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THE NATIONAL RESEARCH CENTER ON THE GIFTED AND TALENTED

University of Connecticut
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## ABSTRACT

The purpose of this research was to assess the factors that lead to success in transitions of giftedness. Currently, traditional analytic abilities are stressed in the identification of children for gifted education programs. However, our previous research suggests that creative and practical skills are as important as, if not more important, than analytical skills to success in life. In the studies reported here, we tested the hypotheses that creative and practical abilities will become of increasing importance with age and that members of underrepresented minority groups will, on average, score relatively highly on measures of creative and practical abilities than on measures of analytical abilities. To verify these hypotheses, we looked at individuals in various life stages, employing cross-sectional methods (Main Study), and across those same life stages, employing longitudinal methods (Longitudinal Study). Based on our data analyses, we conclude that preschool children who are identified as gifted do perform better on a number of cognitive and achievement tasks, but the distinction between analytical, creative, and practical skills at this level is not yet clear. The difference is clearer during middle and high school, when creative and practical abilities become more important relative to analytical skills, especially for underrepresented minority students.

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## EXECUTIVE SUMMARY

The purpose of this research was to assess the factors that lead to success in transitions of giftedness. In using the term *giftedness*, we refer to individuals who (a) are excellent in work they can or do produce, (b) possess this excellence relative to peers, (c) are able to display this excellence through some kind of tangible performance, (d) can repeat this performance multiple times, and (e) excel in a way that is societally valued. This definition is based on a confluence model of giftedness, and we investigated the different components of the confluence model: (i) successful intelligence, (ii) domain-relevant knowledge, (iii) thinking styles, (iv) personality, (v) motivation, and (vi) environment. We do not claim that these are the only attributes of giftedness that matter. For example, wisdom can also be important (Sternberg, 2005a, 2005b). But we do believe that the set of attributes is fairly comprehensive with regard to existing models. The two main research questions we attempted to answer in this study were:

1. What leads some but not other people successfully to make transitions in the kinds of expertise they develop?
2. Is it possible that many underserved minority students have the abilities they will need to succeed at high levels in careers, but never get the chance because the educational system fails to recognize their strengths?

We believe that the problem addressed by this study is one of the most fundamental ones in gifted education, in particular, and in education, in general. The problem is how to optimize the talent of the nation's youngsters, our most precious resource as a nation. Currently, traditional analytic abilities are stressed in the identification of children for gifted education programs. However, our research suggests that creative and practical skills are as important as, if not more important, than analytical skills to success in life. We have found that even individuals who are analytically and creatively gifted will not necessarily possess the abilities to excel as adults. For example, they may be able to produce creative artwork but not know how to get it exhibited, or write creative stories but not know how to get them published, or compose creative

musical arrangements but not know how to get them played. The may fail in later transitions of giftedness because they are ineffective at promoting their ideas.

We proposed specific hypotheses posing testable predictions, such as that creative and practical abilities will become of increasing importance with age and that members of underrepresented minority groups will, on average, score relatively highly on measures of creative and practical abilities than on measures of analytical abilities. To verify these hypotheses, we looked at individuals in various life stages, employing cross-sectional methods (*Main Study*), and across those same life stages, employing longitudinal methods (*Longitudinal Study*).

The main study was designed to take the broadest snapshot. We initially intended to assess fifth and sixth graders, eleventh and twelfth graders, college students, graduate students, and young professionals across the country who had been identified as achieving at various levels of success. As a result of the difficulty encountered when trying to recruit young professionals, we decided (with the agreement of The National Research Center on the Gifted and Talented [NRC/GT]) to replace this age group with a group of pre-k students and thus to include additional data at the other end of the age spectrum. The revised design therefore investigated students in pre-k centers, middle school, high school, and college. Within each of these data-collection age groups, we included participants from diverse socioeconomic and ethnic backgrounds. In addition to these groups of students, we collected data from evaluators (e.g., teachers, parents, college/university professors and instructors).

Students in each age cohort were divided into 3 general groups, based on evaluation of their performance as: (a) highly gifted (study group); (b) gifted but not highly gifted (comparison group); and (c) not gifted (control group). We chose 2 areas of giftedness that could be studied for each of the age groups described above: (a) verbally oriented (reading/writing) performance; and (b) quantitatively oriented (mathematical/scientific) performance.

In addition to quantitative assessments, we used qualitative assessments based on interviews to identify which skills are most important to giftedness within any given group. Although we plan to assess the same attributes across age levels, we recognize the inevitable need for flexibility in the way we assess these attributes. Based on our data analyses, we conclude that preschool children who are identified as gifted do perform better on a number of cognitive and achievement tasks, but the distinction between analytical, creative, and practical skills at this level is not yet clear. The difference is clearer during middle and high school, when creative and practical abilities become more important relative to analytical skills, especially for underrepresented minority students. Legislative thinking style becomes more prominent with development, whereas the importance of the executive thinking style decreases. Finally, students who are more motivated are more likely to be identified as gifted.

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## Background and Theory

### Rationale

William James and William James Sidis represent almost opposite ends of a continuum. William James was a gifted youngster who was to become one of the leading philosophers and psychologists of his generation. Some consider him to be the greatest American psychologist of all time. William James Sidis was a gifted youngster who flamed out early in life and, after an extraordinary start, became bitter, let his health go, and died at an early age. James is remembered as a gifted adult who started off as a gifted youngster. Sidis never reached the glory of his namesake and is remembered as a classic example of a bright flame that was extinguished early.

What is it that leads some gifted youngsters to become gifted adults and others not to make the transition from being a gifted youngster to being a gifted adult? What leads individuals to make transitions in the kinds of developing expertise that lead society to label these individuals as gifted, not only from childhood to adulthood but from one stage of childhood to another stage of childhood or from one stage of adulthood to another stage of adulthood? More specifically, what leads individuals from some ethnic groups to be identified as gifted more frequently than individuals from other ethnic groups?

In using the term *giftedness*, we refer to individuals who (a) are excellent in work they can or do produce, (b) possess this excellence relative to peers, (c) are able to display this excellence through some kind of tangible performance, (d) can repeat this performance multiple times, and (e) excel in a way that is societally valued (the criteria of the pentagonal implicit theory of giftedness—Sternberg & Zhang, 1995—which has been empirically validated both in the United States and China—Zhang & Sternberg, 1998).

