BEYOND TERMAN:

Contemporary Longitudinal Studies Of Giftedness and Talent

edited by

Rena F. Subotnik

and

Karen D. Arnold

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The Munich Longitudinal Study of Giftedness*

Christoph Perleth
Kurt A. Heller

From 1985 to 1989 an educational-psychological research project, the Munich Longitudinal Study of Giftedness (Heller, 1992; Heller & Hany, 1986), was carried out at the University of Munich. Data from gifted students were collected in three waves from 1986 to 1988 starting with a large multiregional sample of 26,000 students in six cohorts. In 1989, a replication study was begun in Moscow by a team of psychologists at the Academy of Pedagogical Sciences of the USSR under the leadership of Prof. Dr. A.M. Matyushkin (cf. Averina, Scheblanova, & Perleth, 1991; Heller, Perleth, & Sierwald, 1991; Perleth, Averina, & Scheblanova, 1991). A data collection point for the German sample is planned for 1993.[1]

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[1] Two follow-up studies on developmental aspects and conditions of metacognition investigate implications of the mother-child interaction on the metacognitive development in preschool children (main investigators Dipl-Psych. C. S. Browder & Dr. J. Kretschmer) and the metamemory of primary school children (main investigators: Dr. C. Perleth & Dr. E. Rader). This research is being carried out cooperatively between the University of Munich (project leader: Prof. Dr. K.A. Heller) and the University of Leipzig (project leader: Prof. Dr. G. Lehwald) and is financed by the Volkswagen foundation (Az: II/66 350).

A team of Korean educational scientists is planning to conduct a giftedness study with similar design to ours, using similar or even the same methods. As described in more detail in the design section, only relatively large studies starting with randomly selected samples are best suited to produce reliable results on complex intercorrelations between a variety of giftedness, achievement, personality, and environmental variables. On the other hand, the replication studies in Russia or Korea can give valuable hints for the generalization of findings in the field of giftedness over different cultures.

GIFTEDNESS MODEL UNDERLYING THE MUNICH LONGITUDINAL STUDY

Most modern conceptions of giftedness include multiple giftedness factors: intellectual, creative, motivational, social, and so on (e.g., Gardner, 1983). The Munich Study of Giftedness is similarly based on a multidimensional giftedness concept. More specifically, we define *giftedness* as an individual's cognitive, motivational, and social potential to attain excellence in one or more areas. Giftedness domains (cognitive competencies), personality characteristics, and environmental conditions served as predictors for performance behavior (see Figure 4.1).

Thus, in the Munich Longitudinal Study of Giftedness the following constructs were taken into consideration:

1. Giftedness exists in intellectual, creative, social, musical, and psychomotor domains. These giftedness domains were assumed to be independent.

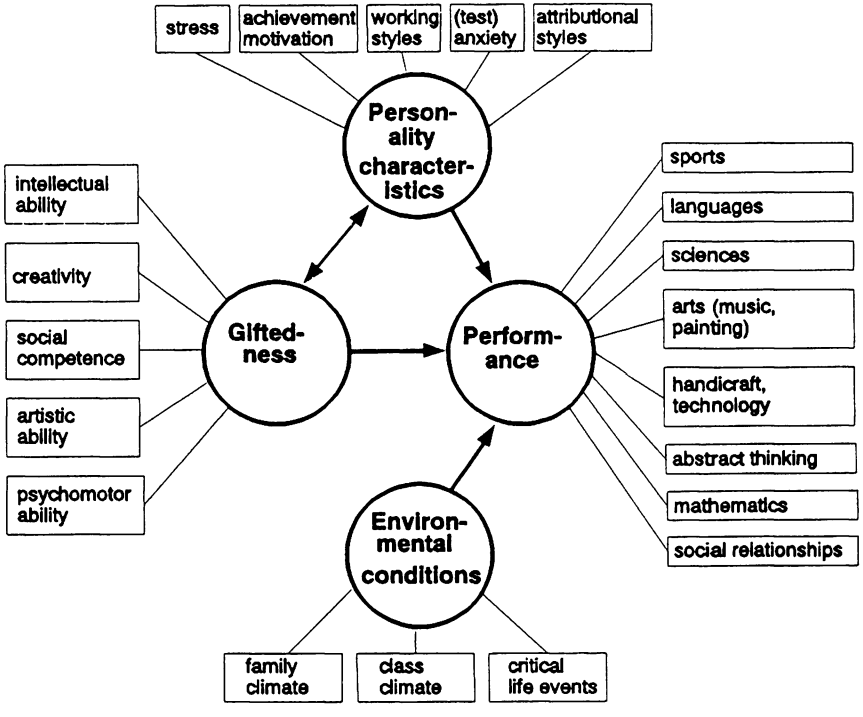


Figure 4.1. Giftedness model of the Munich Longitudinal Study of Giftedness

2. Academic and nonacademic achievements were observed in different areas corresponding to the giftedness domains.
3. Noncognitive personality traits under investigation were achievement motivation, working styles, (test) anxiety, stress, attributional styles, and so on. These variables were considered to mediate the giftedness-achievement relationship.
4. The main socialization factors were family and school climate as well as critical life events.

OBJECTIVES

Goals of the Identification Phase

The first phase of the study was dedicated to questions of identification and the validity of the giftedness model used. The goals of this identification phase (1986-1987) were the following:

1. Development and evaluation of a battery of tests and questionnaires for the identification of gifted students.
2. Testing aspects of the giftedness model underlying the study, particularly the independence of the domains of giftedness under investigation.
3. Analysis of the typological structure of the sample, especially identifying possible types of gifted students in different age groups.

Goals of the Longitudinal Phase

In the second phase of the project, the longitudinal phase, developmental, academic, and nonacademic achievement analyses based on the developmental models were computed. Essential goals of this second phase were:

1. The evaluation of the predictive validity of instruments employed during the first (Wave 1: 1986), second (Wave 2: 1987), and third (Wave 3: 1988) measurement periods for identifying gifted students in the 1st to 13th grades.
2. Longitudinal evaluation of the validity of the typological concept of giftedness and relationships between various types of giftedness and performance.
3. Evaluation of the effects of personality and environmental factors on the performance of gifted students over time.

4. Description and analysis of the developmental course of gifted children and adolescents in relation to changes in cognitive and noncognitive characteristics.
5. Analysis of the interaction between giftedness, achievement, personality, and environment.

In the limited frame of this chapter we can only give a general overview of some important results of these general research goals. We will feature findings concerning personality characteristics of gifted secondary school students. These results should contribute to answering the following specific questions:

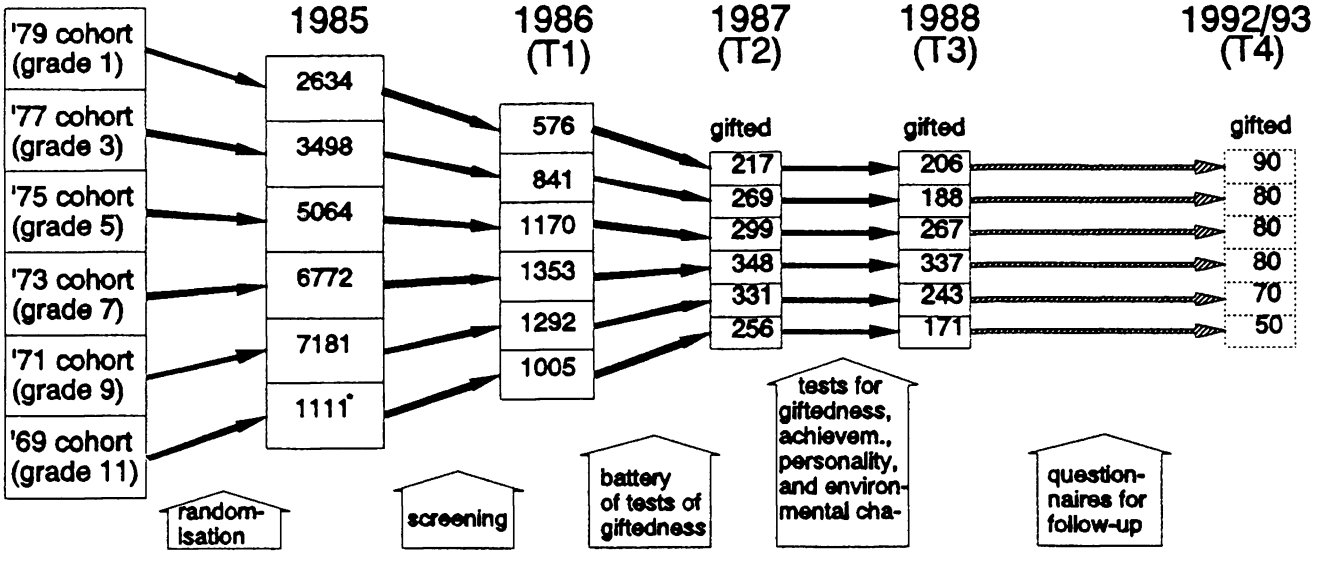
1. Are there differences in personality characteristics between students of different levels of giftedness in intelligence and creativity?
2. Do underachieving gifted differ from other gifted students in terms of personality characteristics?
3. Are there relationships among intelligence and creativity, noncognitive personality characteristics, and achievement?
4. What is the influence of intelligence, motivation, and other personality characteristics on the development of academic achievement?

