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KNOWLEDGE

An Introductory Reading on
GIFTEDNESS IN CHILDREN



NATIONAL INSTITUTE OF ADVANCED STUDIES

Bangalore, India

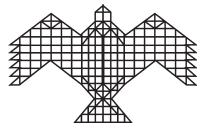
An Introductory Reading on Giftedness in Children

A Report Prepared As Part of
The NIAS **Gifted Education Project**

by

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A nation's resources of intellectual talent are among the most precious it will ever have.

– Lewis Terman, 1925

FOREWORD

The debate about nature vs. nurture in the social sciences continues to yield fruitful research and fresh perspectives, but is less polarising than in its heyday. Most social scientists now embrace a ‘middle’ or ‘interactionist’ view. Gifted education is no exception. We now know that the highest levels of achievement, especially in academic disciplines, require exceptional ability; but we also acknowledge that ability without environmental support often disappears into the crowd.

While India has a historical tradition of mentoring, training, and nurturance of talent in the arts, especially in music, no such parallel system exists in the sciences in a structure that is inclusive and comprehensive. While several private institutions and government schemes cater to gifted children in the sciences, these schemes operate in isolation and without foundation in current theory and practices in gifted education. These schemes tend to use imported as well as limited definitions of giftedness, reflecting those of the mainstream educational system where academic achievement is valued rather than original thought.

It is in an attempt to challenge limited definitions of giftedness, as well as to highlight the need for a more concerted programme of gifted education in India, that we present this Introductory Reading on Giftedness in Children. This document presents and reviews current research on important concepts in giftedness from countries with well-established gifted education programmes, and discusses their relevance to the Indian context. In the 21st century, as India both strives to fulfill her promise as a world power and struggles with problems of science and society including climate change, unchecked population growth, brain drain, and the destruction of natural resources, we can no longer afford to do without a national system to identify and nurture talent wherever it may exist.

This document is presented as part of the Gifted Education project undertaken by NIAS. The project was commissioned in 2010 by the Office of the Principal Scientific Advisor, Government of India and aims to study giftedness in Indian contexts, with the view of developing context-appropriate means of identification and nurturance. Our partners in this endeavour include Agastya Foundation and Delhi University.

I join the Gifted Education team in expressing the hope that researchers, educationists, and educational policymakers across the country recognise the need for this effort and come together in their attempts to develop a gifted education programme for India.

Prof. V.S. Ramamurthy
Director
NIAS Bangalore India

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ABSTRACT

Giftedness, or the existence of remarkable natural talents, is believed to occur once in every hundred individuals, and exceptional giftedness once in every ten thousand as per current definitions. The phenomenon of giftedness has caught the attention of psychologists, pedagogists, educationists, and neuroscientists, from the mid-19th to the 20th centuries. Giftedness research is the basis of various specially developed tests and programmes the world over. These tests and programmes are intended to identify gifted children and to encourage them to develop their talents and realise their potential, as well as to handle the social and emotional issues that may arise from their differentness. Giftedness has been defined in many ways, pointing to the complexities associated with its identification. Inevitably, special programmes for the gifted draw as much criticism as applause, triggering debates on elitism vs. equity in education. The present review of literature of giftedness research attempts to outline the phenomenon of giftedness in children in its various manifestations, the methods of evaluation and tests in current use, the need for gifted programmes and their efficacy, the developmental trajectory of giftedness, the social and emotional issues accompanying giftedness, and the impact of the socio-cultural environment, educational intervention options for gifted children are also discussed.

INTRODUCTION

“For the first time in the history of education, we are now able to identify the highly endowed while they are in early childhood, and to educate them as we see fit. This is a serious responsibility for the intellectual guardians of youth – educators. Whether we shall choose to act as though we were ignorant of this new knowledge, or whether we shall accept the responsibility for it by...modification of current practice...remains to be seen.”

– Leta Stetter Hollingworth, 1931

THE PHENOMENON OF GIFTEDNESS

A commonsense perception is that some children are brighter than others: either in one area, like a child who is exceptional at mathematics (specific giftedness), or across the board (general giftedness). Such children may be called 'gifted'. The issue becomes more complex when we try to quantify giftedness, as this inevitably involves measuring qualities that are difficult to define, as well as qualities which may lie dormant because the environment is in-conducive. The Intelligence Quotient, or IQ, is a commonly-used psychometric measure of mental ability. However, giftedness, by contrast with an IQ measure, is associated with both potential ability and demonstrated achievement.

Thus, while some children may excel at mathematics or reading, performing at a level years above that of their peers, others may show remarkable ability in the performing arts or the visual and creative arts; and yet others may demonstrate leadership skills, organising their peers to achieve specific goals. Typically, a school education programme, targeted at the average student, is insufficient to help these bright students develop their abilities into skills and translate their potential into achievement. For this, gifted children require activities that stimulate their interests and an environment that both nurtures and challenges them.

TYPES OF GIFTEDNESS

Gifted, Talented, Skilled, or Bright?

According to François Gagné's Differentiated Model of Giftedness and Talent (Gagné F, 1999), *giftedness* is the possession and use of untrained and spontaneously expressed superior natural ability (aptitude/gift) in at least one domain and to a degree that places the individual among the top 10% of age peers. *Talent* is an ability or skill which has been systematically developed exceptionally well, placing the individual in the top 10% of age peers who are or have been active in the field. A person starting with a gift has the opportunity to develop it into a talent by the agency of a variety of catalysts. These catalysts include interpersonal factors such as maturity, motivation, interests; chance; and environmental factors such as family and school. However, not all researchers view 'giftedness' and 'talent' in the same manner; some even use them interchangeably. The term 'giftedness' itself is also subject to much disagreement, with some researchers – including one of the pioneers of modern giftedness studies, Francis Galton – describing as gifted a person who has demonstrated exceptional talent in some area (Galton, 1869). The eminent giftedness researcher Lewis Terman defined children with IQs of 140 or more as being gifted; which is fewer than 2% of all children (Terman L. M., 1925).

In the United States, in 2002, under the legislation commonly referred to as No Child Left Behind, in the sub-act entitled the Jacob K. Javits Gifted and Talented Students Education Act of 2001 – gifted children were defined as 'students, children, or youth who give evidence of high achievement capability in areas such as intellectual, creative, artistic, or leadership capacity, or in specific academic fields, and who need services and activities not ordinarily provided by the school in order to fully develop those capabilities' (FR Doc E8-8589, 2008).

A *skill* is defined as a primarily motor ability demonstrated in fields such as sport, musical performance, and other physical or physically-based activities, etc. In many such cases there is also an artistic element, a degree of inventiveness, imagination, originality (Budden, 1981). One might think of a *skilled* surgeon, but not a *skilled* scientist; in the latter case the term used *talented* might be used instead.

A child who appears to be *bright* is a high achiever in class. Not all high achievers are actually gifted, however, and not all gifted children are high achievers. The term *good student* is generally used to describe a high achiever who is not gifted. Appendix 1 compares a high achiever, a *gifted* thinker and a *creative* thinker. High achieving children are often focused on pleasing their teachers or parents. Both high achievers and gifted children may be creative thinkers (Szabos, 1989).

Is Giftedness Merely a Difference of Degree?

Certainly, it is pertinent to ask whether giftedness is merely a difference of degree from the average, or whether it involves a difference of the *type* of capabilities. According to Gross et al. (2005), there are differences both of degree and of kind in how a gifted learner assimilates new information or solves a problem.

Specifically, the differences were detailed as below, by Gross et al. (2005).

Differences of kind or qualitative differences exist in:

- how time is utilised in solving a problem or completing a task
- how thoroughly the learner seeks possible solutions
- the kinds of relationships between problem elements the learner spontaneously identifies
- the manner in which the learner absorbs and stores information – gifted learners tend to ‘chunk’ problem elements, absorbing entire concepts

Differences of degree, or *quantitative differences* exist in:

- the preference for working independently
- the preference for learning something new rather than building upon what is already known.

Levels of Giftedness

According to Gagne’ (2008), the terms ‘gifted or talented’ can be qualified in the following manner:

Level of Giftedness	Fraction of Population	Frequency of Occurrence
Mildly	Top 10%	1: 10
Moderately	Top 1%	1: 100
Highly	Top 0.1%	1: 1,000
Exceptionally	Top 0.01%	1:10,000
Extremely	Top 0.001%	1: 100,000

The level of giftedness is typically estimated via standardised IQ tests administered individually to children. Standardised norm-referenced IQ tests are designed such that IQ scores for a large normal population are hypothesised to be distributed along a normal (or Gaussian) distribution, characterised by a mean and a standard deviation (Dorfman, 1978; Black, 2002). The *true* underlying distribution of intelligence in the population of *all* humans, even as measured by standardised intelligence tests, is thus an unknown. (This is a separate problem from that of the difficulties in defining the term ‘intelligence’ itself).

An IQ score can be represented as a percentile score (‘deviation IQ’), indicating what proportion of the scores obtained by the normative population fall below that of the given individual on that test. The IQ score was originally represented as a ratio between the ‘mental age’ achieved on the test and the chronological age of the subject (Binet, A., and Simon, T., 1911/2011). Scores are now typically multiplied by 100 to eliminate fractions.

However, even with this deliberate design, there are reports of significant departures from a normal distribution in the *actual* observed distribution of intelligence. This is an issue when we try to predict the statistical frequency in the population of exceptionally and profoundly gifted individuals (Raven J. C., 1959; Raven J. , 1983; Terman L. M., 1925). Recent research suggests that the ‘tails’ of the actual distribution of intelligence (along with that of many other traits hypothesised to lie along a normal description) are in fact thicker than a Gaussian curve. In other words, there may be more individuals at both the lower and the upper extremes of intelligence, than hereto believed.

For the Stanford-Binet or Wechsler IQ scores, the definitions of giftedness are in terms of standard deviations from the mean of 100. Using a normal distribution, 68% of the population falls within ± 1 standard deviation from the norm. The Stanford-Binet has a standard deviation of 16; the Wechsler scale has an SD of 15. Both the Stanford-Binet and the Wechsler use a separate scoring procedure for the highest ranges of IQ, known as the Extended IQ (Stanford-Binet) and the Extended Norms (Wechsler). Thus, for the Wechsler WISC-IV (Extended Norms) IQ scores (Zhu, J., Cayton, T., Weiss, L., and Gabel, A., 2008):

Category	IQ range	Standard Deviations from the norm at lower bound
Mildly Gifted	115 to 129	+1
Moderately Gifted	130 to 144	+2
Highly Gifted	145 to 159	+3
Exceptionally Gifted	160-179	+4 to +5
Profoundly Gifted	180 and above	Above +5

The Stanford-Binet scores commonly cited in the literature correspond to the so-called Form L-M scores (Terman, L. M., and Merrill, M. A., 1973). Currently, the Stanford-Binet 5 (SB5) (Ruf, 2003) list revised levels of giftedness against the SB5 IQ score ranges, with ‘Extended IQ’ calculations to increase sensitivity to the two highest ranges (Roid, 2003). The table below compares these two levels:

Form L-M of Stanford-Binet		SB5	
Giftedness Levels	IQ Range	Giftedness Levels	IQ Range
Moderately Gifted	125-144	Superior	120-129
Highly Gifted	145-159	Gifted/Very Advanced	131 to 144
Exceptionally Gifted	160-179	Very Gifted/Highly Advanced	145-160
Profoundly Gifted	180+	Extremely Gifted/Extremely Advanced	161-175 (via EXIQ)
		Profoundly Gifted/Profoundly Advanced	176-225 (via EXIQ)

In 2003, an international group determined the ranges of IQ corresponding to the levels of giftedness, as reported in the first two columns of the table below (Wasserman, 2003):

Category	IQ range	Standard Deviations from the norm at lower bound	Approximate frequency for normally distributed scores
Gifted	130 to 144	+2	1:40 to 1:1,000
Highly Gifted	145 to 159	+3	1:1,000 to 1:10,000
Exceptionally Gifted	160 to 174	+4	1:10,000 to 1:1million
Profoundly Gifted	175 and above	+5	Rarer than 1:1million

IQ scores for an individual using different tests show legitimate differences for the reason that each test has a unique theoretical basis, and is thus a measure of a unique combination of intellectual functions. These functions themselves may be differently operationalised across tests (*cf.* Section ahead on *Models of Intelligence*). Another reason for difference in test scores of the same individual, using different tests, is the *method* each test uses for computing the IQ score. *Ratio IQs* are slightly (for the bulk of the population) to significantly (for the wings) higher than *deviation IQs*. This is because the percentile values for the latter are converted to an IQ score via a normal distribution.

It is pertinent at this point to mention the Flynn Effect. This curious phenomenon, also known as *norm obsolescence*, was publicised by James Flynn (1987; 1984). It refers to the fact that on standardised IQ tests (e.g. Raven’s Progressive Matrices, Stanford-Binet, Wechsler), the average reported IQ of people in many countries is rising by about 3 points per decade. (These gains are not evenly distributed

geographically; as well, the size of the gain varies across different ability domains). IQ tests are therefore standardised or re-normed from time to time so as to maintain the mean score at 100 (American Educational Research Association, American Psychological Association, and the National Council on Measurement in Education, 1999; Wechsler, 1997). Comparisons between the IQ score statistics of different eras must take this effect into account. However, there is some question whether this increment is distributed uniformly over the whole IQ range, or whether it only applies to the mean value. The Flynn Effect is discussed in some detail in the section on *The Flynn Effect and Changing IQ*.

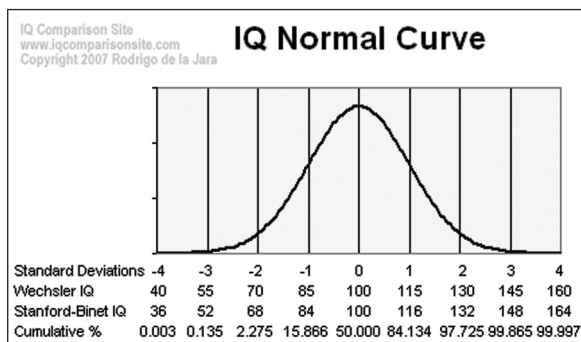


Figure 1. A Comparison between Wechsler and Stanford-Binet IQs

Exceptionally and Profoundly Gifted Children

The child of 160 IQ (top 0.01%) is as different from the child of 130 IQ (top 2%) as that child is from the child of average ability.”

– (Hollingworth, L. S., 1942)

Children of IQ ranges 160-179 are labelled ‘exceptionally gifted.’ (They occur once in every 10,000 to once in every 1 million children). Those of IQ 180+ are labelled ‘profoundly gifted’ (rarer than once in every 1 million)

(Gross M. U., 2000). In general, these children will have spoken their first meaningful word by 9 months or earlier (some as early as 6 months), have achieved motor milestones months before their peers (Gross M. U., 2000), and about half would have been reading by age 4 (VanTassel-Baska, 1983). Expectedly, such extremely gifted children have their special needs and problems (Gross M. , 1999). Their needs are distinct from those of even the moderately to highly gifted. Problems result from a lack of awareness of this difference, even among teachers familiar with gifted education. Because these children are so rare, so it is unlikely that a teacher in a mainstream school will encounter even one such child firsthand in his/her entire teaching career. Since such children’s academic performance is generally atypical, a teacher who might easily identify a moderately gifted child might fail to recognise the extremely or profoundly gifted child. Compared to his moderately gifted peers, an exceptionally or profoundly gifted child may appear disinterested or apathetic when faced with all-too-unchallenging classwork. Such a child would be described as lacking in task commitment and interest, perhaps even as having a dislike of school. Combined with these academic difficulties are the social problems of exclusion and isolation by their age-peers on account of their different interests, their advanced language abilities, and their extremely mature moral thinking. These children have exceptional potential to learn, provided that their special needs are recognised and suitably addressed. The pressures of social conformity may cause these children to learn to disguise their gifts. Studies of such children are to be found in Hollingworth (1942; 1926) and Gross (1993).

Twice Exceptional Children

‘Twice Exceptional’ or ‘2e’ is the description given to children who show exceptional ability in one or more areas and special needs in other areas. They may achieve high scores on certain intelligence tests but may not do well in school. They may have giftedness in combination with autism, emotional and behavioural disorders, or learning disabilities (dyscalculia, dyslexia, dysgraphia), ADD or ADHD, visual and auditory processing anomalies, or sensory integration and modulation disorders (Chamberlin, S. A., Buchanan, M., and Vercimak, D., 2007). Such children require programming to help develop their abilities as well as to acquire compensatory mechanisms for their disabilities. It is estimated that 2% to 5% of children with disabilities are gifted (Nielsen, 2002). A special problem is that of identifying such children: their giftedness may mask their disabilities, or their disabilities may obstruct optimal performance. Unidentified and unaided, such children may suffer from low self-esteem, frustration, anxiety, and depression. A combination of formal and informal assessments is needed to identify such children. Below is a table of the strengths and weaknesses commonly noted in such children (Higgins, L. D., and Nielsen, M. E., 2000):

Table: Common strengths and weaknesses of twice exceptional children

Strengths	Weaknesses
Superior vocabulary	Poor social skills
Advanced ideas and opinions	High sensitivity to criticism
High levels of creativity and problem-solving ability	Lack of organisational and study skills
Extremely curious, imaginative, and questioning	Discrepancy between verbal and performance skills
Wide range of interests outside school	Poor performance in one or more academic areas
Penetrating insight into complex issues	Difficulty with written expression

Strengths	Weaknesses
Specific talent or interest area	Stubborn, opinionated demeanour
Sophisticated sense of humor	High impulsivity

Savants

A rare condition, savantism may be either genetic or acquired. A savant has a developmental disorder or a psychological disorder, accompanied by outstanding ability or expertise in one domain. The American Association on Mental Deficiency defined a savant as ‘a person with low general intelligence who possesses an unusually high skill in some special task like mental arithmetic, remembering dates or numbers, or in performing other rote tasks at a remarkably high level’ (Grossman, 1983).

Very rarely, savantism exists in the absence of apparent brain dysfunction. Savants generally have a prodigious memory and high processing speed specific to one area. Originally the French term ‘idiot savant’ (which translates as ‘unlearned knowledgeable’) was used in connection to describe such individuals by John Down (1887). The preferred term now is ‘autistic savants’ (Rimland B. , 1978), which may be misleading as not all savants are autistic. (About 10% of autists are savants, as opposed to 1% of the general population who are savants) .The gifts of the savant are primarily for arithmetic calculations performed at lightning speed, feats of memory, and calendar calculation; and, less often, gifts in arts or music. Savants show no metacognition, i.e. they cannot describe how they perform their feats or how they learned their skills. Rimland (2003) describes savantism as a condition of ‘stimulus oversensitivity’ whereby ‘focusing on the trees interferes with seeing the forest.’ Afflicted individuals generally have

IQs above 40, i.e. those with profound mental retardation are unlikely to be savants. This phenomenon is not yet clearly understood. One hypothesis is that damage to one hemisphere of the brain causes the other hemisphere to take over some functions and to perform them in non-normative ways. (Treffert, 2009). A review of ‘savant syndrome’ can be found in Treffert (2006).

Savantism is a phenomenon of interest in our quest to understand giftedness – it demonstrates that certain gifts, at least, may be independent of general intelligence.

Child Prodigies

Neuropsychological literature on the phenomenon of the ‘child prodigy’ was reviewed by Shavinina (2007). (Also see a later section of this report for a neurobiological view.) Shavinina regards child prodigies as a purely developmental phenomenon, in which very young children exhibit expertise at levels usually exclusive to adults. Shavinina (2007) maintained that a prodigy is a child who, before the age of 10 years, displays extraordinary intellectual/creative performance and/or achievements in any natural activity (intellectual, musical, or artistic). It must be noted that this definition says nothing about the IQ of the child. There is an underlying assumption that IQ is stable through development. The study of prodigies has prompted a rethinking of this issue; developmental psychologists now recognise certain ‘*sensitive periods*’ in a child’s life, at which the child’s brain is unusually and selectively receptive to certain types of

stimulation. An example of a sensitive period is the span of infancy and early childhood during which language begins to be acquired. The lack of appropriate stimulation (in this case, the presence of speaking adults near the child) during the sensitive period may impede normal development (Vygotsky, 1956).

Prodigies in art, chess, and music appear to be of a distinct type from prodigies who display advanced levels of general thinking. The latter are referred to as *omnibus* prodigies (Shavinina L. V., 1999). Neuropsychological research indicates that the brains of the gifted are functionally different from the average brain. The extraordinary achievements of the gifted in general, and of prodigies especially, are the result of domain-specific attentional control, acquired beginning in infancy and modulated via connections between the prefrontal cortex and the cerebellum. High attentional control accelerates the development of higher intellectual processes. Prodigies usually engage spontaneously in deliberate practice, and show a ‘rage to master’ their given domain (Winner, 1996). This results in a highly developed *long-term*¹ working memory, specific to the field of expertise, which is significantly larger in capacity than the domain-specific long-term memory of an average individual (Vandervert, 2009). The brains of the gifted also show exceptional *neural plasticity*, or the ability to alter structurally and functionally in response to environmental input (*cf.* review by Shavinina (2007)). Note that neural plasticity characterises all animals; this is thus an example of a difference in degree, rather than a difference in type.

¹ This is by contrast with the *short-term* working memory, which may be highly developed by, say, a waiter in a restaurant to store, for a short period of time (hours), a large number of orders from customers, and thereafter discarded.

A BRIEF HISTORY OF GIFTEDNESS RESEARCH

Children of exceptional ability have historically attracted attention in cultures over the world. In ancient Greece, Plato (4th century BCE) was an advocate of specialised education for intellectually and physically exceptional young men and women at a free academy. In China during the Tang Dynasty of the 6th century CE, child prodigies received specialised education at the imperial court. Conceptions and recognition of giftedness is always filtered through prevalent sociocultural values. Thus the Spartans valued military skills, the Athenians valued academics and physical fitness, and the Romans valued engineering skills. India, too, has had a record of remarkably talented young people, particularly in the fields of religious and philosophical inquiry (including Dnyaneshwar and Adi Sankara). Historically, the identification of early giftedness was via demonstrated early achievement rather than via systematic ability testing.

The assessment of individual differences became an important field of study in the late 19th century. Particularly in the United States, from the 17th to mid-19th centuries, the political philosophy that all men are created equal informed the educational system – which offered all children similar curricula regardless of their aptitudes. Schools in the U.S. became sensitive to the different needs of gifted students only in the latter part of the 19th century, when quick learners began to be allowed to progress more

rapidly through school. In the late 19th century, the English genius and polymath Francis Galton set up a psychometric laboratory in London where he tested different mental abilities. The first large anthropometric study came out this lab (Galton, 1869). Galton concluded that mental abilities are heritable. He also studied twins to investigate the importance of nature over nurture, pioneering a long and fertile line of research.

The first practical intelligence scale applied to schoolchildren, developed for the identification of children requiring special education, was the Binet-Simon scale developed in France by the French psychologist Binet and the physician Simon in 1905. This scale was revised by Terman at Stanford in the U.S. in 1916, came to be and known as the Stanford-Binet test. This test is the forerunner of all standardised IQ testing. The test result was originally returned as a ‘mental age’ (see above), but is now represented as a number, the mental quotient, also known as the intelligence quotient or IQ. ‘Gifted’ children were classified as those with IQs of 140 or above, then considered to be the highest intellectual range (Colangelo, N., and Davis, G. A., 1997). The Stanford-Binet is now in its fifth revision (2003). It is pertinent to note that Binet himself had inferred that intelligence is somewhat plastic and that such tests had some degree of inherent error; he

therefore introduced a confidence interval into the results (Fancher, 1985).