Is it possible that some of the children not being identified as gifted have the gifts and talents to be major contributors to their fields, and that some of the children being identified have lesser talents? In particular, is it possible that underserved minority students have the abilities to excel in their careers, but never get the chance to display these talents because the educational system does not recognize their gifts? Only through

investigations of the kind described here is there any hope of providing empirical data for how we can close the gap between minority and non-minority students' academic achievement scores (Jencks & Philips, 1998), and ultimately, the gap in what members of different ethnic groups are encouraged by their societies to contribute to the world.

We believe that the problem addressed by this study is one of the most fundamental ones in gifted education, in particular, and in education, in general. There are at least three reasons why the problem is an important one.

First, consider the issue of *identification*. One of the goals of gifted education is to identify those who are most likely to make important contributions, of whatever kind, to society. From this point of view, we need to understand transitions in giftedness in order to understand which children truly have the most potential to develop the kinds of expertise needed to make such contributions, and which are more likely to flame out and thus be less likely to develop needed expertise and to make such contributions. Without such understanding, we may be identifying as gifted individuals those who have a lesser potential contribution to make. We may be failing to identify underserved minority children who could excel in careers, but whose excellence is not shown in conventional assessments used for identification.

Second, consider the issue of *instruction*. To the extent that giftedness is in part a matter of developing expertise, educators may be able to help young children develop the kinds of expertise that will lead to long-term contributions if they can determine just what types of expertise these are. Educators cannot adequately decide on how and what to teach if they are not clear as to what kinds of expertise they are trying to develop through their instruction. A further important issue is that underserved minority children often may best learn in ways that do not correspond well to the ways in which traditional instruction is delivered, so that these children do not have the opportunity to fulfill their potential to excel. Instruction needs to match identification to ensure that students identified as gifted are taught in a way that helps them capitalize on strengths and compensate for or correct weaknesses.

Third, consider the issue of *evaluation*. Samples of children's performance—homework assignments, examinations, essays, projects, and the like—should be evaluated in terms of the kinds of expertise that are important to develop. Such evaluation thus requires identifying what kinds of expertise are important. Otherwise, we may end up evaluating children on the wrong criteria, and rewarding the wrong children (as well as adults). Essentially, these are criteria that are viewed as mattering in school but not later in careers. The evaluation must match the identification and instruction. Underserved minority children may make it through the identification and instruction processes, but unless the evaluations of achievement match what they have learned, they will not get credit for their achievements.

Thus, the objective of the proposed research was to discover the bases for identification, instruction, and evaluation that warrant successful transitions in giftedness across developmental levels and that, in particular, does justice to members of

underrepresented minorities (which at the present time is not being done). The problem is how to capitalize on the talent of the nation's youngsters, our most precious resource as a nation. Currently, traditional analytic abilities are stressed in the identification of children for gifted education programs. However, our research suggested that creative and practical skills are as important as, if not more important than, analytical skills to success in life. We have found that even individuals who are analytically and creatively gifted will not necessarily possess the abilities to excel as adults. For example, they may be able to produce creative artwork but not know how to get it exhibited, or write creative stories but not know how to get them published, or compose creative musical arrangements but not know how to get them played. The may fail in later transitions of giftedness because they are ineffective at promoting their ideas.

## Theoretical Model

Our review of the relevant literature led to a characterization of the field of intellectual giftedness in terms of 3 models (Sternberg & Davidson, 2005). Background research can be loosely characterized as following one of the models. These models will organize our review of background research.

### Model I: The Analytical-Intelligence (g-Based) Model

One model of this phenomenon is based on a theory dating back to Spearman (1904, 1927; see also Jensen & Phillips, 1998), who argued that individual differences in human intelligence can be understood primarily in terms of differences in a general factor of intelligence, or *g*, which Spearman believed to be mental energy. The most well-known study of giftedness, the Terman study (Terman & Oden, 1959), actually provided a way to assess this notion as it applies to the transition between childhood and adulthood giftedness. The study classified participants (individuals who grew up in California whose IQs generally exceeded 140, or 2.5 standard deviations above the population mean) into 3 groups, A, B, and C, depending on the level of their IQs. Although IQ is not equivalent to psychometric *g,* it is highly correlated with it. We refer to these measures as being of "analytical intelligence," in order to use a uniform terminology in describing the 3 models. The researchers then compared the achievements of individuals in the 3 groups as adults. The A's generally reached higher levels of achievement than the C's, with the B's in-between. But the differences were not large and there were many A's who were not particularly successful and C's that were.

Another, less direct interpretation of this hypothesis can be achieved by looking at the Terman study in another way, or by supplementing it with a study done by Subotnik, Kassan, Summers, and Wasser (1994) of Hunter College Elementary School graduates, children who were also identified as gifted primarily on the basis of IQ-based abilities. Subotnik et al.'s East-coast study replicated Terman's West-coast study in a key respect: In both samples, the individuals were notable for their overall success in terms of the outcomes society values (money, fame, and to a much lesser extent, power). But they also were notable for the lack of truly outstanding success of the kind that leads to Nobel Prizes or the highest levels of major recognition in their fields. Some of the participants

reached the heights of their professions, but the numbers were surprisingly small if one took these samples to represent the most gifted children to be found on the 2 coasts of the United States. Notably, the large majority of participants in these studies were White and middle class. Relatively few were from underrepresented minorities, suggesting that the means used to identify the students as gifted may have been skewed.

**Model II: The Analytical + Creative Intelligence Model**

A second model emphasizes the importance not only of conventional (analytical) intelligence, but of creative intelligence as well (or, in more conventional terminology, intelligence plus creativity). Renzulli (1984), for example, has distinguished between "schoolhouse gifted" children and "creative-productive gifted" children. The former are notable for their good test scores, grades, and ability to achieve at the highest levels in a variety of academic settings. The latter are notable for their creative products, such as artwork, musical compositions, poems, short stories, science projects, or other forms of creative production. Renzulli has pointed out that the groups of children, although they may overlap, are by no means the same. Many schoolhouse gifted children are not creatively-productively gifted, and many children who do outstanding creative work are not particularly valued by their teachers and schools.

Bamberger (1986) has taken a related point of view in her studies of musically gifted individuals. Bamberger has suggested that there appears to be a marked transition between what it takes to be gifted as a musician in childhood and what it takes to be a gifted musician in adulthood. Bamberger has suggested that musically gifted children tend to do what others do and do it extremely well. In a sense, their giftedness is reproductive or imitative. Gifted adults, however, need to go beyond what others have done, and great skill in childhood therefore does not necessarily predict great or even distinctive skill as an adult.