In addition, we will present results of a small interview study conducted with a subsample of the secondary school students to obtain information on socioemotional problems and related counseling needs of gifted students.

DESIGN OF THE STUDY

Figure 4.2 shows the complete sample design as planned by Heller and Hany (1986). The numbers in brackets indicate the actual numbers of participants in the three waves. In the dotted boxes at the end of the shaded arrows we added a planned follow-up data collection point. The numbers indicate those students who voluntarily gave us their addresses and who were willing to answer additional questionnaires.

The "bandwidth-fidelity dilemma," formulated by Cronbach and Gleser (1965), stresses the fact that psychological tests cannot simultaneously measure a broad variety of characteristics with high precision (reliability). Bearing this in mind, a two-step identification process was employed in the first phase of the study as pro-



*Total evaluation without screening (since the 11th grade in Gymnasium consists of the most gifted students)

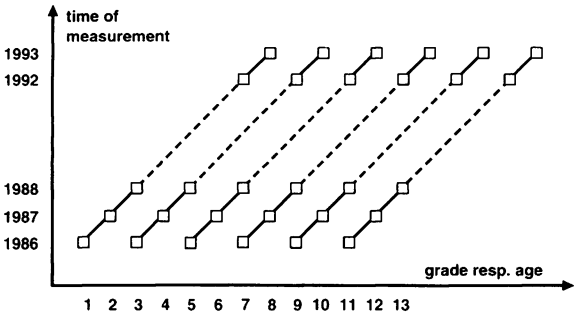
Figure 4.2. Sample design of the Munich Longitudinal Study of Giftedness

posed by Heller and Hany (1986; Heller & Perleth, 1989). In the Fall of 1985, teachers were asked to nominate the most gifted students from their classes on a check list that covered the five dimensions of the study's giftedness model. Approximately 30% of the whole sample of about 26,000 students was preselected on the basis of these ratings. Although this screening procedure reduces the identification of underachieving gifted, it was practically and economically the only possible way to handle such a large sample. Second, the preselected 30% of the original sample were administered aptitude tests and questionnaires (Spring/Summer, 1986) in order to find the top 2-5% in each domain of giftedness. The top 10% of the preselected sample represented the top 2-5% of all students in the intellectual, creative, social, psychomotor, and musical domains. These top scorers among already preselected students were chosen for the longitudinal study. (Differences in Figure 4.2 percentage rates result from students refusing to take part in Wave 1 or the following waves.) The longitudinal sample selected by this two-step procedure were administered tests and questionnaires at two other measurement points in Spring/Summer 1987 and 1988.

The longitudinal design of the study reflected the nature of the research goals. There is no doubt that only longitudinal studies are appropriate for the study of developmental patterns. In spite of this, most research is done with cross-sectional designs. Schneider (1989) remarked that 99% of studies on memory development used cross-sectional design. As one focus of our study was the assessment of change using different developmental rationales, a longitudinal design was indispensable. Quite apart from the problems associated with retrospective studies, such attempts were not suitable for our purposes because the assessment of our giftedness factors required psychometric data.

The design, which combined cross-sectional and longitudinal sequences with six cohorts, facilitated control of age/grade and cohort effects. Time of measurement effects, however, could not be controlled (see Schaie & Baltes, 1975). The main focus was on the analyses of age/grade effects: at Wave 3 each cohort reached the grade the next older cohort had reached at Wave 1 (Figure 4.3a). This facilitated an extrapolation of the development of gifted students despite the relatively short duration of the study. Cohort effects were not analyzed because they were not likely to appear in our 3-year study which covered a decade between the youngest and oldest cohort.

Within each cohort, the design and the methods selected enabled analysis of the following developmental rationales (Buss, 1979;



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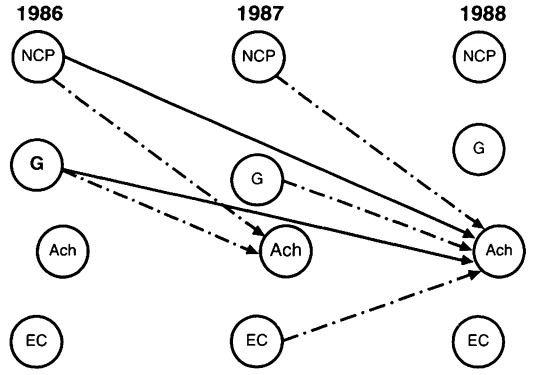

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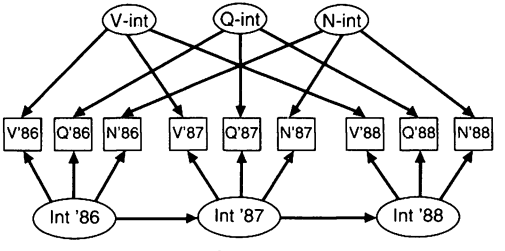

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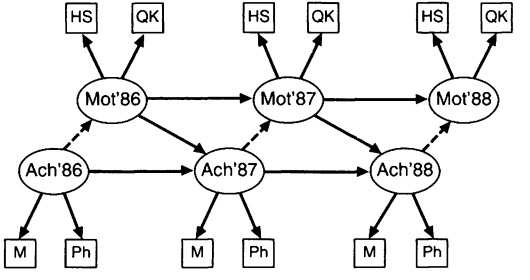

(3d)

Figure 4.3. Developmental model/framework of the Munich Longitudinal Study of Giftedness

Schneider, 1989): (a) interindividual differences (at each time of measurement), (b) intraindividual changes (developmental functions), (c) interindividual differences in intraindividual changes, and (d) interindividual differences in interindividual changes (changes of relative position of individuals). Not all analyses were available for all variables in all cohorts, however. For example, with the scales used for measuring cognitive abilities (German CAT), we cannot analyze developmental functions in the sense of intraindividual changes.

Apart from these ANOVA-based approaches, the design allowed for the use of structural equation analysis for each cohort. Special attention was given to models that included latent variables. Figures 4.3b to 4.3d give examples of models adequate for: (a) analysis of predictive validity of tests (Figure 4.3b), (b) variability versus stability of traits (e.g., intelligence) including test-specific factors (cf. Jöreskog, 1979), and (c) nonrecursive models for analysis of interrelations between different constructs (i.e., reciprocal causal relationships between achievement and motivation). The structural approach also allows for future testing of the equivalence of the structural relations of two or more cohorts (Jöreskog & Sörbom, 1984).