The First World War saw the U.S. Army introduce intelligence testing for its recruits as a placement measure. This practice gained wide popularity among civilian populations and schools thereafter. By 1922, psychometric testing was a well-established means for educational psychologists to shape school practices, curricula, and educational policy (Lagemann, 2000). Also by this time, almost two-thirds of schools in the U.S. had some form of programme for gifted students. Gifted programmes in the U.S. ran into their first roadblock during the Great Depression, when survival became a priority for most people (Colangelo, N. and Davis, G. A., 2003).

Lewis Terman, known as the 'Father of Gifted Education,' and Leta Stetter Hollingworth conducted pioneering studies in the U.S. in the early 20th century (1920s to 1930s). Terman published his five-volume magnum opus, *Genetic Studies of Genius*, based on the first ever longitudinal study of a sample of 1500 gifted children (Burks, B.S., Jensen, D. W., and Terman, L.M., 1930) (Cox, 1926) (Terman L. M., 1925) (Terman, L. M., and Oden, M. H., 1947) (Terman, L. M., and Oden, M. H., 1959). Hollingworth drew attention for the first time to the unique emotional and counselling needs of highly gifted students (Hollingworth, L. S., 1926; 1942).

In 1955, the American psychologist David Wechsler published the Wechsler Adult Intelligence Scale (WAIS) IQ test, based on a series of Wechsler-Bellevue tests developed in the 1930s at the Bellevue Hospital Centre, New York (Wechsler, 1939). These tests were innovative in that they included non-verbal or performance scales as well as verbal

scales. Wechsler also published the Wechsler Intelligence Scale for Children (ages 6 to 16 years) (WISC, 1947, latest revision WISC IV, 2004) and the Wechsler Preschool and Primary Scale of Intelligence (ages 2 ½ to 7 years 3 months) (WPPSI, 1967). Wechsler's tests were based on his philosophy that intelligence is "the global capacity to act purposefully, to think rationally, and to deal effectively with (one's) environment" (Kaplan, R. M., and Sacuzzo, D. P., 2009). The WAIS test is currently in its fourth revision (WAIS-IV) and has been standardised for ages 16 to 90 years. The WISC is also into its fourth revision, and is used both as an intelligence test and as a diagnostic tool for ADHD and learning disabilities – although the latter use has been challenged (Watkins, M. W., Kush, J., and Glutting, J. J., 1997). The WPPSI is currently in its third revision, and is used to assess intelligence, diagnose giftedness, and to identify developmental delays and learning disabilities.

In the U.S., interest in educating bright students received a boost after the Soviets launched the first earth satellite ever, the Sputnik, in 1957. The U.S. recognised the need to prepare bright students to remain competitive in the Soviet era. Particularly, there was substantial funding for identifying students who would benefit from an advanced technology, mathematics and science curriculum. In 1954 the U.S. had founded the National Association of Gifted Children (NAGC). In 1957, the National Defense Education Act was passed: the first large-scale federal government effort in gifted education.

In 1998, NAGC published the Pre-K-Grade 12 Gifted Programme Standards (revised in 2010) to provide guidance in seven key areas to programmes serving gifted and talented

students. In 2004, a national research-based report on acceleration strategies for advanced learners was published by the University of Iowa, entitled *'A Nation Deceived: How Schools Hold Back America's Brightest Students.'* The report drew attention to the negative consequences of the general reluctance of teachers and parents to permit talented students to accelerate through school. This report put forward academic acceleration as the most effective intervention for gifted children, as well as the most cost-effective. This report resulted in the founding

of the Institute for Research and Policy on Acceleration.

At present, there is wide recognition that gifted children require special educational support. Countries all over the world have gifted programmes and national policies with regard to giftedness. In addition, many countries have non-governmental/private funded organisations engaging in research and the provision of facilities, networking, and other forms of support for such students and their parents.

THE NATURE OF RESEARCH INTO GIFTEDNESS

There is some question as to whether giftedness research is a separate discipline or is more accurately viewed as a loosely organised field of researchers with a common interest in the phenomenon of giftedness (Dai, D. Y., Swanson, J. A., and Cheng, H., 2011). Historically there have been two streams of researches: one concerned with *psychosocial* issues such as the psychological basis of giftedness, its nature, and how it develops; and the other concerned with the *educational* requirements of gifted children. In the last few decades of the 20th century, these two streams began communicating with each other, leading to rapid developments in the field of gifted education. However, the field as whole remains relatively unstructured, a loose consortium of researchers with shared theoretical and practical interests. As well, many researchers do not have an enduring interest in the field, but are rather guest researchers; in consequence, research in gifted education is often idiosyncratic, fragmented, and lacking in coherent themes. This results in a lack of continuity and clarity in various bodies of work, a lack of methodological rigour, and consequently, difficulty in assessing the enduring worth of various contributions. Reviewers in the field have commented upon the disconnect between academic research and educational practices, indicating a failure of translation from the one to the other (e.g., *op. cit.*).

Doubtless, a part of the problem lies in the definition of what constitutes 'giftedness'.

Within the field there are divergent views. The narrowest definition is in terms of a single number, the IQ score: but here, too, the actual cutoff value of the IQ is a matter of debate. This is in addition to the various other factors affecting the use of IQ tests for such a purpose: for example, the debate over the selection of intellectual functions to be evaluated. (Partly, this debate concerns which cognitive functions are culturally valued in a given culture – in many such tests, quantitative-logical reasoning and verbal ability are emphasised, reflecting Western cultural values). Getzels and Jackson (1958) raised questions about this construct of giftedness and also derived alternative constructs from various starting points, with very different implications for the kinds of performance to be expected from the child. There is a body of researchers who favour methods of testing that seek to measure the *learning capacity* of the child (as in Dynamic Assessment tests) rather than the IQ, given that the educational background (Peña, E., Quinn, R., and Iglesias, A., 1992; Utley, C. A., Haywood, H. C., and Masters, J. C., 1992) and disability status (Lidz C. S., 1987) of the child affect performance on traditional IQ tests (which tend to measure, at least partly, existing learning and not just the capacity to learn). However, the predictive validity of such tests seems to depend on the category of student tested, indicating that Dynamic Assessment tests are probably as biased as traditional IQ tests (Caffrey, E., Fuchs, D., and Fuchs, L. S., 2008).

How this debate affects research on giftedness is apparent: the selection criteria for gifted children differ across samples in ways that obstruct comparisons. For standardised evaluations such as IQ and achievement tests, correlations between tests can indicate how samples selected with them might compare with one another. Such formal tests are traditionally regarded as the gold standard for the identification of the gifted. But comparisons are difficult where the selection procedure has involved wider and more complete criteria (for example, cognitive as well as non-cognitive abilities such as motivational, personality, or attitudinal factors as in Renzulli (1978)) to establish giftedness, using rating-scale or checklist-based assessment.

Narrow as the ambit of a formal test may be, at least this idea of giftedness involved could be said to be *measured* with precision as compared with general definitions such as that of the Marland Report (Marland, 1972), which is based on the manifestation of certain observable characteristics in the child. However, even if one regards the IQ as definable and measurable with reasonable accuracy, it is well-recognised that the IQ is only one of the components of giftedness. (Sternberg R. J., 1984).

Another factor which contemporary research has highlighted is that intelligence is malleable (see section ahead on *Giftedness and Heritability of IQ*), not a fixed trait as per historical concepts. The environment and the individual's socioeconomic status have been shown to play a large part in the development of intelligence through the growing years. Concepts such as *brain plasticity* from the field of neurobiology suggest that humans are capable of developing new abilities well into late adulthood. At the same time, it is recognised that no amount of stimulation or training can make a genius out

of a person with low native ability.

The field of giftedness research draws upon expertise from psychologists, educators, and educationists; and draws support from clinical studies in neurobiology and neuropsychology. Brain-wave studies (Electro Encephalography, EEG), blood flow studies, and brain scans involving functional Magnetic Resonance Imaging (fMRI), Positron Emission Tomography (PET), and Single-Photon Emission Computed Tomography (SPECT) (the latter providing 3D localisation of brain functions) have thrown light on which parts of the brain are involved in specific functions. However, giftedness itself appears to be difficult to localise, save for suggestions that mathematical ability and language arise in specific areas of the brain (see section ahead on *Is There a Neurobiological Basis for Giftedness?*). There are suggestions that the phenomenon of giftedness is a whole brain function.

It is apparent that while the phenomenon of giftedness is hard to pin down to measurables, a gifted individual is not so hard for educators and parents to recognise, given some education about the traits and factors involved. The field of giftedness research has struggled for years with the effects of labelling a child 'gifted' or 'nongifted'. While it is recognised that gifted children do indeed need special facilities to develop their unique abilities and to overcome the difficulties that may accompany their differentness, it is also perceived that it may be damaging to label a child, either as gifted or as nongifted, whether correctly or incorrectly. On balance, though, the consequences of refusing to identify and provide the requisite facilities to the gifted by far outweigh the problems of labelling, which can be addressed by counselling measures (Heller, K. A., and Schofield, N. J., 2008).

CHANGING PERCEPTIONS OF GIFTEDNESS OVER THE YEARS

Much of the earliest work on giftedness emerged from the seminal book *'Hereditary Genius'*, where Francis Galton compared mental capacity to any other heritable characteristic, such as physical stature, size of head, or weight of grey matter in the brain, and maintained that heredity quality was the sole determiner of the achievement of 'eminence' in professional and social life (Galton, 1869). Galton maintained that a mentally superior man naturally achieves eminence, regardless of the vicissitudes of life: 'High reputation is a pretty accurate test of high ability'. Galton was also responsible for coining the term 'gifted' with respect to special abilities, maintaining that mental capacity was genetically determined and nonmodifiable. He believed that different races had different mental capacities (the beginnings of *scientific racism*), and also opined that abstinence should be enforced upon people of inferior mental capacity (the beginnings of *eugenics*). As well, after testing 9,377 men and women in his Anthropometric Laboratory, he also declared that women were inferior in all their capacities to men (Boring, 1950). The measures of mental capacity that he used are now considered to be completely invalid (Carroll, 1993); they included measures of head size, gross motor strength, response latency, and perceptual acuity. However, the scientific credence lent by laboratory testing to deeply-held beliefs such as the innate mental superiority of males, the superiority of certain races over others, and ideas like eugenics,

continue to exert a baleful influence to this day: a cautionary tale of the perils of labelling by defining ability too narrowly.

Hollingworth, one of the leading specialists in gifted education of her time, who herself had faced various obstructions in her attempts to use her gifts professionally, wrote on the 'woman question' that it was 'a matter of how to reproduce the species, and yet to work, and to realise work's full reward, in accordance with individual abilities', a problem primarily of gifted women (Hollingworth, L. S., 1926). She also opined that a woman of the same intellectual calibre as a man was 'not of the same economic value.....because masculinity is in itself an asset of superior worth'(*op.cit.*). Reflecting on these issues, she reinterpreted Galton's findings that women and children of manual workers were inherently inferior, as 'evidenced' by their negligible presence among eminent people in the world's history. Hollingworth pointed out that if education and opportunities (rather than heredity) were interpreted as the prime determinants of achievement, the socially inferior classes (the uncultured, the poor, servants, and women), who had been historically denied these advantages, would seldom be expected to achieve eminence – as in fact was the case. What a person *can* do depends on that person's endowment, but what he or she *does* do probably depends on opportunity.

Terman (1926) defined 'giftedness' as 'the top 1% in general intellectual ability, as measured

by the Stanford-Binet Intelligence Scale or comparable instrument'. Such a definition has the convenience of ease of identification. This is now considered to be a conservative estimate of prevalence, as it would only include children of high academic ability and exclude those whose abilities lie in creativity, the arts, psychomotor skills, or leadership potential, as well as the many students whose potential for superior performance does not show up in intelligence tests, but rather emerges in successful adult life. Terman (1916) had identified giftedness based on IQ testing, and most researchers to this day follow his lead, though eminent researchers Guilford (1967) and Thurstone (1947) pressed for a wider recognition of the multiple components of intelligence.

Views on the nature of giftedness expanded during the decades following, and a book, *'Conceptions of Giftedness'* (Sternberg R. J., 1986) brought together various different perspectives on this issue, demonstrating that the field was moving beyond the narrow confines of IQ as a measure of ability. The scope of giftedness was enlarged to include performance, not just potential, as it was recognised that certain potentialities such as those in art, writing, or social leadership could only be identified through outstanding performance. Consistently remarkable performance could indicate a child who is gifted in any field of achievement valued by humans (Witty, 1958).

Joseph Renzulli (1978) shifted the focus from gifted individuals to gifted behaviour. He proposed a three-ring model for the components of giftedness, involving interactions between clusters of human traits identified as above-average ability, high levels of task commitment, and high levels of creativity. This important work indicated that an individual's ability on

its own does not translate to high achievement. Gifted behaviour is manifest in who possess these traits *and* can apply them to a particular field. Renzulli also saw the need for a wide range of educational services and opportunities not usually provided in the school setting in order to facilitate the development of giftedness.

Robert Sternberg proposed his Triarchic Theory of (Successful) Intelligence, claiming that intelligent behaviour results from a balance between analytical, creative, and practical abilities; it is the collective functioning of these abilities that allows individuals to achieve success within particular sociocultural contexts (Sternberg, 1988; 1997). To be successful, a person must make the best use of his/her particular endowment of these three abilities: exploiting his strengths and compensating his weaknesses – either by improving weak areas, or by choosing an environment that where the focus would be on his strengths. Thus, *adaptability*, both within the individual's profile of abilities, and within the individual's sociocultural context, is recognised as a central feature involved in gifted behaviour. The individual's ability to interact with the environment in a manner appropriate to his profile is also a valuable component of intelligence: achieving success requires recognising one's profile and *selecting, modifying, or adapting to* environments best conducive to one's unique profile of abilities.

Howard Gardner proposed a model of intelligence that went on to become highly influential among educationists because of its practical applicability. (In the academic community, his theory remains controversial). This is the theory of Multiple Intelligences (Gardner, 1983). Rather than considering intelligence a single entity measurable through IQ tests, Gardner proposed that there are

multiple intelligences, more or less independent from each other; and defined intelligence itself as the ability to solve problems or to fashion products that are valued in one or more cultural settings. His work initially listed seven intelligences; two more have been added since. In order to identify an intelligence, Gardner defined several criteria that must be met (*op.cit.*, pp. 62-69), the application of which were described by him as more of an art than a science. These intelligences all had to, as a prerequisite, be usable to resolve real-life problems or difficulties. The intelligences are listed below:

- Linguistic intelligence (a quality that marks out writers, poets, lawyers, and public speakers);
- Logico-mathematical intelligence (associated with scientific and mathematical thinking);
- Musical intelligence;
- Bodily-kinaesthetic intelligence (the ability to use mental abilities to coordinate gross and fine bodily movements);
- Spatial intelligence (the ability to recognise and use the patterns of wide space and confined areas);
- Interpersonal intelligence (this ability demonstrated by salespeople, educators, religious and political leaders, and psychological counsellors);
- Intrapersonal intelligence (having an effective model of ourselves, and using it to regulate our lives);
- Naturalist intelligence (added afterwards; the ability to recognise, categorise, and draw upon certain features of the environment) (Gardner H. E., 1999) .

(Gardner considered further expanding this with newer intelligences, *viz.*, spiritual,

existential, and moral intelligences, but these have not as yet been included.)

The appeal of Gardner's approach is that it appears to validate educators' everyday experience with students, in that children vary in how they think and learn. However, academics raise issue with (a) the subjectivity involved in identifying an intelligence, (b) the large body of work that finds evidence for a general intelligence factor, 'g', rather than specific independent intelligences, and (c) the fact that there is no battery of tests as yet that can measure these so-called multiple intelligences.

Gagné proposed Differentiated Model of Giftedness and Talent (DGMT), which crucially distinguishes between the terms 'giftedness' and 'talent', often used synonymously by other researchers (Gagné, 2000). Gagné defined 'giftedness' to be the possession and use of outstanding *natural* abilities, called aptitudes, in at least one ability *domain*, to a degree that places an individual among the top 10% of age peers. 'Talent' was defined as the outstanding mastery of *systematically developed* abilities, called competencies (knowledge and skills), in at least one *field* of human activity to a degree that places an individual at least among the top 10% of age peers *who are or have been* active in that field for a comparable amount of time. The *talent development* process is the progressive development of gifts into talents. Apart from the three components of giftedness, talent, and talent development, there are intrapersonal catalysts and environmental catalysts operative in the process, as well as chance factors. Gagné recognised that natural abilities, though innate, develop over the course of a person's life, subject to environmental and chance factors. Gagné's thinking is very influential in certain circles, including the gifted education community in Australia.

It can be seen that over the years, educators and academics alike have moved away from extremely conservative or narrow definitions of intelligence to a much more liberal view – from the measurable to the difficult-to-define – in their efforts to capture in its completeness the essence of human intelligence. Similarly, focus has moved away from the idea that intelligence is determined at birth and unchangeable thereafter, to the understanding that intelligence

develops over many years and is the result of a genetic predisposition interacting with the environment, both given and self-created, in which individuals exist, and upon whom cognitive demands of varying degrees are made (see section ahead on *Giftedness and Heritability of IQ*). What has not yet been resolved, among other questions, is whether gifted children differ quantitatively or qualitatively from non-gifted children (Winner, 2000b).

MODELS OF INTELLIGENCE

Attempts to measure intelligence through various IQ tests (the *psychometric approach*) beg the question: what is intelligence? To some, 'intelligence is what intelligence tests measure'. It is recognised that an IQ score is (a) a stable quantity with respect to retesting, (b) fairly continuous across the lifespan, and (c) reliable as a predictor of academic achievement: the correlation between school grades and IQ scores being 0.50 (Neisser et al.1996). This stability persists despite the differences between IQ tests with regard to which abilities are tested, details of administration and score interpretation, cultural and linguistic differences between the test subjects and the normative populations employed, environmental influences on the development of the subjects, and temporary factors that distort test results such as test-taker's level of motivation or ill-health.

In a report published by the American Psychological Association entitled 'Intelligence: Knowns and Unknowns', Neisser et al. (1996) stated that 'individuals differ from one another in their ability to understand complex ideas, to adapt effectively to the environment, to learn from experience, to engage in various forms of reasoning, and to overcome obstacles by taking thought. Although these individual differences can be substantial, they are never entirely consistent: a given person's intellectual performance will vary on different occasions, and in different domains, as judged by different

criteria. Concepts of "intelligence" are attempts to clarify and organise this complex set of phenomena. Although considerable clarity has been achieved in some areas, no such conceptualisation has yet answered all the important questions, and no definition has achieved consensus. Indeed, when two dozen prominent theorists were recently asked to define intelligence, they gave two dozen, somewhat different, definitions.' The concept of intelligence is defined more succinctly, as also more generally, by Sternberg and Salter (1982), who describe it as 'goal-directed adaptive behaviour'.

Intelligence tests vary in type, and may involve both verbal and nonverbal batteries as well as performance tests (see section ahead on *Dynamic Assessment Tests, Tests of Infant Intelligence, Non-Verbal Tests*). For a given IQ battery, scores from the various tests are compiled to yield an overall test score, according to certain prescriptions derived from a normative sample. Spearman (1904, 1927) studied various IQ tests and inferred by a statistical technique that he had invented, *viz.*, factor analysis, that there exists a positive and high correlation between all tests of mental ability. (This is the basis for the apparently circular statement that 'intelligence is what intelligence tests measure.'). Spearman called this common factor 'g', for general intelligence, as opposed to the factor 's', which is specific to

performance on a given test. Not all researchers favoured the interpretation of 'g'; in particular, Thurstone (1938) opposed this interpretation of the correlations between tests, finding instead evidence for 'group factors' relating to seven groups of intelligences, which he called primary mental abilities. When the correlations between tests were factorised in this manner, he found that there remained no evidence for an overarching 'g'. However, many researchers continue to support the interpretation of 'g'. In particular, Raymond Cattell (1963) enlarged on this picture by splitting 'g' into 'gf', fluid intelligence, and 'gc', crystallised intelligence. gf, the structural hardware of the brain, was regarded by Cattell as subject to decrease over the lifetime. gc, the functional software of the brain as well as learned skills and knowledge, Cattell found to be resilient to ageing, even in some areas showing cumulative improvement over the lifetime. Recent neurobiological research suggests that gf is related (through working memory) to, but distinct from, general intelligence. Fluid intelligence gf is associated with certain specific anatomical and functional aspects of the brain (Blair, 2006).

The task of relating psychometric test performance to specific aspects of brain function is aided by brain imaging through PET (Positron Emission Tomography) and fMRI (functional Magnetic Resonance Imaging) scans obtained while subjects perform certain tasks. Such studies have facilitated the understanding of certain functions of the brain (*cf.* section on *Is There a Neurobiological Basis for Giftedness?*). Work on human models, with brains damaged via lesions (e.g. from epileptic seizures) or by surgery, has yielded much understanding of the various mental processes and their locations within the brain. The psychobiologist Sperry

studied brains in which the cerebral hemispheres had been surgically separated as a measure to contain epilepsy, and was able to identify certain differences between the functions of the right and left hemispheres. Sperry found that each hemisphere of the brain has its own higher gnostic functions, mental images, perceptions, and memories – whereas it had formerly been believed that only one hemisphere, the left one, performed the higher functions in most human brains (Sperry, 1981). Levy-Agresti and Sperry (1968) and Levy (1970), quoted in Sperry (1981), obtained evidence for right hemisphere superiority on certain tasks requiring higher cognitive ability. This research also demonstrated that in activities where the left hemisphere performed better, the right hemisphere tended to perform less well, indicating a left-right polarity in cognitive abilities. (However, it is important to note that in a normal, intact brain, the two hemispheres are connected and that on any task, including simple perceptual tasks, both hemispheres are likely to be involved.) Subsequent research using EEG (electroencephalogram) studies also showed that individuals with different cognitive styles tended to use different hemispheres of the brain. Luria (1966) showed that there are two distinct types of mental process, successive and simultaneous, which roughly corresponded to Sperry and colleagues' categorisation (the left-brain dominates sequential tasks; the right brain dominates tasks requiring simultaneous processing). Luria, however, attributed these two types of mental functioning to the fronto-temporal and occipito-parietal regions of the brain, respectively. Sequential processing involves solving problems in a stepwise fashion, placing importance on the serial or time-related order of stimuli; whereas simultaneous

processing is a gestalt-like and often spatial integration of stimuli to solve problems taken as a whole with maximum efficiency (Kaufman, 2009).

Cognitive styles have also been studied by educational psychologists. A review of the literature is to be found in Sternberg and Zhang (2001).

