual items indicated that the respondents placed greater emphasis upon the items describing, "speed in learning new material, "problem solving", "quick comprehension", "curiosity" and "creativity". Teachers endorsed more strongly the items related to "persistence at work". The items in the "social relations" dimension were not found to be among the strong components of the gifted stereotype. Exploratory factor analyses yielded 5 interpretable factors accounting for 44% of the total variance. The item clusters in empirically obtained factors had similarities to, as well as differences from the a priori categories employed to construct the scale. Computations with various distance measures were carried out to reveal the structure of the "gifted child" stereotype. The findings are discussed in relation to the possible biases of teachers that might operate in the nomination process.

Introduction

Identification of gifted children continues to be a challenge for educators and researchers. In a Delphi study, procedures for identifying children for gifted programs were assigned the second most important rank (Cramer, 1991). Giftedness should be defined differently in different settings, but in a manner that is logical and consistent. This proliferation of definitions is inevitable, because locally determined multiple realities exist (Borland, 1990). The reality of giftedness is constructed by each of us, it does not exist apart from human cognition (Borland, 1990). Since the actual encounter with a gifted child is a low-baseline event, the majority of the individuals are assumed to have constructed these mental representations through general stereotypes which is part of adult social cognition. The mental representation of the gifted child is probably maintained as a "stereotype" resistant to change in minor details and in its core characteristics. Very little is known about the sources and maintenance of these cognitive schemata. They may originally be constructed as part of the cognitive frame for such special

children, the initial experience is likely to be based upon indirect observations, information absorbed from media, or extrapolations from the achievements of a bright child. In general, the stereotypes perpetuated in the media portray a mixed set of traits for the gifted individuals. It is often the case that these traits are contradictory, removed from reality and paint a person bordering abnormality. Common populace may maintain a rather well-defined, rigid set of assumptions and conceptualizations of high intelligence and specific procedures for the education of the gifted (Raty, Snellman, & Vesakoivu, 1992). Stereotypes are mental schemata, and as such they may bias the processing of incoming information. Schools and teachers also have implicit definitions of mental ability and giftedness (Sternberg, 1987). When translated into a teacher's observations in the classroom, these stereotypes are expected to influence the attention and selective retention processes.

The study of teachers' stereotypes of giftedness is important from several points of view. Teachers are often the key personnel in referrals to special education programs. Teacher nomination is a frequently-used criterion for acceptance into special programs (Borland, 1978). Teacher identification continues to be the only method of identifying gifted children in some areas of the U.S. Relying heavily on teacher nominations has many shortcomings. In general, teachers without special training have considerable difficulty identifying gifted youngsters (see Minner, 1990). Student's social class may also have an effect upon the teachers' willingness to refer a child to a special program for gifted education (Minner & Threet, 1982). On the other hand, teachers can be trained to make ratings on specific traits rather than to make global judgements of ability (Renzulli, 1990, 1991).

The research reported in this paper was carried out as part of a pioneer project aimed at recruiting children of very high levels of ability for a special school for the gifted, financed by a private charity foundation (Inanç Foundation in Istanbul). A multistep selection-identification procedure is envisaged for the candidates. This process will begin with the teachers' nominations. The study of the stereotype of gifted children was considered to be a first step to understand the systematic biases that might operate in the nominations.

Method

Scale

On the basis of a literature review involving the nomination process and evidence on the characteristics of gifted children and adolescents, more than 100 traits/statements were collected. Excluding those that are related to specific/artistic abilities, and concentrating on those traits that could be observed in classroom settings, the number of traits was reduced to 45.

It was possible to group these traits in 5 dimensions. These were "comprehension", "academic success/ability", "social skill/leadership", "task perseverance" and "curiosity/creativity".

Each dimension was represented by 9 statements. The items were arranged in a questionnaire with 5-point likert-scale format (1=does not describe/apply at all, 5=describes/applies perfectly). The task of the respondents was to check the degree with which they thought the statement describes a gifted child. (Which was specified in the instructions as "a child at very high level of ability, almost a genius".)

Subjects

A total of 233 university students were recruited from 7 different departments of social sciences (psychology, education, philosophy, sociology, history, history of art) from four different universities in Ankara and Izmir. The gender ratio was not equal but comparable in the sample (137 males, 96 females). The status of students in the university ranged from

freshman to senior. The ages of the respondents were between 18 and 22.

In the second phase of the research, a total of 303 elementary school teachers were included in the sample. Teachers were recruited from 34 different schools in 4 provinces, the majority being from the lower SES neighbourhood schools around Ankara. The teachers had an average of 20 years of teaching experience in the primary schools. All of them taught 5th graders for several years, except 23 teachers, and the average length of experience with the 5th graders was 4 years. Since the main project will recruit from among the graduates of elementary schools, especially from the lower SES stratum, teachers working in these neighbourhoods and teaching the 5th graders were given priority in the administration of the questionnaire.

Procedure

The checklist was administered to university students in regular classrooms or in small groups outside the classes. The administration took about 15-30 minutes. The elementary school teachers were given the checklists in their schools. In addition, they filled a brief teacher information sheet.

In the instructions, it was emphasized that the respondents were required to rate the appropriateness of the statements *to describe a child with very high ability*. This point was explicitly spelled out in the instructions to prevent the ratings for gifted adults or individuals in general. The respondents' task was to rate each statement for the degree of applicability to the description of a gifted child by checking one of the five options arranged in ascending order (beginning from "1=does not describe/apply at all" to "5=describes/applies perfectly").

There were several differences in the application of the checklist to the teachers. The wording of some of the statements (a total of 6 statements) in the checklist were slightly changed to improve clarity and to prevent alternative interpretations. One of the items was substantially altered. The remaining statements were identical, with the exception of their order of presentation which was mixed to separate the items suggestive of a certain category. In addition, in spaces left for open-ended questions, teachers were invited to write down their comments on any other trait that they thought was important in the description of the gifted elementary school children. These comments were sought in order to improve the scale for future studies and to reveal the range of salient traits that the teachers were most sensitive to and were not captured in the checklist.

Teachers were also requested to provide the names of the students that they believed matched the characteristics of a gifted child. In other words, the administration of the checklist to teachers was arranged as a small-scale nomination study. Some of these nominated children were subsequently taken into individual evaluation (Şahin & Düzen, 1992).

Results

Scale properties. The results were first analyzed separately for the students and teachers. The mean endorsement rate of each statement (item) in the checklist was computed separately for teachers and students, these means are given in Table 1. The inspection of item means indicated that most of the items were found to be relevant for the definition of stereotypical giftedness. The mean item endorsement in students was $M=3.81$ (min=2.81, max=4.36). Teachers tended to assign higher scores to these traits (overall item mean $M=4.33$, min=3.72, max=4.71).

For all statements, except item 14, teachers' mean assignment rate was significantly higher. On only three items (items 41, 43, and 45) the differences (t-test comparisons) did not reach significance. On item 14, the direction of endorsement was reversed, the difference still being significant, students assigned higher scores to this item.

Table 1: Traits and mean endorsement rates (min=1, max=5)

Items	Students	Teachers
1. His/her academic standing (school success) is superior.	3.60	4.49
2. Can solve difficult problems that children of her/his age cannot solve.	4.30	4.55
3. Solves problems faster than his/her peers.	4.26	4.65
4. His/her rate of correct solution of problems is higher than children of same age.	4.24	4.69
5. Can solve verbal puzzles faster than peers.	3.91	4.36
6. Even if s/he devotes less time to school work, s/he turns out to be more successful.	3.97	4.51
7. Even if s/he does not rehearse some course topics, can still obtain highest grades.	3.81	4.41
8. S/he can extract the correct meaning of a story or a paragraph faster than peers.	3.80	4.46
9. Can explain and communicate a topic that s/he knows, with elaborations based upon personal observations and experience.	3.81	4.27
10. Can express his/her knowledge or thoughts more accurately than children of same age.	3.50	4.52
11. Her/his expressions are well-ordered, correct and comprehensible even if s/he does not speak fluently.	3.35	4.22
12. S/he is adult-like (like an adult in small stature).	3.16	3.90
13. In activities with peers, s/he is often the leader.	2.81	4.01
14. Can use changes in his/her environment as sources to obtain new knowledge.	3.89	3.72
15. Assumes most of the responsibility in group work.	3.02	4.26
16. Has a keen interest in the events happening around him/her.	3.32	4.15
17. Rather than reacting impulsively, tries to understand the negative behavior directed to her/him.	3.07	3.76
18. Shows a markedly elevated interest in daily events, news and issues, compared to peers.	3.54	4.37
19. Grasps a newly-introduced topic faster than peers.	4.33	4.71
20. Discriminates interrelations, connections, similarities and cause-effect relations among events, faster than peers.	4.36	4.58
21. Uses a clear expression and organization of ideas in his/her presentation of a topic.	3.48	4.28
22. Can extract the unspoken, implied message/meaning in a sentence or expression.	3.83	4.48
23. Compared to children of his/her age, knows a greater number of different words, idioms and expressions.	3.66	4.29
24. Reads written material (books, magazines or newspapers) which are above his/her age level.	3.75	4.43
25. Tries to use different sources of information to obtain correct and detailed knowledge.	3.81	4.28

(continued on next page)

26. Can advance reasonable and logical criticisms in various topics.	4.08	4.49
27. Does not forget information once s/he learned (has good memory).	4.32	4.49
28. Does not leave a job unfinished.	2.96	4.05
29. Can succeed in tasks that are difficult for children of his/her age.	3.50	4.18
30. Does not refrain from trying, even if s/he is not sure of the final success.	3.21	4.21
31. Can defend her/his views, comparing them with the views of others.	3.82	4.30
32. S/he does not refrain from entering into discussions with peers or teachers, on issues s/he believes s/he has correct information.	3.77	4.46
33. Can work for a long time, on topics that interest him/her.	4.03	4.26
34. Can assume tasks that require personal responsibility.	3.42	4.26
35. Strives to complete tasks that are intriguing for him/her, even at the cost of neglecting other assignments, at times.	3.53	4.16
36. Has self-confidence, can assume responsibility for tasks.	3.69	4.42
37. Can use (apply) the acquired knowledge in new and different areas.	4.23	4.47
38. His/her curiosity is markedly above peers, in almost all topics.	4.06	4.55
39. Asks unusual questions.	4.31	4.58
40. Can establish logical relationships between knowledge in several areas.	4.24	4.42
41. Can predict the next step among successive steps of related events.	4.25	4.36 n.s.
42. Can complete an assignment with a positive contribution even if this is not expected from him/her.	3.92	4.29
43. Can manipulate objects to make them perform novel functions which are substantially different from their usual (familiar) functions.	4.17	4.15 n.s.
44. Has a special sense of humor which is superior to that of children of his/her age.	3.46	3.88
45. Can find original solutions to a problem or task that s/he has not encountered before.	4.23	4.37 n.s.

The response patterns of both samples also revealed that the characteristics were perceived to be highly interrelated, as it was found in the internal consistency figures of the response of students and teachers (Cronbach's alpha of .92 and .94, respectively). Among students, the correlation of individual statements (endorsements) ranged from $r = .08$ to $r = .58$ with a mean of .22. Among teachers, item intercorrelations ranged from .27 to .61 with a mean correlation of $r = .34$.

A priori categories. Since the items included in the checklist were selected and grouped on the basis of a literature search, they should be considered as "a priori" categories. The differences reported above concerning individual items were replicated in these category scores as well, the teachers scoring higher. The total scores of category endorsements, standard deviations and internal consistencies are given in Table 2 and Table 3, for students, teachers and the two groups combined. In these tables, the number of items within each category is equal (9) and the scores can range between 9 and 45.

As expected, high correlations were obtained among the categories, ranging between .40 and .76, being higher among teachers.

Factor analysis. The items in a scale can be grouped according to the consistency and pattern of their endorsements in the sample. A number of clustering and distance measures are available for this purpose. Among these, factor analysis is probably the most widely-used technique. It has advantages of analyzing a set of items with minimum prior assumptions and also providing cues about the possible underlying dimensions among the responses.

Table 2: Means, standard deviations, and internal consistencies of categories

Category	Students			Teachers		
	M	SD	alpha	M	SD	alpha
Comprehension	35.62	5.10	.80	40.04	4.14	.75
Academic	35.65	4.52	.62	40.39	4.15	.78
Social	29.67	5.92	.78	36.90	5.38	.76
Perseverance	31.94	6.49	.85	38.42	5.27	.79
Curiosity/creativity	36.88	4.96	.80	39.06	4.61	.77

Table 3: A priori category scores in the total group

	M	SD	alpha
Comprehension	38.12	5.08	.81
Academic	38.33	9.91	.77
Social	33.76	6.67	.83
Perseverance	35.61	6.66	.86
Curiosity/creativity	38.11	4.89	.79

Exploratory factor analysis was repeated with different extraction methods (with principal components and principal factor extractions) which yielded very similar results. Similarly, oblique rotations were experimented with different delta values, revealing very few factor intercorrelations exceeding .30, thus indicating that orthogonal rotations would be appropriate to describe the data.

Factor analysis of teacher's responses revealed in the initial extraction 9 factors with eigenvalues greater than unity, explaining 55.4 % of the total variance. In the student data, 11 factors appeared with eigenvalues greater than unity accounting for 58.9 % of the variance. Varimax rotations were tried gradually reducing the number of factors until the weak factors ("singletons" or "doublets") have been discarded and the pattern converged in an interpretable and stable simple structure approximation. The remaining five stable factors explained 44.1 % of the total variance in the sample of teachers (the corresponding figure was 42.6 % in the student sample).

Since the content and the loading patterns of factors show only minimal differences between the two samples, the factors in the sample of teachers will be described below. To simplify the presentation and interpretation, the varimax rotated factor matrix in the principal factor solution with iterations, is reproduced in Table 4.

A minimum factor loading of .30 was accepted for an item to be included in a factor. When an item had high loadings simultaneously on more than one factor, the highest loading was retained in the interpretation of factors. In Table 4, the factor loadings are rounded to the

nearest decimal and multiple-loading (complex) items are underlined in the highest loading. A total of 10 items had multiple loadings on two factors simultaneously, indicating that the trait entered into the definition of more than one factor. We preferred to retain these items at this initial stage of our exploratory analyses, since there seems to exist a subtle pattern indicative of trait constellations.

Table 4: Factor loadings of traits in the checklist (only those with loadings over .30 are shown)

Item	Factors				
	1	2	3	4	5
1				.33	
2	.64				
3	.61				
4	.63				
5	.31	<u>.63</u>			
6	.39				
7	.45				
8	.37				
9	.45				
10					.49
11			.31		<u>.55</u>
12			.62		
13				.45	
14			.43		
15			<u>.51</u>	.30	
16				.64	
17					.34
18		.62			
19	.58				
20	.58				
21		<u>.68</u>			.39
22	.39				
23	.32				
24	.45				
25	.40				
26	.56				
27		.59			
28				.49	
29			.41		
30		.62			
31	.44				
32	<u>.48</u>		.34		
33			.37		
34				.66	
35		.64			
36				.37	<u>.40</u>
37	.36				
38	.39				
39	<u>.45</u>			.34	
40		.61			
41	<u>.45</u>			.44	
42	.36				
43	<u>.43</u>		.32		
44		.53			
45	<u>.50</u>		.33		

The *first factor* (23 items, 25.1% of total - 63.4% common - variance) was labelled as "core giftedness" and was characterized by high loadings on items describing quick comprehension, rapid problem solving and solving of the difficult problems. Logical thinking, curiosity, and ability to use objects in different contexts/functions were also represented in this factor.

The *second factor* (8 items, 6.4% of total - 13.6% common - variance) was labelled as "task persistence and involvement"; in this cluster, interest in environment, task persistence, sense of humor and expressive ability were represented.

The *third factor* (5 items, 5.8% of total - 12.1% of common - variance) was labelled as "maturity-persistence" which was characterized by items on assuming responsibility, ability to work for a long time on issues of interest. These are adult-like traits, all indicating characteristics descriptive of a child appearing older than his/her real age.