SAMPLE AND METHOD

Sample Selection: Recruitment of Schools and Students

After receiving permission from the governments of the German federal states Baden-Württemburg, Bayern, and West Berlin, we asked a total of 1,020 schools to take part in our study. Schools of different types were selected randomly from the official catalogs of the respective states. Participation was voluntary for schools and teachers as specified by law. Only 210 (20.6%) of these schools agreed to participate in the study (participation rate for West Berlin primary schools was only 4.1%; participation rate without Berlin was 23.9%). One hundred and fifty-two schools were finally selected according to specific criteria, ensuring a representative sample (size of town, urban/rural town, schooltypes, region, and so on). After recruitment of the schools and classes, the parents of each of the students were asked to give permission for their children to participate in the study. Many parents refused to sign the relevant agreement. Reasons given were typical for such field studies in Germany: the parents' dislike of scientific testing of their own children and the

fear that teachers might get the results of the tests of giftedness. Some properties of the sample of the first phase of the study are given in Table 4.1. As no standardized tests of general intelligence were used, we cannot give the exact mean IQ of our sample. Different comparisons of the respective means showed, however, that our sample of the identification wave was superior to representative samples by about one standard deviation in general intelligence and speed of information processing.

Some characteristics of the longitudinal sample (cohort, sex, school type) can be seen in Table 4.1. A total of 2,005 students were invited to take part in the longitudinal phase of the study. Unfortunately some students left the schools after Wave 1, and some schools or teachers did not want to participate in the longitudinal study. The figures indicate the numbers of completed results of intelligence testing for students who took part in at least two waves. Because of missing values, the number of cases is slightly smaller for each aspect of the reported results.

In the German school system, children attend primary schools for four years (grades 1 to 4). More academically able students then attend the 9-year grammar school ("Gymnasium"). This school type, the highest level, finishes with the "Abitur" after grade 13 and leads to university. The "Hauptschule" is aimed at the lowest academic level (grade 5 to grade 9 or 10 depending on the federal state). Hauptschule leads to blue-collar jobs, while a certificate from the intermediate schools or "Realschule," (from grade 5 or 7 to grade 10) is needed for most white-collar jobs.

Information Sources, Measured Variables, and Data Processing

Important sources of information, major research variables, and measurement instruments used—each related to the dimensions of the Munich Model of Giftedness (see Figure 4.1 above)—are summarized in Table 4.2. (Means, standard deviations, reliability coefficients, and so on of the different scales are not included because of the limited space.) In addition to the scales mentioned in the table, further tests were conducted to assess spatial thinking, verbal aspects of creativity, parents' ratings of activities and achievement outside school, parents' reports of socioemotional problems of their children, and their wishes for the counseling and support of their children, and so on.

In addition to the psychometric information, semistructured interviews were conducted with a small subsample of highly intelligent

Table 4.1. Description of the Sample of the Munich Study of Giftedness

Cohort 1	**1986**			**1987**			**1988**		
Boys	259/102			100			89		
Girls	296/113			102			102		
Total	597/229			217			205		
Cohort 3	**1986**			**1987**			**1988**		
Boys	395/144			137			100		
Girls	426/130			123			83		
Total	856/280			268			187		
Cohort 5	**1986**			**1987**			**1988**		
	School type			**School type**			**School type**		
	HauptS	**RealS**	**Grammar**	**HauptS**	**RealS**	**Grammar**	**HauptS**	**RealS**	**Grammar**
Boys	81/12	81/18	326/121	8	13	110	6	14	105
Girls	73/8	106/25	365/113	8	24	109	4	18	100
Total	227/23	190/43	780/249	19	37	232	11	32	217

Cohort 7	1986			1987			1988		
	School type			School type			School type		
	HauptS	RealS	Grammar	HauptS	RealS	Grammar	HauptS	RealS	Grammar
Boys	87/5	203/49	352/106	3	39	100	4	44	97
Girls	71/3	193/48	400/143	3	46	133	1	43	127
Total	166/10	407/100	789/271	6	88	248	5	90	235
Cohort 9	**1986**			**1987**			**1988**		
	School type			School type			School type		
	HauptS	RealS	Grammar	HauptS	RealS	Grammar	HauptS	RealS	Grammar
Boys	55/-	194/31	390/119		31	112		1	100
Girls	49/2	205/26	422/160	2	26	156			135
Total	109/2	413/60	817/287	2	59	268		1	239
Cohort 11	**1986**			**1987**			**1988**		
Boys	531/160			160			103		
Girls	461/93			92			65		
Total	1002/288			256			171		

Note. Total in some cases bigger than Girls + Boys because of missing cases. For 1986, numbers of students in the sample of the identification phase (left side of slash) and the smaller number of participants in the longitudinal study (right side of slash) can be seen from the Table. HauptS = *Hauptschule* (lowest level, grade 5-9), RealS = *Realschule* (intermediate level; grade 5/7-10), Grammar school = *Gymnasium* (highest, most academic level, grade 5-13).

Table 4.2. Information Sources and Measured Variables

	Information Sources	
Variables	**Students' Psychometric Scores**	**Teacher**
Intellectual Dimension	Tests: – KFT (German CAT) – ZVT (Numbers Connection Test)	Teachers' Checklist[3]: – T-Int
Creativity Dimension	Tests: – VWT (Unusual Uses) – TCT (Torrance Creativity Test – subtest Completion of Pictures) Questionnaires: – GIFT, GIFFI	Teachers' Checklist[3]: – T-Cre
Social Competence	Questionnaire: – Social Competence	Teachers' Checklist[3]: – T-SC
Psychomotor Dimension	Tests: – Computer Tests[1] – Construction Game Test – Paper-Pencil-Tests[2]	Teachers' Checklist[3]: – T-PM
Art (Music) Dimension		Teachers' Checklist[3]: – T-Mus
Noncognitive Personality Characteristics	Questionnaires: – QK (Thirst or Quest for Knowledge) – HS (Hope for Success) – FF (Fear of Failure) – Anxiety[2] – Self Concept[2] – Attribution[2] – Learning Styles[2] – Interests[2]	
Environmental Characteristics	Questionnaires: – Family Climate[2] – Class Climate[2] – Critical Life Events[2]	
Achievement	Questionnaire: – MAI (Munich Activity Inventory with subscales: Arts, Literature, Social, Science, Technology, Music, Sport	Teachers' checklist[3] School Marks

Legend: [1] = only at Wave 1; [2] = only at Wave 2 and 3; [3] = long and detailed checklist at Wave 1, short checklist at Wave 2 and 3.

students (10 girls and 10 boys) to obtain information about their early development and on the typical effects (over time) of personality and environment on performance. This interview study has a retrospective character. A second interview study was carried out with a sample of 18 students who seemed from their answers on an

Table 4.3. Definition of Group Labels

Construct/variable	Label	Criterion (Sample)	Correspondence in population
General intelligence (KFT = German CAT), creativity (TCT, subtest completion of pictures)	Average	Percent rank < 70	
	Gifted	Percent rank — 70	Percent rank — 90-95
	Highly gifted	Percent rank — 85	Percent rank — 95-97
	Extremely gifted	Percent rank — 92.5	Percent rank — 97-98
Interests	Average	Percent rank < 70	
	Well interested	Percent rank — 70	
	Highly interested	Percent rank — 90	
Personality and environmental characteristics	Low	Percent rank — 50	
	High	Percent rank > 50	
Academic achievement	Underachiever	z-value (intelligence) – z-value (Mean of German, English, mathematics) > 1.5	

interest and activity inventory to be highly interested in specific fields. The theme of this retrospective study was the development of outstanding interests in particular topics and the identification of conditions that facilitate development.

In order to create dichotomous variables for specific analyses (e.g., comparison of achievement and personality profiles of different groups), we used the following cut-off points (see Table 4.3):

1. General intelligence, creativity, and nonacademic achievement: The criterion was the 70th percentile for high performance. The best 30% of our longitudinal sample in intelligence corresponded to the best 5-10% of the population. We formed more differentiated intelligence and creativity groups by establishing cutoffs at the 85th and 92.5th percentiles of the sample (so that we could also examine the best 15 or 7.5%). We will use the label "gifted" for the top 30%, "highly gifted" for the top 15%, and "extremely gifted" for the top 7.5% of our sample. The latter should correspond to the best 2-3% of the unselected population. By "average," we mean all students with a rank lower than 70% in our sample.
2. Interests: By "interested," we refer to the top 30% in each domain of interests, while we use "highly interested" for the top 10%.
3. Personality and environmental characteristics: Here we divided the subsamples at the median.