Some of the influential theories in intelligence studies are briefly summarised below:

A. Luria's Three-Block Neuropsychological Theory (Luria 1970; 1973)

On the basis of his clinical documentation, Luria viewed the brain's basic functions as being representable by three main blocks (functional systems). Block 1 is responsible for cognitive arousal and attention; Block 2 uses successive and simultaneous processes for analysing, coding, and storing information; and Block 3 is responsible for the application of executive functions to formulating plans and programming behaviour. Block 1 functions correspond to the reticular activating system, and Block 3 functions are associated with the anterior frontal lobes. Block 2 functions, being associated with the senses and involved in encoding the information received, was hypothesised by Luria to be located in the occipital, parietal, and temporal lobes.

B. Sternberg's Triarchic Theory of Successful Intelligence (Sternberg R. A., 1997; 1985; 1996)

According to this theory, intelligent behaviour arises as a result of a balance between analytical, creative, and practical abilities, which operate collectively to allow individuals to be successful within particular sociocultural contexts. In order to achieve success, these abilities must be used as per the

given individual's balance of these abilities: optimising strengths while compensating for weaknesses. *Adaptability* is a key factor in this theory.

C. Gardner's Multiple Intelligences Theory (Gardner H. , 1983)

Howard Gardner is credited with the aphorism, 'Ask not how smart is this child, but *how* is this child smart.' This effectively sums up his philosophy of intelligence. Eight different types of intelligence, viz., interpersonal, intrapersonal, naturalist, logical/mathematical, bodily/kinesthetic, spatial, musical, and linguistic intelligences are the competencies that any individual possesses in varying degrees. Spatial, linguistic, and logico-mathematical intelligences are theoretically linked to Cattell's fluid intelligence.

Other notable theories of human intelligence include:

D. J.P Guilford's Structure of Intellect: (1967, 1977): J.P Guilford's general theory of human intelligence consists of three components: operations (five kinds), contents (five kinds), and products (six kinds). Combinations of these components yield 150 components of intelligence ($5 \times 5 \times 6 = 150$).

E. Naglieri and Das' PASS theory (1997): theoretical basis for the CAS test (described in an upcoming section) Planning, Attention Arousal, Simultaneous and Successive (i.e. Sequential) theory of intelligence. This theory challenges the g-theory of intelligence and claims that the brain is made up of independent functional systems.

F. Cattell-Horn-Carroll Theory (CHC Theory; 1941, 1965, 1993; revised by McGrew (1997), Flanagan (1998), and McGrew (2011)): Cognitive abilities span 9 broad stratum abilities and over 70 narrow

abilities. The broad abilities are crystallised intelligence, fluid intelligence, quantitative reasoning, reading and writing ability, short-tem

memory, long-term memory, visual processing, auditory processing, and processing speed.

POPULAR MISCONCEPTIONS ABOUT GIFTED CHILDREN

- *Myth 1: Gifted children are weak and sickly, eccentric, and 'half-mad'.* Galton's writings reinforced this impression. However, in early studies of giftedness (Terman, 1925), it was reported that gifted children tended to be bigger, healthier, and emotionally better-balanced than their non-gifted peers. Exceptionally/profoundly gifted children, on the other hand, do face certain social and emotional issues on account of the great differences in their interests and aptitudes as compared to those of age peers. The drive to fulfill these interests puts exceptionally/profoundly gifted children in direct conflict with their need for acceptance by and intimacy with their peers (Hollingworth, L. S., 1926).
- *Myth 2: Giftedness puts some children in a position of advantage over their peers and therefore such children do not need any special educational facilities: they can look after themselves.* That such children would be much more fulfilled by aiming at different educational goals than the average child (Gross M. U., 2000) is not considered. Another area of concern is that some of these children, especially girls (Dalzell, 1998), are at risk of being 'turned off'(fall victims to boredom and disenchantment, see e.g. (Yoo, J. E., and Moon, S. M., 2006)) for a variety of emotional and social reasons if not counselled appropriately.
- *Myth 3: IQ testing in very young children is unreliable as compared with testing older children, as high IQ scores at young ages is a product of environment, and can be artificially inflated by parental coaching or by a good preschool.* While environment does indeed influence IQ, the environmental effect should certainly be more apparent in older children rather than in younger ones, as they have had more time for environmental influences.
- *Myth 4: All children are gifted in one way or another.* While there is a range in the types and degrees of giftedness in children, the term 'gifted' cannot be applied to all children. Among others, Gardner's theory has been used to justify claims that all children are gifted; Gardner himself has challenged the use of his theory for such purposes. The difficult truth is that some children are indeed obviously and measurably more able than others (Gross M. , 2004). This myth is partly an issue of ideology, and partly the result of a confusion between a child's *strengths* (all children have their profiles of strengths and weaknesses) and a child's *gifts*.

DO GIFTED CHILDREN HAVE SPECIAL NEEDS?

Giftedness is more often than not viewed purely as heightened ability, with the assumption that no special intervention is required for it to blossom. Time and again, however, research shows that a gift confers special needs upon children (e.g., Reis (2008) and references therein). Not only do gifted children have special needs on account of their gifts, but just as for other special-needs children, the sooner the identification and appropriate intervention, the more fulfilled is the life they are able to lead, and the greater their ability to contribute the fruit of their gifts to society. In addition, ‘twice-exceptional’ children have two sets of special needs, and present a more complex set of socioemotional and educational counselling issues.

What are the special needs of a gifted child?

- Need for talent-appropriate stimulation that is not restricted by the chronological age of the child, but rather takes account of the asynchronous development of the child’s ability profile (e.g., in a given child, motor skills may not be at par with conceptual skills; asynchrony may also be observed *within* a domain of achievement, such as within reading: a child may have superior phonetic and decoding skills but average comprehension skills) (Roedell, 1989).
- Need to be accepted by a peer group and by parents and teachers for what they are, rather than have to hide behind a mask of ‘averageness’ in order to achieve intimacy with peers and the approval of elders (Gross M., 1998).
- ‘Twice-exceptional’ children need to be assured that their abilities are adequately recognised, so that they can access facilities/material/stimuli appropriate to their talents; at the same time, they need help in managing and minimising the impact of their disabilities (Silverman L. K., 1989).
- Programmes and encouragement to aid the growth and blossoming of their special abilities (Reis, 2008).
- Counselling (Reis, 2008), to optimise achievement, prevent demotivation, and facilitate socioemotional adjustment including healthy self-esteem (Gross M. , 1998).
- ‘Late bloomers’ (late achievers who may not stand out in childhood, but who may be identified as gifted on the basis of achievement or test scores early on) need support and encouragement as they come to understand how to handle their abilities (Silverman L. K., 2002).
- Initial ‘high-flyers’ or early buds who may ‘lose altitude’ in later years for various reasons often need counselling to cope with their specific issues, and help regain altitude (Silverman 1986b, Borland 1986). The phenomena of late-bloomers and early buds suggest the developmental nature

of giftedness. Despite the broad trend of continuity of IQ across development, in some cases a child identified as gifted in early childhood may cease to merit the label in later years.

- The exceptionally gifted (IQ ranges 160-179) and the profoundly gifted (IQ 180+) have intellectual and emotional needs that are underserved even by regular gifted programmes (which are designed for the moderately gifted) (Gross M. , 2004).

IS THERE A NEUROBIOLOGICAL BASIS FOR GIFTEDNESS?

Extremely gifted individuals often have a history of intellectual precocity combined with abnormalities in development and behaviour. A fascinating area of research investigates whether there are neuro-physiological and neuroanatomical differences between the brains of the extremely gifted and other brains. Some aspects of gifted cognitive ability have a hereditary component, according to research (Posthuma, D., DeGeus, E. J. C., and Boomsma, D. I., 2001; Thompson, P., Cannon, T. D., and Toga, A. W., 2002). It would appear that effortful and deliberate practice is also important in the development of gifted abilities (Ericsson, K. A., Krampe, R., and Tesch-Romer, C., 1993; Bloom, 1985). The middle ground in this nature-versus-nurture debate, increasingly espoused by researchers, is that giftedness is the product of a reciprocal dynamic relationship between hereditary endowment and environment (LaBuda, M., DeFries, J. C., and Fulker, D. W., 1987; Scarr, S. M., and McCartney, K., 1983).

Neurobiologists (Mrazik, M., and Dombrowski, S. C., 2010) view giftedness as high cognitive performance as measured by psychometric scales; neurobiologists' view tend to focus on the highly and the profoundly gifted. Creative geniuses such as da Vinci, Freud, Einstein, and Picasso, according to biographical accounts, showed patterns of aberrant development beyond the normal range of psychological functioning, and were

also plagued by pervasive affective and mood disturbances (Ehrenwald, 1984).

Differences in brain morphology are implicated by neurobiologists in giftedness (Fingelkurts, An. A. and Fingelkurts Al. A., 2002; Geschwind, N. and Galaburda, A. M., 1987a; Winner, *The Origins and Ends of Giftedness*, 2000a). As early as 1960, Brain (1960) intuited that genius was related to superior integration of perceptual and motor skills along with differences in the higher-level organisation of neurons in the brain into 'schemas.' A seminal work by Geschwind and Galaburda (1987b) postulated that mild abnormalities in neuronal migration may result not only in disorders of the nervous system, but may also manifest themselves as superior abilities. Further explorations of the possible correlation between superior abilities and disorders (Geschwind, N. and Galaburda, A. M., 1987b; Geschwind, N. and Behan, P. C., 1982) have found that mathematically precocious youth have a higher prevalence of autoimmune disorders, asthma, allergies, and myopia, although other research either disputes this correlation altogether (Bryden, M. P., McManus, J.C., and Bulman-Fleming, M. B., 1994), or questions its strength (Berenbaum, S. A., and Denburg, S. D., 1995). Uneven patterns of intellectual profiles have also been noted in children gifted in music or art (Gardner H. , 1983; Winner, 2000a). The functional and neurological anomaly most

commonly associated with giftedness is right hemisphere dominance (Jin, S. H., Kim, S.Y., Park, K. H., and Lee, K. J., 2007), with frontal asymmetry in the right cortical area as a possible physiological marker of giftedness (Fingelkurts, An. A. and Fingelkurts Al. A., 2002). However, fMRI studies comparing the functioning of gifted versus other brains (Lee, K. H., Choi, Y. Y., Gray, J. R., Cho, S. H., Chae, J. H., Lee, S., et al., 2006) showed that gifted individuals did not use more, or different, brain structures; rather, increased activation of the entire frontal-parietal network was noted: perhaps indicating higher-than-average activity distributed across the brain when performing difficult tasks. Another finding is what is termed ‘neural efficiency’, where gifted functioning involves a more integrated brain with greater cooperation between the hemispheres (O’Boyle, 2008), with reduced activity in certain areas as compared with average brains when performing similar tasks – possibly implying that gifted brains spend less time on such tasks.

As to the causative mechanism of these neurological anomalies, atypical brain development has been attributed to various factors, including high sensitivity to testosterone or higher than normal concentrations of testosterone during foetal development (the Geschwind-Behan-Galaburda (1987) hypothesis; (Fingelkurts, An. A. and Fingelkurts Al. A., 2002)), resulting in inhibition of aspects of left-hemisphere functioning while enhancing aspects of right-brain development. In extreme cases, individuals with enhanced right-brain development and mathematical precocity are also more likely to show disabilities of verbal-language development as well as health concerns. In fact, the negative correlation between high

mathematical and language abilities may be the rule rather than the exception (Winner, 2000a). At the microscopic level, foetal brain development may be accompanied by neuronal proliferation in one part of the cortex, for example the inferior parietal region responsible for visual-spatial, musical, and mathematical reasoning – resulting in unusually high neuronal densities in these areas. Another possible pathway is the failure of neuronal pruning (apoptosis) in the first two years of life, again resulting in higher neuronal densities. A third explanation is that neurons destined for, say, a brain area involved in language development may instead be diverted to the inferior parietal region instead in the process of neuronal migration during the formation of the foetal neural tube (Mrazik, M., and Dombrowski, S. C., 2010). These authors also postulated that neurons destined to differentiate into dopamine, serotonin, or glutamate neurotransmitters systems (which play a role in perception and behaviour) may be altered by developmental anomalies as a result of prenatal exposure to certain chemicals, creating a diathesis for eccentric or psychotic behaviour in later life. In evidence of such hypothesised mechanisms, prenatal exposure to influenza during the second and third trimesters of pregnancy has been reported as creating a vulnerability to psychopathology (in particular, schizophrenia) later in life (Waddington, J. L., O’Callaghan, E., Youssef, H. A., Buckley, P., Lane, A., Cotter, D., et al., 1999; McGrath, J., and Castle, D., 1995). Appendix 6 outlines the mechanism of the Prenatal Exposure Hypothesis for Giftedness (Mrazik, M., and Dombrowski, S. C., 2010), one possible etiological factor in this phenomenon. However, see also the note on ‘

Savants

A rare condition, savantism may be either genetic or acquired. A savant has a developmental disorder or a psychological disorder, accompanied by outstanding ability or expertise in one domain. The American Association on Mental Deficiency defined a savant as ‘a person with low general intelligence who possesses an unusually high skill in some special task like mental arithmetic, remembering dates or numbers, or in performing other rote tasks at a remarkably high level’ (Grossman, 1983).

Very rarely, savantism exists in the absence of apparent brain dysfunction. Savants generally have a prodigious memory and high processing speed specific to one area. Originally the French term ‘idiot savant’ (which translates as ‘unlearned knowledgeable’) was used in connection to describe such individuals by John Down (1887). The preferred term now is ‘autistic savants’ (Rimland B. , 1978), which may be misleading as not all savants are autistic. (About 10% of autists are savants, as opposed to 1% of

the general population who are savants) .The gifts of the savant are primarily for arithmetic calculations performed at lightning speed, feats of memory, and calendar calculation; and, less often, gifts in arts or music. Savants show no metacognition, i.e. they cannot describe how they perform their feats or how they learned their skills. Rimland (2003) describes savantism as a condition of ‘stimulus oversensitivity’ whereby ‘focusing on the trees interferes with seeing the forest.’ Afflicted individuals generally have IQs above 40, i.e. those with profound mental retardation are unlikely to be savants. This phenomenon is not yet clearly understood. One hypothesis is that damage to one hemisphere of the brain causes the other hemisphere to take over some functions and to perform them in non-normative ways. (Treffert, 2009). A review of ‘savant syndrome’ can be found in Treffert (2006).

Savantism is a phenomenon of interest in our quest to understand giftedness – it demonstrates that certain gifts, at least, may be independent of general intelligence.

GIFTEDNESS AND HERITABILITY OF IQ

Observations on the heritability² of intelligence predate IQ testing (Terman L. M., 1925). Today it is generally held that the IQs of adults correlate highly with those of their biological parents (Neisser et al. (1996), Plomin et al. (1994)). This observation raises several questions:

- To what extent is this correlation based upon genetic factors, and to what extent on family-related environmental factors (i.e., the environment provided by the parents for the foetus/infant/young child)?
- What is responsible for the well-established *Flynn Effect* (Flynn (1987; 1984))? Is it a result of improvements in health

care (including prenatal care), nutrition and vaccination (facilitating neural development), and education? Or is it a mere statistical artefact?

- Once a child is born, to what extent can his/her IQ be modified?

In these matters, it is important to consider that there are both long-term factors affecting the development of the brain (natural selection), and short-term factors including environmental influences which may take effect over several generations or even within the lifetime of an individual. Like all other organisms and organs, the human brain is still evolving.

² Heritability measures the proportion of variation in a trait that can be attributed to genes, rather than the proportion of the trait caused by genes. The mean value of a trait (e.g., average height of a people) may change without any change to its heritability, the variation of the trait among individuals remaining the same. The heritability figure is also sensitive to changes in the environment; if everyone had the same environment, heritability would be 100%, but lower if the environmental variation encountered by different individuals increases.

HERITABILITY OF IQ

Behaviour genetics shows that the heritability of psychological traits *increases* with the age of the individual. In other words, as individual's age, hereditary influences on their intelligence increase, while the influence of environmental factors correspondingly decreases. Heritability accounts for about 20% of the variance in IQ in 1-year olds. At age 10, the heritability of IQ is about 40%; by some estimates this figure rises to 80% in adulthood (Plomin et al. (1994)), and continues to increase through adulthood. The explanation for this phenomenon is that quantitative behaviour traits develop in a particular way subject to background conditions, and they express themselves in an environmental context. Intelligence is not something an individual is born with, but is developed over time, through interactions with and feedback from the environment, and depending on initial individual tendencies and abilities. Children have little control over their environments; as they grow older, their genetic tendencies have more scope to express themselves by the selection, modification, and adaptation to environments. In other words, growing children and adults tend to seek an environments that permits the expression of their genetic disposition (Scarr (1983)).

Interestingly, the heritability of IQ is moderated by the *socioeconomic* status of the parents (Turkheimer, E., Haley, A., Waldron, M., d'Onofrio, B., and Gottesman, I. I., 2003). A study of 750 pairs of twins compared the heritability

coefficient of IQ at 10 months and at two years in children from lower, middle-class, and higher socioeconomic status families. At 10 months, heredity was found as usual to exert a negligible role on IQ across socioeconomic conditions (Tucker-Drob et al., (2011)). However, at age 2 years, heritability of IQ rose to about 50% for the high socioeconomic families, but remained negligible for the low socioeconomic status families. A criticism of this sort of work is that it is performed only on children, rather than following them into adulthood: the IQs of children are still in the process of developing. In fact, some research shows that socioeconomic status has no effect in the heritability of IQ (Nagoshi, C. T., and Johnson, R. C., 2005). The observation that socioeconomic status could have a bearing on the heritability of IQ accords with views that genetic propensities can be more fully cultivated, expressed, and actuated in more enriched and supportive environments (Bronfenbrenner, U., and Ceci, S. J., 1994; Turkheimer, E., and Gottesman, I. I., 1991) – in other words, that a more cognitively stimulating environment allows the fullest development of a child's natural potential, regardless of where along the ability spectrum the child may fall.

The Flynn Effect and Changing IQs

The Flynn Effect was widely publicised by James Flynn (1987; 1984), and refers to the fact that on standardised IQ tests (Stanford-Binet,

Wechsler and Raven's Progressive Matrices), the IQs of populations in many countries are increasing by about 3 points per decade (though the increases are not evenly distributed), and even faster in certain countries such as Israel and the Netherlands (Flynn (1987); (1998); (1994), The Psychological Corporation (2003); (2008)). This effect is also known as *norm obsolescence*, referring to the fact that the IQ distribution needs to be re-normed every so often so as to maintain a mean score of 100. The average Dutch 14-year-old in 1982 scored 20 points higher on verbal and performance IQ than the average Dutch 14-year-old in 1952, a change too rapid to be explained by natural selection. Further, average IQ scores have been rising linearly since almost the earliest days of testing (Neisser, 1997). However, there have been certain criticisms of the comparability of available statistics across decades (Teasdale, T. W., and Owen, D. R., 2008; Raven J., 2000).

The reality or otherwise of the Flynn Effect has been studied by many researchers. A review of 113 papers by McGrew (2010) concludes that most (but not all) intelligence scholars are of the opinion that the Flynn Effect is indeed real (rather than a statistical artefact), i.e. that it shows real gains in the population in what the tests are measuring.

This effect has been attributed to various causes, relating to both social and educational changes as well as to biological factors such as improved healthcare and nutrition (Neisser, 1998). Modern life increasingly demands and rewards complex and abstract reasoning and the ability to handle large amounts of data. Differences in working memory, which can be developed by practice (Jaeggi et al. (2008)), account for 50-70% of individual differences in fluid intelligence or abstract reasoning,

suggesting that this is an important contributor to IQ (Ackerman et al. (2005), Kane et al. (2005), Süsset al. (2005)). Children also undergo more years of education than previously, and are more accustomed to test-taking. Both levels of education (Barber, 2005; Blair, C., Gamson, D., Thorne, S., and Baker, D., 2005) and experience with test-taking are known to contribute to raising scores on IQ tests. However, it appears that the cross-generational rise of measured IQs are now gradually reversing in some countries like Denmark. One study reporting such reversal was a study of Danish adult males evaluated at conscription and followed from 1998-2003/2004 (Teasdale, T. W., and Owen, D. R., 2008); the reversal of the Flynn effect reported by this study was only partially accounted for by immigration to Denmark from less-developed countries (te Nijenhuis et al. (2004)). This reversal has also been reported in Norway (Sundet, J. M., Barlaug, D. G., and Torjussen, T. M., 2004), and may reflect the possibility that in highly developed countries, average human intelligence may be reaching its peak. The Flynn Effect continues to be reported from less-developed countries (Cocodia et al. (2003), Daley et al. (2003), Meisenberg et al. (2005)).

Can IQ be altered after birth?

From the above, it is evident that, apart from the complement of genes a child receives at conception and influences during foetal development, IQ does indeed continue to develop after birth, in response to (a) childcare, nutrition and health, (b) cognitive demands in life, including years spent in education, (c) practice in test-taking, and (d) various environmental factors, including the availability of appropriate stimulation at developmental

sensitive periods. Among factors that correlate negatively with IQ in children and adolescents is exposure to interpersonal physical violence with consequent post-traumatic stress disorder (Saltzman, K., Weems, C., and Carrion, V., 2006). At the same time, it has been noted that certain outstanding individuals have emerged from traumatic or from deprived, unstable family environments. In this section we address issues relating to purposeful efforts at improving IQ.

Enrichment Programmes

Early research suggested that programmes to enrich the learning environment via a cognitive development programme for very young children of mothers with low IQs could result in a marked increase in the IQs of the children. For example, the ‘Milwaukee Project’ at the University of Wisconsin-Madison in the U.S. ran from 1966 to 1973, with 17 children born to inner-city mothers of IQ less than 75, and a control group of 18 children. All children were admitted to the study as infants, and were randomly assigned to control and intervention groups. The children in the intervention group were educated in an infant stimulation centre, receiving inputs for appropriate cognitive development. Mothers of the intervention-group children received education, and vocational, childcare, and homemaking training. The programme ended when the turned 6, entering first grade. At this point, the average IQ difference between the controls and the intervention group was 32 points: with the mean IQ of the intervention group being 117, and the mean IQ of the control group being 87. However, these gains appeared to be shortlived: after a few years, both groups of children performed at an IQ level of about 80 in an actual classroom environment. A book on

the Milwaukee Project by one of the researchers involved was published after the children reached adulthood (Garber, 1988). While there have been criticisms that the apparent increase in IQ was a result of ‘teaching to test’ (i.e. the product of practice in test-taking rather than of any real gains in underlying intelligence), others have opined that the decline was the result of social factors and the short duration of the programme. Unfortunately, the Milwaukee Project fell into disrepute on account for other reasons; the results were never published in a journal, nor were the raw data made available.

Another similar study was the Abecedarian Early Intervention Project (Ramey, T., and Campbell, F. A., 1984) at the University of North Carolina, a carefully controlled study commencing in 1972 and lasting five years. The experimental group consisted of 57 infants; 54 controls were recruited from similar low-income backgrounds. Mothers had a mean IQ of 84. This programme began following the children in infancy, and provided high quality intervention. Each child had an individualised curriculum of activities through games, addressing social, emotional, and cognitive development, with a focus on language. To begin with, the mental and motor scores of the two groups of infants were similar. Differences appeared by age 18 months, with the intervention group significantly ahead. Follow-up assessments at ages 12 and 15 years showed a decreasing difference between the groups, but their trajectories still did not converge (as happened in the Milwaukee project). The effect sizes were the greatest for reading; mathematics too showed large to moderate improvements. Differences persisted into adulthood. About 35% of young adults in the intervention group later went on to attend college, as opposed to 14% from the control group.