The *fourth factor* (5 items, 3.5% of total - 5.7% common - variance) was labelled as "responsibility-leadership" which seems to describe maturity in the context of social interaction. The traits "leadership" and "school success" (high grades in courses) are also found in this cluster.

The *fifth factor* (4 items, 3.3% of total - 5.2% of common - variance) was labelled as "communicative-interactive abilities" which emphasized items on clarity and order in verbal expression, self-confidence, and ability to take criticism in a mature way.

As outlined above, the traits embodied in the statements (items) of the checklist possessed high internal consistency. The respondents, both teachers and students, found high degree of relevance for these traits in the characterization of gifted children. Yet the response patterns can still be decomposed in factor analysis into smaller clusters, each indicating a different composition of the traits of a gifted child. The factor similarity index (Kendall's coefficient of concordance), between the two samples ranged between .92 and .83 from the first through the fifth factor, indicating almost identical composition of the underlying factors.

Factor-based subscales. The results of factor analysis can be used as a guide to create empirically- derived, factor-based subscales. We referred to the pattern of factor loadings as an approximative guide and added together those items that showed a similar loading pattern on a factor. Thus, the 45 items in the checklist were distributed over 5 factors. In case of multiple loading, the item was assigned to the factor with the highest loading (Guertin & Bailey, 1970; Rummel, 1970). Assuming that these empirically derived categories represent approximations to the major dimensions of giftedness in the minds of the respondents, the properties of these subscales can be inspected.

As expected, teachers and students differed significantly on each of the five factor-based subscale, (t-test comparisons of subscale total scores) teachers assigning higher scores to each cluster. In both samples, the subscales possessed moderate to high internal consistency even though the number of items in third and fifth factor-scales was very small (the Cronbach Alpha values ranged between .56 (for "communicative-interactive abilities") and .90 (for "core giftedness").

These newly created subscales were also found to correlate among themselves, the correlations ranged between .41 and .79.

If the correlations are interpreted as a measure of overlap or similarity or co-occurrence of these traits in the minds of the respondents, then, it is clear that the cluster that is related to the speed and accuracy of the mental functions is the central issue. The remaining characteristics contribute to the gifted child stereotype in decreasing magnitudes. The subscales obtained from the factor analysis are empirically established categories, thus, more reality might be attributed to them. The core cluster defining giftedness appears to be centered on the traits emphasizing the "mental" characteristics, speed of grasping, solving difficult problems and mastering cognitive tasks that are appropriate to older age groups. Motivational/personality variables such

as "task persistence" are considered to be a very important component of giftedness especially among the teachers.

Discussion

The study of the gifted stereotype among university students and teachers revealed that a trait cluster defined largely by characteristics, such as reasoning, problem solving, speed in mental operations, task persistence and creativity etc. is likely to be the "core" cluster in the assignment of the "gifted" label to a child. This may be considered partly as an outcome of the choices presented to teachers. We deliberately sampled those traits that were frequently reported in the literature. Entirely culture-specific criteria for giftedness may not exist, even if it does, the evidence obtained from a totally open-ended approach might be difficult to relate to ability scores or to school success. The task of developing identification models for gifted children is a critical one, because appropriate selection of children underlies an effective program. An appropriate model requires an operational definition of giftedness and types of abilities to be selected.

Our research was directed to practical concerns. We were interested in obtaining descriptive information on the trait clusters that teachers are more sensitive to. Since selection process of the project will emphasize general academic ability, the traits in the checklist were selected keeping this priority in mind. Affective variables, such as task commitment and creativity were also included and they turned out to be important traits in the definition of giftedness by our respondents. The traits included in the checklist, come as a first approximation to the "indicators" of giftedness that a teacher might observe in a large classroom setting. Teachers are the primary "sources" to obtain information about these indicators. The point that emerges from our research is that teachers as a group, endorse the core traits more strongly. In contrast, social skills are found to be relatively less central to giftedness. Higher means in item or category endorsements indicate that the teachers might possess a more tightly-packed stereotype for the gifted child. The data also suggest that the respondents might entertain slightly different combinations of trait clusters to be essential for the definition of giftedness. In analyses with subgroups of respondents, the core cluster always appears to be a strong determiner, but peripheral clusters may fluctuate. Additional analyses are in progress regarding this tendency.

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Author notes

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X. POLICY AND ADVOCACY IN GIFTED EDUCATION

Introduction

The first five or rather six contributions, deal with the situation of gifted education in Germany. First, Ernst A. Blanke describes goals and measures of *extracurricular* and *industrial* promotion of the gifted from the point of view of the federal government. Two main motives are claimed: the individual's rights to optimal nurturance of development and the societal responsibility for nurturing giftedness with consideration given to the entire personality of the adolescent. Georg A. Knauss then sketches the educational political framework for nurturance of giftedness at *school* as determined by the decisions of the Standing Conference of the Ministers of Education of the *Laender* (states), abbreviated KMK. Due to the federal structure in Germany, the competence for the educational system is in the hands of the 16 states which are in turn represented by their individual educational minister in the KMK. The KMK thus has the important function of coordinating the rights of the individual students to an appropriate nurturance of his or her talents.

Representing the 16 federal states, three states have given *state reports*, two of the "original" states and one of the "new" states. Peter Pauly first presents the situation in the state of *Baden-Württemberg* where an extensive enrichment program for gifted students at the secondary school level has been in existence for about ten years. More than 3000 gifted students now participate yearly in this state-wide program which was scientifically evaluated from 1985 to 1990. It was determined that approximately 20% of the gifted and talented students were not being adequately nurtured according to their cognitive abilities despite challenging and difficult courses offered in the enrichment program. Therefore, in 1991/92 an acceleration program for gymnasium students (college preparatory track) was begun. In this program, the *abitur* (prerequisite examination for admittance to university) was to be completed in eight years

instead of the usual nine years (with a comparable curricula). This eight-year gymnasium is also being evaluated in an eight-year longitudinal study. In *Bavaria*, so-called plus courses have been offered to especially talented and interested students since 1987/88 according to the report given by Eduard Pütterich. These (presently more than 150) plus courses for especially talented and interested students are a part of an enrichment program where these students are able to choose additional electives from the areas of culture/humanities, sciences (and sports). Supplementary measures are summer camps, state competitions and scholarships from the Bavarian Maximilianeum Foundation for extraordinary scholars (for the length of their university studies).

In contrast to Baden-Württemberg and Saxony, Bavaria hangs onto the concept of a nine-year gymnasium, recommending skipping individual classes as an accelerative measure for extremely gifted students. The situation in the "new" federal state of Saxony is, as Hans-Wilhelm Berenbruch describes, marked by the process of reunifying Germany and the new development of the school system there. The state of Saxony is attempting to integrate tested forms of giftedness nurturance in the new states with the experiences from the former German states, in particular with those from Bavaria and Baden-Württemberg. Within the school, nurturance of giftedness is closely related to the curriculum reform with a main emphasis on enrichment. In addition, work groups for especially interested and talented students are offered with active participation by scientists from neighboring universities and colleges. There are special schools for music and sports; and the participation in national and international competitions, e. g. Math Olympics, is recommended.

The state nurturance concepts presented here were then critically discussed in a contribution from A. Harry Passow. This also includes the symposium contribution from Barbara Grillmayr, Austria (whose English version was unfortunately not given to the editors). Passow's explications on the *international* situation of nurturing the gifted should be of special interest to readers, especially the comparisons of USA and Europe. And since the recent spectacular wins by the Chinese in the latest Math Olympics, the Asian-Pacific area's dynamic development of giftedness has become obvious.

Günter Trost reports on the nationwide support of gifted university students in the third to last presentation of this section. Although these pieces of information refer to the situation in Germany, the scholarship programs presented should also provide interesting and, perhaps, useful ideas for financial and educational-psychological supports in other countries. In particular, the methods of the selection for student scholarships should be considered.

In the second to last contribution Wilgosh discusses achievement versus underachievement problems in a cross-national (Canadian) perspective. With respect to the development of giftedness and talent, the author emphasizes the necessity of comprehensive individual and societal nurturing efforts in order to fulfill each individual's potential. Educational goals and problems of evaluation in the field of gifted education are addressed, too.

Wu-Tien Wu, the present President of the World Council for Gifted and Talented Children (WCGT), who organized the 2nd Asian Conference on Giftedness in Taipei/Taiwan in 1992, presents the situation of gifted nurturance in his country, representative of the east Asian countries. The international community of those concerned with nurturing and educating gifted students is obviously growing. There is also a noticeable increase in the willingness to approach one another and to learn from others from other countries, continents and cultures. Perhaps, and this is our hope, the new generation of young talents will one day better be able to overcome national egoism and hate than the present generation and thus to ensure lasting peace in the entire world.

Education policy concept of the government of The Federal Republic of Germany on the promotion of giftedness

Ernst August Blanke

Federal Ministry of Education and Science, Bonn/Berlin, Germany

I.

I am pleased to be able to report to you on the political concept of the Federal Government for the promotion of giftedness. This description of my task - due to Germany's federal structure - indicates at the same time its restriction. I shall confine myself to the concept for extra-curricular programs as well as for the promotion of giftedness in vocational training and at higher education institutions; I shall not, however, talk about the - no doubt - very important sector of promotion of giftedness in schools. The Federal Government has neither influence nor responsibility with regard to schools.

II.

The basic position of the Federal Government

The Federal Government's policy is aimed at allowing each individual to fully develop his or her talent profile. What is required for this in the first place is a range of differentiated education and training programs; supplementary promotion measures outside the education institutions are, however, also indispensable. It is basically true of all and in all education institutions and applies in the same way also to the highly talented. The opinion prevailing in the past that the gifted would invariably get by under their own steam is incorrect. The former Minister of Education and Science and present Vice-Chancellor, Jürgen W. Möllemann, warned that, with our education system geared to mediocrity, we are wasting talent - a lapse which comes at too high a price both individually and socially.

The Federal Government's motivation is twofold

The Federal Government gives priority to the *individual aspect*. In the conviction that the full development also of outstanding talent is an essential condition for the formation of the overall personality and, therefore, for a responsible and fulfilled life, the Federal Government desires that these young people be provided - for their own sake - with the required pedagogic care.

In addition, considerable significance is attributed to the *social aspect*. Mastering the ever increasing demands on society - for example German unity, European unification, securing our cultural identity as well as our natural basis for living - requires above-average achievements. These achievements are produced by the highly talented - or they are not produced if these people are not guided towards the apex of their achievement potential.

The activities in support of the highly talented are *no alternative to promotion of the masses* or to the care for the disadvantaged. Rather, they are a supplementary measure at the other -

I am consciously choosing the word "other" rather than "top" - end of the talent scale. Promotion of giftedness has *nothing* to do with forming a *new elite* in the sense of earlier social elites. Anyone who - like the Federal Government - wishes to create a liberal and open achievement society, must help every citizen to achieve his or her individual best. Only thus can a leading stratum be created whose impact, authority and self-complement rest above all on personal achievement.

III.

Now let me turn to the *fundamental considerations* followed by the Federal Government in its initiatives:

- Participation in the programs offered must always be *voluntary*, the measures must therefore always be opportunities and challenges in essence; they must be geared to the specific needs of highly talented young people and enable them to deepen and broaden their interests.
- Promotion of giftedness must be aimed at *developing the overall personality*; one-sidedness should be avoided. Social skills should be taught.
- Promotion of giftedness must as a rule begin *in time*, which means as early as possible. Major distinctions have to be made depending on the type of talent; as a rule, musical talent must begin to be supported at an earlier age than intellectual talent.
- Constant *guidance* before and during participation in the promotion scheme is essential; *cooperation with the parents* is indispensable.
- It is the *task of schools and higher education institutions* to support particularly talented students by means of counselling and suitable special programs. Educating these young people in *separate* education institutions or classes must remain the *exception*, especially if this involves separation from the family.
- Extra-curricular opportunities for the gifted can be made available by a variety also of *private institutions*. There is a productive relationship between the work of these private sponsors and that of the usually public education institutions.

IV.

These fundamental remarks are now to be supplemented by a number of *practical Federal Government activities*:

(1) One of the most urgent tasks is to bring about a situation of *public awareness* of the *justification and necessity* of special promotion of the gifted, particularly in relation to parents and teachers - but also in relation to the adolescents themselves. The Federal Government participates to the best of its abilities in doing the job of convincing those concerned and urges others to follow suit. Thus, every year, the Federal Chancellor holds a reception in honor of the winners of a large nationwide competition. On this occasion last May, *Federal Chancellor Kohl* made the following statement to the press: "I have invited you here in order to emphasize once again how important it is for our society to promote talent and the disposition to achieve, the spirit of invention and ability in the widest variety of fields. This also requires that the political leadership makes clear that it champions those who have confidence in themselves, who have proved their readiness to strive for achievements and have demonstrated inventiveness and ability."

(2) An important tool in the promotion of the talented are the *nationwide competitions* in the fields of mathematics, chemistry, physics, informatics, foreign languages and history. Cultural and musical competitions supplement the opportunities for adolescents. A competition for artistic talent is currently in its introductory phase. These competitions pose particular demands on analytical skills and creativity. They are an invitation to the talented young people

to develop their particular abilities and to test them in a fair competition. The most important of these competitions is "Young Researchers" (Jugend forscht) where, unusually, the entrants are not judged on the solution of set tasks but rather submit to the jury scientific and technological projects which they have undertaken on their own account. This competition, particularly, promotes scientific and technical creativity.

The national winners are sent to the *international scientific olympics* in mathematics, chemistry, physics, informatics and biology where, we are pleased to report, the German teams regularly achieve impressive successes.

(3) Learning from American models, the Federal Minister of Education and Science has, since 1988, arranged for pilot experiments for a *pupils' academy*. On the basis of a very severe selection process, the adolescents, aged 16 to 18, live together for several weeks in selected, somewhat remote places, for example, boarding schools, and work in subject fields chosen by themselves on challenging issues with university professors, esteemed artists and leading economic experts. These pilot experiments have been very successful; fortunately, it has also been possible to integrate disabled - more specifically blind - pupils. The Federal Ministry of Education and Science aims at establishing long-term pupils' academies for roughly 1,500 adolescents annually.

(4) In Germany approximately two thirds of young people are prepared for their career in the system of *on-the-job training*. An extensive program for the promotion of the gifted in this training area - which is very significant in terms of numbers - was put into effect in the summer of 1991. Particularly gifted young employees who have completed a training program in the manner described above and who - particularly in the final examination - have shown especial occupational aptitude receive grants for participation in exacting training schemes - which are run parallel to their jobs - for the further development of their vocational and personal capacity to act. The grants can, for example, be used for learning foreign languages, for visits abroad or for the acquisition of knowledge and skills in related fields of training. The above program is an important new approach to the promotion of giftedness, which is given priority by the Federal Government.

(5) In the *higher education sector* the situation is very different in comparison with other education sectors. Here, the concept of promoting outstanding talent is considerably more familiar. The traditional and no doubt proven form of the promotion of talent is immediate contact between students and professors and their assistants. As the course of study progresses, this contact intensifies. Nevertheless, the Federal Government believes that *further measures* to promote the talented are required. Suitable opportunities were created in 1985 through an amendment to the Federal Framework Act on Higher Education. Another important development has been the setting-up of the so-called *post-graduate colleges* ("Graduiertenkolleg"). Following a completed first degree, particularly qualified graduates collaborate in research projects over a period of two or three years. While the colleges in the first place deal with specific projects, there is no doubt that participation in them constitutes a highly effective opportunity of obtaining scientific qualifications for the selected graduates.

As in the past, the Federal Government makes available to the nine large *foundations devoted to the promotion of the gifted in the higher education sector* the funds for their work. Their task is to provide guidance - including intellectual and academic guidance. But their particular aim is to prepare outstanding students for responsible cooperation in cultural, political and social tasks in society.

V.