4. Underachievers were those students whose scores in z-transformed general intelligence exceeded their average school marks (German and English language, mathematics) by more than 1.5 standard deviations.

Practical Problems in the Execution of the Study

As in most cases, the first practical problem of our research was financial. The costs of the Munich Longitudinal Study of Giftedness could not be met at our institute and thus had to be financed by the Federal Ministry for Education and Science. However, this financial support was restricted to a maximum of 4 years. Given that the screening procedure (in 1985) needed to be completed first, this constraint cut the number of points of measurement down to three. From the scientific point of view, a longer study with the option of following the school careers of gifted students through the whole primary or secondary school process would have been desirable. This was a reason why cohort effects could not be analyzed. As the difference between the youngest and the oldest cohort was only 10 school years within a decade without major changes in society or in educational policy, however, we did not expect cohort effects at all.

At the time our study began, there was much debate about research and guidance of gifted students in German society. The conservative and liberal parties supported activities for gifted students, but the social democrats argued that this would support elitism and put the majority of children at a disadvantage. After we received permission to collect data in schools—which was only possible in German federal states governed by the conservative party—some schools and teachers did not want to participate. In many cases this was because of organizational problems. But some schools and teachers said frankly that the reason they would not participate was related to their viewpoint in the giftedness discussion. In many cases, unfortunately, it was not possible to get information on reasons why teachers or schools did not want to take part. A similar problem arose with parents refusing to give agreement, and unfortunately we do not know why. This general problem for any research conducted in schools in the former West Germany hinders precise judgment of the representativeness of field study samples.

A major logistical problem that arose in the course of the study was the enormous sample of schools spread all over south Germany

and West Berlin. During the weeks before the data collection, the organizing staff completed the massive task of establishing a time schedule accommodating all the following constraints: the schools' requirements, region of the school, holidays, availability of the coworkers, availability of cars, size of the student groups, available number of booklets, and so forth. All in all, the data collection could not have been conducted without the effort and commitment of all coworkers. As our institute has no vehicles of its own, the car-owning coworkers had to change their personal plans in many cases. On top of this, part-time research assistants tend to have old and unreliable cars so that occasionally the time schedule was threatened because of breakdowns. Global political events almost endangered the time schedule as well. The West Berlin testing sessions took place during the last visit of U.S. President Ronald Reagan. Extremely strict police controls inspected cars and luggage at various checkpoints. When our coworkers' car was searched, the police found some metal boards which we needed for a sort-recall task. It was somewhat complicated to explain what these "suspicious metal objects" were needed for.

A more serious problem arose with the strict laws on data protection in the Federal Republic of Germany. The ministries of education did not allow our team to have the names and addresses of the participating children. We used identity codes for all the students. Lists matching codes to names were mostly in the hands of the class teachers at the schools. Unfortunately some teachers threw away these lists between two waves or took the list with them when they left the school. Sometimes, during the actual test sessions, wrong numbers were written on the answer sheets and booklets. After the phases of measurement, especially after Waves 2 and 3, we needed a specialized coworker to help clear up all these cases. Without the work of this "Sam Spade of the data archive" the sample sizes for the longitudinal analyses would have been much reduced.

Yet another problem was caused by the German school system. After grade 4, most children change schools and after grade 7 intermediate school ("Realschule") begins in Bavaria, so that it was quite hard to get parts of the sample for the testing sessions of the following waves. The Hauptschule and the Realschule finish at the end of the 9th and 10th grades, respectively, so that, with a few exceptions, these students were lost for Waves 2 and 3. At Wave 3, the students of some classes of the oldest cohort did not want to attend future testing sessions because they did not want to lose study time for their high school diploma examinations (Abitur).

Statistical-Methodological Problems Occurring in Investigations of the Gifted and in Studies with Special Selection Procedures

In the course of the study we had to deal with three major statistical-methodological problems. The first problem resulted from the differentiation power of the methods in the upper area of the distribution. As most giftedness tests are usually designed to differentiate best with normal, average gifted children, ceiling effects were likely to occur (see also Heller, 1989). Ceiling effects hinder discrimination, especially between highly and extremely gifted students. As an attempt to solve this problem we adapted the tests. With the intelligence test used, the multilevel KFT (Heller, Gaedike, & Weinläder, 1985), German version of the Thorndike and Hagen (1971) CAT for example, we combatted the ceiling effects of the test by giving items to the students which are normally attempted by students who are two years older. We also shortened the time allowed for certain speed tests and revised the items of some questionnaires in order to adapt them for our sample of above-average students.

The second major methodological problem concerned the distribution properties of the variables in the study, especially the variables which were used for the selection procedure. The investigation groups—average, highly, and extremely gifted—were defined in the longitudinal sample by using (multidimensional) cutoff points. The shapes of the distribution curves of the respective variables were affected and, as a consequence, normal distribution of errors was lost. As the assumption of normal distribution is essential for most parametric statistical methods, the results of the analyses may be misleading. We employed two approaches to solve this problem: First, we used nonparametric methods such as log-linear analysis (Perleth & Sierwald, 1988), and second, we conducted robustness studies to examine the extent to which the results were affected by the violation of the assumptions (Sierwald & Perleth, 1989).

A third problem arose from the fact that many variables, such as the winning of prizes, are of a genuinely qualitative character. In order to analyze such variables in complex interrelations, we employed nonparametric methods such as log-linear models (Perleth & Sierwald, 1988), which also allow for the use of recursive causal models (see Fox, 1984).

RESULTS FOR THE FIRST PHASE OF THE STUDY (IDENTIFICATION PHASE)

Several major results emerged from the first phase of the Munich Longitudinal Study of Giftedness (cf. Hany, 1987; Heller & Perleth,

1989; Heller, 1990). The instruments used to measure cognitive and noncognitive (especially motivational) dimensions of the gifted, together with relevant conditions of the social learning environment, were sufficiently reliable (see Heller, 1986). The five factors of the Munich Longitudinal Study of Giftedness (intelligence, creativity, psychomotor ability, practical intelligence/social competence, musical ability) were independent dimensions of giftedness (as indicated by the results of factor analyses). Thus the hypothesis of domain-specific forms of giftedness was confirmed.

Significant differences could be found between the highly gifted and average students in each domain of giftedness and among the various types of giftedness. For example, the intellectually (or academically) gifted had better school grades than the rest of the sample. The creative students were in some aspects more active and more successful in artistic and literary areas, the socially gifted in social areas, and so on. Multiple or many-sided gifted were found relatively infrequently in the selected sample ($N = 1{,}800$). If, however, one views those students (from ages 6 to 16 or 18 years), who were both highly intellectually and creatively talented, one sees that they were superior to all of the other students in important performance areas. From the methodological point of view, this finding is not too surprising, but nevertheless it underlines the point that the diagnosis of giftedness should not continue along single dimensions. Particularly capable students differed from the others in personality characteristics (in this case, motivational variables).

Research conducted to evaluate different strategies for the identification of gifted students using different statistical approaches (factor analysis, cluster analysis, regression analysis) and diverse sources of information (Hany, 1987) showed that both for practical purposes and with regards to our research, a multidimensional cutoff best optimized the different constraints (simplicity, practicability, effectiveness, efficiency). Cluster analyses seem to be more appropriate for the description than for the identification of gifted students (see Hany, 1987, for an extensive discussion of identification questions).

RESULTS OF THE SECOND PHASE OF THE STUDY (LONGITUDINAL PHASE)

The Predictive Validity of the Test Battery

Multiple regression analyses showed for primary school pupils that our giftedness tests, especially the intelligence test used, were able to predict academic achievement to an acceptable degree over peri-

ods of one and two years. Quite surprisingly, the tests (uncorrected multiple $r = .5 - .6$) were superior to teacher judgments (uncorrected multiple $r = .4$) especially in the major subjects (German language, mathematics, and natural sciences). Teacher judgments tended to be global, whereas our test battery tended to give differentiated results. For the primary school age range, the need for psychological diagnosis of giftedness was therefore well demonstrated. This finding is particularly important in Germany, as the decision about school career is based on teacher judgment and is made at the end of grade 4.