The Headstart Programme in the United States, initiated in 1965 and still running, is one of the longest-running programmes designed to address by educational means systemic poverty in that country. By 2005, the programme had catered to more than 22 million preschool children, with a mission to promote social and cognitive development by providing educational, health, nutritional, social, and other services. In 2011 the U.S. Department of Health and Human Services produced a report entitled 'Head Start Impact Study.' This report concluded that the programme benefited the children in cognitive, health, and parenting domains, as well as the younger children in the social-emotional domain; but that the benefits had largely disappeared by first grade, after the programme ended (Puma, M., Bell, S., Cook, R., Heid, C., et al., 2010). A conclusion is that while early environmental interventions may modify the depressing effects of poverty on intelligence, such programmes need to continue beyond early childhood to provide a lasting buffer against continuing family poverty and other negative environmental factors.

Improving Working Memory

Working Memory is the online store of information in one's mind while manipulating it to achieve a cognitive goal. The term gained currency in the 1960s, originating from a comparison of the mind with the functioning of a computer (Miller, G.A., Galanter, E., and Pribram, K. H., 1960). The capacity of the working memory has been described as limited in the average brain (Miller, 1956). However, this capacity varies between individuals. Measures of working memory capacity show a relationship with performance on complex

cognitive tasks, including measures of IQ (Conway, A. R., Kane, M. J., and Engle, R. W., 2003). Highly gifted people in general, and prodigies in particular, show highly developed working memory capacity, particularly in specific domains of expertise. Research shows that optimal working memory functioning involves high *attentional control*, i.e. the ability to focus on information relevant to the task at hand and to ignore or attenuate irrelevant information and distractions (Zanto, T. P., and Gazzaley, A., 2009). Working memory capacity may even be better correlated with academic success than measures of IQ (Alloway, T. P., and Alloway, R. G., 2010).

Deficits in working memory have been implicated in poor academic achievement by learning-disabled children and those with ADHD or ADD, irrespective of their IQs (Alloway et al. (2009)).

Training working memory has been shown to improve the measured *fluid intelligence* of young adults (e.g. Jaeggi et al (2008)), mediating the ability to understand relationships between various concepts independent of any previous knowledge or skills, and to use these relationships to solve problems. Fluid intelligence is a component of IQ. It remains to be seen how long the benefits of working memory training last, however. Jaeggi et al. (2008) surmise that the observed increase in fluid intelligence could be related to plasticity of the brain stimulated by the training. If these gains are shown to be long-term, as opposed to findings from previous similar studies, then it is possible that young children with attention-deficit disorders and older adults experiencing degradation of fluid intelligence may benefit from such training.

THE IDENTIFICATION OF GIFTEDNESS

A complete identification of giftedness in young children poses a challenge in view of the range of phenomena that constitute what is recognised as giftedness, and of the fact that the sociocultural milieu may either not provide adequate opportunity for the exercise of certain gifts, or may encourage children to mask certain gifts considered inappropriate to their gender or age. In other words, any identification programme must consider social aspects of the manifestation of giftedness.

Early identification of giftedness is important in that it allows parents and educators to understand the behaviour and development of the gifted (Walsh, R. L., Hodge, K. A., Bowes, J. M., and Kemp, C. R., 2010). Early childhood educators tend to recognise the positive behavioural traits of gifted children more readily than the negative traits. Whether a given gifted children expresses more positive or negative traits depends largely on the environment: a young gifted child who lacks appropriate intellectual stimulation may react with aggressive frustration, which is viewed as a behavioural problem rather than a problem related to giftedness (Mares, 1991).

It is widely believed that giftedness cannot be reliably determined in young children until the age of about 7 or 8. Research, on the other hand, has indicated for more than fifty years that indicates that it is possible to accurately identify a large number of the gifted in primary school,

preschool, and even younger. Studies of eminent individuals point to the fact that they showed superior ability and precocious development before reaching primary school age (Albert, 1978; Terman L. M., *Mental and Physical Traits of a Thousand Gifted Children: Genetic Studies of Genius Vol 1*, 1925). Hollingworth (1942) studied highly gifted children and reported that the earlier these children were identified, the more favourable their developmental outcomes. Early identification permits any child to be provided early with the optimal opportunities for the development of ability.

Manifestations of Giftedness in Infancy and Early Childhood

Identification by parents provides some of the earliest insights into the possibility that a child is gifted. Some of the earliest signs from infancy through age 3 are listed below (Silverman L. S., 2011). Children showing a majority of these signs are candidates for evaluation for giftedness by experienced examiners. Giftedness tends to run in families, so the existence of a gifted sibling is often a sign that others may be gifted as well.

- less need for sleep in infancy
- long attention span
- high activity level
- smiling at or recognising caretakers early
- intense reactions to noise, pain, and frustration

- advanced progression through the developmental milestones
- extraordinary memory
- enjoyment and speed of learning
- early and extensive language development
- fascination with books
- curiosity
- excellent sense of humour
- abstract reasoning and problem-solving skills
- vivid imagination (e.g. imaginary companions)
- sensitivity and compassion

An expanded list of indicators of giftedness for the preschool and primary-school-aged child (0 to 8 years) can be found in Appendix 4.

Identifying and Evaluating Giftedness in the Young – Process, Tools, Tests, Pitfalls

It's better to have imprecise answers to the right questions than precise answers to the wrong questions.

– Donald Campbell

A multiplicity of factors influences the development of gifts into high achievement, as observed by Abraham Tannenbaum (2003). These factors were identified as:

- General ability (IQ);
- Special abilities (in specific areas);
- Non-intellective facilitators (dedication to a chosen field, strong self-concept, willingness to sacrifice, mental health);
- Environmental influences (parents, peers, classroom, culture, social class); and
- Chance (accidental, sagacity, personalised action).

Given the range of these factors, no single method of identifying giftedness can capture the full range of potential among children. Different environments and social backgrounds encourage in children different ways of exploring the world around themselves, and their learning from it, as well as how they choose to express (or conceal) their gifts.

Given this complexity, how are educators to identify potentially gifted children?

Best Practices for Identifying Gifted Children:

Current ideas about the best practices for identifying gifted children have been succinctly summarised by Johnsen (2009) in an article directed at school leaders:

- (a) *Multiple assessments* must be made to identify gifted children, since the range of gifted behaviours is large. Various qualitative assessments include checklists and portfolios of children's work over the years. Quantitative assessments need to be made. Information must be obtained from different sources (teachers, parents, the student, peers), and in different contexts (home, school, extracurricular activities);
- (b) *Pre-assessment*: Teachers need to provide challenging and differentiated opportunities in the classroom and observe the children's reactions before assessments are made;
- (c) *Parental involvement*: Parents need to be involved in the process of gift development, for their own understanding and so that they can aid their children.

Typically, a school in a country with a gifted education programme undertakes the following steps to identify gifted children:

1. *Nomination:* It is the practice to collect teacher and parent checklists, accounts of performances and portfolios, student background information, teacher observations, peer and self-nomination, and to conduct group intelligence and achievement tests.
2. *Screening and Identification:* Individual or small-group testing is undertaken to identify giftedness in specific domains. (Mathematically gifted students may undertake a specially designed test for mathematics aptitude; those with gifts in the performing arts may audition before a professional panel; those creatively or artistically endowed may submit portfolios of work. Interviews may be conducted.)
3. *Selection:* Panels of professionals in gifted education study all the findings to determine whether or not the students' needs will be met in a regular classroom. In assessing the work, the best performances are taken as indicators of potential. All assessments must be equally weighted, and possible errors noted; also, the child's development must be recorded over time.

See also the thoughtful article by Pfeiffer (2002) for a review of best practices in identification of the gifted and talented, and related issues.

Pitfalls:

There are certain pitfalls in current identification processes that may lead to the non-identification of some gifted children or the failure to locate the specific talents of identified children. Gifted children exhibit ability not just in a general sense, but also in their domains of

specific interest. (If testing is reduced to a single score, it is a report only of general ability.)

- Giftedness is a phenomenon that must be tracked over time, and should ideally *not* be assessed by a single test score. Especially for children who have limited out-of-school enrichment possibilities, opportunities to reveal their gifts need to be furnished before a definitive assessment is made (Johnsen et al. (2003)).
- Teacher nominations of gifted children have been shown to be somewhat unreliable (Carroll (1940)), on account of various issues (Brown et al. (2005)), although teachers who have experience of some duration with the students should ideally be well-placed to make these nominations. Especially where the class is large, such nominations tend to be inaccurate and incomplete. Appendix 2 contains a rubric designed by Kingore (2004) that can be used by teachers (and students) in several ways, including classroom assessment of gifted behaviour. The effectiveness of teacher nomination is enhanced by training the teachers; without any instruction, teachers simply tend to nominate well-behaved students with good grades.
- Early identification of giftedness is important for the further development of the child, especially if from a disadvantaged background. If education focuses on remedying the deficits in children's backgrounds rather than on challenging and nurturing their gifts, developmental outcomes are less favourable (Johnsen, S. K. and Ryser, G., 1994).
- Giftedness shows up in children with disabilities, and those from diverse cultural,

social, and economic backgrounds, but identification is often not as effective as for children from the mainstream. Identifying giftedness requires special training to recognise how it is manifest among different groups of children (Fernández et al. (1998), Johnsen and Ryser (1994), Whitmore (1981)).

- There are pitfalls in the administration of IQ tests to children (Prabhu, G. G., and Raguram, A., 1984), which are considered in the following section.

IQ Tests, Dynamic Assessment Tests, Tests of Infant Intelligence, Non-Verbal Tests

Over the history of gifted studies, various quantitative measures and qualitative assessments of intelligence (affecting all mental abilities), aptitude (ability in a particular domain), and achievement (developed skill/knowledge) have been proposed. Given the wide variety of manifestations of giftedness, it is generally believed to be impossible to put a single number to an individual's potential and thus to identify him or her as gifted. Thus there is now a plethora of assessment methods for general intelligence or cognitive abilities, specific domain abilities or aptitudes, the diagnosis of learning disabilities, and the identification of giftedness. The sheer number of tests in current practice reflects the inherent difficulty in defining intelligence / ability / achievement / giftedness, and the knowledge that no single test can claim to identify giftedness with complete accuracy. Again, the research community and the educational community have differing approaches to this issue.

The use of standardised comprehensive IQ test scores based on individually administered

tests is traditionally considered by many in the gifted education community to be the gold standard for identification (Gilman, 2008), although many also point out the need for multiple assessment methods, including checklists and other qualitative considerations, for a more complete identification protocol (see also earlier section on Best Practices for Identifying Gifted Students, and later section on Should IQ Test Scores be Used to Identify Gifted Children?). Students are labelled as gifted when their performance as measured by an IQ score is outstanding as compared with the general distribution of student scores for a population that is representative of that from which the students under consideration are drawn (normative sample). Generally, it is held by psychologists that this distribution is a normal or Gaussian distribution (a 'Bell Curve'). However, the actual shape of the distribution of IQ test scores depends on the average difficulty of the test items as well as upon the degree of intercorrelation between items. If there are high intercorrelations between test items, the distribution in scores may take a variety of shapes significantly different from a normal probability curve (Lord, 1952; Dorfman, D. D., 1995). A standardised, norm-referenced IQ test has test items designed and selected so as to yield a normal distribution for a normative sample of test takers, chosen to be representative in terms of age range, racial or ethnic origin, parents' educational backgrounds, and distribution in socio-economic status, and balanced for gender. Avoiding gender bias in IQ tests also requires the selection of different types of tests (or even abilities tested) such as to achieve comparable scores for both genders (cf. section ahead on Gender-related Issues).

Listed below are the major intelligence

and achievement tests in use today. Some tests may be administered to groups as well as to individuals; some are suitable only for individualised administration. Appendix 7 compares Individualised Testing and Group Testing.

Listed along with the test descriptions are their goals, characteristics, age ranges, and psychometric properties (reliability³ and validity⁴).

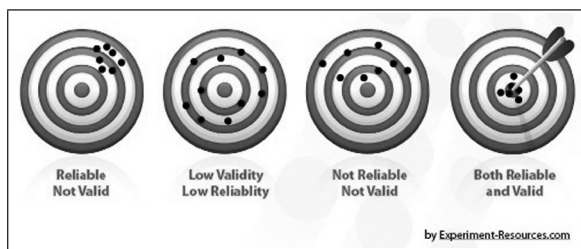


Figure 2: Illustrating the Concepts of Reliability and Validity

Stanford-Binet Intelligence Test

The first of the modern intelligence tests, this was originally developed in France by the psychologist Binet and his physician colleague Simon, and published between 1908 and 1911. Binet had been commissioned by the French Government to identify intellectually challenged children for the purpose of providing them with appropriate education. The 1911 Binet-Simon publication is available online in English translation as *Mentally Defective Children* (Binet, A., and Simon, T., 1911/2011). This test was later revised at Stanford University by Terman (1916), and became known as the Stanford-Binet test. With a student at Stanford, Terman created two parallel tests, known as L and M forms, which were later combined into

a single format, the Stanford-Binet (L-M) test. Currently this test is in its fifth edition, the SB5 (Roid, 2003). It is an individually-administered test of intelligence and cognitive abilities, and is considered the standard among intelligence tests. This test must be administered by a clinician. Details of the SB5 test are to be found in Roid and Barram (2004).

Characteristics:

- Measures: Fluid Reasoning, Knowledge, Quantitative Reasoning, Visual-Spatial Processing, Working Memory
- Scores that can be generated by the **SB5** include: Full Scale IQ, Nonverbal IQ, Verbal IQ, Abbreviated Battery IQ, Standard Scores, Percentile Ranks, Change-Sensitive Scores, and Extended IQ. The **SB5** can be hand-scored or scored with optional scoring software.
- Extended scoring from IQ 10 to IQ 225.
- 10 subtests, each taking about 5 minutes.
- Half of the test has nonverbal content requiring no or limited verbal responses to the examiner (useful for autists, the deaf, and those with limited English, as well as children with language-related learning disabilities).
- Supports early identification of learning disabilities: as young as 4 years of age. Can identify both reading and mathematics disabilities.
- The SB5 is used in clinical and neuropsychological assessment, psycho-educational evaluations for special education placements, and research on abilities and aptitudes.

³ *Reliability* refers to the accuracy with which the same result is obtained upon retesting the subject.

⁴ *Validity* refers to the degree to which evidence and theory support the interpretations of test scores as required by proposed uses of tests.

- Normative sample: 4,800 individuals aged 2 to 85 years

There are two different tests for different age-ranges:

- Age range 2 to 85+ years (SB5).
- Special kit for children 0-7 years (Early SB5).

The Early SB5 kit contains manipulatives; administration requires close supervision.

Psychometrics:

- Reliability scores for the SB-5 are very high. For the FSIQ, NVIQ, and VIQ, reliabilities range from .95 to .98 (average internal consistency composite reliability, across all age groups). Reliabilities for the Factor Indexes range from .90 to .92. For the ten subtests, reliabilities range from .84 to .89.
- Extensive validity studies were conducted including clinical-group differences, correlations with other tests, age trends, factor structure, and predictive validity. Many of these studies are presented in the Technical Manual and others in the Supplemental Interpretive Manual.

The Wechsler Intelligence Tests

In 1955, the American psychologist Wechsler published the Wechsler Adult Intelligence Scale (WAIS) IQ test, based on a series of Wechsler-Bellevue tests developed in the 1930s at the Bellevue Hospital Center, New York (Wechsler, 1939). These tests were innovative in that they included non-verbal or performance scales as well as verbal scales. There were also the Wechsler Intelligence Scale for Children (ages 6 to 16 years 11 months) (WISC, 1947, latest revision WISC IV, 2004) and the Wechsler Preschool and Primary Scale of Intelligence

(ages 2 years 6 months to 7 years 3 months) (WPPSI, 1967). The Wechsler Individual Achievement Test (WIAT, 1992, currently WIAT-III) tests academic achievement.

Wechsler Intelligence Scale for Children – IV (Wechsler, D., 2003)

This is an individually administered clinical instrument for assessing cognitive ability in children aged 6 years to 16 years 11 months. The time taken is 1½ to 2 hours. The scoring of results and report takes a qualified psychologist 4 to 8 hours to complete.

Characteristics:

The WISC-IV allows the psychologist to identify learning patterns. It has four main components, referred to as Indexes. These are called the Verbal Comprehension Index, the Perceptual Reasoning Index, the Working Memory Index, and the Processing Speed Index.

1. The Verbal Comprehension Score emphasises crystallised intelligence and knowledge application.
2. The Perceptual Reasoning Scores relates to fluid reasoning/intelligence or the ability to learn new information.
3. The Working Memory Score assesses auditory short-term memory and retrieval.
4. The Processing Speed Index assesses mental quickness and task performance with focussed concentration and attention.

Uses include:

- Early identification of reading and learning issues;
- Identifying learning disabilities;
- Understanding an individual's learning profile;

- Identification of gifted children;
- Helping schools develop learning plans for individual students; and
- Determining the learning processes: the strengths and weaknesses of a test-taker and their impact on academic performance.

Psychometrics:

- Test-retest reliability is 0.98
- Various measures of validity have been obtained

The WISC-IV has a low ceiling, making it difficult to locate exceptionally and profoundly gifted children. To ameliorate this, Pearson released the Extended Norms for WISC-IV (Zhu, J., Cayton, T., Weiss, L., and Gabel, A., 2008), allowing scaled scores to rise significantly, and FSIQs of 210 become possible. Scores this high are extremely rare, and according to predictions from the bell curve, only 1 per 20 million of children of a given age would obtain a FSIQ score of 180 or higher (*op.cit.*). Extended norms are useful only when children score at the ceiling in two or more subtests in the WISC-IV.

Wechsler Individual Achievement Test (WIAT-III)

Developed by Wechsler and first published in the UK in 1992, this assesses academic achievement by children, adolescents, college students, and adults from ages 4 to 85. The WIAT-III U.S. edition was published in 2009 for ages 4 to 50 yrs 11 months.

Characteristics:

- Useful for diagnosis, eligibility, placement, and decisions regarding academic interventions, in combination with behavioural observation and history.

- Four basic scales: Reading, Mathematics, Writing, and Oral Language, with 9 subtest scores within these scales.
- Takes 45 to 90 minutes to administer, depending on the age of the subject.
- Mean score of 100 and standard deviation of 15; and scores range between 40 and 160.
- WIAT-III U.S. was standardised on 3,000 subjects between 4 years and 19 years 11 months.

Psychometric Properties:

- Internal consistency ranges from 0.80 to 0.98
- Reliability ranges from 0.85 to 0.98

Wechsler Adult Intelligence Scale (WAIS-IV)

Originally developed by Wechsler in 1955, this test is now in version IV, released in 2008.

Characteristics:

- Designed for ages 16 years to 90 years 11 months.
- The score returned is the Full Scale IQ (FSIQ), with four scales: the Verbal Comprehension Scale, the Perceptual Reasoning Scale, the Working Memory Scale, and the Processing Speed Scale. Each scale has core subtests (for a total of 10 core subtests) and supplemental subtests.
- Normative sample is 2200, with the U.S. national sample stratified for gender, education level, ethnicity, and region.
- The test has been used to assess intellectual disability of mild to moderate severity, borderline intellectual functioning, gifted intellectual functioning, autism, Asperger's syndrome, reading disabilities, mathematics disabilities, ADHD, dementia, Alzheimer's

disorder, mild cognitive impairment, etc.

Psychometrics:

- WAIS-IV has been put through several studies for validity with similar tests
- WAIS-IV reliability scores vary from 0.88 (Processing Speed) to 0.97 (Full Scale)

Studies conducted with the WAIS-IV show that two of the four indexes, the Verbal Comprehension Index and the Perceptual Reasoning Index, provide the best measures of giftedness (Silverman, L .K., Gilman, B., and Falk, R. E., 2004). Therefore administering just these scales (with their six subtests) is adequate to identify giftedness.

Gifted Rating Scales (GRS)

Gifted Rating Scales by Pfeiffer and Jarosewich (2003) are a set of evaluations for giftedness that are easier to administer and less expensive than traditional large-scale tests, and are designed to be administered by laypeople rather than by professionals. The GRS is currently in its third revision (*op.cit.*).

Characteristics:

- Gifted Rating Scales Preschool/Kindergarten Form (GRS-P) evaluates preschool/ kindergarten children in five areas: intellectual ability, academic ability, artistic talent, creative ability, and motivation.
- Gifted Rating Scales School Form (GRS-S) evaluates students of grades 1 to 8 in six fields (the five above, plus leadership ability).
- The standardisation sample matches the U.S. census data in terms of race/ethnicity, parent education level, and regional representation; and reflects a multi-ability conceptualisation of giftedness (Pfeiffer, S.

I., and Jarosewich, T., 2003).

- Designed for screening giftedness, and as a rating scale to be used along with IQ tests, auditions, portfolio samples, and nonverbal tests as apart of a full diagnostic battery.
- The GRS was co-linked during standardisation with the standardisation of the Wechsler Intelligence Scale for Children, 4th edition (WISC-IV) and the Wechsler Preschool and Primary Scale of Intelligence, 3rd edition (WPPSI-III; Pfeiffer and Jarosewich, 2003).

Psychometrics:

The following data are from the GRS test manual, as quoted in Pfeiffer, Petscher and Kumtepe (2008).

- Based on the standardisation sample, GRS-S coefficient alpha reliabilities ranged from .97 to .99 and standard error of measurements ranged from 1.0 to 1.73 across the six scales and eight age ranges, 6:0-13:11 years.
- Test-retest coefficients based on a sample of 160 students and a median retest interval of 7 days ranged from 0.83 on the Artistic Scale (at age range 8:00-9:11) to 0.97 on the Academic Ability and Motivation scales (at age range 12:0-13:11).
- Inter-rater reliability, based on a sample of 152 students rated by two teachers, ranged from 0.64 for Artistic Talent (at age range 10:0-13:11) to 0.79 for Academic Ability (at age range 6:0-9:11).

The GRS assessment is somewhat controversial on account of dependency on teachers' ratings; however the tests have undergone validation and are seen as a promising first-stage screening test for giftedness (Pfeiffer, S. I., and Petscher, Y., 2008).

Learning Propensity Assessment Device (LPAD)

The Learning Propensity Assessment Device was developed by Feuerstein and colleagues (Feuerstein, 1979; Feuerstein, R., Falik, L. H., and Feuerstein, R. S., 1998; Feuerstein, R., Feuerstein, R. S., Falik, L. H., and Rand, Y., 2002). Based on Feuerstein's Structural Cognitive Modifiability theory (cf. p.70), it is a form of Dynamic Assessment.(cf.p.69). It is thus designed to measure fluid rather than crystallised intelligence.