In recent years, the Federal Ministry of Education and Science has considerably increased

departmental research in the field of promotion of the talented. The focus has been on questions concerning the identification of the gifted and of the special nature of their talent as well as on questions of environmental influences and the possibilities of specific promotion for certain groups of gifted persons. Meanwhile, the emphasis of our interest is on the *integration of groups not reached to a satisfactory extent*.

The most important point here is the participation of *women* in the realms of technology and the natural sciences. The proportion of women interested in these fields and especially the proportion of women who produce outstanding achievements is extraordinarily low. It is important to identify the reasons why this is so and to develop instruments of counteracting this trend.

Another important research theme is the promotion of the *gifted disabled*. The chances of scholastic and educational development on the part of gifted people with various types of disabilities are to be investigated. The project results are to contribute to the specific promotion of the gifted disabled, thus enabling them to make optimum use of their development potential.

The promotion of highly gifted pupils

as seen by the Kultusministerkonferenz

Georg A. Knauss

Bavarian State Ministry of Education, Culture, Science and Arts, Munich, Germany

In the Federal Republic of Germany, according to the German constitution, the responsibility and the competence for the structure and management of the school system lie with the German states, the "laender". Their number has increased in 1990 from eleven to sixteen as a consequence of the re-unification. The sixteen laender are vested with what is called "Kulturhoheit", which might be translated by "cultural and educational sovereignty". The laender have thus the right and the possibility to put their own educational concepts into practice. These concepts are shaped by the historical development of the Laender and by their educational and pedagogical traditions, but also by the social goals and targets of the respective governments. However, the laender do cooperate in educational matters in the interest of mobility and of equal living conditions all over Germany. Cooperation is effected by the Standing Conference of the Ministers of Education of the Laender, the so-called Kultusministerkonferenz, abbreviated KMK. The Conference sees its task in the common endeavour to safeguard by agreements what has been called "a common and comparable basic structure" of the various education systems and, by doing so, provide the young generation with an education and training which is as much in concordance as possible.

Practically all the laender constitutions comprise articles which guarantee the individual promotion of children and adolescents. Thus, as an example, the Bavarian Constitution postulates in article 128: "Every inhabitant of Bavaria has a rightful claim to an education and training which corresponds to his or her recognizable abilities and his or her inner vocation". Article 132 of the Bavarian Constitution postulates further that for the access of children to a particular school his or her talents, inclinations and performances shall be decisive and not the economic or social status of the parents.

These constitutional provisions undoubtedly entail the mandate to foster the individual pupil with his or her differential talents in an individualized and differentiated way. On the other hand, article 7 of the German constitution rules out "Vorschulen", i. e. pre-schools in the sense of institutions providing an early, but separated promotion of gifted pupils. Since the Weimar Constitution of 1920 it is a commonly accepted principle of German educational policy that in any case for primary schools - the period between the sixth and tenth year of life - differentiation in the form of separate streaming is not acceptable. Priority is very definitely given to the education of children in a social context embracing all other children of the same age.

In the 1970's, the structure of education after primary school was the object of vehement educational and political debates in the German laender. The traditional splitting-up of the school system into three types of school with different profiles of talent and performance - Hauptschule, Realschule and Gymnasium - was faced by demands for a comprehensive type of school, the "Integrierte Gesamtschule", chiefly on the grounds of equal educational opportunity and continuing social integration. But whereas the former German Democratic Republic established an undifferentiated uniform school system from grades 5 to 10, developments in the West German laender were characterized by partially opposite tendencies: Laender governed by conservative parties continued to stick to the traditional differentiated school

system, other Laender ruled by the Social Democratic party tried to establish the integrated comprehensive school as an "offer" beside the traditional schools. Moreover, for grades 5 and 6, i. e. for the eleven- and twelve-year-olds, there was a tendency to develop intermediate forms called "Förderstufen" (stages of promotion) or "Orientierungsstufen" (stages of orientation) with the aim of preventing or, at any rate, postponing a selection which was held to come at too early an age.

The controversies between the laender and the different political parties subsided only when in 1982 the KMK succeeded in concluding an agreement on the mutual recognition of the final certificates of the integrated comprehensive schools. This agreement bound and still binds the comprehensive school to minimum requirements as to streaming regulations in the most important subjects, but at the same time accepted the comprehensive school as a fourth type of school beside the traditional ones.

Another development is important for our consideration, too. In the traditional school system the Gymnasium was practically the school where gifted pupils received the promotion they needed - and this was certainly due to the fact that well into the 1960's only a small proportion of an age group was able to reach the "Abitur", i. e. the final certificate of the Gymnasium entailing free access to higher education. This situation has in the meantime changed completely. In 1960, the number of those acquiring the Abitur was under 10% of the age group, whereas by 1990 this proportion had gone up to almost 23%, and the KMK forecasts more than 30% for the year 2000. This increase is, by the way, mainly due to the growing participation of girls and young women in upper secondary education so that they are no longer in a position of disadvantage or under-representation. In spite of this enormous increase, the KMK claims that it has been possible to maintain the quality of the Abitur. The laender have moreover undertaken the attempt to elaborate joint examination requirements for the Abitur, thus creating standards and measures of quality for a certificate which still holds the highest esteem in the education system since it conveys the "allgemeine Hochschulreife", i. e. the right to study any subject at any German university with the exception of the numerus clausus subjects (mainly medicine) for which special admission procedures have been developed.

The laender will claim even now that an adequate promotion of highly gifted children and youngsters is possible by the very structure and the performance requirements of the Gymnasium. Indeed, the Gymnasium comprises subjects and contents which will take up the most frequent options also for gifted pupils. In the upper cycle, during grades 11 to 13, the Gymnasium offers "Leistungskurse", i. e. courses with elevated performance requirements which can be chosen out of a large spectrum of subjects. These courses offer distinct possibilities of an individualized curriculum at a considerable level of pre-scientific learning and work. In any case, we do not accept the idea of specialized schools for highly gifted pupils typical for the former Socialist educational systems in Eastern Europe where a counterpart was needed for the uniform comprehensive schools. We do believe that the existing system of differentiated schools provides for sufficient possibilities of promotion even for highly gifted pupils. It is, however, equally a fact that increasingly additional measures of promotion or a more rapid course through the school system are being offered.

But the school system has not only expanded in the field of the highly gifted. At least as intensive were the efforts of the laender to open adequate possibilities of learning for handicapped children and youngsters. An agreement of the KMK of 1960 marks the starting-point for a far-reaching development of special schools which provide differentiated learning possibilities for these pupils according to their various handicaps and needs. True enough, more recent research leads to moving away again from a rigid separation of handicapped pupils and to attempt joint learning situations of handicapped with "normal" children wherever possible. But the care for the handicapped in itself is a definite priority.

Thus, the KMK has been guided in its work of educational coordination by the aim to convey to all children, whether gifted, average or handicapped, educational programs adapted to their respective talents, abilities and needs. The promotion of highly gifted pupils must be viewed under this overall target as an important aspect, but only one amongst others. The representatives of the laender which will take the floor afterwards will certainly describe more in detail how they plan for the promotion of highly gifted pupils. My impression is that such measures will be chiefly programs of enrichment and acceleration. Apart from these, one of the most efficient possibilities consists in the attempt to provoke the potentials of gifted pupils by public competitions. There are numerous competitions on the scale of the individual laender, but particular mention is due to competitions on the national level which are sponsored and carried out by various institutions. I will acknowledge without envy the initiatives undertaken and the financial support given by the Federal Government in this field. In a joint statement with the Federal Government the KMK has confirmed in 1984 that such competitions for pupils and youths have the task of challenging the individual to outstanding performances, thus contributing to the general mission of our schools. No less than 14 competitions on the national level are thus officially recognized and are supported in various forms by the Federal Government, the laender, private associations and foundations. Although sometimes schools complain of an overflowing by competitions at the detriment of their immediate tasks, these competitions cannot be excluded any more from the spectrum of the promotion of gifted pupils in our education system.

Let me finally ask the famous question which - as in other countries - has also played such a decisive role in German educational debates in the sixties and seventies. How can we be equal and excellent, too? Those responsible for education on the level of the KMK have to my mind answered this question in both directions. They have created a consistent framework of external and internal conditions with the aim of safeguarding that no gifted pupil will be kept away from demanding educational opportunities for personal, social or economic reasons. They have endeavoured to maintain the quality of education even in a time of massive expansion of the schools. But they have also responded to their social obligation towards those pupils who are less talented or even handicapped. I hope that such a policy will also be appreciated by a congress which has its focus on the promotion of the highly gifted.

Types of giftedness promotion in Baden-Württemberg

Peter Pauly

Ministry of Education and Sports of Baden-Württemberg, Stuttgart, Germany

Since 1984, measures aimed at the promotion of particularly able pupils are an integral part of educational provision offered at secondary schools in Baden-Württemberg.

This can be mainly attributed to an initiative taken by the School Advisory Board of the Land Baden-Württemberg in the year 1982; in a detailed statement on the subject, the Board criticized that "for decades, the individual educational needs of a small group of highly gifted children and young people have been constantly ignored" by educational policy. Thus, highly gifted pupils "have until now been denied ... what is considered to be the universal request of education in a democratic society, namely the development of the individual talents of each single child".

This initiative caused the Ministry to elaborate a conception aimed at the promotion of the gifted in the schools of the Land. After extensive discussions, the following corner stones for an appropriate support program were determined:

- Promotion should not result in isolating the specially talented pupils from their average gifted peer group; it should, therefore, be offered in form of additional after-school lessons.
- Promotion measures should be clearly marked off from the advanced courses offered on the upper level of secondary education, and the topics to be dealt with should distinctly contrast with those specified by the syllabuses of the single subjects.
- The topics should be mainly taken from fields like languages, mathematics and natural sciences/technology; arts and sports should be explicitly left out, since there are sufficient extra-curricular activities offered in these areas.
- The supporting character of the courses on offer should be underlined by the topics in order avoid the impression of an additional "hobby subject".

In addition, a number of framework conditions were laid down:

- The group of pupils to be promoted should be recruited from classes 7 to 12.
- It should also be possible to organize the working groups on the basis of mixed age-groups.
- The special courses should be offered in form of two-hour working groups.
- As a rule, only pupils with a good record of achievement in all the subjects taught at school should be accepted.
- The decision about the admission of a pupil should be taken by the head of the working group after consultation with his corresponding colleagues at school.

The above mentioned points formed the basis for the establishment of the first 67 working groups for specially gifted pupils at 40 secondary schools in Baden-Württemberg in the school year 1984/85. In the following years, the supporting measures were steadily expanded: in the school year 1990/91, the promotion program reached a momentary all time high with 608 working groups at 396 schools. Among these 396 schools were 49 "Hauptschulen" (grade 5-9), 113 "Realschulen" (grade 5-10), 27 vocational schools and 207 "Gymnasien" providing general education (grades 5-13).

In the course of the last two years, the number of working groups for particularly able pupils has slightly decreased due to a beginning shortage of teachers. These working groups form, however, still the basis for the promotion of the gifted in Baden-Württemberg.

But in addition other types of promotion have been developed or further developed in the course of the last years:

Thus, Baden-Württemberg introduced two top performance competitions on the regional or Land level, namely a mathematics competition for pupils from the intermediate stage of secondary education and a competition in German language and literature for upper secondary school pupils. The main purpose of the Land mathematics competition is to prepare pupils in the intermediate grades for the national top performance competition in mathematics by means of suitable tasks. This year, approximately 300 pupils participated in the first (of two) rounds of this Land competition.

The Land competition in German language and literature aims at encouraging the pupils to deal with works of German literature or with the history and forms of today's language, but it is also meant to foster the creative use of language in order to express one's own perceptions and observations.

Seminars to which particularly qualified participants of the working groups, but often also the winners of the competitions, are invited constitute another form of giftedness promotion in Baden-Württemberg. These seminars, which last several days, offer their participants an opportunity to treat a demanding topic in cooperation with other young people who have the same interests; the seminars are always accompanied by a stimulating cultural program.

Since 1985, Prof. Heller and his collaborators have been responsible for the follow-up research on the program for the promotion of particularly gifted pupils. The choice of participants for the promotion program as well as the program's aims have been basically confirmed by the research results in hand.

In order to further improve the quality of the supporting measures, experiments are being made right now in different places in Baden-Württemberg each of it involving several schools. One of the projects run in Freiburg under the title "Freiburg Seminar" seems to be particularly promising: about 60 pupils from all the "Gymnasien" in Freiburg take part in one of the eight study groups on offer. Participation in these study groups is supplemented by lectures given by university teachers and in some cases by weekend seminars.

Finally, in four cities in Baden-Württemberg a pilot scheme has been going on for two years now called "Gymnasium with an eight-year stream"; it offers qualified pupils an opportunity to already obtain their university entrance qualification after eight years of secondary schooling instead of nine. In order to be admitted to the fast-track course they have to submit a report of their former school and they have to undergo an interview for admission at the receiving "Gymnasium". Great importance is attached to the pupils' previous performance at school, but in addition to that, the central question is whether the pupil is endowed with qualities such as resourcefulness, broad interests, enthusiasm, inquisitiveness and open-mindedness, and whether he or she shows a sense of initiative and responsibility, performane orientation as well as power of endurance and pertinacity when faced with difficult and lengthy problems. Again, this pilot scheme - explicitly approved by the Standing Conference of the Ministers of Education of the Länder in the Federal Republic of Germany (KMK) - is being evaluated by Prof. Heller and his research team.

Although the interest on the part of the parents is not extremely large until now - this school year the overall number of pupils admitted to the experimental course in the four schools amounts to 73 -, the experiences made in the first two school years are favourable. This shows a letter dated September 14, 1992, from the parents' representatives of the model class at "Tulla-Gymnasium" in Rastatt, where it says among other things:

"It is one year now that we entrusted our children to this pilot scheme, full of hope, courage and curiosity, but also with scepticism, and now we are already looking forward to what lies ahead with great satisfaction and with confidence. In our opinion, the children not only participated in all school events with great interest, intellectual curiosity and open-mindedness, but they were also motivated and enjoyed what was being offered to them."

Today, special educational provision also for the needs of particularly gifted pupils forms part of everyday practice at secondary schools in Baden-Württemberg.

Initial reservations against the supposed "elite breeding" could be largely overcome by now, partly because of the undeniable fact that a lack of challenges can be just as harmful for the development of a child as excessive demands made upon a child can be; on the other hand, it was the great commitment of the teachers, who assumed this task, as well as the altogether positive reactions on the part of pupils involved which helped to redress these prejudices.

Nurturance in Bavaria

Eduard Pütterich

Bavarian State Ministry for Education, Culture, Science and Arts, Munich, Germany

Thanks to its *multiple level system*, the *Bavarian School System* is able to realize the Bavarian Constitution article 128 paragraph 1 providing that every individual has the right to an education which corresponds to his/her needs, abilities and interests. I will outline the Bavarian School System briefly and in broad terms.

After four years of grade school, the students' educational directions fork. They either continue at the *Hauptschule* (grades 5 to 9) or at the *Gymnasium* (grades 5 to 13), which leads to the *Abitur* (prerequisite for college). A further differentiation begins in grade 7. After grade 6 of the *Hauptschule* or the *Gymnasium*, the *Realschule* (grades 7 to 10) begins, which leads to the so-called *Mittlerer Schulabschluss*. In addition, there is a greatly differentiated special education system for certain types of handicapped pupils. Following the *Hauptschule* and *Realschule*, a differentiated vocational school system can be attended, which includes not only a vocational school, the dual system and also continuing education like the *Fachoberschule* and vocational secondary school, which can lead to the admittance standards for technical schools or subject-specific admittance standards for university or, with an additional examination, to general university admission standards.

The *Hauptschule*, *Realschule* and *Gymnasium* are no monoliths. The *Hauptschule* offers two course levels. The *Realschule* offers the option of choosing between either mathematic-scientific, business or musical-social emphasis. The *Gymnasium*, too, includes various instruction branches meeting the needs of various types of gifts:

- the humanistic/classical language branch with the foreign languages Latin-Greek-English;
- the modern language branch with English and Latin as well as French or Italian or Russian or Spanish as foreign languages;
- the mathematic-scientific branch with emphasis on mathematics, physics and chemistry;
- the musical branch with an emphasis on German, music and art; as well as
- the business and social science branch.