The creativity test used ("Completion of Figures" subtest of the Torrance Creativity Test) was—in contrast to the teachers' check lists—not a good predictor of arts and music in primary school, even though it might seem to have face validity. When analyzing nonacademic achievement in different areas, both tests and teacher judgments proved to be good predictors in discriminant function analyses.

The predictive validity of our tests seems to be a little weaker in secondary school (uncorrected multiple $r = .3 - .5$), decreasing somewhat from cohort to cohort. The teachers' ratings played a more important role here (uncorrected multiple $r = .4 - .6$). The increasing influence of the knowledge base for high achievement at this age could plausibly explain this finding. The intelligence scales used nevertheless turned out to be relatively good predictors (up to $r = .45$), especially for the most important school subjects.

In contrast to the results reported for primary school children, the creativity test, which was an "Unusual Uses" test for the respective cohorts, showed some predictive validity for arts (up to $r = .2$). Concerning nonacademic areas, teacher ratings play a much smaller role in predicting activities and achievement (tests: uncorrected multiple $r = .3 - .6$; teacher check lists: uncorrected multiple $r = .1 - .3$). Quite surprisingly, this even held true for activities in natural sciences and technology. In the latter, a larger part of the variance could be explained by including both tests and teachers' ratings in the analysis (uncorrected multiple $r = .4 - .6$). The inclusion of motivational variables in the regression analyses increased the portion of explained variance, especially in nonacademic domains. Quest for knowledge played an especially important role in the prediction of activities and achievement in natural sciences and technology.

Overall, the analyses confirmed our model of giftedness: Domain-specific giftedness tests were best able to predict domain-specific achievement, while personality characteristics (here: motivational

variables) played a mediating role (cf. Gagné, 1985). Therefore, identification of gifted students should not simply rely on intelligence tests.

Results Concerning the Typological Concept of Giftedness

As mentioned above, one of the aims of the longitudinal phase of the study was to establish a typology of giftedness with an exploratory approach. Cluster analyses were conducted which included many factors extracted by factor analyses of test and questionnaire data from the first identification phase of the project. Equivocal results were obtained: No clear types of gifted students could be identified. It had been planned to construct the longitudinal sample according to a possible giftedness typology. As no clear typology could be found, we decided on multiple cutoff as the selection strategy for building the sample for the longitudinal phase.

In the course of the longitudinal phase of the project, some additional attempts were made to analyze types of giftedness and their stability over time. As it had not been possible to identify special types of giftedness by cluster analysis (k-way method, see Wisehard, 1984), the hypothesis arose that gifted students show such highly individual structures of giftedness that they differ from normal students in the very fact that they cannot be grouped at all. Accordingly, we applied Bergman's (1987) program to identify possible "singular types" of giftedness. This method tries to separate the possibly clusterable part of a sample from the nonclusterable residuum. Unfortunately, the residual of nonclusterable cases did not contain gifted students with special combinations of giftedness factors, but rather extreme cases of low-gifted pupils. Cluster analyses with the cases not in the residuum again showed no clear types of giftedness. In addition, the resulting types were not stable over the course of the three measurement points. This means that the students belonged to different clusters at different measurement points even though the giftedness traits in the analysis were relatively stable. All in all, from the cluster analysis point of view, the results show that, in our sample there were no typological differences between gifted and average students. The students were distributed continuously along the dimensions of giftedness, the samples of the different cohorts therefore being homogeneous and not divisible into clearly distinguishable groups. These findings strengthen the hypothesis that the different giftedness domains are relatively independent.

The Influence of Environmental Factors on the Performance of Gifted Students

Environmental factors, as measured by questionnaires of critical life events as well as family and school climate, did not show a great deal of influence or association on the performance of gifted and average students, especially in the older cohorts. These results are based on group statistics. We also conducted an interview study which showed the important role of environmental factors on the development of individual highly gifted students. The need for guidance and nurturing of the gifted was more obvious in the case study. Moreover, among students with extraordinary interests, the role of the family climate became apparent. A controlling, achievement-oriented family climate seems to favor the development of technical interests, while students with interests in arts and music came from families with ongoing, culturally oriented leisure-time activities, high independence, and an average level of parental control and achievement orientation. If one considers the whole sample, however, influences from socialization as well as critical life events seem to be of minor importance for the actual genesis of achievement. One interpretation is that these influences seem to become less significant, especially in the course of secondary school, in comparison with young people's perception of their degree of control over their own lives.

Reasons for these negative results include the fact that the instruments used covered only a segment of possible environmental features (family and school climate, critical life events). Further, the analyzed interrelations in the framework of the mostly linear models might have been too simple to capture the complexity of real life. Using the causal model and taking into account quite complicated interactions between intelligence, motivation, family climate, and achievement yielded some hints: Intelligence and motivation might, for example, have a direct impact on academic achievement, while family climate, itself influenced by school grades, has an indirect effect on academic achievement via motivation. These results should be treated as exploratory, however, because of the severe identification problems in estimating the structural model parameters.

Changes in Cognitive and Noncognitive Features

Differentiated analyses for the subsample of gifted primary school children showed that intelligence seems to be a relatively stable trait (e.g., $r = .75$ between the results of Wave 2 and 3 in the cohort of

third graders). Recall that only the relative positions of the children in our sample were investigated. This does not give a developmental function of intelligence. Hence the stability of interindividual differences in our findings does not mean that there is no increase in intelligence in the primary school age. The structural model of Figure 4.3c applied on the KFT data of the cohort of third graders gave correlations between the latent variables "general intelligence" at the three points of measurement of $.71 \leq r \leq .87$.

The results indicated that the measured creativity variable was quite unstable. We cannot decide whether this was because of the low reliability of the test used (Completion of Pictures) or the instability of the measured trait. When similar findings from other studies (e.g., Sefer, 1989, who undertook a longitudinal study with primary school children) are taken into account, there is some considerable reason to doubt the theory and the quality of this type of test.

Concerning intelligence, the results for secondary school students were similar to those for children of primary school age. The interindividual differences in the German Cognitive Abilities Test turned out to be so stable (correlations $.65 \leq r \leq .77$ between results of Waves 1 and 3), that it was not possible to analyze simultaneous influence of more than one of the variables sex, constellation of siblings, or level of intelligence at the first point of measurement. Applying the structural model shown in Figure 4.3c to derive the "error-free" estimate of the stability of the latent variable general intelligence, we obtained for the cohort of ninth graders correlations of .76 (results of Waves 1 and 2) and .93 (results of Waves 2 and 3). Here the model explained 56-79% of the variance of the measured scales, showing a good fit to the data.

The "Unusual Uses" creativity test used for secondary school students turned out to have better properties than the "Completion of Pictures" creativity test used for primary school children. Although the examined interindividual differences were more stable, the use of such an instrument for important, irreversible selection decisions seems, in our opinion, to be neither possible nor warranted.

With secondary school students we were able to study developmental functions of the speed of information processing (Number Connection Test, i.e., German trail-making test). The findings indicated that performance on this task increased between grade 5 and grade 10/11 and remained stable for older students of grade 11 to 13. This finding is in accordance with the results of Oswald and Roth (1978), the authors of the test. Interindividual differences were extremely stable in this test of speed of information processing (correlations $.65 \leq r \leq .73$ between results of Wave 1 and 3).

A majority of the results reported up to this point indicate that most interindividual differences in giftedness domains are quite stable. We then investigated stability versus development of noncognitive personality characteristics. Consider one hypothesis as an example. For ninth graders, we analyzed the interrelation between motivation (here thirst for knowledge and hope for success) and academic achievement in science (mathematics and physics) with a structural model (see Figure 4.3d). The hypothesis was that motivation and achievement are to a certain degree stable constructs (arrows between the latent Mot and Ach variables). Motivation should influence academic achievement (one year later), while the impact of academic achievement on motivation should only be found in average but not in highly intelligent students. When interpreting the attained coefficients, however, we found that both motivation and achievement were stable characteristics in both groups, influencing one another only a little.