Characteristics:

- It tests a child's ability to make cognitive changes when faced with a challenge.
- It stimulates cognitive changes in the learner and evaluates learning propensity and cognitive modifiability.
- The test report is a descriptive profile of modifiability that includes the area and degree of cognitive change.
- The LPAD battery consists of 15 instruments aimed at assessing cognitive processes related to perception, attention, memory, problem-solving, and logical reasoning.
- The LPAD-B, a basic form, has 16 instruments in 4 areas: Perceptual-Motor Development, Memory, Concept Development, and Abstract Thinking.
- The LPAD assessment can be carried out both individually and in a group format (10-15 students per group) (Silverman L. K., Personality and Learning Styles of Gifted Children, 1998).
- The LPAD can be used for assessing children with severe developmental, behavioural, and learning problems, and for developing remediation programs for them. The LPAD in a group format can be used for selecting

adult learners for professional training or pre-academic courses.

- The LPAD is also used for identifying gifted children, and is important for the identification of gifted but disadvantaged children, creative and divergent thinkers, and twice exceptional gifted children.

Age Ranges:

- The LPAD-Basic is a basic form of the LPAD that can be used for children ages 3 to 7 years (or severely low-functioning older learners).
- The LPAD-Standard can be used with older children and adults.

Psychometrics:

There have been criticisms of the validity of LPAD (Glutting, J., and McDermott, F. A., 1990). There is evidence of validity for dynamic assessment itself (Guthke, J., Beckman, J. F., and Dobat, H., 1997).

Cognitive Abilities Test (CogAT, CogAT-6)

A group-administered test, this was originally designed by Thorndike and Hagen (1971; 1984; 1992) and developed further by Lohman and Hagen as CogAT-6 (2001a; 2001b; 2002), in order to measure students' reasoning abilities and problem-solving using verbal, quantitative, and non-verbal (spatial) symbols, which are the measures most predictive of academic success at school. When used in combination with the Iowa Tests of Basic Skills (Hoover, H. D., Dunbar, S. B., and Frisbie, D. A., 2001, 2003, 2008, 2011), it also provides predicted achievement scores.

Characteristics:

- Designed to help teachers expand

educational opportunities for all students, not just the special-needs group.

- Administered from Primary level K (30 minutes per session), Primary levels 1, 2 (50 minutes per session), and Multilevel Edition A to H (60 minutes per session).
- Each level has three batteries: verbal, quantitative, and non-verbal. The test can also be administered in part.
- Ability Profile System permits understanding of how the different participating students learn.

Psychometrics:

- CogAT consistently shows gender differences at the upper and lower ends of the scale, in various subtests (Lohman, D. F., and Lakin, J., 2009). This is a common finding across tests, with more boys than girls showing up at both the upper and lower extremes of the score range.
- Has strong psychometric properties with reliability and validity estimated from the 0.70s to the 0.90s (Goldstein and Hersen, 2000).

Intelligence Tests based on brain function:

CAS (Cognitive Assessment System

– Naglieri and Das, based on the theories of Soviet neuropsychologist A. R. Luria). CAS does not correlate with traditional tests such as the WISC.

K-ABC (Kaufman Assessment Battery for Children) (early 1980s, also based on Luria's work)

Woodcock-Johnson Psychoeducational Battery (WJ-III)

These tests are based on the intellectual

factors, both broad and narrow, from the Cattell-Horn-Carroll Theory (see earlier section on *Models for Intelligence*; also see Appendix 8 for the hypothesised model of the WJ-III based on these factors). The WJ-III is the most recent revision of a test originally published in 1977. It consists of two co-normed batteries, namely the WJ-III Test of Cognitive Abilities or WJ-III COG (Woodcock, R. W., McGrew, K. S., and Mather, N., 2001a) and the WJ-III Test of Achievement or WJ-III ACH (Woodcock, R. W., McGrew, K. S., and Mather, N., 2001b). When used together, the two batteries provide a comprehensive framework for evaluating and exploring the relationships and interactions between cognitive abilities and academic performance for individuals between 2 and 90+ years of age (Mather, N., and Wendling, B. J., 2010).

Although abilities at all three strata of the CHC Theory are measured (*cf.* section on *Models for Intelligence*, entry on *CHC Theory*), the primary focus is on the measurement of the broad CHC factors at stratum II. The stratum III *g* score is estimated from the first principal component of the scores for stratum II abilities (Lohman, 2003).

Characteristics: (Schrank, F. A., McGrew, K. S., and Woodcock, R. W., 2001)

- The WJ-III COG's most commonly administered subtests (Standard Battery) consist of verbal comprehension, visual-auditory learning, spatial relations, sound blending, concept formation, visual matching, numbers reversed, incomplete words, visual-auditory memory – delayed, and auditory working memory. There are 20 subtests in all.
- The WJ-III ACH includes letter-word identification, reading fluency, calculation,

math fluency, spelling, writing fluency, passage comprehension, applied problems, writing samples, word attack, and quantitative concepts. This battery has 22 subtests in all. There are two parallel forms, A and B, divided into two batteries, Standard (tests 1 through 12, providing a broad set of scores) and Extended (10 tests providing more in-depth diagnostic information on specific strengths and weaknesses). The Standard Battery can be administered alone or in combination with the Extended Battery.

- WJ-III ACH is used to help assess students for learning disabilities or those in need of special services, and to identify learning variances between abilities and achievement.
- WJ-III produces General Intellectual Ability (GIA) scores in two forms, standard (GIA-Std) and extended (GIA-Ext), which are general intelligence (g) scores, being the first principal component based on principal component analyses, wherein optimal weights are used for the different subtests. (By contrast, the Wechsler scales weight all subtests equally) The weights for WJ-II are derived from the norms from the ‘technical age group’ relevant to the subject.

Psychometrics: (Schrank, F. A., McGrew, K. S., and Woodcock, R. W., 2001)

- WJ-III norms are based on data collected from a large sample representative of the United States, with 8,818 subjects, all of whom were administered tests from both the WJ-III COG and the WJ-III ACH. 1,143 preschoolers of age 2-5 years, 4,783 students from kindergarten to 12th grade and 1,165 undergraduate and graduate college

students were included. The adult sample contained 1,843 subjects. The abilities measured in WJ-II undergo the greatest changes during the school years, hence the greater size of this sample.

- The norming sample age ranges from 24 months to 90+ years.
- Details as to the distribution of race, profession and educational background are given in Schrank, F. A., McGrew, K. S., and Woodcock, R. W., 2001.
- Reliabilities have been calculated; of the 42 median test reliabilities reported, 38 are .80 or higher, of which 15 are .90 or higher. Cluster scores, based on combinations of two or more tests, are considered to be consistently even more reliable.
- Concurrent validity: WJ-III has shown correlations with full-scale/composite scores of WPPSI-R, WISC-III, and Stanford-Binet-IV at the level of 0.67 to 0.76 for its General Intellectual Ability (GIA-Std and GIA-Ext) scores.

Characteristics of Giftedness Scale

Earlier, this was the *Silverman/Waters Checklist for Identifying Gifted Children*, containing 16 items and copyrighted in 1984.

The current Characteristics of Giftedness Scale (Silverman, L. K., 2012) was originally developed in 1973 after 10 years of teaching/counselling experience with the gifted by Silverman et al. (1986), and it is tested to be culture- and gender-fair. This checklist for parents of gifted children serves to identify children who are later found to be gifted on the Stanford-Binet test, for example, and has been administered to parents of children from 2½ to 12½ years of age, where the children had IQs in the range 160 to 237. No difference has been

found between girls and boys in a test of 241 children of exceptional ability. Over 80% of this sample was reported to fit 20 of the current 25 characteristics.

1. Good problem-solving/reasoning abilities
2. Rapid learning ability
3. Extensive vocabulary
4. Excellent memory
5. Long attention span
6. Personal sensitivity
7. Compassion
8. Perfectionism
9. Intensity
10. Moral sensitivity
11. Unusual curiosity
12. Perseverant when interested
13. High degree of energy
14. Preference for older companions
15. Wide range of interests
16. Great sense of humor
17. Early or avid reading ability
18. Concerned with justice, fairness
19. At times, judgment seems mature for age
20. Keen powers of observation
21. Vivid imagination
22. High degree of creativity
23. Tends to question authority
24. Shows ability with numbers
25. Good at jigsaw puzzles

A student showing 75% or more of 25 characteristics is deemed to be gifted. When anecdotal evidence is obtained from parents, the accuracy of this test is enhanced.

Non-Verbal Tests:

(1) Draw a Person Test

Good enough (1926) developed what was at the time known as the Draw-a-Man Test,

based on the notion that a child's drawing is an indicator of his/her intellectual development, not just of visual-motor skills. It was later revised and extended by Harris (1963), and came to be called the Good enough-Harris Drawing Test/Draw-a-Person Test (DAP). In its current form, it is called the DAP:IQ Test (Reynolds, C. R., and Hickman, J. A., 2004). The test is administered by asking a child to draw a man, a woman, and himself/herself, all from a frontal view, with no further instructions given and no time limit specified. Thus the test is essentially non-verbal, with no time-pressure.

Characteristics (Sandoval, 2007):

- The test has been administered to children, adolescents, and adults, the prescribed age-range being 4 years 0 months to 89 years 11 months.
- Time taken is about 8 to 15 minutes for all three drawings.
- Maximum score is 49 points; the raw score is converted into an IQ/T-score/z-score/stanine/percentile rank.
- Administration requires a pencil, eraser, and drawing form.
- Suitable for group or individual administration.
- Examiners require background and training, though the test is quick to administer and easy to score.
- It is claimed to provide a lower bound to cognitive abilities by the authors, but is not a comprehensive evaluation.
- It is unsuitable for use with children with visual/motor impairments.
- Scoring is by the test administrator and takes account of 14 different aspects including body parts, clothing, details, and proportion. Each drawing has 64 scoring

items, with the scores for each added up to a total score. The scoring is unrelated to the drawing talent of the child.

Psychometrics (Source: Review by Mental Measurements Yearbook/Test Reviews Online (Sandoval, 2007)):

- Norms for the test were based on 2,295 individuals matched to U.S. Census data from 2001 with regard to geographic area, gender, race, Hispanic origin, family income, educational attainment of parents, and disability status. Much of the data are from Texas.
- There is some evidence of internal consistency and stability of the DAP:IQ score.
- Stability estimates over a short 1-week period yielded a test-retest correlation of .84 ($n = 45$).
- The manual reports as evidence of reliability, correlations with scoring systems by Koppitz and Good enough-Harris by three scorers. These correlations are .85, .86, and .86. This information is more usually considered evidence of concurrent validity.
- Inter-scorer reliability was estimated at .95 for protocols selected from across the sample, and at .91 for the more difficult-to-score age group of 6 to 11.
- Fairness issues have been addressed by the test developers by examining differential item functioning on the test by ethnicity and gender. The results showed moderate to large effect sizes for four items on gender, although the directions of the differences counterbalanced each other. No moderate or large effect sizes surfaced in the race and ethnic comparisons.
- Correlations with school achievement are

range from the mid .40s to the low 0.50s (Oakland, T., and Dowling, L., 1983).

A potential pitfall of this test is that children from middle-class backgrounds tend to score more than those from lower-income backgrounds, apparently for the reason that the latter have fewer opportunities to draw than the former. The Draw-A-Person Test is also used as a projective test for diagnosis of psychological state, although regarded as having low validity with this use.

(2) Raven's Progressive Matrices

This is the major non-verbal test currently in use. It is widely used as an intelligence test, and also for research. Originally, it was developed by Raven as his Master's thesis (Raven J. C., 1936), though published two year later, and is designed to measure Spearman's g for research into the genetic and environmental origins of cognitive ability. Spearman considered the Standard Progressive Matrices (see below) to be the best measure of g . Raven's Progressive Matrices test is currently under the trademark of Pearson, Inc. and costs \$24 per online administration.

The Progressive Matrices tests the ability to (a) think clearly to make sense of complexity, and (b) to store and reproduce information.

Characteristics:

- Non-verbal test relying on visually presented matter independent of language or formal schooling. Instructions are simple and given orally.
- Measures a person's ability to form perceptual relations and to reason by analogy.
- Items are progressively more difficult, requiring greater cognitive capacity to encode and analyse.
- Scores are in terms of percentile ranks.

- Data for normative groups exist for British children (6-16 years), Irish children (6-12 years), military and civilian subjects (20-65 years), and also from Canada, Germany, and the U.S..

There are three different tests for different age groups:

- Coloured Progressed Matrices (younger children and special groups)
- Standard Progressive Matrices (average 6 to 80 year olds): 47 minutes for 28 matrices
- Advanced Progressive Matrices (above average adolescents and adults): 42 minutes for 23 matrices

In terms of its psychometrics, the Raven's Progressive Matrices:

- Has good test-retest reliability between .70 and .90 (however, for low score ranges, the test-retest reliability is lower);
- Has good internal consistency coefficients – mostly in the .80s and .90s;
- correlates with verbal and performance tests at between .40 and .75;
- Has fair concurrent validity in studies with mentally retarded groups;
- Has lower predictive validity than verbal intelligence tests for academic criteria.

(3) Cattell's Culture Free (or Fair) Intelligence Test (CFIT/ CFIT III):

The psychologist R. B. Cattell (1940) and coworkers (Cattell, R. B., Feingold, S., and Sarason, S., 1941) developed a nonverbal intelligence test that attempted to separate the genetic and environmental factors involved in intelligence. Cattell regarded general intelligence (*g*) as consisting of *crystallised*

(*gc*) and *fluid* intelligences (*gf*). The latter intelligence is mobilised when dealing with entirely new (unfamiliar) situations, whereas the former is a set of habitual responses to familiar circumstances. The concepts of crystallised and fluid intelligences were further developed by Horn (1965) and Horn and Cattell (1966; 1967). The Cattell Culture Free Test (Cattell R. B., 1949) has relatively high loading on the fluid intelligence and general intelligence factors rather than on the achievement factor, consistent with its being a measure of fluid rather than crystallised intelligence (Cattell, R. B., Krug, S.E., and Barton, K., 1973).

Characteristics:

- The test in its latest revision consists of three scales, Scale 1 for ages 4 to 8 years/mental retardation; Scale 2 for ages 8 to 13 years, and Scale 3 for high school students and superior adults. Scales 2 and 3 have forms A and B each, which can be administered individually (short intelligence test) or in combination with the other form (full scale intelligence test).
- Each form has four subtests: series, classifications, matrices, and conditions. Practice questions precede the subtests.
- The working time is very limited, about 12½ minutes in all. Administration time is closer to 30 minutes.

Criticisms:

- Bright adults with left-right reversal difficulties are said to obtain low scores on this test (Motta, R. W., and Joseph, J. M., 1999).
- The CFIT has lengthy instructions that cause children to lose attention and become bored.

Psychometrics (from Motta and Joseph 1999):

- Internal consistency coefficients averaged across samples are: Scale 1: .91, Scale 2: .82, and Scale 3: .85.
- Test-retest reliabilities are: Scale 1: .80, Scale 2: .84 and Scale 3: .82
- CFIT correlates with other intelligence tests in the mid-.70 range.
- CFIT correlates at .20 to .50 with scholastic achievement test scores (reaffirming that the CFIT measures g).

(4) The Naglieri Nonverbal Ability Test (NNAT/NNAT2) (Naglieri (1997))

Characteristics:

- Can be administered either individually or in a group setting.
- Measures nonverbal ability and problem-solving.
- Assesses ability without requiring the student to read, speak, or write words or numbers – students record their answers by circling their choice in the examination booklet.
- There are four clusters of items: pattern completion, reasoning by analogy, serial reasoning, and spatial visualisation.

Psychometrics:

- Standardised in 1995 and 1996 with over 89,000 students from a wide variety of socioeconomic and ethnic groups, urban/rural, and geographical locations.
- Internal consistency grade-based reliability coefficients range from .83 to .93, and age-based reliabilities from .81 to .88.

Are Nonverbal Tests Sufficient to Test Aptitude?

An important issue regarding the use of nonverbal tests is their use to level the field; (e.g. a test administered in English for English Language Learning (ELL) students) this was addressed in a paper by Lohman, Korb, and Lakin (2008). A mixed group of 1,198 elementary schoolchildren of composition 40% ELL, 60% non-ELL (English proficient), students was given the Raven's Progressive Matrices (Raven), the Naglieri Nonverbal Ability Test (NNAT), and the Cognitive Abilities Test Form 6 (CogAT-6). The students were also administered the Terra Nova achievement test (CTB/McGraw-Hill, 2002). The ELL children scored 0.5 to 0.67 standard deviations lower than the non-ELL children on all three nonverbal tests, and none of the nonverbal tests were found to predict achievement for the ELL students very well. Part of the problem was attributed to outdated norms or improperly calculated normative scores (the nonverbal tests had been normed on different populations). Another factor is that the development of children should be considered exceptional when exposed to opportunities in their areas of specific interest ideally when compared *only* with a population of students exposed to roughly similar opportunities (Lohman, D. F., and Lakin, J., 2007). (This echoes Gagné's concept of talent.) Thus nonverbal tests alone do not suffice to identify gifted children. However, when combined with measures of quantitative reasoning and spatial ability, nonverbal tests were found to be particularly effective in predicting students who would excel in engineering, mathematics, and

related fields (Shea, D. L., Lubinski, D., and Benbow, C. P., 2001). It has also been found that, combining more than one nonverbal test administered to all students in a mixed composition class (White, Hispanic, and other) with no teacher identification involved – resulted in the identification as gifted of larger (but still not equal) proportions of linguistically and culturally disadvantaged children (Lewis, 2001). The nonverbal tests combined in this study were Cattell’s Culture Fair Intelligence Test, Naglieri Nonverbal Ability Test, and Raven’s Standard Progressive Matrices; each test had its advantages and disadvantages, working better with one population or another.

The cultural biases inherent in any intelligence test are difficult to eliminate. There may be considerable cultural loading even on nonverbal tests, as observed by Anastasi and Urbina (1997), who commented that nonverbal spatial-perceptual tests frequently require relatively abstract thinking processes and analytic cognitive styles characteristic of middle-class Western cultures. Further, they commented, ‘every test tends to favor persons from the culture in which it was developed’ (*op. cit.*, p. 342).

Infant Intelligence Tests

Certain experimental measures of infant attention and memory successfully predict intelligence test scores later in development. Habituation-based measures of infants (age 3-12 months), in which infants are shown visual patterns and the time spent looking at each is recorded, show significant correlations with longitudinal measures of intelligence (Fagan and Singer (1983), Bornstein and Sigman (1986), Colombo (1993), McCall and Carriger (1993)). Studies also showed some

correlations with the children’s test results as 8 to 11 year-olds (Rose and Feldman (1995)). In these habituation-based measures, infants, shown a pattern repeatedly, become less and less interested as they become habituated to a stimulus, and thus spend progressively less time on each successive trial looking at the stimulus. This is taken as an indication of the infant’s information-processing capability. For details of the stability of intelligence test scores over a child’s development, see Neisser et al. (1996). Sigman et al. (1997) reviewed several reasons for the connection between infant habituation scores and intelligence tests in later life. In a long project involving 93 18-year olds administered intelligence tests after being studied at various points in infancy and early childhood, Sigman et al. (*op.cit.*) concluded that a combination of certain characteristics of the infants and their caregiving environments is involved in this correlation. If the rearing environment lacked certain specific qualities, the correlation with infant test scores disappeared.

Listed below are some tests of infant intelligence in current use:

Cattell Infant Intelligence Scale(CIIS)

Developed by P Cattell (1940), this test was designed for infants using household objects, and focusing on mental rather than motor development. The Cattell test borrowed heavily from items on the Gessell Development Schedules, and was developed as a downward extension of the Stanford-Binet Intelligence Scale, Form L (for discussions of this test see for example, Aiken (1996), Kaplan and Sacuzzo (2005)). However, the CIIS at 6 months of age has been reported to be a poor predictor of later intelligence both according to the Stanford

Binet test as well as the CIIS at 12, 18, and 24 months (Cavanaugh, M. C., Cohen, I., Dunphy, D., Ringwell, E. A., and Goldberg, I., 1957).

Characteristics:

- Designed for infants age 2-30 months
- Takes 20-30 minutes to administer
- Scoring is for infants age 3 months and above
- The test contains 95 items (five for each month between 2-12 months of age, five for every second month between 13-24 months of age, ten for the period between 25-30 months of age, and some alternative items).

Psychometrics:

- Standardisation is based on 2,346 examinations made at ages 3, 6, 9, 18, 24, and 30 months on 274 children enrolled at the Harvard School of Public Health. The sample did not include minorities, and was not selected to be representative of any particular ethnic, socioeconomic, or geographical mix of backgrounds.
- Low scores have higher predictive validity than high scores, particularly when the child comes from an impoverished environment or has an unfavorable medical history.

Bayley Scales of Infant and Toddler Development (Bayley-III):

Authored by Bayley (2006a), this series of tests was developed over decades to assess all facets of an infant’s or toddler’s development. Bayley-III is a revision of the Bayley Scales of Infant Development-Second Edition (BSID-II; Bayley (1993)), developed after many years’ work and initially published in 1969 (Bayley, 1969).

Characteristics:

- Takes 30 to 90 minutes to administer, depending on child’s age.
- Not designed as a tool for determining intellectual ability; the developmental age equivalents cannot be used to calculate and IQ or developmental quotient (DQ).
- Ages 1-42 months; however, the test has been used to assess individuals with severe developmental delay even if outside the normal age range of the test.
- Language: English
- Five scales make up the core battery: three to be administered with child interaction (cognitive – 91 items that measure sensorimotor development, exploration and manipulation, object relatedness, concept formation, memory, and other aspects of cognitive processing; motor – fine (66 items), and gross (72 items); language – receptive communication (49 items), and expressive communication (48 items); and two conducted with parent questionnaires (social-emotional (35 items) and adaptive behavior (241 items in 10 skill areas). (BSID-II, by comparison, had only a Mental Scale and a Motor Scale.)
- The Scales identify strengths, competencies, and weaknesses in infants and toddlers.

Psychometrics (from the Technical Manual for Bayley-III (Bayley, 2006b), quoted in Robertson 2010):

- Standardization is based on a representative sample of U.S. children ages 1-42 months. The sample consisted of 1,700 healthy children in 17 age-groups, each with 50 male and 50 female children, stratified by parent education, race/ethnicity, and geographic region.

- Average internal consistency reliabilities for the 17 age groups were .91 for Cognitive Scale, .93 for Language Scale, and .92 for Motor Scale. For the Social-Emotional Scale, the average internal consistency for the 8 standardization age-groups was .90. For the Adaptive Behavior Scale composite score, the value for the 10 standardization age-groups was 0.97.
- Extensive validity data are reported in the Technical Manual for Bayley-III.

IQ Testing in India

Swaroop Rani, Priyadarsini, and Bhaskara Rao (2004) described the situation in India with respect to Intelligence testing in some detail (*op. cit.*, p.111 *et seq.*), with the comment that in the main, psychological testing in India consists of adaptations of foreign tests, with very little original contribution.