The variety of school types in the Bavarian school system translates an idea into action that reaching the goal "equal opportunity" necessitates the nurturing of the especially gifted and the less gifted with equal weighting. Thus, the present view is that all measures that aim at continuing the *Gymnasium* through to *Abitur* are considered an aid for especially gifted students. In particular, this comprises the following measures:

- The early beginning of the *Gymnasium*, which should make it possible for students at the especially educable age of 10 years to enter a nine-year educational continuity aiming directly at university admission standards.
- Admittance to the *Gymnasium* through a selection procedure is to guarantee as far as possible for the young developing person that gifted and motivated students attend the *Gymnasium*, holding the failure quotient as low as possible.
- The setting of high standards already in the first grades of the *Gymnasium*: This especially means that students should be capable of independently applying to new situations the fundamentals learned before, instead of simply learning matter which can be easily tested.

This recollection knowledge is, of course, also essential to a certain extent.

- The safeguard of a broad general education by means of firmly established knowledge and abilities, especially in the subjects German, foreign languages, mathematics, natural sciences and history. Even in the reorganized Oberstufe, the subjects German, history, at least one foreign language, mathematics and at least one science subject are required through to the Abitur. Thus, Bavaria fulfills a university demand; if all federal states were to do so, then the present discussion about the value of the Abitur or its lack, respectively, and the discussion about a university admittance examination would be put to rest.

There are also further possibilities for nurturing gifted - or highly gifted - students within various types of schools, a few of which I would like to mention here.

(1) *The "Plus Program" for exceptionally gifted and interested Gymnasium students.* Starting in the school year 1987/88, a possibility for taking additional courses (outside the usual school and classroom program) was opened up. This enrichment program is made up of *additional electives* for exceptionally gifted students (so-called "Plus Program"). With one or two hours of instruction per week, topics are offered that are supposed to either supplement the regular science or art classes or are based on the supplemental science or arts program of the Oberstufe. These "plus" classes for the exceptionally gifted are intended to differ from the regular elective program in that the teacher selects and advises the students personally.

In the school year 1991/92, a total of 152 Plus Classes were offered at 110 of the roughly 400 existing Bavarian Gymnasien. These 152 classes comprise:

- 45 in language and literature, e. g. 19th Century French Literature, the Roman Comedy "Plautus", the New Testament in Original, or Chamber Music for Advanced Students;
- 13 in social sciences such as Politics/Political Theory, Satellite Geography or Technical Ethics;
- 92, i. e. the majority, in mathematics and sciences, such as Fractals, Astrophysics, Experimental Environmental Chemistry or a practical training in biochemistry;
- 2 classes were offered in sports.

Plus Classes can also be interdisciplinary or assist participants in competitions, e. g. "Jugend forscht".

(2) *Vacation Seminars.* In addition to the "Plus Program", *vacation seminars* are also offered for exceptionally gifted students. Whereas the "Plus Program" has previously only been directed at Gymnasium students, the vacation seminars are offered for various school types (i. e. Gymnasium, Realschule, Hauptschule, Vocational School). The vacation seminars last a week and take place during the school vacations. The criterion for the selection of the participants are academic achievement and social commitment. The program includes lectures about current scientific and business topics, outings, as well as discussions with prominent individuals, sports, musical events and personal discussions.

Two programs of this year's seminars for particularly talented Gymnasium students in a) northern Bavaria - Pegnitz - and b) southern Bavaria - Hohenschwangau - are included to help demonstrate this.

(3) *Support of skipping grades.* In connection with the discussion about the duration of studies at the Gymnasium, it is often stated that it would be no problem - at least for the exceptionally gifted among Gymnasium students - to complete schooling in eight years.

Corresponding studies in Bavaria, however, have shown that no Gymnasium has been willing to introduce an eight-year program, and parents, teachers, and students vehemently rejected such proposals.

Therefore, the Gymnasien in Bavaria were requested on October 1, 1991 to support and advertise the individual's right - as established long before - to skip one grade.

Grade 8 is viewed - without excluding other possibilities beforehand - as the most appropriate grade, since

- it is far enough removed from admittance into the Gymnasium (habituation possible) and, at the same time, from the qualification phase at the senior level, i. e. where negative consequences for the Abitur would be expected from skipping;
- no new foreign language begins here or in grade 7 or 9.

Supportive measures considered necessary are

- counseling at the school involved;
- supportive measures at the school involved so that the student can fulfill on his own the syllabus of the grade skipped;
- vacation seminars in preparation of "skippers'" entry into the new grade;
- counseling material prepared by the State Institute for School Education and Educational Research and distributed to the schools at the end of February;
- opening the possibility that - if the idea meets with favor - a grade can be skipped at midyear the student entering the next grade.

Ninety-two students have registered for the next school year. The regional distribution was quite uneven. There was an emphasis in Upper Bavaria and Upper Franconia. By far not all of the skippers - who came from grades 6 to 11 - wanted to take part in a vacation seminar, so that only *one* vacation seminar was offered during Whitsun vacation and at the beginning of summer vacation. The participants, both students and teachers, were very enthusiastic, so that successful skipping seems to be possible in reality.

The same measures are planned for the coming school year; the State Institute has already prepared materials, this time for skipping grade 6 of the Gymnasium.

(4) *State Competition in Classical Languages*. In 1988/89, a "State Competition in Classical Languages" took place for the first time. It was supported by the State Ministry for Education, Culture, Science and Arts in Bavaria. The competition, which will take place every year since from this year on, is aimed at gifted 12th grade students who are attending proficiency courses in Latin and/or Greek. It is supposed to nurture gifted students' confrontation with Latin and Greek language and literature. The best competitors are admitted to the *Studienstiftung des deutschen Volkes*, the next best competitors receive book money or material prizes.

(5) *Maximilianeum Foundation*. A special Bavarian institution for nurturance of gifted students is the Maximilianeum Foundation. This foundation has admitted a small group of male top graduates since 1980 - according to the wishes of its founder, King Maximilian II of Bavaria and - due to the contribution of the *Zustiftung Wittelsbacher Jubiläumsstiftung* also of female top graduates. In order to be admitted to the Foundation, successful completion of a one-hour examination held by one of the examination boards of the Bavarian State Ministry for Education, Culture, Science and Arts is necessary. The successful students are provided with free board and lodging as well as with other study-related privileges which go beyond financial support.

Support for gifted pupils in Saxony

Hans Wilhelm Berenbruch

Saxon State Ministry of Education, Dresden, Germany

When considering the support offered to gifted pupils in the Free State of Saxony, it is conspicuous that, on the one hand, proven forms of encouragement are being continued, on the other hand, new paths are being taken.

Since the school year 1992/93, the educational system in Saxony comprises, in accordance with the Law on Schools, the school types "Grundschule", "Mittelschule" and "Gymnasium". The previous "Polytechnische Oberschule" and "Erweiterte Oberschule" had to be brought into line with this new school structure. On the credit side, however, it was also possible to note that certain special schools were able to offer pupils with particular talents educational opportunities clearly beyond those of the remaining schools. These were a special school for music, special classes at three schools for intensified musical education, particularly with a view to choral training, and four schools with a mathematical-scientific-technical orientation: a school in Chemnitz, the Martin-Andersen-Nexö School in Dresden, the Wilhelm-Oswald School in Leipzig and the Werner-Heisenberg School in Riesa. There were furthermore special classes at the Technical University in Chemnitz. These institutions date back no further than the sixties. They were founded with the intention not only of offering special encouragement for gifted pupils, but also of providing certain strategic enterprises with highly qualified young recruits. A critical assessment of the work of these schools presented several positive aspects:

- the specific furtherance of talent,
- a fruitful cooperation between schools and universities,
- the successful preparation and holding of competitions,
- the gathering of experience in didactics with regard to the promotion of particular talents.

At the same time, however, critical facets were also revealed:

- the selection of the pupils was not dependent solely on the talent factor,
- the freedom of the pupils was clearly impaired with regard to their future career choice,
- the schools were thus seen as so-called "personnel forges" and firmly integrated into the socialist system.

In the past two to three years the deformations have been fundamentally corrected. Careful thoughts were made as to how the position of these schools should be characterized in the Saxon school system and to which group of pupils they direct their attention.

In order to illuminate this peculiarity I would first like to outline the structure of the Saxon Gymnasium.

The Gymnasium in Saxony

The grades 5 and 6

The pupils have the opportunity to begin their Gymnasium education directly after primary school (Grundschule). For the grades 5 and 6, the curriculum is essentially the same in both the

Mittelschule and the *Gymnasium*. The timetable is designed such that many important subjects are begun during this stage.

In the 5th grade, we can mention the first foreign language, biology, history and geography. The pupils are acquainted with German and mathematics from the *Grundschule*. A new subject in the 6th grade is physics. During this stage, however, the earlier subject handicraft is continued through to the 6th grade, so as not to banish more practical educational components completely from the *Gymnasium*.

The grades 7 to 9

We view this stage of education as a period in which the higher level of achievement of the pupils at the *Gymnasium* becomes especially clear. The curriculum commissions were called upon to arrange the subject matter wisely, so as to enable the pupils to gain a certain advantage over their colleagues at the *Mittelschulen*. The timetable includes the full range of teaching subjects and permits the pupils to decide in favour of a particular profile.

We are purposefully implementing the express formulation in the Law on Schools that *Gymnasium* "also create conditions for vocational training outside the universities". The subject "social studies/law studies/economy" plays a special role here.

It occupies four lessons a week in the grades 9 and 10. Alongside elements of political education we hope to convey a basic knowledge in the legal field. We consider this to be very important from Saxony's point of view.

The 10th grade

The 10th grade fulfills a linking function in the structure of the Saxon *Gymnasien*.

First of all this grade completes the secondary level I. We see it as an important further function of this grade that it prepares the pupils for the *Gymnasium* upper grades. They receive extensive information about this next educational stage and make their course selections.

It was not least for this reason that we determined that pupils from the *Mittelschulen*, who do not make the decision to take the "Abitur" examination at a general *Gymnasium* until they have completed the 10th grade, repeat this 10th grade at their future *Gymnasium*. They thus have the opportunity to study the additional subject matter which is dealt with in the 10th grade at *Gymnasium*, and are at the same time prepared for the *Gymnasium* upper grades. It is to be noted in passing here that under such circumstances it is a 13-year education which leads to the "Abitur" examination.

Gymnasium secondary level II (grades 11 and 12)

In accordance with the Saxon Upper Grade Order pupils who begin the 11th grade from the school year 1992/93 onwards will be taught in line with the course system for secondary level II as outlined in the upper grade model laid down by the Conference of Education Ministers. With certain restrictions, the pupils can choose from the whole range of subjects, and, depending on the courses available at a particular school take two subjects as achievement courses, the remaining subjects as basic courses.

The *Gymnasien* with intensive mathematical and scientific orientation

In the Saxon Ministry of Education, it was decided that the previous special schools should become *Gymnasien* with an intensive mathematical/natural sciences orientation. With this measure it is our aim to maintain such schools or parts of schools whose educational capacity is directed especially at gifted pupils. The traditions which have developed are to be kept alive and enriched with new aspects.

The selection of pupils

In the past two years it has become clear for these schools that they need a new concept for the attraction of pupils. They must take the initiative themselves and must popularize the aims of their school. Many teachers from such schools cooperate closely with the organisers of competitions, whereby their attention is drawn specifically to exceptional talents. These pupils can then be addressed personally. Furthermore, the fact that the tradition and reputation of the school also play a certain role is not to be underestimated. The principal of the Werner-Heisenberg School in Riesa has told me that former pupils of the school have registered their own children for a place at the school because they know of the quality of the teaching here.

The organizers of the school are striving to be able to accept pupils from a wider region. This depends on a well-functioning boarding system. But under our new conditions, it is especially this cost factor which presents a difficult problem. Some local authorities are overstretched in this respect, however high parental contributions would lead to an unintended selection according to social criteria. For this reason, an examination is currently underway as to whether the State Government is in a position to take over sponsorship for a certain few such schools.

Teaching

An undeniable advantage of our schools is to be found in the fact that the concentration of particularly talented pupils permits a high level of teaching in all subjects.

This then becomes a matter of course to a certain extent. While a gifted pupil at a general Gymnasium must sometime feel like something extraordinary because his/her learning capability far exceeds that of his/her classmates, the high demands made at our schools have retained a certain normality. This is without a doubt also favourable for the character development of the pupils.

It is also possible to provide intensive teaching in those subjects which do not form the core profile of the school. This is, on the one hand, because the pupils are used to concentrated and advanced work and because there is also a transfer effect, which can become especially effective in ability areas.

The schools with intensive mathematical-scientific orientation are regularly pleased to note that good results are also achieved in the artistic fields. School orchestra and school theatre groups are frequently found.

Talented pupils also demand teaching appropriate to their character structure. The successful teacher is a genuine specialist in his/her field, who respects and encourages the pupil as a subject and is thus able to give lessons suited to the individual classes and of a very high standard. An autocratic style is just as much condemned to failure as incompetence with regard to the subject matter.

Teaching in the specialist subjects

The desired furtherance effect is naturally to be expected in those subjects in which the pupil is confronted with especially high demands. In designing the timetable we decided to maintain all the general subjects in their full length. In the grades 8, 9 and 10 the number of lessons in the specialist subject is increased by one, giving an opportunity to convey additional subject matter.

In this field the teaching is arranged so that small groups of pupils can be introduced to exercises clearly above the level of the standard curriculum. This means that the pupils learn not only the subject matter required by the curriculum, but also additional material. The teachers

who work in such subjects have many years of experience with gifted pupils and are naturally especially interested in conveying the latest state of the science.

The school's particular emphasis is on treating the material more deeply than is possible at other schools. In mathematics proofs and definitions are also provided by the pupils in areas where this cannot otherwise be demanded. In the natural sciences, experiments develop the skills of the pupils in such a way that they can make observations at a significantly higher level and then evaluate the results and draw conclusions independently. The greater independence of the pupils is also encouraged in the planning of tests, the formation of hypotheses and the assessment of experiments. Many experiments which are marked in the curriculum as demonstrations to be made by the teacher are here carried out by the pupils themselves.

The deeper treatment of the subject matter and the increased independence of the pupils also mean that various solutions can be taken into consideration, that different possibilities can be weighed up and tested, whereby the pupil is also presented with a challenge to his mental flexibility.

Thus it is not absolutely necessary to deal with significantly different subjects at the schools in question, though this naturally does not exclude excursions into additional aspects of science and technology. In the field of computer science, for instance, the pupils in Riesa are acquainted with a more advanced programming language, for example PASCAL.

A particular role in the promotion of gifted pupils is played by the work groups. They permit pupils to come together in small groups and follow an individual learning plan. The participants look at specialist aspects of their subject and thus explore problems which lie far beyond the level of the normal curriculum. The organisers of such groups are teachers from the schools, though it was in the past also possible to gain the assistance of scientists from local colleges and universities. We hope that this will also be the case in the coming years. For the best pupils the promotion through the university lecturers took the form of opportunities to participate in work at the university in question. This special furtherance provided the pupils the chance to shorten their subsequent studies and under certain conditions to start with the second year of the degree course.

The schools are of the opinion that this cooperation with scientists gives rise to especially good results.

In passing it is to be mentioned that at the Special School for Music in Dresden, the instrumental lessons are given by lecturers from the College of Music or members of the Dresden State Orchestra. In this way it is similarly possible to achieve an extraordinarily remarkable level in this aspect of the teaching.

Competitions

In many areas of school life, and far beyond, the idea of competition is an especially effective stimulation. Pupils are being prepared for life, but they often need more immediate goals, they must be given opportunities to test their skills. They need to experience the feeling of success, and for this competitions are ideally suited. On the one hand, they help to draw our attention to special talents. I have already mentioned that at mathematical olympics and similar events we often find pupils who should be invited to the special Gymnasium.