A problem with many studies of creative individuals is that they study individuals who have become creatively accomplished, meaning that the individuals had the *opportunity* to become creatively accomplished. Members of underserved minority groups who might have become creatively accomplished but did not have the opportunity to do so never make it into these samples. These individuals often are not able to receive the educational credentials that will enable them to get to the point where they can contribute creatively. Other studies may look at children who are more wide-ranging in their creative skills, but look at kinds of psychometric tests of creativity (such as the Torrance tests) that historically have favored members of the dominant majority group from middle to upper socioeconomic levels.

**Model III: The Analytical + Creative + Practical Model of Successful Intelligence**

A third model emphasizes the importance not only of analytical and creative intelligence, but of practical intelligence as well. This model, proposed by Sternberg (1985, 1988a, 1997a, 1999a), suggests that even individuals who are analytically and creatively gifted will not necessarily possess the abilities to "make it" as adults. For

example, they may be able to produce creative artwork but not know how to get it exhibited, or write creative stories but not know how to get them published, or compose creative musical arrangements but not know how to get them played. The may fail in later transitions of giftedness because they are ineffective at promoting their ideas.

A relevant distinction is that provided by Csikszentmihalyi (1996) between the "domain" and the "field" in which an individual works. The domain refers to the kind of work one does (musical composition, biological research, painting, and writing novels) whereas the field refers to the social organization of the domain—the entire network of people who both create and judge the products of creators. In terms of the present model, one may be successful in the domain through a combination of analytical and creative intelligence but not particularly successful in the field because of a lack of practical intelligence. Or one may be successful in the field and achieve great recognition, at least in the short term, for work that is mediocre in terms of its creative impact.

Again, there is research suggesting the usefulness of this model. Sternberg et al. (2000) have shown in studies of individuals in dozens of pursuits around the world that people who are high in practical intelligence are not necessarily high in analytical intelligence, and vice versa. Moreover, practical intelligence predicts real-world job success about as well as or even better than does IQ. Moreover, Sternberg, Frigorenko, Ferrari, and Clinkenbeard (1999a), Sternberg et al., 2001 (see also Sternberg & the Rainbow Project Collaborators, 2005, 2006) have shown that the analytical, creative, and practical aspects of intelligence are relatively distinct. Sternberg and Lubart (1995) have shown, as have others (see essays in Sternberg, 1999b) that analytical and creative intelligence, although not necessarily independent, are only weakly related. It is often suggested that creative work requires some minimum level of IQ, such as 120, but that after roughly that level, IQ fails to matter or matters much less (Kaufman & Sternberg, 2006; Simonton, 1997; see also Sternberg, 1999b).

## Research Questions and Hypotheses

Although intelligence presumably is an important part of giftedness at any age level, probably no one seriously believes that intelligence is all that is involved in giftedness. Therefore, a model of giftedness and the transitions within it must be broader to encompass a wider range of factors likely to affect whether an individual makes it from one transition to another and still be validly labeled as "gifted." The theoretical framework we shall use in this proposal is a confluence model proposed by Sternberg and Lubart (1991, 1995), similar to other such models (e.g., Amabile, 1996), which attempts to understand giftedness in terms of a number of different personal and situational factors that must come together for someone to be labeled as gifted. We make no claim that our theoretical framework is exhaustive with respect to the attributes relevant to giftedness, but we believe it covers some of the major ones. There are six converging facets in the model: intelligence, knowledge, thinking styles, personality, motivation, and environment.

The skills that lead society to label some people as gifted and others as not gifted are not fixed quantities, predetermined at birth or soon thereafter. Rather, they are skills that emerge over time through the interactions of genes with the environment (Sternberg & Grigorenko, 1997). According to this view, all skills represent forms of developing expertise (Sternberg, 1998). Giftedness is something that can be developed through the interaction of genes and environment. It is neither wholly innate nor wholly environmental. Educators cannot do anything to change children's genes, but they can do a lot to provide the kinds of environments that allow children to optimize their genetic potential. Moreover, data suggest that *all* children can greatly improve their performance if taught in a way that enables them to use their natural endowments to maximum benefits (Grigorenko, Jarvin, & Sternberg, 2002; Sternberg, Torff, & Grigorenko, 1998a, 1998b). These results were obtained in school districts with high proportions of underserved minority students of lower socioeconomic levels.

Let us now review the six converging facets in the model: intelligence, knowledge, thinking styles, personality, motivation, and environment.

**Intelligence.** We conceive of intelligence in terms of the theory of successful intelligence (a part of which is described as Model 3 above—Sternberg, 1997a, 1999a). *Successful intelligence is the ability to attain success in one's life, according to one's own personal definition of success within one's sociocultural context, through adaptation to, shaping of, and selection of environments, by recognizing and capitalizing on one's strengths at the same time that one recognizes and corrects or compensates for one's weaknesses, through a combination of analytical, creative, and practical abilities.* There are several key features of this definition.

*First*, there is no one definition of success. To measure success, one must consider both nomothetic variables (such as publication rates or citation rates for scientists or prizes won by musicians) as well as idiographic variables (such as things that an individual designates as indicative of his or her own success). At the same time, success is achieved within a sociocultural context (Sternberg, 2004, in press-a, in press-b; see also Sternberg & Grigorenko, 2004), so people cannot be totally flexible in designating the criteria of success. Skill in being a thief, for example, will generally not be socioculturally prosocial. Hence, this kind of skill does not meet societal criteria for success.

*Second*, successful intelligence requires balancing of, adaptation to, selection of, and shaping of environments. In other words, successfully intelligent people change themselves to suit the environment (adaptation), but also change the environment to suit them (shaping), and when necessary, choose a new environment that is more consonant with their abilities, motivations, values, or ambitions.

*Third*, successful intelligence requires the individual to determine what he or she can do particularly well, and to make the most of it. It also requires the individual to ascertain what he or she cannot do particularly well, and to find ways around it. Probably no one is good at everything. Rather, people must find their own individual way to excel,

not only across careers, but even within careers. For example, there is no one formula for successful teaching, scientific research, or musical performance.

*Fourth*, success in any career requires some balance of analytical, creative, and practical abilities. Analytical abilities involve analysis, evaluation, judgment, and critique. Creative abilities involve creation, discovery, invention, and imagination. Practical abilities involve utilization, implementation, contextualization, and application. For example, a scientist must generate ideas (creative), evaluate the value of the ideas he or she has generated (analytical), and persuade other scientists of the value of the ideas (practical). An artist must generate ideas for a composition (creative), evaluate whether he or she has achieved the desired effect (analytical), and persuade gallery owners or museums to display or stores to sell his or her art (practical). An entrepreneur must generate ideas for new products or services (creative), evaluate whether the ideas are good ones (analytical), and then sell the idea to a venture-capital firm or to the public (practical).