Adaptations of the Stanford-Binet Test (Hindustani Binet/Binet Kamath Scale):

The Stanford-Binet test was adapted by Rice for India in 1922 as the Hindustani Binet Test (Rice, 1929), and standardized for children between 5 and 16 years. It was standardized in Marathi and Kannada by Kamath in 1940 for age ranges 3 years to adulthood, and is known as the Binet Kamath Scale (Kamath, 1967). Another adaptation, in Hindi, is available, published from Allahabad (Kulshreshta, 1960). In these tests, the form and classification of items have been retained, although individual items have been adapted to Indian populations. The norms are based on a large sample of both literate and illiterate children. The Stanford-Binet test has a high verbal content; thus the applicability of its adaptation is limited in India by the availability

of translations. The validity of the adaptation beyond age 12 has been questioned (quoted in Prabhu and Raguram (1984)).

Adaptation of the Wechsler Intelligence Scale for Children (MISIC in India):

The Wechsler Intelligence Scale for Children (WISC) has also been adapted for the Indian context (Malin, 1977). Once again, it is a test with high verbal content. It is known as Malin's Intelligence Scale for Indian Children (MISIC).

Bhatia's Performance Battery of Intelligence:

A measurement of intelligence which is mainly performance-based and consists of a battery of 5 tests has been developed by Bhatia (1955), and is useful for measuring intelligence of both literate and illiterate children over the age of 11 years. The battery consists of (i) Koh's Block Design Test, (ii) Alexander's Pass-Along Test, (iii) Pattern Drawing Test, (iv) Immediate Memory Test for Digits, (with a nonverbal alternative), and (v) Picture Construction Test. The first two are borrowed from other sources, and the latter three are developed by Bhatia (Mangal, 2007).

Adaptation of Seguin Form Board Test:

The Seguin Form Board Test was developed by Eduard Seguin in 1866. The Form Board consists of ten geometrical shapes cut out from a board, which are stacked in a standard arrangement; the subject must insert the cutouts in their appropriate places on the board, as quickly as possible. This test assesses visual discrimination and hand-eye coordination, and

is a performance-based test administered to young children. It has been normed with Indian children (Bharath Raj (1971), Pershad, Verma, and Randhawa (1979), quoted in Vyas and Ahuja (1999)).

Central Institute of Education's Scale of Intelligence:

The Central Institute of Education has developed a *Scale of Intelligence* for children of ages 3 years to 11 years. There is a Non-Verbal Group Test of Intelligence originally prepared by J.W. Jenkins and subsequently adapted for Hindi-medium schools, as described in Mangal (2007).

Adaptations of the Draw-A-Person Test:

The *Draw-a-Person* test by Good enough (1926) has been adapted for use by Indian children by various researchers, and can be administered to children ages 4 to 10 years. The disadvantage of this test is that it takes expertise to score the test objectively (Prabhu, G. G., and Raguram, A., 1984). Of the Indian revisions of Goodenough's test, Phatak's work is the best-known and most widely-used today. Phatak's original work is to be found in Phatak (1958); a revision with extended scale is to be found in Phatak (1984), and a critical review in Ravindran (1988).

The Indian Child Intelligence Test (ICIT, 2004), adapted from RAKIT:

This is an adaptation of the RAKIT (Revised Amsterdam Kinder Intelligence Test) by the Institute of Psychology, Jnana Prabodhini, Pune, in collaboration with the Tata Institute of Social Sciences, Mumbai.

Details of this adaptation listed below are

from Jnana Prabodhini's Institute of Psychology website as given in the reference for ICIT above.

Characteristics:

- An individual test
- Age range 4 to 12 years
- Norms cover 6 to 12 years, sample consisted of 50 boys, 50 girls
- Time taken: 75 to 90 minutes, but can be divided into two sessions
- Languages: Hindi, Marathi, Gujarati, Tamil, and English
- Scoring is via self-scoring answer-sheets
- Consists of 9 subtests: some verbal, some non-verbal, and some performance-based
- Abilities tested: Perception of form, concept formation, memory span, associative memory span, learning and remembering, spatial visualisation, visual-motor coordination
- Designed to be culture-fair
- Applications: assessment of mental and motor development, diagnostic counselling, studies of child development, diagnosis of learning disabilities and cognitive disorders, study of underachievers and slow learners.

Psychometrics:

- Retest reliability is stated to be 'very high'
- Cross-Cultural testing (Bleichrodt, N., Hochsbergen, R. A. C., and Khire, U., 1999), with RAKIT and ICIT on their respective populations (1007 Dutch children and 622 Indian children) showed that the coefficients for internal consistency and stability were between .84 and .94
- Results of a factor analysis show that both tests have clear psychometric equivalence
- ICIT and RAKIT were found to be good predictors of reading ability.

A more complete history of adaptations of various intelligence tests to Indian circumstances is to be found in Swaroopa Rani, Priyadarsaini, and Bhaskara Rao (2004). A review of the methods used in intelligence testing, with particular reference to Indian adaptations, is available in Mangal (2007), as also in Sharma and Sharma (2006). Details of certain Indian adaptations are to be found in Pershad and Verma (1988). Jindal (1988) lists and briefly describes numerous Indian intelligence tests and adaptations, including regional language adaptations, with some psychometric data for the tests relating their standardisation samples, reliability, and validity.

Catalogues from Indian companies specialising in psychometric/psychological test materials and publications:

- Bangalore-based Psychotronics (Psychotronics: Catalogue: Intelligence, 2007): producers, procurers, and distributors of psychological test instruments. Includes Indian tests.
- National Psychological Corporation India, based at Agra (National Psychological Corporation, 2011). Catalogue includes many Indian tests.
- Prasad Psycho Corporation, with centres over the country in Delhi, Varanasi, Hyderabad, Kolkata, Mumbai, Chennai, and Kochi (Prasad Psycho Corporation, 2012). The currently available listing does not include Indian tests.

Pitfalls in the Administration and Interpretation of IQ Tests

(Prabhu, G. G., and Raguram, A., 1984)

IQ tests need to be administered by trained personnel, who are trained in administration, scoring, and interpretation procedures (more so

for individual tests), and who are aware of the factors affecting a child's performance:

- A child who is hyperactive, uncooperative, or restless may have difficulty in sitting through the test (intelligence tests generally take from 1 – 1½ hours, and some involve two or three sessions), with misleading results
- If the test is not standardised for the population from which the child comes, the results cannot be correctly interpreted.
- A test should not be administered to a child outside its age range
- It should be ensured that the child understands the instructions, whether verbal or nonverbal
- Each test has a standard prescribed procedure for administration which must be followed. Departure from the instruction or administration procedure damage the viability of the test results
- All psychometric tests must be evaluated for validity and reliability
- The administrator must establish rapport with test-takers to ensure interest and to ensure that the test-taker is in a fit condition to take the test.

In particular, the identification of exceptionality depends upon the quality and recentness of the test norms, the normality of the score distributions, as well as the reliability and validity of the test scores themselves (Lohman, D. F., Korb, K. A., and Lakin, J. M., 2008).

Giftedness in the Very Young Child

Traditionally, very young gifted children have not received as much attention as older gifted children from educators, policymakers,

and researchers. This is due to deeply-entrenched beliefs and practices in early childhood education, where (a) there is resistance to the idea that such children need special services; (b) educators place more emphasis on socialization than curricular content; and (c) there is a reluctance to introduce practices that may be seen as 'pressure' at this stage; and (d) giftedness is more difficult to identify in the very young. Thus, most gifted education programmes commence at ages 8 or 9, at which age identification is believed to be more valid as well as easier (because verbal measures can be used), and when the needs of high-ability students begin to be acknowledged (Cohen, L. M., and Jipson, J. A., 1998).

However, several researchers have made a fervent plea for early identification and educational intervention (Cohen, L. M., and Jipson, J. A., 1998; Smutny, J. F., Walker, S. Y., and Mechstroth, E. A., 1997). The period from birth to 5 years is crucial for the development of a child's intellect, self-esteem, and social functioning (Shore, 1996). However, in this phase, children often attend daycare or early childhood education facilities where educators are untrained in gifted identification/education. Serving the needs of the young gifted children is thus complicated.

There is evidence to show that the very young gifted begin with an extraordinary capacity for reflection and creative thinking, energy, and enthusiasm, which may give way to boredom and frustration in classroom situations where their intellectual needs are underserved. They may learn to ignore their own talents and interests as unworthy of attention, and accept the norms of conformity and neatness at the expense of originality of thought. Some, in fact, develop behaviour problems, which mask their

high abilities from the teacher.

It is now recognised that early intervention not only facilitates the development of gifted children, but also helps prevent the secondary problems that may result from non-identification (Butler-Por, 1993; Stile, S., and Hudson, B., 1993; Stile, S., Kitano, M., Kelley, P. and LeCrone, J., 1993).

Two broad concerns emerge in early intervention:

1. How is giftedness manifested in the very young?
2. What special activities/accommodations need to be provided for a gifted preschool-age child in preschool or in childcare?

How is Giftedness Manifested in the Very Young?

There are numerous definitions of giftedness (Sternberg, R. J. and Davidson, J. E., 2005). Some emphasise the child's current level of achievement (Renzulli J. S., 1978); whereas for others, the key is the child's *potential* to perform at a level significantly beyond age-peers (Gagné F. Y., 2003; Harrison, Giftedness in Early Childhood, 3rd Ed., 2003; Tannenbaum A. J., 1997). Gagné (2003) defined gifteds as spontaneous untrained abilities that place the individual in the top 10% of same-age peers in a given domain. Formal or informal learning provides a means of transforming this potential into talents or systematically trained abilities (achievement). According to Gagné, traits such as motivation and temperament, as well as environment, play an important role in the development of talent.

Thus, certain traits should be evident in potentially gifted young children. There now exists extensive literature on the identification of such children (Robinson, 2008). In terms

of *cognitive behaviours*, a fast pace of learning, exceptional memory, extended concentration span, ability to understand complex concepts, heightened observational ability, curiosity, and an advanced sense of humour should be apparent (Freeman, 1985; Lewis, M., and Michalson, L., 1985; White, 1985; Harrison, 2003; Sankar-DeLeeuw, 1997). In fact, Silverman (1994) has suggested that in addition, certain *affective traits* such as heightened sensitivity, early concern with moral issues, empathy, perfectionism, social maturity, and aesthetic appreciation are evident in such children.

Interventions for Gifted Preschool Children

Some strategies for early gifted intervention have been suggested by researchers in the field (Walsh, R. L., Hodge, K. A., Bowes, J. M., and Kemp, C. R., 2010; Barbour, 1992).

- Implement an *identification plan* based on multiple criteria, combining observation by trained early childhood professionals with information provided by parents, and using activities in a natural setting whereby the child can demonstrate strengths, interests, and abilities. A supplementary option of culturally-sensitive standardised testing should be available.
- A well-planned *curriculum* that is able to take advantage of the unique learning characteristics of gifted young children: with play, elements of accelerated content, and lateral enrichment, this should be flexible enough to incorporate the interests of individual children.
- Opportunities for *peer connections* through grouping of gifted children in preschool for some sessions each week, or permitting such children if in daycare to engage with older children/other gifted children.

- Parental and teacher/carer counselling to help create an environment where there is *acceptance and validation* of the gifts of a young child.

Should IQ Test Scores be Used to Identify Gifted Children?

There has been much debate in the literature over the continuing use of scores from intelligence tests in the identification of gifted children, in particular by the use of a single overall score cutoff (see, e.g. Rizza, McIntosh, and McCunn (2001) and references therein).

Common criticisms of the use of IQ tests for identifying the gifted:

- IQ tests provide limited information. Giftedness needs to be identified through scores on standardised measures of cognitive ability, academic achievement, classroom performance, teacher reports, and parent nomination (Borland, 1989; Davis, G. B., and Rimm, S. B., 1994; Renzulli, J., and Reis, S., 2007). However, the use of an intelligence test as a supplementary source of information has strong support (Kaufman, A. S., and Harrison, P. L., 1986). Qualitative information is valuable in the identification process and much can be gained through cognitive evaluation, where there is interaction between examiner and examinee with regard to the child's level of maturity, expression of thought, and use of strategy (Robinson, N. M., and Chamrad, D. L., 1986).
- The use of a single cutoff from a test score to identify gifted students may increase the possibility of placing students in programmes that do not match the students' strengths (Sparrow, S. S., and Gurland, S.

T., 1998). Tests that furnish multiple scores (in domains or in specific cognitive skills) help address this problem.

- Gifted learning-disabled students ('twice exceptional' children) may be under-selected by programmes using standardized tests with a single cutoff as the sole or major selector. In fact, twice exceptional are often not identified for special services at either end of their requirements (Baum, S. M., Owen, S. V., and Dixon, J., 1991; Brody, L. E., and Mills. C. J., 1997).
- The element of speed required for IQ tests (e.g., in WISC –III) was found to favour some groups or types of thinkers (reflective thinkers, for example), but when removed, the bias disappeared (Sacks, 1999; Fishkin, A. S., and Kampsnyder, J. J., 1996). The choice of speed vs. power tests should be considered.
- IQ testing is fraught with innate biases which are difficult to remove, thus favouring certain groups (Fishkin, A. S., Garlow, D., and Kampsnyder, J. J., 1994).
- IQ tests have been developed for various theoretical bases. There is a question of what they actually measure, with a popular view that the 'general factor' *g* (Spearman, 1927) contributes to correlations between pairs of tests – some being better correlated than others – so that the overall pattern of correlations can be attributed to individual differences in *g* as well as to differences in specific lower-order abilities sampled by the particular tests (Neisser et al. (1996)). However, there are a wide range of human abilities, many with intellectual components, which are outside the domain of standard psychometric tests (*op. cit.*).
- Intriguingly, recent research (Duckworth, A.

L., Quinn, P. D., Lynam, D. R., Loeber, R., and Stouthamer-Loeber, M., 2011) has shown an improvement in performance on IQ tests by an average of 0.64 standard deviations when steps were taken to increase test-takers' motivation (in the cited study, the motivation was a monetary incentive).

Potential Outcomes for Unidentified Gifted Children

In early childhood: It was noted by researchers that, despite several decades of gifted identification and intervention programmes in the United States, as few as 10% of gifted children by the 1970s were identified at kindergarten (Clark, 2002). It is pertinent to consider the possible consequences of this lack of early identification. The importance of the early years in setting patterns of learning has been widely written about in the literature (Bloom, 1964; Clark, 1992; Hunt, 1961; Piaget, 1952). Difficulty in establishing these learning patterns was noted as a potential source of underachievement in the gifted (Butler-Por, 1993; Clark, 1992; Karnes, M., and Johnson, L., 1991; Whitmore J. R., 1985). Porter (2004) opined that despite their advanced opinions and knowledge, gifted children do not know everything and therefore, like any other child, need assistance to extend their education. Yet in informal discussions with teachers, it was apparent that many believed that gifted children did not need additional educational support (Radue, 2009). This widespread belief among educators has been noted by other early education researchers as well.

Do young gifted children recognise their differentness from other children? Porter (1999) wrote that children as young as 2 years

of age know that they are different, and deserve an explanation that would prevent them from developing low self-esteem in a community that does not value their different abilities and learning styles.

Unidentified young gifted children, lacking recognition for their special abilities, are unlikely to reach their potential, may lack incentive to learn, and may fail to develop into confident and competent learners. The early years lay the foundation for cognitive development.

Asynchronous Development in Gifted Children: A common issue with gifted children is asynchronous development, i.e. non-uniform development through the intellectual, emotional, social, and physical domains. For example, a talented young child may be very intense in her own work, but may be socially tactless enough to disdain the work of her companions, resulting in social isolation (Radue, 2009). Intervention can improve the adjustment of such children.

Need for Social Acceptance: In the absence of identification and positive reinforcement, highly gifted children, finding themselves very different from their age mates, and often facing negative reactions in situations where conformity is valued, learn to mask their abilities in order to relieve their social problems (Gross M. , 1999; 1998). This hinders the further development of their unique abilities, and leads to a loss of self-esteem.

Problems with Self-Learning: Gifted children are inclined to learn things on their own, and are tempted to solve by novel methods problems that may be beyond their current abilities, introducing large amounts of error and frustration. Unassisted, such children may

down-regulate their ambitions, develop a fear of making mistakes, and reduce productive risk-taking behaviours (Freehill, 1961).

Loss of Altitude by High Fliers: A study of 120,000 students in the US.. who had in their early years shown signs of giftedness and high performance showed that almost half 'lost altitude' or dropped in performance in their middle school years, despite having been identified as gifted (Xiang, Y., Dahlin, M., Cronin, J., Theaker, R., and Durant, S., 2011). The reasons appeared to be tied up with their personal lives, and disproportionately affected girls. The children did however maintain above-average performance.

Behavioural problems and gifted children: When behavioural problems among the gifted are presented to health care professionals, psychiatrists, psychologists, and paediatricians, the children are apt to be diagnosed with Attention Deficit Hyperactivity Disorder, Oppositional Defiant Disorder, Obsessive Compulsive Disorder, and Mood Disorders such as Cyclothymic Disorder, Dysthymic Disorder, Depression, and Bipolar Disorder (Webb, J. T., Amend, E. R., Webb, N. E., Goerss, J., Beljan, P., and Olenchak, F. R., 2004). In other words, some of the social and emotional characteristics of gifted children may be interpreted as signs of problematic or disordered behaviour. This is due to the lack of awareness even among professionals of the characteristics of gifted children. Sometimes behavioral problems do indeed coexist with giftedness, and in such cases a dual diagnosis including giftedness is desirable so that the approach to treatment can be modified accordingly. Raising awareness of the characteristics of giftedness in both the public

and among professionals dealing with children would address the problem of misdiagnosis (Webb, J. T., and Kleine, P. A., 1993).

Gifted children are affected by a combination of *internal* and *situational* factors, which puts them at psychological risk, leading to interpersonal and psychological problems. Internal factors (Webb, 1993) have only recently been studied. The bulk of research in giftedness so far has concentrated on intellectual and academic aspects. High intellect and creativity are frequently accompanied by personality factors that impact the life of gifted children, particularly those with very high IQs (Silverman L. K., 1993; Webb, 1993; Winner, *The Origins and Ends of Giftedness*, 2000a). These factors are intellectual and emotional intensity, extreme sensitivity to emotions, sounds, touch, taste, etc., an intense drive to understand things leading to questioning, searching for consistency, and an intense idealism and concern with social and moral issues – which can lead to anxiety, depression, and a tendency to challenge others. These internal factors on their own might not create difficulties, but can lead to problems when the gifted child is placed in certain *situations*. Classrooms commonly induce boredom in bright children, leading to behavioural problems. Peer relations may also be difficult for gifted children (Webb, J. T., Meckstroth, E. A., and Tolan, S. S., 1982; Winner, *The Origins and Ends of Giftedness*, 2000a) because of asynchronous development, and because their often lags behind their intellect. Problems are compounded by the lack of understanding by parents, educators, and healthcare professionals. Appendix 5 details problems that may be associated with various facets of giftedness. It is believed that social

programming for the gifted can relieve these problems.

Twice-Exceptionals: A category among the gifted that is especially at risk without intervention is twice-exceptional children. Self-esteem issues are disproportionately high in children with learning disabilities or with notable asynchronous development, as they tend to judge themselves by what they cannot do rather than by what they can. This problem is relieved somewhat by sharing with them assessments of their abilities so that they develop more appropriate levels of self-esteem. It should be noted that the view regarding the unique emotional fragility as a consequence of the innate sensitivities of gifted children is not a universally held view in the research community. A large body of literature, starting with the longitudinal study of high-IQ individuals by Terman and colleagues (Terman, L. M., and Oden, M. H., 1947; 1959), has found gifted children to be superior not only intellectually, but also physically, emotionally, and socially (Cross, T. L., Adams, C., Dixon, F. and Holland, J., 2004; Cross, T. L., Cassady, J. C., Dixon, F. A., and Adams, C. M., 2008; Deary, I. J., Whalley, L. J., and Starr, J. M., 2009).

Factors Affecting the Implementation of Gifted Education Programmes

“Many feel...that the term ‘gifted’ implies ‘receiving something for nothing, and it is difficult to garner sympathy for someone so apparently blessed’...”

– R. Cigman (2006), quoting P.O. Rogne

In a classic article, Miraca Gross (1999)

who has worked with exceptionally gifted children, compared the fate of highly gifted children whose development or levels of achievement exceed that of their peers and who are cut down to size by a culture which requires them to conform to the pace of other children in their class, to that of the tallest poppies in a field, the heads of which are lopped off to bring all flowers to a uniform height. Perhaps, Gross remarked, they offend our egalitarian principles, and our sense of what is fit.

Radue (2009) pointed out that identifying gifted children is not a common practice in early childhood, and that the reasons teachers advance for this are lack of knowledge, uncertainty, and feelings of inadequacy. Special-needs children with language difficulties and behavioural problems are more likely to be identified for special education than gifted children. Special education is also likely to be given to gifted children only if they are twice exceptional (gifted-disabled). According to Radue (2009), the answer to the relative lack of attention to the gifted lies in improving the identification of gifted children in early childhood through teacher education, and by educating teachers about the behavioural problems and support requirements that accompany these gifts. It has been remarked (Subotnik, R. F., Olszewski-Kubilius, P., and Worrell, F. C., 2011) that attention to those who lag behind is a matter that calls for immediate attention, whereas the promotion of excellence is viewed as a long term goal, as an explanation for the willingness of educators to attend to special-needs children other than the gifted.

Rejskind's (2000) research revealed that students were 'intimidated into mediocrity' in classrooms. Many teachers have not been trained to identify and understand gifted

students' unusual ways of thinking and working, and this leads to the students being classified as behavioural problems. However, the solutions then sought are those appropriate to behaviour problems rather than giftedness.

In a recent monograph, Subotnik et al. (2011) reviewed the literature on giftedness from a psychological perspective and in considerable depth, and identified various reasons that educators, scholars and policymakers are 'leery' of gifted education.

Firstly, there is a pervasive belief that gifted children will make it on their own, regardless of the environment in which they are placed. There is also a cultural perception that a gifted person achieves or creates effortlessly, even though in truth, high achievement requires a very considerable investment of time and effort. A study by Tannenbaum (1962) of the factors that make for male public high school popularity and high social status in the United States revealed that the greatest desirables were brilliance, athleticism and non-studiousness. It appears that teachers in the U.S. also preferred high achieving but non-studious students (Martin, C. E. and Cramond, B., 1987). The paradox is obvious: popular opinion values ability, but popular (teenage) opinion also undervalues the hard work needed to develop ability into talent.

Another set of concerns centres around the issue of 'excellence' versus 'equity' in education. Tracking, or grouping of students by ability into separate classes, or within a class, is particularly viewed as being anti-democratic or elitist (Borland, 2005; Slavin, 1987). It is curious to note that such concerns do not come in the way of promoting excellence in athletics and sports, or in the performing arts.

A concern that policymakers have about

investing public funds in specialised gifted programmes regards numbers. Not every young person graduating from high school is prepared for a productive life. In this context, investing in gifted education – which is targeted at a small proportion of children – may be considered an inappropriate use of resources. The idea of funding a programme that further increases the achievement gap makes policymakers uneasy. A major trend in gifted education in the U.S. is the focus on identification of giftedness in minorities, with the eventual aim of achieving representation of minorities in gifted education programmes proportionate to their representation in the population at large.