On the other hand, competitions at national or even international level provide a yardstick for the teachers and pupils of the schools in question.

It may be true that in the past the appearance of the medals table was taken as a too one-sided measure of teaching success, though it cannot be denied that the stimulation effect surrounding success can hardly be overestimated. The schools are proud of the fact that they can point to

good or very good results as various events such as the international chemistry and physics olympics, the international mathematics olympics or computer science competitions.

Whereas we often participated at these international events even before 1990, our pupils now have the opportunity to participate in German national competitions, such as the "Young Researchers" scheme. The results obtained are testimony to the abilities of our pupils.

It is not the principal aim of these schools to produce such excellent results, though it is naturally conspicuous that almost all representatives of Saxony at international competitions are pupils of the special grammar schools. At this point I would like to point out that our encouragement of gifted pupils is not restricted to the special schools I have described. The encouragement of talent is a task for every teacher. A teacher should always keep an eye on the productive abilities of each individual pupil. In this respect the competitions, which are basically open to all pupils, are a welcome opportunity to test one's own abilities parallel to the classroom teaching. Many mathematics, physics and chemistry teachers have in the years since 1990 put a lot of effort into keeping the olympic movement alive in their subjects. The Ministry of Education reacted to the proposals from the teachers and set up a "Saxon Regional Committee for the Promotion of Pupils Gifted or Interested in Mathematics and the Natural Sciences". Its tasks are as follows:

- The discovery of pupils with mathematical-scientific talents and their continuous encouragement,
- Spreading awareness among parents, teachers and various institutions of the importance of arousing interest and developing the pupils in these fields,
- Maintaining and expanding the various forms of encouragement for gifted pupils and the stimulation of scientific studies for effective and practice-orientated furtherance (see the statute of the committee).

The results of the commitment of these teachers to date show that the participation at appropriate competitions is relatively high. It is pleasing to see that in this way the joy of exploring mathematical and scientific problems is being upheld and expanded. That talent-scouting is a further important aspect has already been mentioned. But permit me to return to the pupils at the schools with specialist teaching.

Vocational development

The real test for pupils is, alongside their university studies, their vocational development. Many graduates of the schools have in the past completed their higher education not only with excellent results, but also within a shorter time, and have assumed positions of importance in the economy, in the civil service or in professional branches. Whereas in the GDR system, the pupil was obliged to move into higher education in a directly related subject, today's school-leavers can naturally choose from the whole range of opportunities offered by the universities and colleges. Studies are possible both at home and abroad, and first experiences show that this offer is taken up. Even so, many young students remain first at the universities in Saxony. Experience with studies in the United States or other countries are still not the rule.

It was my intention to explain how the furtherance of talent in Saxony is structured. I would like to mention here that Saxony should be viewed as representative also for the other Eastern regions of Germany, all of which have their own, albeit certainly modified concepts for the encouragement of gifted pupils. We want to avoid throwing out everything connected with the past. On the contrary, fruitful traditions should be maintained and enriched with new knowledge.

That parallel scientific studies can be and must be an important accompaniment, is made visible not least by this conference here in Munich. For our part in Saxony, we will not be closing our ears to these ideas, but will be trying to grasp them and put them into practice.

Commentary on the symposium "Educational policy conceptions on nurturing high giftedness"

A. Harry Passow

Teachers College, Columbia University, New York, USA

I am very sorry that I cannot be present at this ECHA symposium. Working from the abstracts only, I know I am missing a great deal of the substance the presenters have shared with you.

Ernst A. Blanke has described the German Federal Government's goal of providing "each youth the possibility to full develop [his/her] own ability profile" in order to achieve maximum self-fulfillment and to meet society's need for specialized talents. The federal government has a number of basic promises when planning support for giftedness, support which takes place in extracurricular areas, areas of vocational training, and universities. These basic promises - such as "no exclusivity" - are significant in that they set a tone for the states - whose variety of support measures for school programs is welcomed. In addition, the federal government initiates research aimed at improving the opportunities for identifying and nurturing the gifted.

Georg A. Knauss has reported on the Standing Conference of the Ministers of Culture of the States "agreement that it is the task of the schools to provide each student with appropriate education according to [his/her] abilities". Thus, schools are encouraged to provide both a general basic education and individualized differentiation as well as enrichment, acceleration, or special classes or schools. The ministers and senators have also joined with the Federal Republic in promoting nation-wide competitions aimed at identifying and nurturing talents in specific areas.

Peter Pauly, Eduard Pütterich and Hans-Wilhelm Berenbruch have described the policies of their respective states. Baden-Württemberg nurtures giftedness through more than 600 work groups which are "outside regular classes and independent of the school curriculum" in which especially challenging and interesting topics are studied. Supplementing these work groups are state competitions and seminars as well as an accelerated (eight-year) Gymnasium program (instead of the regular nine-year program).

Bavaria "sees its structured school system as already being capable of promoting all types of talents, including high ability". The state believes that through its parallel school types as well as differentiation within each school type plus vacation seminars, optional courses, grade skipping and scholarships for "all-round highly gifted gymnasium graduates", the schools can nurture all types of talents, including those who are gifted.

Saxony, on the other hand, established a number of special schools for the promotion of mathematically, scientifically and musically talented students "to continuously support students who demonstrate special talents and interests". In addition, competitions, olympics and other such events provide additional stimulation and nurture of talents.

Barbara Grillmayr gave us the most explicit example of how policy affects program - what she calls "the interdependence" of gifted education and Austrian politics. Between 1970 and 1984, the Socialist government education policy followed an "egalitarian path" and the promotion of gifted students was neglected, limited to a few competitions. Following the Conservative Party declaration that "the advancement of gifted education is a most urgent

matter", it became a major issue for Austrian educational policy. Salzburg and several other states developed a range of support programs. The success of these efforts resulted in the inclusion of programs for the gifted into Austrian school law.

The accounts we have heard provide useful illustrations of the importance of policy in furthering the education of the gifted.

Educational policy may be proactive or prohibitive - it may mandate or require or suggest or recommend that certain educational provisions or programs be provided or it may prohibit the making of special provisions. A policy may mandate that giftedness be recognized, fostered and nurtured or it can actually forbid, limit or even prevent any special provisions. The dramatic shift in Austria from what Grillmayr described as "this egalitarian path" to what happened when the law included efforts for the gifted illustrates the importance of an affirmative policy.

Let me illustrate this further from the United States experience. In 1971, Congress mandated that the U.S. Commissioner of Education conduct a study to ascertain the extent to which special educational provisions were necessary to meet the needs of the gifted, to determine how programs of federal assistance could become more effective in meeting these needs, and to recommend what new programs were needed at the federal level. The Commissioner's report, known as the *Marland Report*, resulted in the involvement of the federal government in the education of the gifted in a serious way for the first time. Gifted and talented were designated as a population with special needs, a broad definition of "gifted and talented" was proposed, the U.S. Office of Education was to provide staff whose responsibility was the improvement of educational opportunities for the gifted, and some elements of a national strategy for educating gifted and talented students were formulated. The federal education agency became an advocate for gifted education. It undertook a leadership training effort that involved almost every state, aimed at building support among policy-makers, legislators, educators, board members and the public.

Because as in Germany, education is essentially a function of the states, the most important outcome of the *Marland Report* was its influence on the states and local school systems. The report stimulated state and local school district activities on an unprecedented level with policy formulations that resulted in statutory descriptions or definitions of the gifted; regulations regarding identification of such children; appointment of personnel to state education departments with briefs to initiate, coordinate and support educational programs and services for the gifted; appropriation at state-generated funds for such programs and services; and provisions for both pre- and in-service education of teachers for the gifted. When federal funds were made available for research and program development, the formulation and adoption of a "state plan for the gifted" became one of the key requirements for applying. Nor all states took all of these actions but in many different venues at many different levels, education of the gifted reached a plane never before attained.

Currently, through legislation, regulation or rules, about half the states have mandated services for the gifted and talented. Mandated services are required services and carry with them some variation of a *must* directive for local school districts. In about two thirds of the states, funds are distributed to local school districts for implementing programs for the gifted - ranging widely in the size of the support. Mandated programs usually include provisions for accountability on the part of local districts. About the same number of states have legislated support through discretionary programs - i. e., certain standards may be recommended but not required. Some states spell out the elements or components of a mandate while others direct local school districts to prepare a plan for providing services.

The illustrations we have had today from Germany and Austria as well as the USA experience, should remind us that legislation, regulation or rules represent policies - plans of action or guidelines. Either positively or negatively, they imbed efforts on behalf of the gifted into the

entire educational fabric of a nation or a state. They can provide stability to gifted programming or they can prevent or inhibit such programming.

What educators of the gifted should have learned a long time ago is that if substantive efforts are going to be made to identify and nurture giftedness and talent potential, then we must actively engage in efforts to influence governmental policies at all levels and in every way that these affect gifted education.

Identification of gifted university students for scholarships in Germany

Günter Trost

Institute for Test Development and Talent Research, Bonn, Germany

In Germany there are nine organisations offering scholarships for gifted university students. In the first section of my paper I will give an overview over the general goals of the scholarship programs, their material and immaterial offerings and the funding of the programs. In the second section, the nine scholarship organisations will briefly be described in terms of their ideological background, their affiliation and the number of their scholars each. In the third section I will analyse the methods these organisations apply for identifying gifted students.

Goals, offerings and funding of the scholarship programs

Eight out of the nine German scholarship organisations are affiliated with the major political parties, the major confessions, and the Trade-Union Congress respectively. One organisation is neutral with respect to political, social or confessional orientation. All organisations offer scholarships to gifted and highly motivated students in higher education:

- university students (in Germany, after 12 to 13 years of school, students can go straight to university; minimum length of studies: 4 years),
- "Fachhochschule" - polytechnics - students ("Fachhochschulen" offer more practically oriented courses, minimum length of studies: 3 years),
- students working on their doctoral dissertation (doctorands) after completion of university studies.

The general goal of all organisations is to further, in an individual way, the development of the abilities, the development of the total personality and especially the development of a particular commitment of their scholars towards society.

The scholarships offered by the various organisations include three types of assistance:

a) Financial support: The amount of the monthly allowance depends on the family income (maximum: about 900 DM). In addition each scholar is paid a monthly "book-money" of 150 DM allowing him or her to buy the necessary text-books. - For graduate students working on their doctoral dissertation, the monthly - income-dependent - allowance amounts to a maximum of 1200 DM. For studies abroad and study travels additional grants are offered.

b) Individual guidance: Each scholar is offered individual guidance - both in academic and in personal matters - by a professor at his or her university who is entrusted with the honorary function of a special tutor and who meets a small group of scholars regularly for discussions as well as for academic and cultural activities. Furthermore advisors of the scholarship organisations correspond with the scholars and see them individually at regular intervals.

c) Enrichment programs: A wide range of academic and non-academic enrichment programs are offered such as

- summer schools (for groups of scholars enrolled in the same university courses or on an interdisciplinary basis),

- weekend seminars,
- excursions,
- participation in congresses,
- foreign language courses (mostly abroad),
- practical work, and, last but not least,
- one year of study abroad.

By far the largest part of the funds for all the scholarship programs is provided by the Federal Department (Ministry) of Education and Science (1990: 90 million DM). A small percentage of the funds is contributed by the States. However, the public donors do not exert any influence upon the organisations' policies for selection and for the guidance or enrichment programs. The Federal Government only sets rules for the calculation of the monthly allowances and controls the allocation of these allowances.

The scholarship organisations do not only dispose of public funds. They also receive grants or donations from those institutions they are affiliated with - if that is the case -, from foundations, private companies and from former scholars (alumni). They use these extra funds mostly for special programs offered to small numbers of gifted persons, also for unconventional assistance in individual cases of hardship.

A brief description of the nine German scholarship organisations

The nine scholarship organisations, their affiliations and ideological backgrounds and the numbers of their scholars will be briefly described (see also Table 1).

- The *German National Scholarship Foundation (Studienstiftung des deutschen Volkes)* is the largest German organisation of that kind. It is the only one which is neutral with regard to their scholars' political, social or confessional commitment. The foundation's goal is "to further the academic education of students whose high ... giftedness and whose personality give reason to expect outstanding achievement for the society" (BMBW, 1991, p. 8). In the year 1990 the number of scholars amounted to approximately 3,850 students and 590 doctorands.

- The *Friedrich Ebert Scholarship Foundation (Begabtenförderung der Friedrich-Ebert-Stiftung)* offers scholarships for academically gifted students with "marked interest and commitment with regard to public affairs of our community and with a special responsibility for socially disadvantaged sections of the population" (BMBW, 1991, p. 44). It is affiliated with the Social Democrat Party. 1,550 students and 250 doctorands were scholars in the year 1990.

- The *Hans Böckler Scholarship Foundation of the German Trade-Union Congress (Hans-Böckler-Stiftung des Deutschen Gewerkschaftsbundes)* offers scholarships particularly for gifted students coming from worker families and not holding the traditional upper secondary school certificate, who are "willing and capable of using their expertise for the social shaping and steering of economic and technological developments" (BMBW, 1991, p. 30). In 1990 about 1,490 students and 190 doctorands were Hans Böckler scholars.

- The *Konrad Adenauer Scholarship Foundation (Begabtenförderung der Konrad-Adenauer-Stiftung)* offers scholarships for undergraduate and graduate students with high giftedness, certain personality features and "social responsibility and commitment" (BMBW, 1991, p. 36). It is affiliated with the Christian Democrat Party. About 1,100 undergraduate and 300 graduate students were Konrad Adenauer scholars in 1990.

- The *Protestant Scholarship Foundation Haus Villigst (Evangelisches Studienwerk Haus Villigst)* offers scholarships for gifted protestant students who are "willing to pursue their scientific studies with an interdisciplinary orientation, to question conditions, bases and aims of thought and action in their profession and to take responsibility as Christians in scientific work

inside and outside university" (BMBW 1991, p. 23). Approximately 910 students and 170 doctorands were Villigst scholars in 1990.

Table 1: Overview of the German scholarship foundations

Name	Affiliation	Year of Foundation	Number of Students (1990)	Number of Doctorands (1990)
German National Scholarship Foundation	neutral	1925	3,850	950
Friedrich Ebert Scholarship Foundation	Social Democrat Party	1925	1,550	250
Hans Böckler Scholarship Foundation of the German Trade-Union Congress	German Trade-Union Congress	1954	1,490	190
Konrad Adenauer Scholarship Foundation	Christian Democrat Party	1965	1,100	300
Protestant Scholarship Foundation Haus Villigst	Protestant Church	1948	910	170
Cusanus Scholarship Foundation of the Catholic German Bishops	Catholic Church	1956	690	100
Friedrich Naumann Scholarship Foundation	Liberal Party	1973	390	220
Hanns Seidel Foundation Scholarship Organisation	Christian Social Party	1982	350	75
Rainbow Scholarship Foundation	The Greens	1989	180 (1992)	130 (1992)
Total Number of Scholars			10,510	2,385

- The *Cusanus Scholarship Foundation of the Catholic German Bishops (Cusanuswerk - Bischöfliche Studienförderung)* furthers the education of gifted catholic students who are willing "to perform their tasks in the professions, in society and in the catholic community in the spirit of their Christian faith" (BMBW, 1991, p. 16). About 690 students and 100 doctorands were scholars of this organisation in the year 1990.

- The *Friedrich Naumann Scholarship Foundation (Begabtenförderung der Friedrich-Naumann-Stiftung)* offers scholarships for students characterised by "high academic giftedness" and "political and social commitment out of a liberal position making use of their scientific training in social responsibility" (BMBW, 1991, p. 51). This foundation is affiliated with the Liberal Party. In 1990 about 390 students and 220 doctoral candidates were Friedrich Naumann scholars.