Over the years, we have collected a substantial database in support of the theory of successful intelligence (see Hedlund, Wilt, Nebel, Ashford, & Sternberg, 2006; Stemler, Grigorenko, Jarvin, & Sternberg, 2006; Sternberg, 1985, 1988a, 1997a, 1999a, 2003, 2004; Sternberg et al., 2000; Sternberg & the Rainbow Project Collaborators, 2005, 2006). Studies have been done with both children and adults, and in cultures as diverse as the United States, Spain, Finland, India, Kenya, Tanzania, Russia, and Jamaica, among other locations. Some of our main findings are: (a) the relative independence of analytical, creative, and practical intelligence; (b) the empirical validity of all three aspects of intelligence for predicting school and job performance; (c) the incremental validity of creative and practical aspects of intelligence over analytical intelligence for predicting school and job success; (d) the cross-cultural generality of the findings; and (e) the greater proportion of analytically gifted among White middle to upper middle class well-educated populations and the more nearly equal proportions of creatively and practically gifted among a variety of populations, including non-White, lower SES, and less-educated populations. In other words, traditional methods of identification, instruction, and evaluation may fail to capture the strengths of gifted underserved minority children. In particular, we have shown that all three aspects of intelligence are modifiable, and that when students are taught analytically, creatively, and practically, their school achievement increases (Grigorenko et al., 2002; Sternberg, Ferrari, Clinkenbeard, & Grigorenko, 1996; Sternberg et al., 1999b; Sternberg, Torff, & Grigorenko, 1998a, 1998b).

We had several findings that were of particular importance with regard to our emphasis on underserved minorities. *First*, our research in Kenya showed that children outside the societal mainstream can actually show a *negative* relationship between conventional analytical academic abilities and practical abilities (Sternberg et al., 2001). In other words, children can excel in practical abilities required for adaptation to their own environment, but may appear inept in school. For example, in the United States, children in challenging environments may need to develop creative and practical skills to maintain their health and safety. Children in safer and more conventional environments

may not have to develop such skills and may have the luxury of concentrating on memory-analytical skills. The latter children, however, are the ones who often get "credit" in the schools for their gifts. *Second*, our research in Tanzania showed that children who do not perform well on conventional *static* tests of abilities may perform much better on *dynamic* tests of abilities, where children are placed in a more supportive environment that combines testing with instructional functions—the children learn at the time they are tested (Grigorenko et al., in press; Sternberg et al., 1999b; see also Grigorenko & Sternberg, 1998; Sternberg & Grigorenko, 2002). We found that, with dynamic testing, scores improved and the predictive validity of these scores increased. More importantly, the children who did well with dynamic testing were not necessarily those who did well with static testing. In other words, underserved minority children may have important skills that are totally overlooked by conventional static tests. *Third*, our research in California showed that different ethnic groups can have, on average, different conceptions of what it means to be intelligent (Okagaki & Sternberg, 1993). For example, we found that Latino parents emphasized social skills, whereas European-American parents emphasized cognitive skills, in their conceptions of intelligence. Heath (1983) found, similarly, that African-American parents placed more emphasis on nonverbal communication skills than did White parents, whereas White parents placed more emphasis on verbal communication skills. In sum, to adequately identify children's strengths and weaknesses, we need to know what skills are considered important in the communities from which they emerge.

**Knowledge.** Research comparing experts and novices shows that the single attribute that probably best distinguishes experts from novices in a given domain is knowledge—both its amount and its organization (e.g., Bereiter & Scardamalia, 1993; Chase & Simon, 1973; Chi, Glaser, & Farr, 1988; Ericsson, 1996). Experts know more than novices and better organize the knowledge they have, so that later they are better able to retrieve, and therefore to utilize it. Of course, schools are largely based on the precept that the acquisition of knowledge is a key to success in life. At the same time, there is evidence that knowledge can be a double-edged sword, which is to say that knowledge can hurt as well as help experts perform well. At times, knowledge can result in a narrowing of vision or a kind of intellectual entrenchment that prevents people from understanding or accepting new ways of thinking (Adelson, 1984; Frensch & Sternberg, 1989; Sternberg & Lubart, 1995).

**Thinking Styles.** Thinking styles are preferred ways of using one's abilities (Grigorenko & Sternberg, 1995, 1997; Sternberg, 1997b; Zhang & Sternberg, 2005, 2006). They refer not to how well a person can think, but rather to how the person prefers to think. The theory we use here is the theory of mental self-government (Sternberg, 1988b, 1994, 1997b; Sternberg & Grigorenko, 1995). According to this theory, people organize their thinking in much of the same way as governments organize themselves. For example, they may be primarily *legislative*, preferring to come up with their own ways of doing things and to decide for themselves on how to structure their work. They may be primarily *executive*, preferring to be given a structure in which to work or to be told how to do things; or primarily *judicial*, preferring to evaluate and

analyze work that they and others have done. We have constructed psychometrically-validated measures to assess these styles from the middle school level onward.

We have found the construct of thinking styles to be useful in school settings (Grigorenko & Sternberg, 1999; Sternberg, 1997b; Sternberg & Grigorenko, 1995). In particular, (a) thinking styles predict school achievement; (b) they predict school achievement incrementally over abilities; (c) the predictive value of particular styles varies across schools, depending upon the preferred styles within a given scholastic setting; and (d) students tend to achieve at higher levels when their profile of preferred style matches that of their teacher.

**Personality.** Although the most widely accepted theory of personality is probably the 5-factor theory (Costa & McCrae, 1992), we have found that, in terms of giftedness, another set of attributes is perhaps more useful, as summarized in Table 1 (Sternberg, 1999c, 2000; Sternberg & Lubart, 1995, 1996). All of these attributes can be assessed with instruments we have used in previous research (Sternberg & Lubart, 1995).