Lastly, there is the concern that through (and far pre-dating) the history of giftedness research and IQ testing, extremists have tried to reduce the worth of a person to the measure of his/her IQ or cranial capacity, and this measure used to justify the backward status of disadvantaged peoples on the basis of race or gender. Intelligence testing has been associated with ‘scientific racism,’ beginning with Galton. Terman (1916) in his manual accompanying the ‘Stanford Revision of the Binet-Simon Test’ or Stanford-Binet IQ test argued that ‘the enormously significant racial differences in general intelligence could not be remedied by education.’ IQ was believed to be hereditary, and hence so too was low intelligence. Arguing on the basis of heritability of IQ, eugenicists in the early 20th century in the U.S. pushed for the ‘improvement’ of the population by enforced sterilisation of low-IQ groups (Kevles, 1998). Later researchers have called into question racial differences in IQ, pointing to culture-specificity in testing. The issue of racial differences in IQ still continues to arise from time to time (Jensen, 1969; Jensen, A. R., and Rushton, J. P.,

2005; Herrnstein, R. J., and Murray, C., 1994). *The Bell Curve: Intelligence and Class Structure in American Life* (Herrnstein, R. J., and Murray, C., 1994) presented mean differences in IQs across ethnic groups in the U.S. Understandably, there educators and policymakers apprehend lest fostering gifted education programmes lead to the creation of elitist societies.

Gender-related Issues

Neisser et al. (1996) point out that most standard tests of intelligence are so constructed that there are no overall score differences between males and females (“gender-fair” tests). The overall similarities in scores do not imply that males and females are identical on various specific abilities. In fact, some tasks show no differences, other tasks show minor differences, and yet other tasks show large and consistent differences by gender. Males have significantly higher scores than females on tasks testing mental rotation (a subarea of visual-spatial ability), and on spatial-temporal tasks such as tracking the motion of an object through space – abilities useful for aiming and throwing (Neisser et al. (1996) and references therein). Females show a consistent advantage on verbal ability throughout school, and also on the ability to recall spatial arrays (visual-spatial), which would have conferred women an evolutionary advantage in food-gathering. Females appear to be better at quantitative tasks in their early years, but sometime before puberty, males then take the lead, which continues into old age. Males also score higher on tests involving proportional and mechanical reasoning. These gender differences are understood to be a product of both biological and social factors (*op.cit.* and references therein).

Sociological Issues

Social problems of the Extremely and Profoundly Gifted: Hollingworth (1926) described the IQ range of 125 to 155 as 'socially optimal intelligence', where social adjustments with age-peers do not constitute a significant problem. For those of IQ 160+, however, cognitive differences with age-mates are so great that social isolation commonly develops. The origin of this problem is apparently not emotional. According to Hollingworth (1942), these children were rejected by their age-peers on account of their differences, but when placed among their intellectual peers, they were able to socialise normally, and became valued classmates and friends. A longitudinal study of 40 exceptionally and profoundly gifted children, commenced in 1986, studied their emotional, social, academic, and intellectual development. Initial results were published by Gross (1993). On the whole, such children had appropriate levels of self-esteem when grouped with their intellectual peers, but low self-esteem if grouped with their age-peers; gifted children with highly advanced moral thinking suffered the greatest degree of social isolation among their age-peers.

Learning Styles and the Identification of Giftedness

Silverman (2002) in an influential work described two types of learning styles among children, creating differences in how information is absorbed. While conventional schooling systems cater to the 'auditory-sequential learner' (the label refers to the preferred methods of receiving and processing information), a fair number of children are actually visual-spatial learners. Silverman (2002) discussed the learning strategies best

suited to the latter category of learners. These two learning styles are believed by some to represent the dominance of left-hemispheric or right hemispheric brain use, respectively (see, for example, the review by Benbow (1992)). What information is considered important to one type of learner may seem irrelevant to the other. As well, there are learners who use both styles.

The identification of giftedness among *strongly* visual-spatial learners may be complicated by coexisting disabilities. For example, such students may show a superior grasp of mathematical relations, but inferior abilities in mathematical computation (a task involving sequential thinking), and may be diagnosed with mathematical learning disorders despite their access to mathematics via the visual-spatial gifts (Silverman (1989)). Whereas gifted auditory-sequential learners are more likely to be high achievers at school and selected for gifted programmes, gifted visual-spatial learners are more likely to be underachievers, or to have dyslexia or attention deficit disorders; they often feel out of step with traditional schooling (Silverman (1998)). Specific sections of the Wechsler tests (WISC, WAIS, or WPPSI) such as the Block Design subtest, the abstract reasoning section of the Stanford-Binet Fourth Edition, or the Matrix Analogies Test, Raven's Progressive Matrices, or the Mental Rotations test assess spatial-visual abilities. High performance on such tests, coupled with significantly lower Digit-Span scores, or Performance IQs which are notably higher than Verbal IQs usually indicate a visual-spatial mode of learning (*op.cit*). The Visual-Spatial Identifier, a test developed by the Gifted Development Center, The Institute for the Study of Advanced Development, Colorado, U.S.A., is commercially available for identifying

such learners' strengths. For more information, see the relevant webpage at the website of the Gifted Development Center (Gifted Development Center: Visual-Spatial Learners, 2012).

Cultural Issues with Giftedness

A consideration of the cultural factors that influence cognitive function is important where many different cultures coexist, and children from various backgrounds are to be found schooling together. How giftedness might be perceived under these circumstances, and how to ensure an 'equitable' identification process irrespective of cultural background, is an important issue. It is an intuitive perception that giftedness should be encountered among all cultures; genetic explanations for why one population might do better on 'standard' tests of cognitive function than another are unpopular. On one hand exists the utilitarian view that if there exists a majority culture to which children from other cultures must adapt in order to take advantage of educational and vocational opportunities; this view necessitates providing minority children with the necessary resources and opportunities to develop the cognitive abilities valued by the majority culture. For example, Western cultures emphasise logical reasoning and verbal abilities. Nomadic cultures, on the other hand, tend to emphasise physical, naturalistic, and visual-spatial (particularly navigational) abilities; they under-emphasise mathematical skills related to measurement of quantity or volume, or counting beyond small numbers. Nomadic cultures also have an active spiritual life, with elaborate and egalitarian social structures, rituals, myths, and symbolic art forms (Dasen, 1994). In the utilitarian view of intelligence, it would be adequate to develop cognitive ability tests based on the abilities

valued by the majority culture, and cease trying to develop 'culture-independent' tests (which many researchers consider impossible, since, for example, beliefs such as the age by which a particular concept is to be achieved are partly products of the cultural value attached to certain concepts, and the expectation that most children in that culture will be exposed to the conditions appropriate for the emergence of that concept by a given age).

On the other hand, there is the view that a purposeful effort needs to be made to preserve the diverse cognitive abilities emphasised to and developed in different cultures. In this case, one might focus on developing culture-specific tests involving the cognitive abilities valued by each culture. This view acknowledges cultural differences as leading to cognitive differences, rather than viewing these differences as deficits. (It only makes sense to talk about deficits if there is a single standard to which children from all cultures are held up.) In this view, children from all cultures would be equally valued and encouraged to develop their unique abilities; reciprocal learning between cultures would also be emphasised.

Cultural Deprivation

In an attempt to view different cultural backgrounds as having something to contribute by way of select cognitive abilities refined to a high degree, it is necessary to also keep in mind that there is such a thing as cultural deprivation, which negatively impacts cognitive growth in children.

The cognitive competence of disadvantaged children needs to be evaluated in the general context of cognitive growth. The manifestations of a child's cognitive abilities and even their development over time are functions of the

environment in which he/she grows up. The abilities themselves are products of the reception, analysis, and integration of information from the environment (Das, 1973).

Cultural deprivation is defined as a complex set of conditions that place a child at risk of intellectual sub-normality (*op. cit.*). Listed are some conditions that have been identified:

- Non- stimulating environment;
- Lack of verbal and physical (particularly for infants) interactions with adults;
- Poor sensory experience; and
- Social-personality factors (poverty, broken home, absence of biological parents, language disability).

The absence of certain environmental factors contributing to cognitive deficits has support from animal studies, as well as from cases of extreme child neglect. Heywood and Tapp (1966) conclude in a review that an enriched early environment increases intelligence, while an impoverished environment may irreparably diminish it.

It may be argued that the antidote to cultural deprivation is cultural enrichment, and that, especially for at-risk children, this should be provided at a sufficiently young age (infancy/

early childhood) so as to aid the development of cognitive abilities. It is debatable whether this approach is indeed efficacious (cf. earlier section on *Enrichment Programmes*). Das (1973) pointed out studies showing that cognitive deficits arising from deprivation *can* be remedied later, in adolescence (Feuerstein, 1970). Das proposed (*op.cit.*) that there could be an IQ range of 70 to 85 which is sensitive to early stimulation, and programmes to develop specific cognitive abilities may be essential to these children. However, between IQs 85-100, a disadvantaged child might neither need nor benefit from targeted cognitive development programmes, the natural cognitive abilities not having been destroyed unless subjected to an unusual degree of deprivation. Such a child would be sufficiently enabled in a normal schooling environment with positive encouragement and experiences. In the case of bright children from disadvantaged backgrounds, it is suggested that obstructions to their learning be removed and that they be provided with the requisite facilities and access to libraries to develop their abilities, without the necessity for a cognitive development programme, which might actually slow them down.

GIFTED PROGRAMMES

The Need for Gifted Programmes?

One argument often presented to justify special education for the gifted is that all children deserve to have their individual needs met, and that therefore, in all fairness, the unique needs of the gifted should not be ignored (Borland 1989). The United Nations Declaration of the Rights of the Child states that ‘the (child) shall be given an education which will... enable him, on the basis of equal opportunity, to develop his abilities’ (Office of the High Commission for Human Rights (1959): Declaration of Rights for the Child, p2). Another view is that gifted children constitute an important resource, which must be developed in the interests of our own future (Colangelo, N., Assouline, S. G., and Gross, M. U. M., 2004). Governments regard early childhood education as an important means of supporting young parents in the workforce, and to reduce future spending on welfare and criminal justice systems (Arthur, L., Beecher, B., Death, E., Dockett, S., and Farmer, S., 2008).

Some educators, however, have argued that children need to find their own path to self-actualisation rather than being moulded to fit adult views of success (Grant, B. A., and Piechowski, M. M., 1999). These authors call for gifted education to become more child-centric and to value children for their inherent worth rather than for their accomplishments.

In the final analysis, unrealised potential is known to have consequences for the individual as well as for society as a whole. Appropriate services are important to help develop a healthy self-concept (Gross, 1993), prevent underachievement (Whitmore, 1986), and enhance motivation to learn (Wolfle, 1989).

Goals of Gifted Programmes

‘Although the path to outstanding performance may begin with demonstrated potential, giftedness must be developed and sustained by way of training and interventions in domain-specific skills, the acquisition of the psychological and social skills needed to pursue difficult new paths, and the individual’s conscious decision to engage fully in a domain. The goal of the developmental process is to transform potential talents during youth into outstanding performance and innovation in adulthood’ (Subotnik, R. F., Olszewski-Kubilius, P., and Worrell, F. C., 2011).

The specific goals and procedures of a gifted programme are influenced by how giftedness is defined (Hoge, 1989 and references therein).

‘*A rising tide lifts all ships*’ is how Joseph Renzulli described his specially developed School wide Enrichment Model (SEM) (Renzulli J., 1998). This model was based on successful practices developed for gifted and talented learners, with a goal to promote challenging and enjoyable high-end learning that can be tailored

to each school's requirements. The percolation of the learnings from gifted programmes to benefit all students, gifted or otherwise, is the finest goal to which a gifted programme can aspire.

Basic Theories Underlying Intervention Programmes for the Gifted

Zone of Proximal Development/ Dynamic Assessment

The developmental psychologist Lev Vygotsky (1896-1934) described the *zone of proximal development* (ZPD) for children as 'the distance between the actual developmental level as determined by independent problem-solving and the level of potential development as determined through problem-solving under adult guidance, or in collaboration with more capable peers' (Vygotsky, 1978). The ZPD, in other words, is the difference between what the child can achieve on his/her own, and what he/she can achieve when guided by an adult or a more experienced peer. When the adult or other *mediator* is helpful or supportive of the child's learning process, it is termed as *scaffolding*, a term introduced in the 1950s. Scaffolding does not make the task easier as such, but it makes the task doable by the child, perhaps by breaking it into smaller steps, or by controlling those aspects which are beyond the child while also encouraging higher performance from him or her.

Dynamic Assessment (Feuerstein, 1979) is a type of educational assessment involving interaction, which has its origins in the concept of the zone of proximal development. Assessment and teaching are integrated into a single activity where the teacher seeks to understand the student's abilities as well as to

promote learning through mediated interaction. Various Dynamic Assessment models have been reviewed in Lidz (1987).

Implementing Dynamic Assessment (DA) involves a pre-test, the mediation, a brief period of revision 'at home' with information given to students, and a post-test. The student may be asked to respond to a problem situation, given assistance to improve performance (mediate), and then measured on various indices to gauge improvement in performance on similar problems. The goal of DA is to assess a student's learning potential, as revealed by the extent to which the student absorbs and integrates information obtained during the mediation process. Dynamic Assessment has been used to identify both mental retardation and giftedness, and is particularly useful in identifying giftedness among culturally diverse students (Lidz, Use of Dynamic Assessment with Gifted Children, 2006). DA emphasises the child's fluid intelligence, placing less importance on what the child already knows; it may thus be an inherently more culture-fair means of gifted identification.

Identification of the gifted is typically done in schools and relies on tests that measure academic aptitude (intelligence/achievement tests), grades, and teacher ratings/recommendations. Certain groups of gifted students consistently fall through this sieve. These include (Richert, 1985):

- Underachieving, poor, and minority gifted children (who might most benefit from intervention);
- Creative or divergent thinkers, whose abilities show up neither on intelligence / achievement tests, nor in school grades; and

- Learning-disabled or handicapped gifted children

Structural Cognitive Modifiability / Learning Propensity Assessment Device

The theory of structural cognitive modifiability (SCM) was developed by Feuerstein (1990). It views the human organism as open, adaptive, and capable of change. The aim of SCM is to modify the individual, emphasising autonomous and self-regulated change. Intelligence is viewed as the tendency of the organism to modify itself when confronted with the need to do so. It involves the capacity to be modified by learning and the ability to use whatever modification has occurred for future adjustments. Intelligence is thus regarded as intrinsically modifiable rather than as a fixed quantity. Cognition is viewed as central role such modifiability; behavioral and emotional conditions are viewed as modifiable through cognitive intervention; and behaviours (physical and psychological) are viewed as creating new cognitive structures via brain plasticity.

Two types of interactions may trigger the development of higher cognitive functions: direct experiences and mediated learning experiences. Mediated learning experiences are essential to a child as they facilitate direct learning experiences by providing the prerequisites.

Mediated Learning Experience (MLE) is a theoretical tool developed from SCM theory, wherein, once a task ('stimulus') has been

given to a child, a mediator engages with the child *at the same level*, as a fellow explorer (regarding his/her *approach* to the task rather actual performance of the task). The mediator also interprets for the child what the child has accomplished, stimulating reflection on the solution itself, how the solution was obtained, and what generalisations follow from it. The mediator then encourages the transferring of learnings from the current experience to new situations. While these steps are the basic elements of MLE, mediators also draw attention to affective components of the learning process. MLE can moderate the influence of genetic predisposition, organic impairment, or educational deprivation. MLE was developed by Feuerstein and colleagues (Feuerstein, R., Klein, P. S., and Tannenbaum, A. J., 1999).

SCM and MLE form the basis for the Learning Propensity (or Potential, as it was earlier called) Assessment Device (LPAD), a form of Dynamic Assessment. This is a procedure and a set of instruments that permits the investigator to examine a learner's dynamic propensity and cognitive modifiability rather than just the current level of performance. The LPAD is process- rather than result-oriented, and studies the process of reasoning rather than the quantifiable answers. The process produces in the learner a sample of cognitive changes and uses them for evaluation. The results of an LPAD assessment are a descriptive profile of modifiability, including the area and degree of cognitive change.

GIFTED PROGRAMMES IN INDIA

According to provisional data released from the 2011 decadal census (Chandramouli, 2011), India has 158.8 million children in the age group 0-6 years, of whom 41.2 million live in urban areas. Figures for children in the age group 0-14 years have not been released as yet, but estimates put the fraction of the Indian population in this group at about 30% (Central Intelligence Agency, 2012), which, of the current population of 1.21 billion people as reported in the 2011 decadal census, amounts to about 360 million. If the top 2% of these are considered as 'gifted', the nation has about **7.2 million children** between the ages of 0-14 years, of which about **3 million children** are between ages 0-6 years. If the scope of the definition of giftedness is enlarged to include the top 10%, it would imply a staggering 36 million children up to 14 years of age, largely in rural India. However, the ASER study '*Inside Primary Schools: Teaching and Learning in Rural India*' (ASER Centre, 2011) shows that despite impressive enrollment in schools, both teacher skills and learning outcomes leave a lot to be desired even in general education. In this context, the prospect seems bleak for gifted education.

Testing for giftedness is the exception rather than the rule in most schools, although there have been in existence programmes for the identification of talent for decades, mostly for scientific talent; these programmes tend to

take effect after children have already completed after high school, i.e. *after* the entire educational career of a large number of children. The major such programmes are:

National Talent Search Examination (NTSE, http://www.ncert.nic.in/programmes/talent_exam/index_talent.html, in original form the National Science Talent Search since 1963, extended since 1976). Organised by the National Council for Education Research and Training (NCERT), this was originally for Basic Sciences students, but in 1976 was extended to social sciences, engineering, and medicine. In the original format, called the National Science Talent Search, evaluation was based on a written examination, a project report, and an interview. In the extended form, it consisted of 500 scholarships, with selection based on two objective tests: the Mental Ability Test and the Scholastic Aptitude Test. Qualifiers (limited by number) were interviewed before selection, which was based on all three criteria. In 1981, 50 more scholarships were added, exclusively for Scheduled Castes/Scheduled Tribes candidates; the total number of scholarships later rose to 750 (with 70 reserved). In 1985, the scheme was decentralised and scholarships were awarded by State Governments. In 2000, the number of scholarships was increased to 1,000, with reservation for Scheduled Castes and Tribes based on fractional representation. The payment of a scholarship was determined

by parental income upper cutoff. The National Talent Search examination, since 2006, is being held at the end of Class VIII.

Kishore Vaigyanik Protsahan Yojana (KVPY, <http://www.kvpy.org.in/>, since 1999) for students of Std IX through MSc, BE, Btech, or BArch and MBBS, BVSc, BDS, and BPharm programmes. Selection is through an aptitude test and interviews, or based on individual projects.

Innovation in Science Pursuit for Inspired REsearch (INSPIRE, <http://www.inspire-dst.gov.in/>, since 2008) operating at various levels, from school through the doctorate level, with doctorate level fellows guaranteed an academic position. Selection is based on teacher nomination in schools, and scholarships are available for students in various academic programmes in the basic and natural sciences, based on admissions in elite scientific institutes. This programme has three components:

- Scheme for Early Attraction of Talent (SEATS) for 1 million students in the age group of 10-15 years, with summer/winter camps at 100 locations for about 50,000 students who top at the Class X Board Examinations.
- Scholarships for Higher Education (SHE) for 10,000 students in the age group of 17-22 years in Bachelors or Masters level education in the Natural and Basic Sciences. It involves mentorship for each student, with summer internship with performing researchers.
- Assured Opportunities for Research Careers (AORC) for age group of 22-27 years, in Basic and Applied Sciences (including engineering and medicine). It also plans for contractual and tenure-track positions for

five years in these areas through an INSPIRE Faculty Scheme.

Jawahar Navodaya Vidyalayas

The Central Government in India established a series of co-educational residential schools under the name of the Jawahar Navodaya Vidyalayas, beginning with two schools in 1986, primarily to serve the needs of gifted students in rural India. Students are admitted to Std. VI on the basis of a 'language-and cultural-fair' entrance test, and educated in the system up to Std. XII. Lateral entry in Stds. IX and XI is now possible. Education follows a three-language formula (the majority local language or 'Regional Language', Hindi, and English). The 'Regional Language' is used for all classes upto Std. VIII; from Std. IX onwards, English is used for Science and Mathematics, and Hindi for the Humanities. Education, board and lodging, and healthcare are provided at no cost to the student. 75% of seats are reserved for rural students.

The population of students in the Jawahar Navodaya Vidyalayas as of 2007 was 180,391, with 565 schools all over the country (except in Tamil Nadu, Lakshadweep, and the Andaman and Nicobar Islands). Since 2001, the pass percentage of students in the Navodaya Vidyalayas has consistently been 10%-20% higher than the average for Central Board schools in the country, and a few percent higher than that of the Kendriya Vidyalayas. Std XII results similarly show an average pass percentage about 10% higher than the national average. Enrollment statistics have adhered to the original intake policy, so that Scheduled Castes and Tribes as well as girls are being served as intended.

Jnana Prabodhini

Jnana Prabodhini Prashala was established in Pune in 1962, and claims to be the first and perhaps only secondary school in India exclusively for intellectually gifted children. Bright children are admitted in Std. V through a rigorous entrance examination involving a battery of seven psychological tests. This is followed by a series of group interviews with the school's teachers. 1,000 students attempt

the entrance examination every year, with only 80 students gaining admission, of which 40 are girls. The teaching programme draws from J. P. Guilford's intelligence model. The school claims to make a conscious effort to arouse curiosity, sensitivity, observation, and critical and divergent thinking, as well as creativity. Jnana Prabodhini also follows a three-language formula in its teaching.

GLOSSARY OF TERMS

Acceleration: Intervention that permits a gifted child to skip to a higher class appropriate to his/her academic abilities.

Achievement Test: A standardised or norm-referenced test for measuring the skill or knowledge attained by an individual in one or more domains of work or study (*cf. Intelligence Test*).

Asynchronous Development: The phenomenon of a child being at disparate stages of development in intellectual, social, physical, and emotional domains at a given point in time (Ministry of Education, New Zealand, 2008).

Attentional Control: The ability to focus on information relevant to the task at hand and to ignore distractions.

Crystallised Intelligence: Skills, knowledge, and experiences acquired by the individual, which is used to solve problems by accessing information from long-term memory (*cf. Fluid Intelligence*).

Dynamic Assessment: A type of assessment in an educational situation that involves interacting with the learner, and focuses on the ability of the learner to respond to intervention.

Eugenics: A branch of applied science or a social movement advocating the adoption of practices

that improve the genetic composition of a population

Flynn Effect: The observation that the average measured IQ of populations in different countries has been increasing at a rate of around 3 points per decade (Flynn, 1987).

General Intelligence: A higher-order factor proposed by Cattell to explain the correlations between intelligence tests.

Gift: Naturally-endowed intelligence or other inborn potential (Budden, 1981)

Hothousing: The process of inducing infants to acquire knowledge that is typically acquired at a later developmental level (Sigel, 1987) and typically relies on rote learning, with no real depth of understanding.

Moderately Gifted: Stanford-Binet IQ range variously defined as 115, 120, 135, 140 and above, to 159, or the top 10% or top 5% or top 2% of a class (but not the exceptionally or profoundly gifted).

Exceptionally Gifted: Stanford-Binet IQ range 160 to 179.

Fluid intelligence: The ability to understand relationships between various concepts,

independent of any previous knowledge or skills, and to solve new problems (*cf. Crystallised Intelligence*).