- The *Hanns Seidel Foundation Scholarship Organisation (Begabtenförderung der Hanns-Seidel-Stiftung)* offers scholarships for students "whose personality, giftedness and previous achievement give reason to expect an academic record above average", furthermore "a sense of responsibility as a citizen, political awareness and active work in social, confessional and political organisations that are in line with the goals of the Hanns Seidel Foundation" are required (BMBW, 1991, p. 57). The foundation is affiliated with the Christian-Social Party. About 350 students and 75 doctoral candidates were scholars in 1990.

- The *Rainbow Scholarship Foundation (Studienwerk im Stiftungsverband Regenbogen)* is the youngest of these organisations (founded in 1989). It offers scholarships for "gifted and socially-politically motivated students who feel bound to the statutory goals of the foundation" (BMBW, 1991, p. 60). The foundation is affiliated with the Greens. There are about 180 undergraduate and 130 graduate Regenbogen scholars at present.

The total number of (German) scholars of all the scholarship foundations amounts to about 10,500 students and 2,400 doctorands. This is less than one per cent of the total student population.

Methods of identification of gifted students

The following description is focused on the selection for student scholarships; the selection for doctorand scholarships differs from the procedures described here in several respects.

Application

Seven out of the nine organisations accept applications submitted by the candidates themselves. Two organisations (the German National Scholarship Foundation and the Hans Böckler Scholarship Foundation) only accept nominations of gifted persons (by school teachers, university professors, alumni or other persons such as representatives of political or confessional organisations, members of Trade-Union Executive Boards etc.).

Criteria of selection

All organisations demand academic achievement at least well above average as a necessary but not sufficient condition for being awarded a scholarship. Yet they differ considerably in the degree of selectivity: While some require top records, others set their limits lower and give more weight to non-cognitive factors.

A second criterion used by all organisations is a sense of responsibility as a citizen and active participation in social, political, religious or cultural life. Which kinds of activities, attitudes and values are particularly esteemed depends on the affiliation of the scholarship organisation (the neutral German National Scholarship Foundation does not favour any particular orientation).

Other personality traits such as task commitment, initiative, open-mindedness, breadth of interests and social competence are frequently mentioned as further criteria of selection.

Two-stage selection procedures

All scholarship organisations reach their selection decisions in two steps:

(a) A pre-selection is made either by the organisations themselves on the basis of written material, e. g. application forms, biographical questionnaires, curriculum vitae, testimonials, school-reports, certificates, or by school headmasters and university professors who are entitled to nominate a certain percentage of a school leaving class or a student cohort and thus make an "external" pre-selection.

(b) The pre-selected candidates are invited to meet members of the organisations' selection

committees either in selection seminars or on individual appointments. In the face-to-face situations an attempt is made to assess a variety of personality features.

Instruments of selection

The following diagnostic instruments or indicators are used by virtually all organisations on the *first stage* of selection:

- school-reports,
- course-work certificates,
- other certificates,
- testimonials or letters of recommendation,
- curriculum vitae.

The majority of foundations have the candidates fill in a structured biographical questionnaire inquiring, among other things, about family background and about extracurricular activities.

One organisation, the Protestant Scholarship Foundation Haus Villigst, requires a written report on last year's work or study experiences.

In the *second stage* of selection more individualised (and more time-consuming) assessment techniques are used:

- Extended *interviews* are a common element of all selection programs. They usually last 45 minutes or more. Part of the organisations prefer one or two interviews with one member of the selection committee each, others prefer board interviews with one candidate meeting two to three interviewers at a time.
- Three organisations (the German National Scholarship Foundation, the Konrad Adenauer Scholarship Foundation and the Protestant Scholarship Foundation Haus Villigst) observe the candidates in *group discussions*.
- Two organisations (the Konrad Adenauer Scholarship Foundation and the Hanns Seidel Foundation Scholarship Organisation) ask the candidates to write one or two *essays* on actual political and social issues during the selection seminar.
- Only one organisation (the Konrad Adenauer Scholarship Foundation) uses an *intelligence test* as part of the selection program. During the years 1971 to 1980 the German National Scholarship Foundation used a *scholastic aptitude test* with a very high difficulty level as the second stage in a three stage selection program.
- One organisation (the German National Scholarship Foundation) requests the candidates to *present a paper*.

Selection ratios

Figures about the selection ratios I only found for three of the scholarship foundations (German National Scholarship Foundation, Konrad Adenauer Scholarship Foundation and Cusanus Scholarship Foundation). They indicate that one out of four to five applicants or nominees is awarded a scholarship.

Time of probation

At first scholarships are generally awarded for a time of probation, mostly for one year. On the basis of the academic record, testimonials and students' reports on their academic and non-academic activities, the final decision to award or refuse a scholarship is made.

Follow-up studies

Most organisations conduct follow-up studies on the academic records and the professional

careers of their former scholars. The results indicate that, in general, the scholars do very well in their academic studies. On an average, the scholars of those organisations who are most selective in terms of previous academic achievement earn higher marks in the final university examinations than the scholars of organisations who attach greater importance to the non-academic qualities. As far as the scholarship foundations have included criteria of professional achievement into their follow-up studies, the results show that large proportions of the former scholars gain positions of high responsibility and influence in various domains (cf. Trost, 1986; Trost & Sieglén, 1992).

Satisfying as these results are, they can be due to quite different mechanisms such as

- the procedures of selection of the scholars and the high selectivity of the organisations,
- the motivating and stimulating effect of being awarded a scholarship (in the sense of a self-fulfilling prophecy),
- the (additional) financial support a scholarship offers,
- the personal guidance and counseling,
- the variety of enrichment programs,
- the item "former scholar of the XY foundation" in the curriculum vitae giving an advantage in the competition for jobs, for promotion, etc.

No attempt has been made so far to separate these effects in research studies. Only one follow-up validity study including those candidates who had been rejected was carried out (Trost, 1986); the results indicate satisfactory validity for the particular selection procedure.

An example of a selection procedure

In order to give an idea how a selection program of a given scholarship organisation works in practice, one such program is described in detail. It is the one that involves the largest number of applicants in the Federal Republic every year: the selection procedure of the German National Scholarship Foundation for graduates of upper secondary school.

All schools leading to the entrance qualification for higher education (Abitur) are invited to nominate one student out of every 50 graduates they consider best qualified for a scholarship and to back up their nomination by the nominated student's upper secondary school records and by recommendation reports characterising the nominees' personalities (e. g. with respect to motivation, aspiration, extracurricular interests and activities, leadership activities, family background).

All correctly nominated persons are invited by the foundation to attend - free of costs - a two day selection seminar. The seminars take place on weekends and are arranged in all parts of Germany for 48 candidates and six members of the selection committee each. The committee consists of university professors, representatives of various professions, and young alumni that have recently graduated from university.

Every candidate meets two members of the committee in two interviews of 45 minutes duration each (one-to-one interviews). The interviewers know the academic record, the testimonials, an extended curriculum vitae and the candidate's responses in a biographical questionnaire before conducting the interview. Furthermore, the candidate participates in eight group discussions with seven competitors, silently observed by a third member of the selection committee. In each session one of the participants reads a paper (15 minutes) on a topic of his or her choice that has been prepared at home; the paper is subsequently discussed by the group (30 minutes). Each observer rates each of the 24 candidates he or she has met on a ten point scale. At the end of the selection seminar the ratings are added for each candidate, diverging ratings are discussed, and all candidates are put into a rank order according to their total scores. The decision where the cutoff point is set - i. e. which candidate is the last one in the rank order

who is to be awarded the scholarship - is made by the committee at each seminar. On an average 25 percent of the participants are accepted for the scholarship. In the year 1991, 2,940 candidates participated in one of these selection seminars.

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High achievement and underachievement in a cross-national context

Lorraine Wilgosh

Department of Educational Psychology, University of Alberta, Edmonton, Alberta, Canada

Abstract

This paper examines issues related to high achievement and underachievement in a cross-national context. Cross-national comparisons of academic achievement, particularly between Canadian children and children from other nations, are used to illustrate major concerns with such comparisons, whereby a whole nation could be labelled as underachieving. The appropriateness of product versus process approaches for assessing achievement is discussed as well. I emphasize that individual, as well as societal, goals and interests must be considered in order to develop the full potential of all members of society, identifying and nurturing each individual's specific gifts and talents.

In Canada and the U.S., concern with lagging economic performance has focussed political and media attention on the critical role that education plays in attaining economic superiority over rival nations. There is public concern that the educational system has failed to meet the economic challenge, producing generations of underachievers, economically. The demand for marketable skills focuses increased attention on assessment as a means of increasing the efficiency and quality of educational institutions and certifying student achievement (Ungerleider, 1987). Tests appear to offer scientific and unbiased means of measuring students, however, they serve to maintain a hierarchical system of education based on ability, in the guise of equal educational opportunity for all young people.

At the national level, there are concerns that standardized, norm-referenced assessment of students may be used to maintain a hierarchy in educational opportunity and achievement. Has the political rhetoric missed the key philosophical question? Do we educate for measurable achievement (product), or to develop independent learning and thinking skills (process)?

Ysseldyke, Algozzine, and Thurlow (1992) have discussed the thrust toward assessing educational accomplishments in terms of outcomes or products rather than processes involved in learning. This has led to a major debate in the U.S. about whether a national achievement test should be developed. Such a test would entail setting national pupil performance standards and measuring whether students have attained those standards. Published scores would indicate how students are performing by school and district. Failure to attain such standards would be defined as underachievement under such a system. Would the outcome be high costs in test development and administration, with the tests driving the curriculum rather than having students develop critical thinking skills?

To use a standardized achievement test with culturally different students or those with special needs, who differ from the normative group, or to exclude the same students from achievement assessment does a disservice to the students (Ysseldyke *et al.*, 1992). Furthermore, such

practices can alter the meaningfulness of outcome measures attempting to assess national average levels of achievement in different subject areas.

Toch and Wagner (1992) have reported that pressure on teachers and school administrators to raise standardized test scores has led to abuses within standardized achievement testing. Teachers have reported "doctoring" test scores and answer sheets, coaching, and teaching directly to the test at the expense of curriculum content.

The current North American concerns with cross-national economic, and, therefore, educational competitiveness have been examined from a gender perspective by Robertson (1992). She noted that there was much less concern with exclusion of girls from participation and success in senior sciences when it was a gender difference (i.e., there was a tolerance of girls as "underachievers" in science), rather than a marketplace issue. "It becomes tempting to see students as little more than pre-adults in need of programming, and girls as a source of untapped capital... In the long run, our survival as a planet may well depend more on our ability to collaborate than compete" (Robertson, 1992, p. A7).

Global Competition: Misdirected Educational Goals?

Pacholko (1992), an Alberta businessman representing a business perspective on educational inadequacies, has reported that over 50% of highschool students do not graduate at the expected time, and one-third drop out altogether, a form of underachievement. He noted that teachers are increasingly forced to focus not only on curriculum but also on student social problems, and suggested that effective school models must be developed and competition must be emphasized, "an unadulterated business approach to educational reform" (Pacholko, 1992, p. 51).

In the same spirit, Alberta Education (1991), the provincial government ministry, has recently specified provincial educational goals:

All of our children will get the education they need to succeed ... Our brightest and most capable children will be challenged to excel and achieve the best ... Our students will be at the top on national and international test results. (Alberta Education, 1991, p. 8)

The priority will be developing and clearly specifying the high standards to challenge students to achieve, providing leadership in developing national indicators, and participating in international testing projects to assess how well Alberta student achievement compares to that of others in the world.

Wilson (1992) reacted to the Alberta Education (1991) statement with concern that increased and improved testing programs will not necessarily contribute to better education, in that monies will be diverted from student learning to student assessment. "Aspirations to be the best in the world (as measured by test scores) appear to clash with initiatives like 'encouraging students to stay in school'" (Wilson, 1992, p. A9).

In 1992 (Alberta Education, 1992a), results were released for the performance of Alberta thirteen-year-olds from the International Assessment of Educational Progress (IAEP) study. Results showed that, overall, Alberta students were outperformed only by students in Taiwan and Korea of the 20 countries participating in the study. Alberta students outperformed all others on applying science knowledge and skills to solve complex problems, on questions about the nature of science, and scientific inquiry skills, evidence of high achievement. In mathematics, Alberta students ranked tenth of 20 countries. "Clearly there is more work to be done before our students rank with the best in the world" (Alberta Education, 1992a, p. 1-2). Thus, in mathematics, these students are being labelled "underachieving" by a global standard.

In Alberta, 119 schools participated, with over 1400 students included in both the science and mathematics assessments. Among the other 19 countries were Hungary, Jordan,

Mozambique, Slovenia, and the United States, representing a range of developed and developing countries.¹

Only 11 days after release of the Alberta Education (1992a) document, a second study was released (Alberta Education, 1992b). Emphasis was placed on the low levels of student interest in science and technology and lack of preparation for the job market, and the need for educational excellence for all Alberta students because the *competitive* world is leaving Alberta behind. Disregarding the study published days earlier, discounting all such studies as flawed and open to controversy, yet publishing no data to strongly support poor performance (i.e., underachievement) of Alberta students compared to those beyond Canada, this second study (Alberta Education, 1992b) carried out a direct comparison between textbooks in Alberta, Germany, Hungary, and Japan.²

The comparison countries were seen to have a strong focus on achievement, outcomes, national standards and tests, reflective of societal values supporting a strong work ethic, self-discipline and acquisition of specific skills. In Alberta, societal values have drifted towards individualism, self-discovery and self-indulgence, and resistance appears to have built up against the operation of a more demanding, outcome focused education system. (Alberta Education, 1992b, p. 2).

Thus Alberta schools have been charged with the responsibility to devalue individual goals (presumed to create underachievement), and increase student achievement test results beyond the standard of the "*competitive world*", defined by Alberta Education as Germany, Japan, and Hungary.

What Should be the Goals of Education?

Numerous authors have expressed serious reservations about norm-referenced comparisons of academic achievement, as serving political purposes of national and international economic competition (e. g., Ungerleider, 1987). Furthermore, such comparisons create a hierarchical educational structure wherein greater value is placed on high achievement (product) and, therefore, on high achievers to the detriment of developing such qualities as critical thinking skills (process) in all students (e. g., Flaherty, 1990).

At least one jurisdiction (Alberta Education, 1991), while recognizing education as the key to "shaping a global future," has argued that the goal is to be at the top in international test results, rather than to specify what qualities and skills young people should develop, what "learning for life" (Wilson, 1992).

Even if being *Number 1* is a legitimate goal in a global competitive context, there remains the question of what dimensions and what global standard should be considered the ideal. Can we ignore that Alberta thirteen-year-olds were outperformed by only Taiwan and Korean students (Alberta Education, 1992a) because Alberta science and mathematics textbooks were judged to be less adequate than those of Germany, Hungary, and Japan (Alberta Education, 1992b)? Indeed, others have questioned whether the Japanese "ideal" is best. According to Patterson (1992), Japanese reformers suggest that those children lack freedom to pursue their own educational goals. The Japanese Educational Reform Council argues for the importance of educational vitality and creativity, and enriched humanity.

To deal with the identified problems and issues, some researchers are suggesting radically different approaches to assessment, teaching and learning. For example, Mulcahy and Marfo (1987) have stated that educational assessment should emphasize cognitive processes underlying learning, and should be individualized much more so than is done at present. Rather than analyzing scores attained on standardized tests (i. e., products), the strategies, or processes, that the individual has used to arrive at a particular product should be evaluated; then one can

teach learning-thinking skills to children in a direct way in order to increase their cognitive functioning. This represents a direct approach to dealing with achievement and underachievement at an individual level.

It would be irresponsible to suggest that all forms of evaluation should be rejected. We must guard against judging the educational performance of young people by inappropriate standards, as when culturally disadvantaged children, or those with disabilities, are compared to inappropriate majority norms. As well, we must guard against defining the goal of education as attainment of high national achievement test scores compared to other nations. Nonetheless, there must be assessment of the processes of learning and thinking, and of each child's educational accomplishments compared to curriculum objectives, to ensure that each child benefits maximally from his or her educational experiences.