Table 1

Attributes of Giftedness

1. Willingness to defy convention. Gifted individuals, and particularly creatively gifted ones, are willing to defy convention and to go their own way.
2. Willingness to surmount obstacles. Because their ideas are inconsistent with those of the majority, the majority often rejects their ideas and often them as well. The gifted person must thus be willing to overcome obstacles that are set in his or her way.
3. Willingness to take risks. Being creatively gifted requires one to take risks, often with only modest to moderate hope of reward. Those who insist on "playing it safe" are not likely to be among those who have the most impact.
4. Willingness to tolerate ambiguity. Great ideas usually do not come to their originators in a sudden flash (Gruber, 1981, 1986). Rather, they build up slowly over time. The gifted individual must be willing to tolerate the ambiguity of not quite having things right for long enough to allow time to get things right.
5. Self-efficacy. Gifted individuals believe in their ability to get done what they need to do (Bandura, 1996). They must do so because there often are times when no one else seems to believe in them.

In our research, we have found measures of these personality attributes, which we view as flexible rather than as fixed, to predict creative performance (Lubart & Sternberg, 1988, 1998). Merely encouraging students to be creative improves their creative performance (O'Hara & Sternberg, 2000-2001).

**Motivation.** Although we do not emphasize motivation as much as does, say, Amabile (1996), we believe that motivation is a key to continued giftedness. People who are not motivated do not attain or maintain expertise. Indeed, we believe that many of the effects of expertise are attributed to deliberate practice of skills (Ericsson, 1996; Ericsson & Smith, 1991) originate at least partially with motivation. It is not just the practice, per se, but the motivation to practice, which is needed to develop expertise.

Motivation is a state, not a trait. We have found in our research that children can be more motivated to learn if they are taught in a way that matches their patterns of strengths (Grigorenko et al., 2002). Underserved minority children are often placed in a situation where instructions fail to match their strengths, resulting in a lack of motivation.

**Environment.** Many studies have shown the crucial role of the environment in stimulating creative giftedness (see, e.g., Simonton, 1975), but any kind of giftedness will require great levels of motivation to manifest itself. We suggest that giftedness depends in part on having a supportive and nurturant environment for one's contributions. Work by Steele (1992, 1997) has suggested that underserved minority children may disidentify with the tests used to label children as gifted. In this case, the testing environment may contribute to the appearance that these children lack gifts they may actually possess.

**Specific Research Hypotheses**

We hypothesized, based on theoretical considerations and past research by ourselves and others, that:

1. Creative and practical abilities will be of increasing importance to giftedness, with increasing age and across domains; in contrast, the importance of analytical abilities will remain but will decrease relative to that of creative and practical abilities.
2. Members of underrepresented minority groups will, on average, score relatively higher on measures of creative and practical abilities than on measures of analytical abilities, whereas members of the majority group will, on average, show a reverse pattern.
3. Consistent with past results, students will show greater knowledge with increasing age, and highly gifted students will show proportionately more knowledge with increasing age relatively to gifted students, and gifted students will show proportionately more knowledge with increasing age relative to ungifted students.
4. The importance of the legislative style of thinking will increase with age in tandem with the importance of creative giftedness and the importance of the executive style, associated with memory learning, will decrease.
5. Willingness to defy convention, surmount obstacles, take sensible risks, tolerate ambiguity, and develop self-efficacy will become more important to giftedness with increasing age as creativity becomes more and more with respect to the field and less and less with respect merely to one's school peers or oneself.

6. Students who are more highly motivated by their teachers and coursework will be more likely to be identified as gifted than students who are not as highly motivated.
7. A supportive environment will be important to identification of giftedness at all ages.

# Method

## Design Overview

Transitions in the nature of developing expertise that leads to a label of giftedness can be studied longitudinally (i.e., the same participants studied over time) or cross-sectionally (i.e., participants at different stages of life studied at the same time). We chose a cross-sectional design for the main study for three reasons (Subotnik & Arnold, 1993). First, longitudinal studies often have high dropout rates over time, with the more successful individuals (in terms of whatever the study is measuring) being more likely to remain in the study and thus bias the results as the sample size progressively diminishes. Second, longitudinal studies of the kind we would need would require half a century to complete, and we could not assure the availability of personnel over that period of time adequately to complete the work—nor did we believe that the problem addressed by the research should wait that long to be addressed. Third, the realities of research funding render it problematical to maintain funding over such a long period of time. We decided, however, to complement the large cross-sectional study with a smaller longitudinal sample.

In both the cross-sectional and longitudinal studies, the main independent variables were the results of the measures assessing the skills of evaluated individuals within the confluence framework. The main dependent variables were the group classification of these individuals (highly gifted versus gifted versus non-identified as gifted). It was not possible adequately to study children with all kinds of gifts in all areas of specialization, and these specializations needed to be defined broadly enough to allow us to find adequate samples yet narrowly enough to ensure that there was at least some homogeneity in the gifts that were being studied within an area. We therefore chose two areas of giftedness that can be studied at each of the life epochs described above. These two areas, loosely representing aspects of the humanities and sciences, were (a) verbally oriented (reading/writing) performance (we use the letter V to signify this group) and (b) quantitatively oriented (mathematical/scientific) performance (we use the letter Q to signify this group). We chose these areas because: (a) both are important to society; (b) they are the two areas that seem to be valued most by schools; (c) they are the two broad areas most frequently assessed by conventional standardized tests of abilities and achievement; (d) various objective and subjective measures are readily available; and (e) giftedness in both is often recognized fairly early (in contrast, say, to giftedness in sculpture, which often is not recognized until later). The main comparisons of interest between participants were:

1. between highly gifted and gifted (not highly gifted) groups;
2. between both gifted groups and the not gifted groups;
3. across the 4 stages of life (preschool, middle school, high school, and college and graduate school years);
4. across the 2 fields of endeavor (verbally and quantitatively oriented);
5. across the 3 models of giftedness: Model 1 (analytical), model 2 (analytical + creative) and model 3 (analytical + creative + practical) as they apply at different stages of life.

We anticipated that Model 1 (analytical intelligence only) would be predictive of who is identified as gifted in childhood, but that it would fail in adulthood, as creative and practical abilities become more important to distinguished success and Model 3 (analytical, creative, practical intelligence) becomes better predictive of gifted performance. We also believed that the role of a legislative thinking style, as well as of the personality and motivational variables examined, would become more prominent in adulthood.

## Participants

There were two groups of participants: individuals who are evaluators (teachers, parents, college/university professors/instructors), and individuals who are evaluated (students).

The members of the first group of participants filled out questionnaires and were interviewed regarding the characteristics of highly gifted, gifted but not highly gifted, and not gifted individuals in their area of endeavor. The second class of participants was assessed for their potentials and demonstrated levels of performance.