The Role of Interests

The first striking result, when analyzing the data of the interest questionnaire (secondary school) applied in Waves 2 and 3, was gender differences reflecting stereotyped patterns. Girls were more interested in music, arts and literature, and social activities, and boys showed more interest in natural science, technology, sports, and competition. These findings were reinforced when we examined the proportion of boys and girls in the top 30% of the interest range. Nevertheless, there are hints that girls who are particularly interested in technology do not lose their interest, while a decline in technical interest can be seen in boys or moderately interested girls.

Analyses of students highly interested in specific domains showed them to have a broader spectrum of interests than average. An exception to this positive finding of broad interest is given by the technically interested students, who describe themselves as significantly uninterested in the music, literature, and arts domains. This fits the common picture of the "techno freak" who is not interested in anything except computers. As mentioned above, we found only a few girls among the technically interested students, so our results for this group cannot be interpreted without consideration of the gender-specific findings.

The highly interested students (top 10%) showed specific profiles in cognitive and noncognitive personality characteristics including those aspects of their family climate mentioned above. The technically highly interested were success-oriented, curious, independent,

and showed especially strong quantitative intelligence. Students highly interested in arts seemed to be positively motivated young people, brought up to think and act independently, with good school marks in German language and worse marks in English and mathematics. The musically highly interested earned quite good grades overall, their interests being the most stable. Finally, comparing the fields of interest with the areas of achievement, it became apparent that high interest is reflected in good academic and nonacademic achievement in corresponding fields. The interest questionnaire in the planned follow-up study will allow comparisons between the interests during school years and the choice of career/college and later life achievement.

Personality Characteristics of Gifted Secondary School Students

In our subsamples of seventh to eleventh graders, we were surprised to find no differences between the intellectually gifted and other pupils in curiosity and motivation. Although one could perhaps have expected that intelligence is not related to curiosity in the domains of science and technology, we were surprised that the means for hope of success and fear of failure also did not differ according to different levels of giftedness. Because the students in our sample had been preselected by teachers and selected by a test battery, the average members of the sample are not really representative of the general population. Our selection procedures and the study as a whole might have selected the more motivated pupils or those with a tendency to conformity.

The second interesting result concerned the groups considered creative: They also did not differ in personality characteristics from the other groups. Interpreting this, one should be aware that nearly all our variables on anxiety, coping with stress, self-concept, and learning styles are based on items that deal with situations in school or with homework and test preparation.

The most obvious and consistent result when investigating intelligence groups was the stronger academic self-concept of the gifted and highly gifted students. There were no differences in general or nonacademic self-concept. No differences were found on the variables of anxiety, but there seems to be a slight trend that the more gifted one is, the lower the anxiety scores are. This would seem to indicate that stressful situations, including tests, influence the quality of thinking of the gifted to a lesser extent than less gifted

pupils. The gifted members of our sample also tended to attribute success and failure less to external causes when compared with average students.

We also found interesting differences between intellectually gifted and average students regarding learning styles. While the average and the moderately gifted did not differ, the highly and extremely gifted are much less likely to use simple learning techniques such as making a plan for homework or doing homework before playing. It seems as if older highly and extremely gifted students have no problems with homework and thus do not need simple techniques for successful homework management.

In addition, we found that the older intellectually gifted students prefer working alone and do not like to work cooperatively with pupils in their classes. This should not be interpreted as saying that the gifted do not want to work with other students; rather, they do not want to work with other members of the class who are usually not as gifted. It cannot be concluded from this that the gifted are socially isolated because the character of the items of the scale used is largely schoolwork related.

Comparing the intellectually gifted academic achievers and underachievers in our samples, we found many of the differences that are reported in the literature. Because of the small sample sizes, the results should not be emphasized, but nevertheless they may provide some important hints. Underachievers tend to be more anxious, their thinking is more disturbed by stressful situations, they tend to attribute academic success and failure externally, they have a weaker academic self-concept, and their motivational structure tends to be less favorable.

Two-way ANOVAs were computed to investigate the influence of specific noncognitive personality characteristics and intelligence on academic and nonacademic achievement. As described above, we regard personality characteristics as mediators between giftedness and achievement. In the field of academic achievement, intelligence has the greatest impact, but anxiety, stability of thinking, external attribution, and academic self-concept also play important roles. The same general pattern holds true for leisure time activities and nonacademic achievement in the domain of science. The influence of resistance to stress is particularly salient in highly intelligent students while average and moderately gifted students do not differ.

Similar ANOVAs showed no significant effects of personality characteristics on activities in the domain of literature and arts. In the field of social activities, willingness to cooperate with peers and a strong self-concept seem to be advantageous for high achievements,

while intelligence seems to have a negative, but not very strong influence. This means that more intelligent students engage somewhat less in social activities.

The findings reported next should illustrate the role of cognitive and noncognitive personality characteristics in the development of academic achievement. In college-track students attending grades 5 to 7, no influences of personality characteristics on the development of achievement (ANOVAs with repeated measure design) could be found. However, in contrast to gifted students, the school marks of the averagely gifted decreased during this period of time. Between grades 7 and 9 (grammar school students only), intelligent students with strong academic self-concept and high stress resistance were able to improve their school marks while all other groups got worse results. In students attending grade 9 to grade 13 (grammar school students only) in the period of time under investigation, none of the effects was significant.

Overall, we can say that at the beginning of grammar school ("Gymnasium"), intellectually gifted students were better able to cope with the new tasks in German, English, and mathematics. In grades 7 to 9, personality characteristics gained more influence as mediators between giftedness and achievement. In these grades, German students learn a second foreign language; begin physics, history, and social sciences; and encounter more stress from outside school (e.g., puberty). After this period, changes in interindividual differences in academic achievement cannot, according to our results, be regarded as consequences of differences in personality characteristics.

RESULTS OF THE INTERVIEW STUDY

The research reported above draws from statistical analyses of test and questionnaire results using large samples. We were also interested in looking beyond these statistical findings to obtain information about intellectually gifted pupils whose questionnaires and test scores indicated high test anxiety, low stability of thinking in stressful situations, weak self-concept, high fear of failure, unfavorable causal attribution, or underachievement. We also included pupils in the interview study who explicitly sought psychological counseling.

In general, we found few gifted pupils in the top 5-10% of the intelligence range who suffered from these kind of problems, at least according to their questionnaire responses. Twenty students (10 girls and 10 boys) were finally included in an interview study carried

out in 1988 (see Schmidt, 1989; see also Perleth & Sierwald, 1992, Ch. 9).

The interview study included among its goals the following:

1. Collecting information to achieve better insight about the validity of the questionnaires employed. This was realized by checking whether students with high scores on personality aspects of the questionnaires actually reported the respective characteristics.
2. Obtaining more information about the possible ways in which noncognitive personality and environmental characteristics mediate between giftedness and achievement. Here the focus was on constructs such as anxiety, self-concept, coping with stress, patterns of attribution, and task commitment.
3. Finding developmental conditions which cause low self-concept and underachievement.

Validity of the Questionnaires

When we compared the statements the pupils made in the interview study with their scores in the 1987 questionnaires, we were surprised that in some cases there was little correspondence. However, when we then compared the statements with the scores of the 1988 wave, which was carried out two months before the interview study, we realized that the statements were consistent with these latter results. Moreover, the pupils told us in the interviews that many of the problems they had reported in the questionnaires in 1987 had disappeared in the meantime. In general, the validity of our questionnaires was well demonstrated.

Pupils with high test anxiety or low self-concept were more evasive than the others in the interviews. Sometimes pupils denied having such characteristics, had inhibitions in speaking, or gave evasive answers. Only after the pupils had gained more confidence in the interviewer were they able to speak more freely about their problems. Thus, interview studies can also have validity problems, because it seems to be easier for some pupils to be open in questionnaires than in an interview.