In conclusion, the paper has questioned an industrial, competitive model of education with the goal of international achievement assessment to be *Number 1*. It is suggested that global and societal benefits derive from education which fosters individual gifts and talents, and full development of the potential of all individuals, rather than development of excellent test-taking skills.

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Footnotes

¹Two documents (Educational Testing Service [ETS], 1992a, 1992b) presented extensive detail indicating very careful, although limited, sampling of students and curricular content across jurisdictions, while recognizing limitations due to fundamental societal and educational differences across jurisdictions. The documents warned against examining the results "to find out how to become *Number 1* in the world. A more thoughtful course of action would be for each country to use this information to set reasonable goals that are in harmony with its own values and culture" (ETS, 1992a, p. 5).

²A closer examination of the international curriculum comparisons (Tilroe & Pacholko, 1992), indicated that sampling procedures were used, for both the content areas examined (a 32-concept sub-set of 546 concepts identified in mathematics; every 7th concept for 40 concepts in physics for the Alberta/Japan in-depth analysis), and the particular (generally most popular) textbook series examined. It was acknowledged that what is actually taught in a classroom depends primarily on the teacher, limiting any conclusions drawn from textbook analysis alone.

Growing up gifted and talented in Taiwan

Wu-Tien Wu

National Taiwan Normal University, Department of Special Education, Taipei, Taiwan, R.O.C.

Abstract

According to the 1991 statistics of the Republic of China (Taiwan), 307 schools - including elementary, junior high, and senior high levels - participated in gifted/talented education programs. The total number of classes reached was 924 with 26,013 students - of whom 11,144 were boys and 14,869 were girls. A total of 10,355 students were enrolled at the elementary level, and 10,266 and 3,887 in the junior and senior high levels, respectively. It is estimated that approximately 0.6 % of the total student population was being served by GATE programs, using either the self-contained special class or the resource room model. Although the number of the students being served by the special programs has been steadily increasing, yet much remains to be done for developing the maximum potential of all gifted/talented students. These include program expansion, program evaluation, and program integration.

To watch a little sprout growing to be a big tree is a joy of natural beauty. However, to develop the potential of gifted children is even more than this, as it embodies endless hopes and anticipation. Gifted education assumes the responsibility of developing gifted children's potential. In Taiwan, R.O.C., due to rapid social changes, gifted education has recently become the focus of attention by educators and administrators but also has been placed as one of the top priorities by policymakers. Although the history of gifted education in Taiwan is short, only a couple of decades, it can be traced far back to the education of ancient Chinese.

Historical Background

Since the Three Dynasties (2205BC-249BC), the Chinese government instituted education for the purpose of training and selecting individuals for administrative positions. This was a system that integrated administration with education. During the Han Dynasty (206BC-7AD), the government encouraged research in the areas of classical literature and fine arts by establishing special schools. This was similar to today's gifted and talented education.

The Tang Dynasty (618AD-906AD) adopted the civil service examination system for selection of administrators. Mencius said, "Educating all the gifted and talented in the world would indeed make me happy." The history of Chinese education demonstrated an educational system with an emphasis on educating the nation's best-qualified candidates, of whom the majority eventually became administrators of the government.

Since the overthrow of the Ching Dynasty in 1922 and the founding of the Republic of China, education has been gradually extended to all levels. Over the past forty years, that is, since the Central Government was moved to Taiwan, the development of education has progressed with astonishing rapidity.

Stages of Development

The rapid advance in living standards and technology in the Republic of China has brought expectations and concerns related to its economic and social success. After gaining public recognition gradually, gifted and talented education now has become an important field of special education for ensuring such success.

At the Fourth National Education Conference, a plan was made toward developing gifted education, starting on a very small scale with two Taipei elementary schools. In 1973, the Ministry of Education developed regulations and provided funding for experimental gifted programs at the elementary level. The first six-year cycle of experiments in elementary schools was completed in 1979. In 1982 a so-called third-stage experimental program for the gifted in elementary, junior high, and senior high level was set up by the Ministry of Education in order to expand gifted education.

Programs also have been designed for pupils with talents since 1973. The talented students' abilities which are now developed include fine arts, music, dance, and athletics.

Influential Factors

Three factors for this educational development are:

- (a) the nation's need for educating the gifted and talented,
- (b) the need for individual development, and
- (c) the need for improving the quality of education

Educational Goals

The goals of gifted programs were as follows:

- (a) developing the potential of gifted children,
- (b) cultivating good living habits and healthy personality traits, and
- (c) teaching for high cognitive achievement.

Operational System

A functional conceptualization of the framework of gifted education in the Republic of China can be well understood through an analysis of the operational system, this can be broken down into three levels: the implementation level, the supervisory level, and the resource level. Components of the implementation level include the identification and placement of the gifted, curriculum and teaching materials, and teaching methods for staff and faculty. The supervisory systems involve policy and legislation, administrative organizations, and guidance and research. The resource level consists of such components as parental involvement, community resources, and private organizations (see Figure 1).

Gifted Education Legislation

The implementation of the gifted education is based on the legislation. The Special Education Law (SEL) was passed in 1984. Chapter II of the SEL covers education for the gifted and talented and specifies the types, awards, identification, and resource utilization. The detailed amendments of this act regulate the identification criteria and procedures, as well as the principles for placement and counseling.

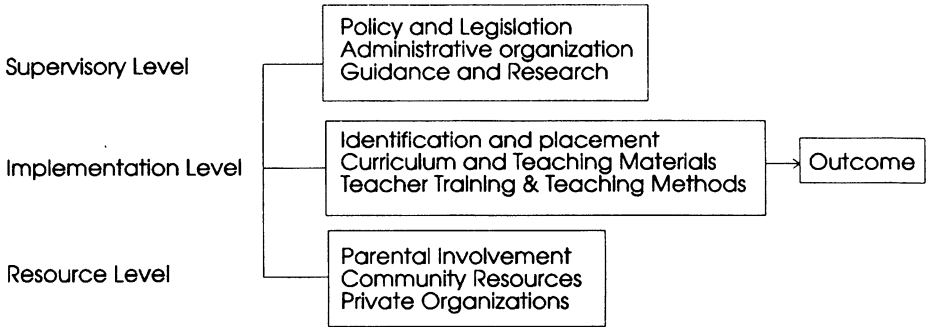


Figure 1: The operational System of Gifted Education in Taiwan, R.O.C.

Table 1: The current development of the Gifted Education Program in Taiwan, 1991

	No. of Schools				No. of Classes				No. of Students					
	*E	JH	SH	Tot.	*E	JH	SH	Tot.	*E	JH	SH	M	F	Tot.
G. Ability	65	30	2	97	206	71	7	284	4816	2077	140	4169	2864	7033
Math & Science	2	12	15	29	4	26	42	72	98	758	1654	1697	813	2510
Music	21	16	10	47	76	51	30	157	2153	1586	994	637	4096	1733
Fine Arts	25	35	13	73	88	135	31	254	2553	4230	883	3744	3922	7666
Dance	15	14	6	35	56	43	10	109	1545	1181	216	296	2646	2942
Athletics	16	3	0	19	30	7	0	37	695	131	0	434	392	826
Chinese	0	2	0	2	0	4	0	4	0	137	0	60	77	137
English	0	4	0	4	0	4	0	4	0	166	0	107	59	166
Total	144	117	46	307	460	344	120	924	11860	10266	3887	11144	14869	26013

*E: elementary, JH: junior high, SH: senior high

Table 2: The increase of numbers of students in GATE programs in Taiwan, 1981-1991

	1981	1984	1987	1991
Gifted	3475	4490 (+29%)	6356 (+42%)	9846 (+55%)
Talented	2366	4347 (+84%)	7404 (+70%)	16167 (+118%)
Total	5841	8837 (+51%)	13760 (+56%)	26013 (+89%)

Note: The percentages of increase are given in brackets.

Statistical Description

Over the past decade, gifted and talented education in the Republic of China has expanded through a series of pilot programs. It is apparent that since 1981, the number of the gifted/talented students in special education programs has increased greatly, especially in the talented program. This can be noted in Tables 1 and 2.

Identification

In those classes set up for the intellectually gifted, participants are first screened by the school itself through group intelligence tests, students' daily performances, and teachers' observation. Then a series of group and individual standardized tests (including Stanford-Binet, WISC-R, Raven's Progressive Matrices, Torrance Test of Creative Thinking, and other academic achievement tests) are administered by the school under the supervision of the university guidance institute to the upper 10% screened as potential candidates. The identification process is thus based on multi-assessment procedure. The flow chart below outlines the procedure used in the Republic of China (Figure 2).

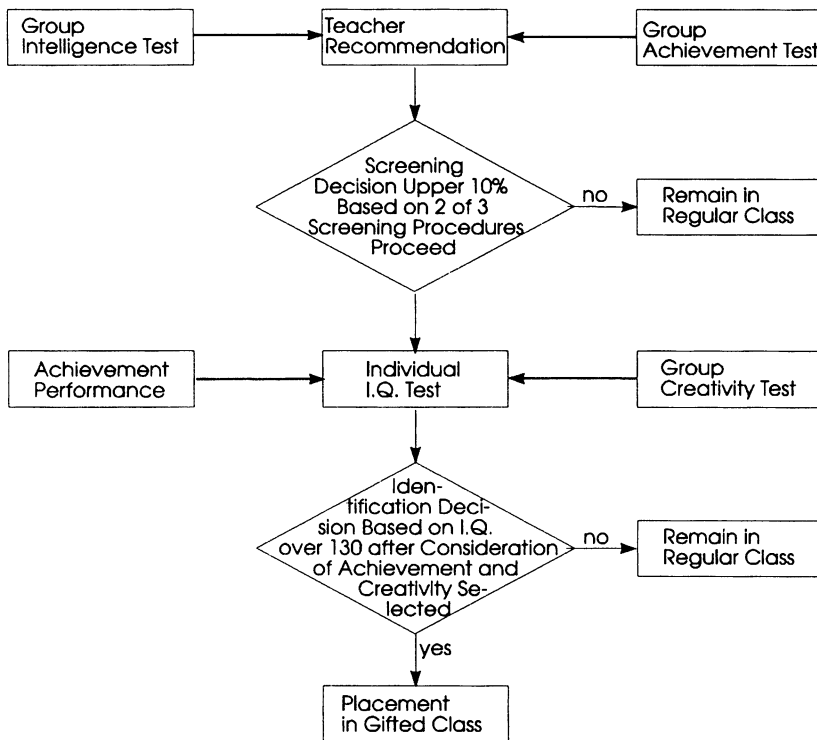


Figure 2: Screening procedures for intellectually gifted students in the R.O.C.

With regard to the special classes for the artistically and musically talented, children are assessed through their performance in fine arts, on musical instruments, and via a series of artistic or musical aptitude tests. As to the talented in dance, the eligibility criterion is mainly focused on the dancing performance of a child. However, in order to be classified as talent, an above-average IQ is also essential requirement.

Support System

Any program needs the encouragement and material support of the government and people to become successful. In this program the variety of strategies employed by the Ministry of Education to provide resources for the development of children's capacities includes: curriculum design, teacher training, resources, and research (Figure 3).

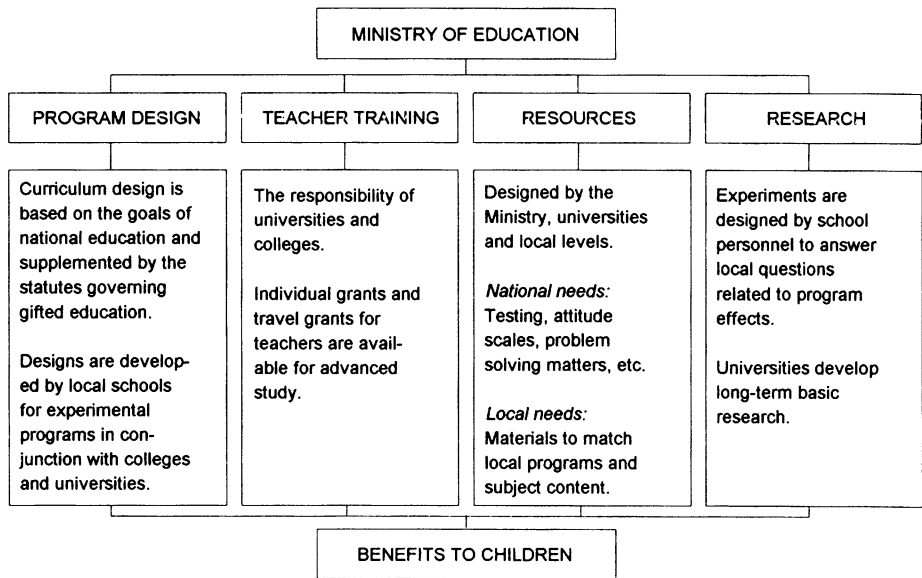


Figure 3: Support System for Gifted Education in the R.O.C.

Program Design

Program design for gifted students is handled on a number of levels. Basically, the central government sets goals for the curricula, whereas the local schools develop specific programs and experimental classes with conjoint efforts of colleges and universities. Specialists, experts, and teachers in gifted education hold meetings periodically to refine programs. Recent topics of these meetings have focused on summer enrichment programs, evaluation methods, and follow-up studies on gifted students' development.

Enrichment

The principles of instruction for the gifted are: (a) to deepen and broaden the teaching materials; and (b) to adopt creative teaching methods in the classrooms. Flexible teaching methods, such as peer-tutoring, debates, discussions, brainstorming, experiments, dramas, contests, and games are employed to stimulate students' interests and creativity. Most of the time, teachers only play a guiding role in the classroom by recording students performances and assisting follow-up discussions. Rather than passively listening to the teacher, gifted pupils actively discuss, make speeches, and further express their talents. Therefore, the classroom atmosphere is more alive than that in a regular class.

To reach the educational goal of global development, Mao recently proposed the Integrated Enrichment Model, which in turn incorporated the following models: the Enrichment Triad (Renzulli, 1977), the Autonomous Learner (Betts, 1985), and the Creative Thinking Clusters (Wiles, 1981). In general, Integrated Enrichment Model is content-oriented, process-based, and outcome-directed.

Training the creating thinking of the gifted can be achieved in part through appropriate curriculum design. For instance, the Creative Thinking Teaching Center of the Taipei Municipal Teachers' College provides assistance in editing teaching materials and offers short-term inservice teacher training programs in this field.

In addition to the enrichment of the cognitive domain, affective development is another important component of gifted education. A peer-assisted program entitled "the caring peer-tutor system" is a good example. In this system, gifted students provide poorly achieving peers with assistance in academic work. Consequently, gifted children develop not only a gifted mind but, more importantly, a tender and loving heart.

In order to provide a better learning environment, classrooms are often arranged next to the library and resource room because this room has resources on different areas and enough space for free discussion. Some special topic research is carried out by gifted students in addition to regular activities. For example, a report on "The plants on campus" (presented through written reports, pictures, specimen, and profiles) has been evaluated as a well-done independent study by experts.

Summer Camps

The summer camps sponsored by local colleges and universities are most attractive to gifted students. Many gifted students felt that they gained much from attending summer camp programs specially designed for them. For example, every summer since 1980, the Sunshine Summer Camp conducted by the Special Education Center of the National Taiwan Normal University (NTNU) has been providing gifted students of junior high schools in the Taipei area with a two-week extracurricular activity program. This activities included studying with university professors, independent study, playing with computers, group counseling, recreational and athletic activities, field trips, creative writing, leadership training, problem solving, and so on.

Talent Search

Since 1983, a new program of nationwide search for high school students talented in math and science has been implemented by the Ministry of Education. Participants include those who had done an outstanding job in national and international events, e. g., the International Invention Exhibitions, Science Exhibitions, and the Math Olympics. Every year, in early April, those who are selected attend a week-long science camp program held at NTNU. University professors are invited to guide and evaluate their performances. Qualified students are allowed

to enter higher levels of schools with exemption from entrance examination. Moreover, fellowships are awarded to those who major in fundamental sciences in universities.