Evaluated participants (and their corresponding evaluators) consisted of three samples of individuals ([1] highly gifted (study group); [2] gifted but not highly gifted (comparison group); and [3] not gifted (control group)) in each of four age cohorts: (a) pre-k students (ages 3-5), (b) middle school students (grades 5-6); (c) secondary school students (grades 11-12); and (d) college students (majors in Mathematics and English/English Literature). Within each group, we sampled for minority groups, including African-American and subgroups of Hispanic underserved minority students.

Our aim was to recruit schools representing a wide range of (a) geographical locations, (b) urban vs. suburban status, (c) ethnic makeup, and (d) socioeconomic makeup. Overall, we recruited 76 schools and 7 universities from 12 counties in 8 states across the United States, highlighted on the map (Figure 1).

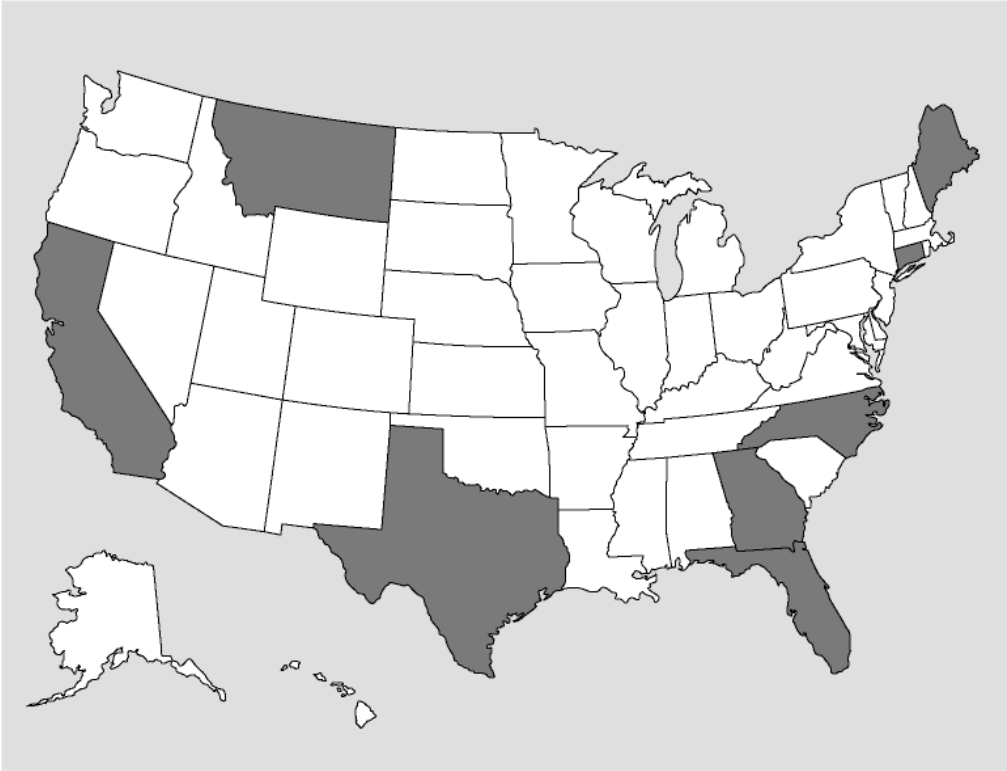

Figure 1. States from which participants were recruited.

Table 2 summarizes the final samples of participants at each age level.

Table 2

Summary of Participants in the Study

| GROUP | | NO. OF STUDENTS |
|---|---|---|
| Preschool Participants | | 81 |
| Middle School Participants | Longitudinal study | 153 |
| | Cross-sectional study | 724 |
| High Schools Participants | | 475 |
| College Participants | | 624 |

## Materials

Different assessments were administered to different types of participants (teachers, parents, students) and to different age-levels (pre-k, middle school, high school and college), as listed in Table 3. A more detailed description of each measure follows the table.

Table 3

Assessment Instruments

| **Measure** | **Teachers** | **Parents** | **Pre-k** | **Middle School** | **High School** | **College** |
|---|---|---|---|---|---|---|
| Demographic Information | X | X | | X | X | X |
| Student's/Parent's Educational Style Teaching Style | X | X | | X | X | |
| Teacher Rating Scale of Child's Actual Behavior (Harter) | X | X | | | | |
| Analytical, Creative, and Practical Ability Ratings | X | X | | | | |
| Subject Preferences | | | | X | X | X |
| Student Future Goals | | | | X | X | X |
| Bracken School Readiness Assessment | | | X | | | |
| Comprehensive Assessment of Spoken Language (CASL) | | | X | | | |
| Concept About Print (CAP) | | | X | | | |
| Pre-CTOPP (Comprehensive Test of Phonological Processing) | | | X | | | |
| Wechsler Preschool and Primary Scale of Intelligence—III | | | X | | | |
| Woodcock-Johnson III (WJ-III) | | | X | | | |
| Culture Fair Intelligence Test (Cattell) | | | | X | X | X |
| Mill Hill Vocabulary Scale | | | | X | X | X |
| School/College Life Questionnaire | | | | X | X | X |
| Creative Story | | | | X | X | X |
| Creative Collage Task | | | X | X | X | |
| Adjective Check List (Gough) | X | X | | X | X | |
| Sternberg Triarchic Abilities Test (STAT) | | | | X | X | |
| Thinking Style Questionnaire (Sternberg) | X | X | | X | X | |
| Potential Success Factors Questionnaire | X | X | | X | X | |
| Achievement Motivation Questionnaire (Elliot) | | | | X | X | |
| Implicit Theories of Intelligence Scale (Dweck) | X | | | X | X | |
| Self-Perception Profile (Harter) | | | | X | X | |
| Standardized Achievement Test Scores | | | | X | X | X |
| Academic and Nonacademic Awards | | X | | | | X |
| Teacher's Giews on Giftedness | X | | | | | |

**Assessments Administered to Students**

**Demographic information.** Middle and high school students were asked to indicate their ethnicity, age, gender, and current grade level. College students were asked a number of open-ended and multiple-choice questions about their ethnicity, age, current level of education and major, academic and nonacademic awards that they have received as well as participation in gifted and talented educational programs. A rubric for rating student responses was developed. Interrater reliability analysis revealed a high level of agreement between raters on the categories of the scoring rubric (with a mean percent agreement of 94.33% and a mean Cohen's kappa of 0.85).

**Educational style.** Middle and high school students were asked to indicate how much time per week they spend doing homework as well as engaged in extracurricular reading, extracurricular math problem solving, extracurricular creative activities, and extracurricular exploration of scientific questions. Students were asked to estimate time they devote to each activity on a scale ranging from *less than 1 hour/week* to *10+ hours/week*.