Intervention: Programming for children with special needs.

Neural Plasticity: The ability of the brain/nervous system to change structurally and functionally in response to input from the environment (neuroscience). This ability is not confined to infancy or childhood, and occurs at the cellular level as well as on larger scales, as in cortical remapping following brain injury.

Prodigy: A child who, before the age of 10 years, displays extraordinary intellectual-creative performance and/or achievements in any type of a real activity (i.e. intellectual, musical, or artistic activity, etc.) (Shavinina L. , 2007).

Profoundly Gifted: Stanford-Binet IQ range 180 and above

Scientific Racism: Use of techniques and hypotheses, ostensibly from scientific research, to support the notion of the superiority of some races over others.

Sensitive Periods: Periods in the development of an organism (cognitive, intellectual, emotional, personality, psychomotor, and social), especially of children, characterised by a heightened

responsiveness to selective types of information or stimulation (Vygotsky, Selected Papers, 1956; Leites, 1971; Shavinina L. V., 1999).

Skill: A primarily motor ability such as in sport, performing on a musical instrument, rock-climbing, etc. (Many skills also contain an artistic element, a degree of inventiveness, imagination, or originality) (Budden, 1981).

Special-Needs Children: Children whose requirements are not served by the standard educational practices directed at the average child, including children with learning disabilities (dyslexia, dysgraphia, etc.), handicaps (cerebral palsy, deafness, blindness, muteness, muscular dystrophy, etc.), Attention Deficit (Hyperactivity) Disorder, Autism Spectrum Disorders, Down's Syndrome, or giftedness (moderate, exceptional, or profound), or with combinations of any of these circumstances.

Talent: Gifts that have been systematically exercised and developed (Budden, 1981)

Twice-Exceptional Children: Children who possess giftedness in combination with a learning disability or other handicap.

Working Memory: The ability to hold information in one's mind while manipulating it to achieve a cognitive goal (Wang, S., and Aamodt, S., 2009)

APPENDICES

Appendix 1: A Comparison of High Achievers, Gifted Learners, and Creative Thinkers (Szabos, 1989)

A High Achiever...	A Gifted Learner...	A Creative Thinker...
Remembers the answers	Poses unforeseen questions	Sees exceptions
Is interested	Is curious	Wonders
Is attentive	Is selectively mentally engaged	Daydreams; may seem off task
Generates advanced ideas	Generates complex, abstract ideas	Brims over with ideas, many of which will never be developed
Works hard to achieve	Knows without working hard	Plays with ideas and concepts
Answer the questions in detail	Ponders with depth and multiple perspectives	Considers new possibilities
Performs at the top of the group	Is beyond the group	Is in own group
Responds with interest and opinions	Exhibits feelings and opinions from multiple perspectives	Shares bizarre, sometimes conflicting opinions
Learns with ease	Already knows	Questions: What if...
Needs 6 to 8 repetitions to master	Needs 1 to 3 repetitions to master	Questions the need for mastery
Enjoys the company of age peers	Prefers the company of intellectual peers	Prefers the company of creative peers but often works alone
Understands complex, abstract humour	Creates complex, abstract humour	Relishes wild, off-the-wall humour
Grasps the meaning	Infers and connects concepts	Makes mental leaps: Aha!
Completes assignments on time	Initiates projects and extensions of assignments	Initiates more projects that will ever be completed
Is receptive	Is intense	Is independent and unconventional
Is accurate and complete	Is original and continually developing	Is original and continually developing
Enjoys school often	Enjoys self-directed learning	Enjoys creating
Absorbs information	Manipulates information	Improvises
Is a technician with expertise in a field	Is an expert who abstracts beyond the field	Is an inventor and idea generator
Memorises well	Guesses and infers well	Creates and brainstorms well
Is highly alert and observant	Anticipates and relates observations	Is intuitive
Is pleased with own learning	Is self-critical	Is never finished with possibilities
Gets A's	May not be motivated by grades	May not be motivated by grades
Is able	Is intellectual	Is idiosyncratic

Appendix 2: Rubric for Identifying, Assessing, and Encouraging Gifted Performance in the Classroom (Kingore, 2004)

Rubrics are valuable assessment tools that make standards and expectations transparent to the student. Many rubrics that are used in daily classroom instruction focus primarily on proficiency, overlooking advanced, exceptional, and innovative standards of performance. This design by Kingore is specifically tuned to gifted performance.

Guidelines for assessing advanced responses and exceptional and innovative work in practical terms:

Advanced Response

- (Only) some students achieve this level of competency.
- Product demonstrates a strong, above-average response.
- Occasional sparks of advanced potential are evident.
- Performance is typical of high-achieving students.

Exceeds Expectations

- Few students achieve this level of competency.
- Product exceeds the standards and expectations of the grade level.
- The student exhibits consistent excellence; heightened abilities and insights; greater depth, complexity, and scope.
- Responds positively to task complexity and challenge.
- Performance is typical of gifted students.

Innovative

- This level of competency is rare.
- Responses are remarkable and substantially exceed expectations.
- Strengths are clearly outstanding.
- Product is an original contribution to the discipline for a student of this age.
- Performance is typical of highly-gifted students.

How advanced, exceptional, and innovative student performance may *look* throughout different types of learning objectives in schoolwork:

Learning Standards

Advanced Response: Concludes appropriate relationships; uses some metaphors to develop relationships; discusses concepts and principles based upon events.

Exceeds Expectations: Symbolic or metaphorical thinking is evident; concludes beyond concrete realities or specific objects; idea-based.

Innovative: Creates complex symbolic or metaphorical relationships; uses idea-based thinking to pose principals or generalisations between abstract ideas and intangibles.

Abstract Thinking

Advanced Response: Covers topic effectively; well-developed; explores the topic beyond basic facts and details.

Exceeds Expectations: Precise data; in-depth; well-supported; develops more advanced concepts and relationships; insightful; evaluates the issues of the topic.

Innovative: Forms original generalisations using complex concepts and relationships; hypothesises and infers beyond the data; unique ideas or responses; evaluates issues across disciplines and topics.

Complexity

Advanced Response: Critical thinking is evident; compares and contrasts; integrates topics, time, or disciplines.

Exceeds Expectations: Analyses, synthesises, and evaluates across time and disciplines; interprets and creatively integrates multiple perspectives and issues; uses beyond grade-level resources.

Innovative: Internalises complex information and relationships; expands concepts beyond age expectations; works with multiple abstractions; sophisticated use of resources.

Content Depth

Advanced Response: Covers topic effectively; well-developed; explores the topic beyond the basic facts and details.

Exceeds Expectations: Precise data; in-depth; well-supported; develops more advanced concepts and relationships; insightful; evaluates the issues of the topic.

Innovative: Forms original generalisations using complex concepts and relationships; hypothesises and infers beyond the data; unique ideas or responses; evaluates issues across disciplines and topics.

Communication: Written, Oral, and/or Graphic

Advanced Response: Elaborates in response to questions or probes; incorporates appropriate terminology, graphics, and/or notation; communication is clear and interesting; shows

awareness of the audience.

Exceeds Expectations: Explains independently, clearly, and confidently; precise vocabulary, graphics, and/or notation; critiques; develops product or performance with nuances for a specific audience.

Innovative: Outstanding; communicates a level of insight that enhances the understanding of others; sophisticated and professional level of vocabulary, graphics, and/or notation; engages others in reflection.

Extension

Advanced Response: Response is embellished; ideas or concepts are elaborated and developed to enhance assignment.

Exceeds Expectations: Response is developed beyond the assignment; poses unanswered questions; extends through personal insight, examples, graphics, performance, or an atypical application.

Innovative: Response demonstrates intense involvement in the topic or data; pursues a self-selected problem beyond the assignment; response is multi-faceted and developed over time.

Autonomy

Advanced Response: Critical thinking is evident; compares and contrasts; integrates topics, time, or disciplines.

Exceeds Expectations: Analyses, synthesises, and evaluates across time and disciplines; interprets and creatively integrates multiple perspectives and issues; uses beyond grade-level resources.

Innovative: Internalizes information and relationships; expands concepts beyond age-expectations; works with multiple abstractions; sophisticated use of resources.

Problem-Solving: Procedural Knowledge

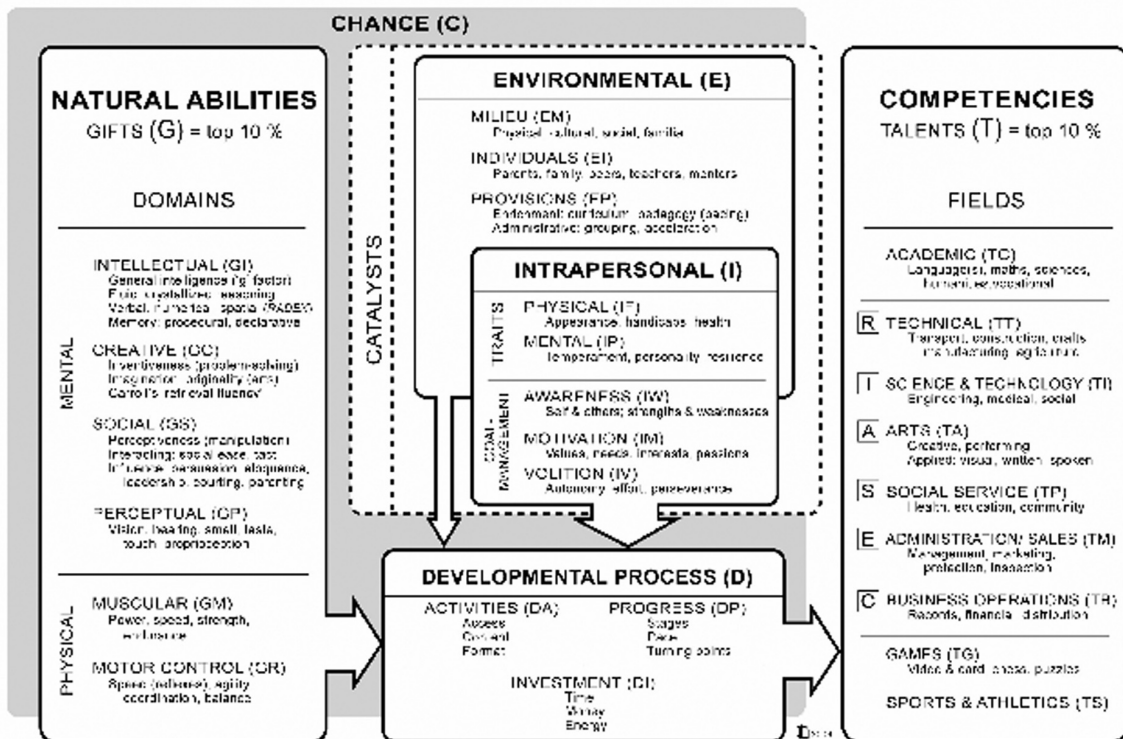
Advanced Response: Anticipates directions and time lines; applies the skills of independence.

Exceeds Expectations: Self-directed; self-governing; functions independently; frequently initiates own learning; exceeds the parameters

of assignments.

Innovative: Self-motivating; self-selects problems and procedures; efforts and products exceed the parameters of the assignment; develops systems and habits for effective, efficient learning.

Appendix 3: Differentiated Model of Giftedness and Talent
(Gagné, 2000)



Appendix 4: Characteristics and Traits of a Gifted Preschooler

(From the Appendix in Chamberlin et al. (2007))

Language and Learning

- talks and reads early and has a large vocabulary;
- demonstrates advanced language proficiency;
- enjoys self-expression, especially in discussion;
- has unique learning style.
- has greater than average attention span.
- asks many questions.
- Exhibits advanced observational skills and retains information about what is observed or read;
- is challenged by problems and chooses sophisticated activities, such as chess or collecting, as early as age 5 and shows interest in many kinds of books, atlases, and encyclopedias;
- is interested in calendars, clocks, and puzzles; and
- is proficient in drawing, music, or other arts.

Psychomotor Development and Motivation

- walks early and displays early or advanced fine motor control in writing, coloring, and

building things;

- loves projects that require inquiry;
- is driven to explore things, is curious, asks “why”;
- wants to master the environment;
- enjoys learning;
- is extremely active and goal-oriented; and
- has wide-ranging, consuming interests.

Personal-Social Characteristics

- spends less time sleeping;
- is more dependent on adults for communication;
- interacts with adults more effectively than with children, and struggles with adult inconsistency;
- is sensitive to dishonesty and insincerity in adults; and
- demonstrates awareness of issues, such as death, war, and world hunger.

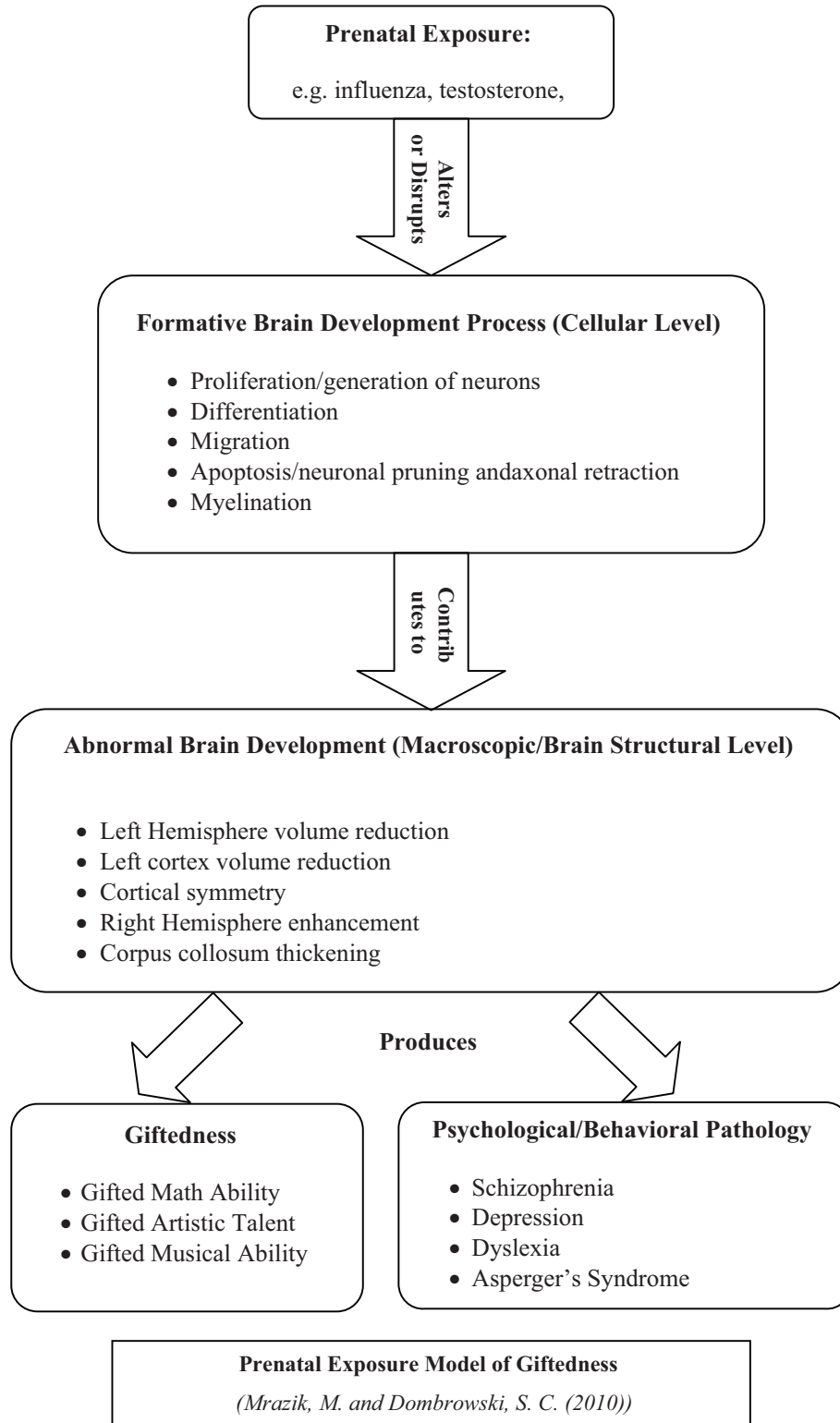
(A child need not have all of these characteristics to be identified as gifted. The existence of multiple traits in a child, however, may warrant additional scrutiny.)

Appendix 5: Possible Problems That May be Associated with Characteristic Strengths of Gifted Children

Strengths	Possible Problems
Acquires and retains information quickly.	Impatient with slowness of others; dislikes routine and drill; may resist mastering foundational skills; may make concepts unduly complex.
Inquisitive attitude, intellectual curiosity; intrinsic motivation; searching for significance.	Asks embarrassing questions; strong-willed; resists direction; seems excessive in interests; expects same of others.
Ability to conceptualize, abstract, synthesize; enjoys problem-solving and intellectual activity.	Rejects or omits details; resists practice or drill; questions teaching procedures.
Can see cause-effect relations.	Difficulty accepting the illogical – such as feelings, traditions, or things usually taken on faith.
Love of truth, equity, and fair play.	Difficulty being practical; worry about humanitarian concerns.
Enjoys organising things and people into structure and order; seeks to systematise.	Constructs complicated rules or systems; may be seen as bossy, rude, or domineering.
Large vocabulary and verbal proficiency; broad information in advanced areas.	May use words to escape or avoid situations; becomes bored with school and age-peers; seen by others as a “know-it-all” (Clark, <i>Growing up Gifted: Developing the potential of children at home and at school</i> (4th Ed.), 1992) (Seagoe, 1974).
Thinks critically; has high expectancies; is self-critical and evaluates others.	Critical or intolerant toward others; may become discouraged or depressed; perfectionistic.
Keen observer; willing to consider the unusual; open to new experiences.	Overly intense focus; occasional gullibility.
Creative and inventive; likes new ways of doing things.	May disrupt plans or reject what is already known; seen by others as different and out of step.
Intense concentration; long attention span in areas of interest; goal-directed behaviour; persistence.	Resists interruption; neglects duties or people during period of focused interests; stubbornness.
Sensitivity, empathy for others; desire to be accepted by others.	Sensitivity to criticism or peer rejection; expects others to have similar values; need for success and recognition; may feel different and alienated.
High energy, alertness, eagerness; periods of intense efforts.	Frustration with inactivity; eagerness may disrupt others’ schedules; needs continual stimulation; may be seen as hyperactive.
Independent; prefers individual work; self-reliant.	May reject parent or peer input; non-conformity; may be unconventional.
Diverse interests and abilities; versatility.	May appear scattered and disorganised; frustrations over lack of time; others may expect continual competence.
Strong sense of humour.	Sees absurdities of situations; humour may not be understood by peers; may become “class clown” to gain attention.

Adapted from Clark (1992) and Seagoe (1974)

Appendix 6: A Neurological Basis for Giftedness: Prenatal Exposure Model



Appendix 7: A Comparison of Individual Testing and Group Testing

(after Mangal (2007))

Individual Testing	Group Testing
Only one individual is tested at a time, making the process costly in terms of time, labour and money.	These can be administered efficiently to a whole group, and can also be administered individually.
These can be used with adults as well as children.	Group testing cannot be effectively administered to children below 9 or 10 years of age.
The examiner has close contact with the subject being tested and can thus factor in emotional and personal information when interpreting the test scores.	Group testing does not permit accounting for factors like ill-health, poor social background, mood, or the possibility that an individual subject has prior experience or coaching in similar tests, which may artificially inflate the score.
There is some concern about objectivity and standardisation with regard to the administration of individual tests – necessitating well-trained and competent examiners.	The administration of group tests does not call for the same degree of training for examiners in order to maintain objectivity and standardisation. The process of administration, scoring, and interpretation is very easy.

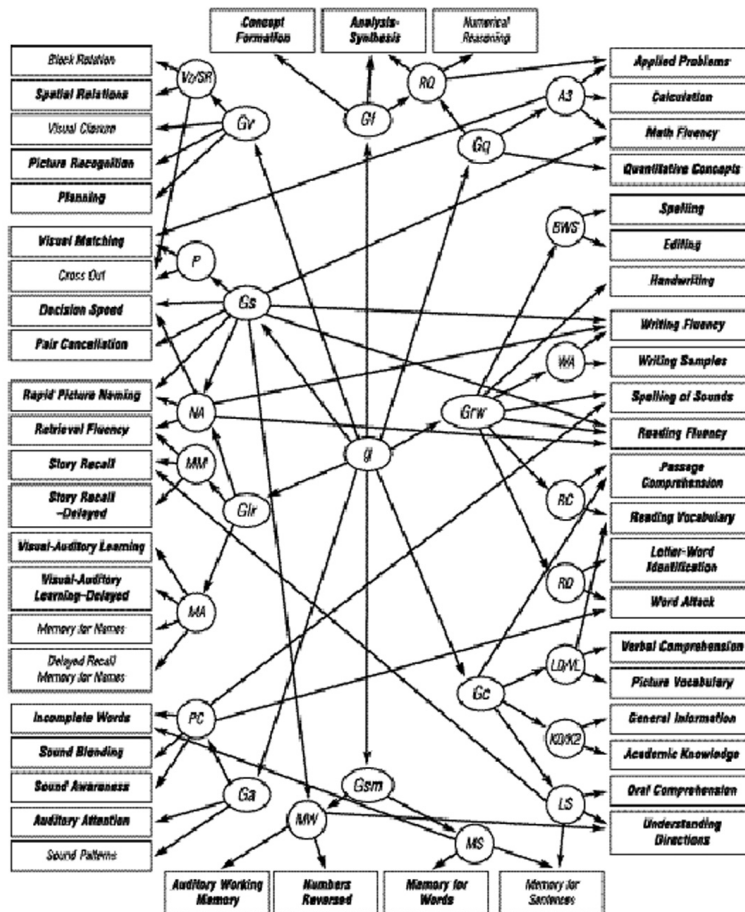
Appendix 8: Hypothesized Model of the WJ III Based on Three Levels of Factors: g, the Broad CHC Factors, and the Narrow CHC Abilities

From Schrank, McGrew, and Woodcock (2001)

Note: Bold font indicates WJ III tests. Regular font indicates WJ III Research tests. Ovals = Broad CHC factors and g. Circles = Narrow CHC factors. Residuals omitted from figure.

Broad Abilities Specified: *g* = General Intellectual Ability, *Gf* = Fluid Reasoning, *Gc* = Comprehension-Knowledge, *Gq* = Quantitative Ability, *Grw* = Reading/Writing Ability, *Gsm* = Short Term Memory, *Glr* = Long Term Retrieval, *Gs* = Processing Speed, *Gv* = Visual-Spatial Thinking, *Ga* = Auditory Processing.

Narrow Abilities Specified: RQ = Quantitative reasoning, A3 = Math achievement, BWS = Basic writing skills, WA = Writing ability, RC = Reading comprehension, RD = Reading decoding, LD/VL = Language development/Lexical knowledge, K0/K2 = General information/Cultural information, LS = Listening skills, MS = Memory span, MW = Working memory, PC = Phonetic coding, MA = Associative memory, MM = Meaningful memory, NA = Naming facility, P = Perceptual speed, Vz/SR = Visualization/Spatial Relations



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