Acceleration

The measures to fulfill acceleration for extremely gifted students in primary schools were also announced in 1983 by the Ministry of Education. According to the published measures, highly gifted students can employ such means as early entrance, grade-skipping, early graduation, and telescoping grades.

To date, highly gifted students of primary, junior high, senior high schools, and colleges can shorten one year of education at each stage according to the acceleration measures. Therefore, ideally, a very intelligent student can save four years from primary school to university. Thus, he can complete his college education at the age of 18. Dr. Po-Ying Yang is a good example. He was graduated at the age of 18 from National Taiwan University and, at 22, he was awarded Ph.D. in mathematics at Massachusetts Institute of Technology, U.S.A. However, the SEL of 1984 also allows some more flexible measures of acceleration, (i. e., without the limit of one year at each stage for those extremely gifted). As a result, in recent years, more highly gifted students benefit a lot from the acceleration programs. In addition, the guidance program which was developed by the National Science Council, incorporates the College Pre-Enrolling Project. As a result, gifted high school students are permitted to take college courses of interest on weekends.

Teachers Training

A certified gifted education teacher must complete 20 credit hours in the field of gifted education. Programs for teachers include weekend workshops, week programs, and summer programs. Also, the staff of the government and faculty at colleges and universities are retrained regularly overseas through funding from the Ministry of Education.

To help educators keep abreast of the latest development, the government sponsors trips to national and international meetings for teachers and administrators involved in gifted education. Reports from these events are then published and circulated throughout the island. The Ministry of Education also sends review teams abroad to observe programs, speak with educational authorities, and obtain information from the most recent research.

International Communications

At an international level, the Republic of China has maintained contacts with national and international programs by attending meetings and reporting on the progress and findings of research in the field of gifted education. In addition, the Ministry of Education systematically sends review teams to foreign countries to observe their programs, talk to educators and learn about the most recent research in these countries. Since 1977, our scholars and educators of the gifted/talented education have been attending the World Conference on Gifted and Talented Children held every two years, and at the same time, many distinguished scholars in gifted/talented education have been visiting Taiwan and sharing their expertise with local educators.

Resources

To enrich the learning experiences for the gifted, field trips are the mostly used teaching activities in the curriculum design. Community resources such as libraries, museums, astronomical observatories, and television stations are learning environments utilized in school activities.

Along with the funds provided to reduce the student-teacher ratio, each school receives governmental funds for the development of resources for students in the programs. Examples of using these funds would include upgrading of facilities for teaching, such as classrooms and reading rooms for gifted students, and the purchase of advanced library material, necessary equipment, and apparatus.

However, the amount of financial support actually differs greatly among experimental schools. Many schools raise funds through other sources, such as Parent Association or commercial companies to purchase the newest facilities and teaching materials. Therefore, some of the resources in the gifted programs are much more abundant than those in the regular settings.

Publications

There are some publications in the Republic of China directly related to the study of gifted education. The Gifted Education Quarterly, which is edited and circulated by the Special Education Center, NTNU, reports on recent findings from local programs and analyzes national trends in gifted education.

In addition, other teachers colleges or the Bureau of Education at city or county levels have published various books and teaching materials for the gifted. Recently, commercial publishers also have published many materials and books in this field.

Private Organization and Parental Involvement

Several private organizations set up programs each year to provide leisure time activities for gifted/talented children, especially during the summer vacation. For instances, the Chinese Youth Summer Camp, Audio-visual Library, Learning Camp, Computer Camp, Recreation Camp, and Chorus and Orchestra Clubs were among the programs sponsored by these organizations in the past.

Most typical activities in these programs include visiting museums, memorial halls, astronomical observatories, and TV-stations; teaching Chinese and English arts; picnicking, puppet shows; music, art and Chinese calligraphy activities; craft; swimming.

Parental involvement is one of the valuable resources for the development of gifted children who have demonstrated willingness and commitment to donating resources or working as a volunteer. In either way, their involvement provides support to optimal development of gifted education in the country.

Research and Evaluation

Research is performed both in theoretical and applied aspects. Schools perform applied research for the analysis of student performance on testing, anxiety, and the effects of specific programs on cultivating student leadership.

University research often evaluates national trends in gifted education, levels of teacher education, and the impacts of programs on the attitude and aptitude of students.

Perspectives

Although an overwhelming merit in the gifted and talented education is shown in the R.O.C., it is by no means problem free. The immediate goals of gifted education in the R.O.C. are to deepen and broaden the expertise and materials available to the schools. The richness of materials necessary to sustain sophisticated programs from early education through high school are being developed and field tested by college professors and school teachers across the

country. Concurrently, teachers, administrators, university personnel and government educational officials are being trained to understand, develop, and direct programs for the gifted. Hopefully, these leaders will guide the programs for the gifted in the near future.

Program Expansion. A long term goal of gifted education is cultivating leaders and professionals to contribute their talents to the society to the utmost. Therefore, differentiated programs to train various talents are needed in the future.

Examination Alternatives. The use of examination for placing junior high schools graduates in the senior high schools influences the curriculum content of junior high school programs to the more test-oriented. Thus, alternative programs with an emphasis on formative evaluation are needed in the future.

Placement Alternatives. Numerous studies have provided support for the use of acceleration as a method of advancement for intelligent students. Also, in Taiwan, many gifted education experimental programs have developed various acceleration models including early entrance and reassignment of students to advanced placement. The effects of these acceleration programs still are unknown and need to be evaluated through follow-up studies.

Program Experimentation. Experimentation in gifted education has also included studies in self-contained special class and resource room programs. At present there are no data supporting one program significantly more than the other. However, the mainstreaming program has been supported by some educators and most administrators. Therefore, it can be expected that the part-time pullout programs will continue to expand for the gifted.

Program Evaluation. Currently, program evaluation still is not appropriate enough. Most evaluations have been carried out through a short visit and self-reports of schools. However, more robust and systematic evaluations should be planned in the future.

Program Integration. The integration of programs from elementary through high school level is still problematic. With the recent implementation of junior high school programs and a newly planned senior high school program, this difficulty may be overcome. It is also hoped that with the enforcement of the SEL, which has quite a strong claim for gifted education, integration may be achieved.

Preschool Gifted. In Taiwan, children at the kindergarten level have already been exposed to varied, exciting courses which are usually presented in a flexible and inspiring manner. Apart from public kindergartens, a great variety of preschool programs are offered by private institutes. Such headstart programs are featured by developing early children's potential, creative thinking, and parent-child interaction. Thus, the preschool learning experiences set the stage for later formal school education. It is hoped that more efforts would be made so that the above headstart program would be integrated with gifted education.

Gifted Handicapped. It has been well-documented that a good proportion of individuals in our society come in handicapped appearance but with a creative mind. In our endeavor to boost special education, we should by no means ignore their often masked talents. Instead, efforts should be directed toward development of the gifted-handicapped education such that we might end up with more distinguished handicapped individuals such as Prof. Cho-Yun Hsu and Dr. Mei-Lien Hwang.

Ecological Environment. In the light of the increasing emphasis on quality of living environment, we should place top priority on providing the gifted students with a conducive, ecological environment. Just as a sprout needs nutrients to grow, ecological resources are called for in order for the gifted to have their potential fully developed.

Conclusion

Gifted education in the R.O.C. is indeed effective. It should be carried on and planned for further development. To ensure the full development of all of talents in our society, we must not be content with the limited programs in limited areas on an experimental basis. Multi-flexible gifted education programs ought to be designed to meet the divergent needs of the students with multi-capabilities. As the country gains knowledge and experience with gifted education, the future of gifted education will be brighter and, hopefully, we can continue to improve education for all as well. As the gifted and talented children grow up, we hope they can add to the welfare of human beings.

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Authors' Addresses

The address of the first author of each contribution is given in full length. In most cases, the second author and further authors are of the same institute as the first author. Names of German and Austrian institutions are given in German but their English translation can be found next to the author's name at the top of his or her chapter.

Prof. Dr. Ornella Andreani Dentici

Istituto di Psicologia, Facoltà di Lettere e Filosofia, Università di Pavia, p.zza Botta, I-27100 Pavia, Italy

Prof. Dr. Hansgeorg Bartenwerfer

Deutsches Institut für Internationale Pädagogische Forschung, Schloss-Str. 29, D-60486 Frankfurt am Main, Germany

Prof. Dr. Hans Günther Bastian

Fachbereich 4: Kunst, Musik, Gestaltung, Universität Gesamthochschule Paderborn, Postfach 1621, D-33095 Paderborn, Germany

Hans Wilhelm Berenbruch, Abteilungsleiter

Abteilung Allgemeinbildende Schulen, Sächsisches Staatsministerium für Kultus, Archivstr. 1, D-01097 Dresden, Germany

Dr. Ernst August Blanke, Ministerialdirigent

Bundesministerium für Bildung und Wissenschaft, Postfach 20 01 08, D-53175 Bonn, Germany

Prof. Dr. Linda E. Brody

Center for Talented Youth, The Johns Hopkins University, 3400 North Charles Street, Baltimore, MD 21218, USA

Dr. Nava Butler-Por

School of Education, University of Haifa, Mount Carmel, Haifa 31999, Israel

Dr. Seokee Cho

Korean Educational Development Institute, 92-6, Umyeon-dong, Seocho-gu, Seoul, 137-791, Korea

Prof. Dr. John F. Feldhusen

Gifted Education Resource Institute, Purdue University, South Campus Courts G, West Lafayette, IN 47907-1446, USA

Prof. Dr. Joan Freeman

21 Montague Square, London W1H 1RE, UK

Prof. Dr. David Goldstein

Talent Identification Program, Duke University, 1121 West Main Street, Suite 100, Durham, NC 27705, USA

Dr. Jan B. Hansen

Gifted Education Resource Institute, Purdue University, South Campus Courts G, West Lafayette IN 47907-1446, USA

Dr. Ernst A. Hany

Max-Planck-Institut für psychologische Forschung, Leopoldstr. 24, D-80802 München, Germany

- Prof. Dr. Kurt A. Heller*
Abteilung Psychologische Diagnostik, Institut für Pädagogische Psychologie, Universität München, Leopoldstr. 13, D-80802 München, Germany
- Dr. Maria Herskovits*
Institute for Psychology of the Hungarian Academy of Sciences, P.O. Box 398, H-1394 Budapest, Hungary
- Prof. Dr. Helmut Kasper*
Extraordinariat für Allgemeine Betriebswirtschaftslehre, Wirtschaftsuniversität Wien, Augasse 2-6, A-1090 Wien, Austria
- Georg A. Knauss, Ministerialdirigent*
Bayerisches Staatsministerium für Unterricht, Kultus, Wissenschaft und Kunst, Salvatorplatz 1, D-80333 München, Germany
- Prof. Dr. Ivan Koren*
Faculty of Philosophy, University of Zagreb, Trg J. Broza 15, Sisak, 44000, Croatia
- Prof. Dr. Janice A. Leroux*
Faculty of Education, University of Ottawa, 145 Jean-Jacques-Lussier, P.O. Box 450 STN A, Ottawa ON K1N 6N5, Canada
- Prof. Dr. Diane Montgomery*
Learning Difficulties Project at Middlesex University, 21 Butt Lane, Maldon Essex CM9 7HD, UK
- Prof. Dr. Franz J. Mönks*
Center for the Study of Giftedness, University of Nijmegen, P. O. Box 9104, 6500 HE Nijmegen, The Netherlands
- PD Dr. Heinz Neber*
Abteilung Psychologische Diagnostik, Institut für Pädagogische Psychologie, Universität München, Leopoldstr. 13, D-80802 München, Germany
- Dr. habil. Edward Necka*
Institute of Psychology, Jagiellonian University, ul. Golebia 13, PL-31-007 Kraków, Poland
- Prof. Dr. Rainer Ortleb*
Bundesministerium für Bildung und Wissenschaft, Postfach 20 01 08, D-53175 Bonn, Germany
- Prof. Dr. A. Harry Passow*
Teachers College, Columbia University, New York, NY 10027, USA
- Dr. Peter Pauly, Ministerialdirigent*
Ministerium für Kultus und Sport Baden-Württemberg, Postfach 103442, D-70029 Stuttgart, Germany
- Dr. Christoph Perleth*
Abteilung Psychologische Diagnostik, Institut für Pädagogische Psychologie, Universität München, Leopoldstr. 13, D-80802 München, Germany
- Dr. Eduard Pütterich, Leitender Ministerialrat*
Bayerisches Staatsministerium für Unterricht, Kultus, Wissenschaft und Kunst, Salvatorplatz, D-80333 München, Germany
- Dr. Michael C. Pyryt*
Centre for Gifted Education, The University of Calgary, 2500 University Drive N. W., Calgary, Alberta, Canada

- Prof. Dr. Brigitte Rollett*
Abteilung für Entwicklungspsychologie und Pädagogische Psychologie, Psychologisches Institut der Universität Wien, Liebiggasse 5, A-1010 Wien, Austria
- Prof. Dr. Lutz von Rosenstiel*
Abteilung Organisations- und Wirtschaftspsychologie, Institut für Psychologie, Universität München, Leopoldstr. 13, D-80802 München, Germany
- Prof. Dr. Hermann Rüppell*
Abteilung Pädagogische Psychologie, Pädagogisches Seminar der Universität zu Köln, Albertus-Magnus-Platz, D-50931 Köln, Germany
- Prof. Dr. Nail Şahin*
Department of Psychology, Middle East Technical University, Ankara 06531, Turkey
- Prof. Dr. Heinz Schuler*
Lehrstuhl für Psychologie, Institut 430, Universität Hohenheim, Schloss, D-70593 Stuttgart (Hohenheim), Germany
- Dr. habil. Andrzej Sękowski*
Department of Psychology, Catholic University of Lublin, Al. Raclawickie 14, 20-950 Lublin, Poland
- PD Dr. Christiane Spiel*
Abteilung für Entwicklungspsychologie und Pädagogische Psychologie, Psychologisches Institut der Universität Wien, Liebiggasse 5, A-1010 Wien, Austria
- Dr. Katya Stoycheva*
Institute of Psychology of the Bulgarian Academy of Sciences, Sofia 1407, Bulgaria
- Dr. Heinrich Stumpf*
Center for Talented Youth, The Johns Hopkins University, 3400 North Charles Street, Baltimore, MD 21218, USA
- Dr. Zuzana Tomášková*
Faculty of Education, Charles University, M. D. Rettigove 4, 116 39 Prague 1, Czech Republic
- Maria Trifonova*
Permanent Mission of the Republic of Bulgaria to the United Nations and the Other International Organisations at Geneva, 16, Chemin des Crets-de-Pregny, CH-1218 Grand-Saconnex/Geneva, Switzerland
- Dr. Günter Trost*
Institut für Test- und Begabungsforschung der Studienstiftung des deutschen Volkes, Koblenzer Str. 77, D-53177 Bonn, Germany
- Prof. Dr. Klaus K. Urban*
FB Erziehungswissenschaften I, Universität Hannover, Bismarckstr. 2, P. O. Box 6009, D-30173 Hannover, Germany
- Dr. Harald Wagner*
Bildung & Begabung e.V., Wissenschaftszentrum, Ahrstr. 45, P. O. Box 610, D-53144 Bonn, Germany
- Prof. Dr. Herbert J. Walberg*
College of Education, University of Illinois in Chicago, Box 4348, Chicago, IL 60680, USA
- Prof. Dr. Ingemar Wedman*
Department of Education, University of Umeå, S-90187 Umeå, Sweden

Prof. Dr. Lorraine Wilgosh

Department of Educational Psychology, Faculty of Education, University of Alberta, 6-102
Education North, Edmonton, T6G 2G5, Canada

Prof. Dr. Wu-Tien Wu

Graduate Institute of Special Education, National Taiwan Normal University, Taipei,
Taiwan 106, Republic of China

Dr. Aysenur Yontar

Department of Science Education, Boğaziçi University, 80815, Bebek, Istanbul, Turkey