**Academic subject preferences and competence.** All students were asked to rank-order 4 academic subjects—math, science, language arts, and social studies—according to their level of competence in that subject area and according to their own preference for that particular subject.

**Future goals and plans.** Middle and high school students were asked a number of open-ended and multiple-choice questions about career and educational plans, as well as about their 1-, 5- and 10-year future goals. A rubric for rating student future goals was developed. Interrater reliability analysis revealed a high level of agreement between raters on the categories of the scoring rubric (with a mean percent agreement of 95.35% and a mean Cohen's kappa of 0.99).

College students were asked a number of open-ended questions about career and educational plans, as well as about their 1- and 10-year future goals. A rubric for rating student responses was developed. Interrater reliability analysis revealed high agreement between raters on the categories of the scoring rubric (with a mean percent agreement of 85.03% and a mean Cohen's kappa of 0.78).

**The Bracken School Readiness Assessment.** The Bracken School Readiness Assessment (BSRA, Bracken, 2002) is an assessment of school readiness concepts in young children that are directly related to early childhood education and that predict readiness for more formal education. The BSRA consists of six subtests: (a) Colors: Children were asked to identify primary colors; (b) Letters: Children were asked to identify upper- and lower-case letters; (c) Numbers/Counting: Children were asked to identify single- and double-digit numbers and to assign number values to a given set of objects; (d) Sizes: Children were asked to describe dimensions of pictured items (e.g., tall, long, short, big, small, and so forth); (e) Comparisons: Children were asked to match and/or differentiate objects based on one or more characteristics; and (6) Shapes:

Children were asked to identify 1-, 2-, and 3-dimensional shapes (e.g., curve, circle, pyramid, column, and so forth).

**Comprehensive Assessment of Spoken Language.** The Comprehensive Assessment of Spoken Language (CASL, Carrow-Woolfolk, 2001) is an assessment of oral language including comprehension, expression, word retrieval, knowledge of use of words and grammar, and the ability to use language for communication. The following three subtests were administered: (a) *Basic Concepts:* In this task, children were shown a set of 4 pictures and asked to point to the picture that represents the meaning of a word given orally. The words were nouns (e.g., girl), prepositions (e.g., under), and adjectives (e.g., big). This test measures comprehension of words important to success in early education. (b) *Syntax Construction:* Children were asked to complete sentences using prepositional phrases and answer questions that elicit specific syntactic forms. This measures the ability to formulate sentences using syntactic rules such as verb tense for regular and irregular words. (c) *Pragmatic Judgment:* Children were presented with short sentences or paragraphs that describe everyday situations and then asked to judge the appropriateness of the language or provide the appropriate language for the situation. This test measures pragmatic competency such as how to initiate conversations, express gratitude or sorrow, and make requests.

**Concept About Print.** Concept About Print (CAP, Clay, 2002) is an unusual but very informative task that utilizes a book with deliberate errors for the child to notice—upside down pictures and print, out-of-order words, misspelled words, and so forth. Children were presented with one of the two books ("Follow Me Moon" or "No Shoes") and asked several questions regarding directional rules of print, word-by-word reading, line/word sequence, and rules of punctuation and capitalization. This is an informal assessment of knowledge of the way we print words.

**Preschool Comprehensive Test of Phonological Processing.** The Preschool Comprehensive Test of Phonological Process (Pre-CTOPP, Lonigan, Wagner, Torgesen, & Rashotte, 2002) is a test that is designed to assess phonological awareness, phonological memory, and rapid naming—all of which play a role in learning to read. Phonological awareness tasks tap a child's ability to hear and play with phonemes that make up words. Phonological memory tasks assess the ability to hold in memory the sounds that make up words. Rapid Naming tasks require children to quickly access words from memory. Three subtests were given (a) Elision: Children were asked to repeat a word and then say what is left after dropping out designated sounds (e.g., bold minus /b/ = old). This is a phonological awareness task. (b) Nonword Repetition: Children were asked to repeat orally presented nonwords or pseudowords. This is a phonological memory task. And (c) Rapid Object Naming: Children were presented with rows of pictures of 4 drawings of objects (e.g., dog, tree, ball, car) placed randomly in a row. They were asked to name the objects, one after the other, left to right, as fast as they could, until they reached the end of the last row. This is a rapid naming task.

**Wechsler Preschool and Primary Scale of Intelligence-III.** The Perceptual Reasoning portion of the Wechsler Preschool and Primary Scale of Intelligence (WPPSI)

was administered (Wechsler, 2002). These subtests provide a composite measure that reflects the ability to reason on tasks that are nonverbal and novel to children. The tasks involve spatial processing, attentiveness to detail, and integrating visual information and fine motor movement. The following four subtests were given: (a) Block Design (*all children*): Children were asked to construct abstract designs with blocks, based on a model that was shown. This is a measure of the ability to perceive, analyze, and synthesize visual stimuli. (b) Object Assembly (*ages 3:11 and younger*): Children were given simple 2-6 piece puzzles to construct. Easier items were presented with a title, for example, put these pieces together to make a train. Later items were presented without any information. This is a measure of visual-spatial processing. (c) Matrix Reasoning (*ages 4:0 and older*): Children were shown incomplete sets of pictures in a matrix. They were asked to choose from a set of 4 or 5 responses a shape or picture that would complete the matrix based on a pattern or classification system. This is a measure of visual information processing and abstract reasoning skills. And (d) Picture Concepts (*ages 4:0 and older*): Children were presented with 2 or 3 rows of pictures and asked to choose one picture from each row that went together (e.g., same color) or had a common characteristic (e.g., similar function). This is a measure of abstract, categorical reasoning ability.

**Woodcock-Johnson-III Tests of Achievement.** The Woodcock-Johnson-III Tests of Achievement (WJ-III) is an assessment of academic achievement that includes Reading Skills and Oral Language Skills (Woodcock, McGrew, & Mather, 2001). The following three subtests were given: (a) Word Attack: This subtest measures ability to pronounce the sounds of single letters, then to read aloud pseudowords or non-words, such as "ab", "ket", or "mibgus." This is an assessment of the ability to decode (attach the sounds of language to the letters) words that are not familiar to a child. (b) Picture Vocabulary: Children were asked to identify increasingly difficult pictured objects. This is an assessment of expressive vocabulary. And (c) Story Recall: Children were asked to recall details of increasingly complex short stories presented orally by the examiner. This is an assessment of oral language development and meaningful memory.