Moderating Effects of Personality Characteristics

The interviews revealed a great variety of interactions among intelligence, noncognitive personality characteristics, environmental variables, and achievement. A comprehensive summary of the re-

sults of the interview study is hardly possible. Nevertheless, we will cautiously try to outline some constellations which seemed to us to be typical.

We found gifted students who are underachievers, who regarded this as a problem, and who are helpless. Because of impulsiveness, for example, they could not control careless mistakes. Other students viewed their own underachievement positively: Underachievement was preferred to "learning senseless things." These students seemed to be sure of their ability to get good grades, saying "If I wanted to, I could get better grades." It is interesting that some of these students were willing to try to improve their grades for the "Abitur" (high school diploma) and were convinced of reaching that goal. It is important to know that German grammar schools have a course system in which every single mark during the last two years (grades 12 and 13) goes toward the final diploma mark. Since some subjects at university require a minimum diploma grade, this is quite meaningful. These students began to put more effort toward improving academic achievement at the beginning of grade 12. If underachievement, as in these cases, is not accompanied by helplessness, we have to question whether this sort of underachievement is really a cause for counseling. A follow-up study will determine whether or not these students were indeed able to increase their academic achievement.

A similar situation to underachievement was found concerning anxiety variables. Some pupils experienced physical symptoms of test anxiety or worried about school grades only before the test. In these cases, anxiety seemed to have no negative influence on their performance. With other students, anxiety appeared during the test itself, sometimes only in certain subjects. A typical statement was: "If I see that I can't manage the last problem which is the most difficult, I can't concentrate any longer, even on the easiest problem." These were the pupils who received low scores on scales such as stability of thinking and who regarded their test anxiety as a problem. Some seemed to have developed coping strategies: They consciously talked to themselves during the test in order to calm themselves or, as in the above-mentioned case, they told themselves to ignore the problems not yet worked on.

Other students considered their problems "normal." For example, they judged their "butterflies" as not being unduly important. They were convinced that their performance was not affected because anxiety wears off as soon as they start working on a problem. These pupils seemed to place little importance on possible failure because they were certain of doing better the next time. Furthermore, these

students seemed to be less anxious in the social domain. They did not judge it as very problematic to confess a failure to their friends or their parents. Where anxiety existed about reporting bad marks to parents, friends, or teachers, it seemed to be especially detrimental to concentration during examinations.

According to Pekrun (1983), who used similar quantitative methods, academic and general self-concepts correlate well. However, we found a gap between academic and general self-concepts in strongly achievement-oriented pupils in the interview study. There were students who had a strong academic self-concept because of good grades, but who had a weak general self-concept. These seemed to be pupils who had few social contacts. This was not surprising because we know from developmental studies that peers are important for the formation of self-concept. Learning theory explains this in terms of the absence of reinforcement from others. Aside from this, pupils with few social contacts have fewer opportunities to compare their achievement with each other, so they develop unrealistically high standards for themselves. With one girl, these high standards could be seen in her role models, who were "nonexistent fantasy persons." This distance from reality could also be another hindering factor in making close friends.

Gifted students seem to set high standards for themselves outside school because they are used to achieving brilliantly in school. That could mean that students with extremely high grades are quite vulnerable concerning criticism outside school. They have not yet learned to cope with failure. They are not, as Schwarzer (1987) expressed, immune (see also Seligman, 1979). Other students, who have extensive social contact but nevertheless have a weak self-concept and consider themselves average, seem to be much less concerned. They do not have the drive to change themselves.

We cannot answer the question of why some gifted students had a weak general self-concept and were also failure oriented. One girl who was failure oriented in the domain of school and career said, "I tend to be a bit pessimistic," and believed she had inherited this from her mother. However, to give a general explanation of all personality characteristics is beyond the scope of this chapter. With regards to our practical psychological and educational aims, we see it as our task to be able to help these students attain a realistic view of their own potential and abilities. Whether a student remains "a bit pessimistic" or not is, in the end, up to him or her.

Developmental Conditions

One way that weak self-concept could arise in highly intelligent pupils is the following: Some pupils in our study had, because of

their more unusual interests, little social contact with peers in earlier years. Because of this they did not receive reinforcement from their surroundings, which seems to have resulted in weak self-concept in further development. However, weak general self-concept was not problematic for all affected students, especially if they had ways of compensating.

In some cases pupils suppress their potential in order to avoid being seen as pushy by their peers. Negative consequences for their development followed, especially if a student had no chance to pursue his or her interests outside school. Some attended adult education centers, for instance, but that is not possible everywhere, especially in rural areas. More individually centered lessons could prevent understimulation with its negative impacts on gifted students.

Students who attract attention with their outstanding abilities, for example by mastery of mental arithmetic, are not usually regarded as pushy by their peers. Other good pupils who do not show such outstanding skills develop social problems if they are particularly hard workers in classes with a low achievement-oriented class climate. Pupils who are able to compensate for this lack of social acknowledgment on the basis of their high performance are not bothered so much by this. Some students found that their friends were only interested in them because of their knowledge. They might indeed have contact in class, but, according to their statements, the academically weaker pupils only cultivated them in order to profit for their own school tasks. This, again, seems to be unfavorable to general self-concept.

DISCUSSION AND CONCLUSIONS

Selected results of our research suggest practical and pedagogical applications for parents, teachers, and counseling psychologists. Possible consequences for the identification and support of gifted children and adolescents also follow from the Munich Longitudinal Study of Giftedness.

Giftedness Identification as a Necessary Prerequisite for Individual Development Support

The results of the investigations, especially of the identification phase of the study, pose new challenges. The most important consequences are summarized below.

First, giftedness *is* clearly a highly complex phenomenon. Multidimensional constructs (cf. Hany & Heller, 1991; Sternberg, 1990) are required, together with hierarchical giftedness models, in which general intelligence at the highest level could perhaps mediate between the generalist and the structuralist positions. Heller (1989) defined giftedness as a hierarchy of correlated but clearly distinguishable intellectual ability constructs and area-specific creativity potentials. This model would seem to be compatible with Guilford's (1967) threshold hypothesis, according to which exceptional creativity and giftedness, at least as far as academic performance is concerned, are to be expected predominantly in the upper intelligence range. Moreover we share the opinion of those who expect both theoretical and practical results with a research approach combining psychometric (trait-oriented) and cognitive paradigms. The results presented in this chapter represent the first of these paradigms. There are, however, further complementary, individual studies which have not yet been completed and which belong to the second paradigm. In general it must be said that the psychometric diagnosis approach is more directly relevant to giftedness identification practice at present.

A further consequence would be to stress the importance of defining the concept of giftedness differently for different purposes. This also applies to giftedness diagnoses, which alongside cognitive and motivational personality characteristics, should assess relevant socialization factors. Information on the individual case, reinforced by diagnostic techniques, forms an indispensable starting point for preventative measures, developmental intervention, and psychological counseling.

In a similar way, satisfactory results in giftedness identification, for instance during "talent searches," are only possible when all available information sources have been accessed. These include both formal and informal measuring instruments (for instance, teacher check lists or questionnaires on giftedness features). We do not agree with the wholesale condemnation of psychometric diagnostics. Testing must be refined, however, by the inclusion of process analyses, such as within the framework of learning test (pretest/treatment/posttest design) or experimental diagnostics. This refinement is particularly important when conditional analyses are necessary, for instance, for intervention and preventative purposes in supporting gifted children and youth.

Reliable prognoses on the personality development of gifted children and young people and on their school achievement and leisure-time activities require not only an appropriate prediction model and

relevant decision strategies for classification, placement, and selection, but also empirically backed giftedness indicators and usable criterion variables for individual performance, not to mention suitable conditions in the social learning situation.

Among the high-risk groups—those young people whose giftedness is easily overlooked or recognized too late—are, above all, gifted girls and also the underachievers, whose number is, according to experts, not to be underestimated (cf. Mönks & Heller, 1992). The latter group comprises those school children whose performance at school clearly lags behind what could be expected from their intellectual ability. Their psychological and social situation presumably does not allow their giftedness potential to be converted into adequate performance. Experts estimate that up to 50% of gifted children remain unrecognized through underachievement and are therefore not faced with challenges fitting their individual abilities (e.g., Mönks, van Boxtel, Roelofs, & Sanders, 1986).

Further investigations stress very heavily the importance of early recognition and support of especially able children, above all with regard to the establishment of a suitable learning environment and favorable socialization conditions. Here the development of giftedness must be understood from the start as an interactive process. Gifted children exert influence on their environment actively and spontaneously, often from a very early age, in order to satisfy their considerable urge to learn. Curiosity, as a preliminary form of striving for knowledge, and creativity in play are important giftedness indicators of later excellence (Lehwald & Friedrich, 1987; Mönks & Lehwald, 1991).

Giftedness support is valuable for all school children and does not put support for the disabled under threat, as some critics have claimed. Instead it has a complementary effect, often opening up new and useful aspects for mainstream teaching or for special needs classes. The legal right to educational opportunity appropriate to giftedness, in the form of appropriate socialization conditions, corresponds well to the measures suggested by developmental and educational psychology.

Recommendations to Schools and Teachers

The need for giftedness-specific socialization conditions has already been addressed on a number of occasions. This thesis is not only theoretically well based, but it has also been empirically confirmed. Its translation into practical educational measures must take into account the following points.

Giftedness is initially a relatively nonspecific set of individual predispositions which interact with the social learning environment—that is, with concrete educational and socializing influences—right through the developmental process. Giftedness represents an interaction product at every instant of the individual's development.

Variations in giftedness between individuals are observable in the first years of life, expressed, for example in play by the desire to learn, outstanding memory performance, learning and work styles, problem sensitivity, originality of problem solving, and so on (Lehwald & Friedrich, 1987).

Once the differences in forms of giftedness have been acknowledged, along with the now generally accepted fact that most school learning processes are not additive but cumulative, the responsibility of educational policy becomes clear: to provide appropriate educational and socialization conditions for the different forms of giftedness in each individual. In practice, this involves providing differentiated giftedness-specific learning environments and curricula. No matter how varied the organizational and institutional frameworks may be, they must all follow the principles mentioned above: developmental support of children and young people appropriate to different forms of giftedness.

We see diagnosis and support as a functional unity. Diagnostic investigations of the gifted primarily serve the interests of the individual and support his or her development. It should be clear from the above that we doubt the value of one-dimensional definitions of giftedness and call for multidimensional definitions (e.g., profile analyses). Giftedness diagnosis relying on a single IQ threshold should be abandoned in favor of analyses which take in the most important cognitive and noncognitive personality and process features in the most differentiated way possible. The analyses should also include the influence of such variables as the social learning environment on the development and achievement of the gifted. Individual diagnoses should be based on information from all available sources: life, questionnaire, and test data in Cattell's (1965) terminology. Here the measurement scale level must, of course, be borne in mind. Status diagnostic procedures should be complemented (not replaced) by process diagnostic approaches as far as possible.

A special problem in diagnosis of giftedness arises with the use of standardized tests. Due to variance limitations on psychometric measures in the upper ranges of the scale, so-called "ceiling effects" arise in which there is an insufficient discrimination of the given feature. These can be combated with performance tests, including

intelligence and ability tests in the narrower sense, by administering items from tests for an older age range (up to 3 years' difference); the "acceleration principle." However, many tests on the market are not fully standardized; moreover only "level" or "multilevel" tests such as the Cognitive Abilities Test (CAT), which performed well in our giftedness investigations, are really suitable (see also Hagen, 1989).

In addition, teacher and parent check lists with appropriate categories and rating scales (e.g., operationalization of observable behavior features) have proved useful in our investigations, providing certain criteria are fulfilled. When choosing the raters, careful attention must be paid to their individual area of experience. Seen in this light, it is not just assessments by teachers and parents which complement one another well but also self and other ratings (e.g., in talent searches for particular support programs). Since "soft" data such as these are usually less reliable, checks on reliability are indispensable. On the other hand, ecological validity, which must also be empirically checked, is often better than with fully standardized measuring procedures (tests). For these reasons, along with decision theory considerations of the bandwidth-fidelity dilemma and the well-known error risks associated with selection decisions, the importance of a broad combination of methods in giftedness diagnosis is essential.

The bandwidth-fidelity dilemma, applied by Cronbach and Gleser (1965) to diagnostic personnel decisions, is also relevant to giftedness identification. It highlights the tension between the desired wide range of data gathering—as many giftedness features as possible—and the related criterion, accuracy (reliability) of the diagnostic information sources or test results. Both criteria cannot be simultaneously optimized. For this reason, we recommend a sequential decision strategy in giftedness diagnostics. First, a wide-range giftedness survey (rough sorting) is employed as means of screening with the help of rough check lists, observation techniques, ratings, nomination procedures, and so on. In this way, no form of giftedness should remain unidentified. Inclusion of a number of not highly gifted testees in the first selection group leads to deliberate α-errors. In a second and perhaps third stage, increasingly accurate but more area-specific diagnostic instruments (e.g., tests) are applied. The risk of making β-errors is also reduced, minimalizing incorrect labeling.

Another question concerns the timing of identification. Developmental psychologists tend to argue for early giftedness diagnoses, in spite of methodological objections concerning the unreliability of

intelligence tests in the preschool and in the first school years. According to empirical studies, these objections are less relevant with gifted children. On the other hand, the fears of educators (only partly confirmed empirically; Robinson, 1986) about the danger of negative labeling effects cannot be dismissed completely. In this connection, arguments for an optimization of individual socialization opportunities have been strongly advanced (Lehwald & Friedrich, 1987; Mönks & Lehwald, 1991). The need for an early giftedness diagnosis must be carefully assessed in each case, even where this would present practical difficulties.

FURTHER INVESTIGATIONS

As the opportunity arose to collect additional data on the school and university careers of some members of the sample within the following year, we were able to analyze the further development of gifted students. Some of the participants of the oldest cohorts are now at university, in some cases having already taken their Part I examination ("Vordiplom"), while students of other cohorts have had to make important decisions about their school careers. Thus, the planned follow-up study will concentrate on the investigation of the school, university, and vocational careers of some students from our sample. A total of about 450 students from all cohorts agreed to answer further questionnaires. These questionnaires will cover (if funding can be obtained): (a) personality characteristics, primary working styles, (achievement) motivation, curiosity, and thirst for knowledge; (b) interests with respect to motivation, emotion, action and other aspects; special attention will be given to field of university study and vocational interests in the oldest cohorts; (c) indicators of academic achievement such as school grades, decisions in school career, results of diplomas, and so on, as well as indicators of achievement outside school and university; (d) motives and reasons for the chosen university studies or professions (only oldest cohorts); (e) indicators of success in "real life." In addition, we plan to conduct follow-up interviews with subjects of the initial interview study. Using these data we seek to determine (a) the stability of personality characteristics and interests across critical life transitions, (b) the predictive validity of our giftedness tests and questionnaires of personality characteristics and interests for academic and nonacademic achievement (and, in the long run, success in real life), and (c) interrelations between giftedness, personality characteristics, interests, and decisions about school and vocational career in longitudinal designs.

As a second enlargement of the body of longitudinal research in the field of giftedness, a cooperative study is being carried out between our Institute and the Institute of General and Pedagogical Psychology of the Academy of Pedagogical Sciences in Moscow. The Moscow-Munich Study of Giftedness is the first Russian empirical investigation to cover multiple factors of giftedness. It should be possible to reveal for the first time in Russia the interrelations and intercorrelations between different factors of giftedness development at various ages and also to follow the special features of this development with regard to different motivational and social contexts.

The joint study is also planned as a replication of parts of the Munich Longitudinal Study of Giftedness, the main variables under investigation being intelligence and creativity, (achievement) motivation, thirst for knowledge, working styles, other noncognitive personality characteristics, aspects of the social environment, and achievement indicators in different areas. The first wave of data collection was completed in Spring 1991. By enlarging the body of evidence, the Russian data should enable us to assess our confidence in the present findings and to deepen our understanding of the general meaning of the results of the Munich Longitudinal Study of Giftedness.

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