**Cattell Culture Fair Intelligence Test.** Students' analytical intelligence was assessed with the Cattell Culture Fair Intelligence assessment (Cattell & Cattell, 1973). This test is designed to measure nonverbal intellectual abilities in a manner that reduces the influence of verbal fluency, cultural climate, and educational level. Both high and elementary/middle school students completed two subtests of the Cattell test: Conditions (Scale 2 for both groups) and Classification (Scale 2 for elementary/middle and Scale 3 for high school students) subtests. Certain figural elements were presented and the students were asked to select figures that are either different or similar to the given figures (depending on the subtest). The directions for each test were read to the students and examples provided. The tests were timed according to instructions provided in the test manual.

College students' analytical intelligence was assessed with the Cattell Culture Fair Intelligence Test, Scale 3, Conditions and Classification subtests (Cattell & Cattell, 1973) and the Mill Hill Vocabulary Scale, Set B, Senior version (Raven, Court, & Raven,

1992). The Cattell Culture Fair Intelligence Test is designed to measure nonverbal intellectual abilities in a manner that reduces the influence of verbal fluency, cultural climate, and educational level, whereas the Mill Hill Vocabulary Scale, described below, is aimed at measuring verbal intelligence. In our study, reliability for the Cattell was .87 and for the Mill Hill it was .76.

**Mill Hill Vocabulary Scale.** Students' verbal intelligence was assessed with the Mill Hill Vocabulary Scale, Set B (Raven et al., 1992). This is a multiple-choice test, consisting of 33 items, in which students have to select a word that has a similar meaning to a given word. The test was not timed. High school *s*tudents completed the Senior version of the Mill Hill test whereas elementary and middle school students completed the Junior version of this test.

**Student Life Questionnaire.** College students practical abilities were assessed with the College Life Questionnaire (Sternberg et al., 2000), designed to capture relatively general-level tacit knowledge, to which most American college students are exposed. It contains 10 brief vignettes that describe everyday situations encountered by college undergraduates, such as dealing with a roommate who has annoying borrowing habits or making a dreaded trip to the Bursar's Office. The number of possible strategies for handling a given situation varies with each vignette, ranging from 8 to 16. Individuals are asked to indicate the appropriateness of each given strategy on a 7-point Likert scale, ranging from 1, *extremely bad*, to 7, *extremely good*. Given that the scenarios presented in the tacit-knowledge inventories used in this study required tacit knowledge about general societal norms, and therefore no definitive expert could be meaningfully identified, the scoring of individual participant responses was based on deviations from the mean of the sample (Cianciolo et al., 2006). Vignette-level scores assigned to each participant were derived by calculating the Euclidian distance ($d$) and the Mahalanobis distance ($D^2$) of the participant's vector of ratings in a given vignette from the centroid of the sample to which the participant belonged. Practical intelligence scores were determined by averaging the resulting vignette-level scores.

Middle and high school students' practical abilities were assessed with Student Life Questionnaire that was developed as a modification of College Life Questionnaire. Student Life Questionnaire is designed to capture relatively general-level tacit knowledge, to which most American middle and high school students are exposed. Two versions of the test were developed, so that the wording of vignettes was tailored to the appropriate age group (middle or high school students). Each version contains 5 brief vignettes that describe everyday situations encountered by middle and high school students, such as choosing extracurricular activities or working on a project with a person one really dislikes. The number of possible strategies for handling a given situation varies with each vignette, ranging from 7 to 8. Students are asked to indicate the appropriateness of each given strategy on a 7-point Likert scale, ranging from 1, *extremely bad*, to 7, *extremely good*. Given that the scenarios presented in the tacit-knowledge inventories used in this study required tacit knowledge about general societal norms, and therefore no definitive expert could be meaningfully identified, the scoring of individual participant responses was based on deviations from the mean of the sample

(Cianciolo et al., 2006). Vignette-level scores assigned to each participant were derived by calculating the Euclidian distance ($d$) and the Mahalanobis distance ($D^2$) of the participant's vector of ratings in a given vignette from the centroid of the sample to which the participant belonged. Practical intelligence scores were determined by averaging the resulting vignette-level scores.

**Creative story.** Participants were asked to write a creative story on one of the following titles: "Two Chatting Spiders," "A Banana with Many Peels," "The Reading Dragon," "A Spotted Creature," "The Fishing Moose." They were not given a specific time limit to complete the task. Two judges rated the creativity of these stories based on the following 4 dimensions: originality, complexity, emotionality, and task appropriateness.

**Creative Collage Task.** Participants at all age levels were tested on their creative abilities by completing a Creative Collage Task, originally used by Amabile (1982). Students were given a packet of plastic stickers and told to select one topic from the following list of 4 terms: Silliness, Happiness, My Home, or My Dream. The students then made a collage to represent the topic they picked on a 8.5" x 11" piece of paper. They were told to use as many or as few of the stickers as they wished, but not to use any other materials. They were asked to be as creative as possible. They were not given a specific time limit to complete the task. Three judges later rated the creativity of students' art works on the following 8 dimensions: abstractness, symmetry, originality, novel use of materials, likeability, craft, expressiveness, task appropriateness, and complexity.

**Adjective Check List.** 140 adjectives from Gough and Heilbrun's (1983) Adjective Check List (ACL) were used to assess students' personality profile. Students were instructed to mark all adjectives that either fit the profile of a successful student or describe their own personality. Originally, ACL was designed to measure 37 personality traits. In our study we administered 112 adjectives that were shown to be markers of the Big Five personality traits: Neuroticism, Extraversion, Openness to Experience, Agreeableness, and Conscientiousness (John, 1990). In addition, the checklist included 30 adjectives from Gough's Creative Personality Scale (Gough, 1979).

**Sternberg Triarchic Abilities Test.** A modification of Sternberg Triarchic Abilities Test (STAT) was given to each of the students (Sternberg et al., 1996). High school students received one version of STAT, Level H, and elementary and middle school students received another version of STAT, Grades 4-5. Each student completed one of the 3 randomly distributed versions of the STAT. This test consists of 9 subtests and is designed to measure analytical, creative, and practical abilities in three domains—verbal, quantitative, and figural, as summarized below.

| | | Ability | | |
|---|---|---|---|---|
| | | Analytical | Creative | Practical |
| Domain | Verbal | | | |
| | Quantitative | | | |
| | Figural | | | |

The Analytical-Verbal subtest requires students to figure out meanings of neologisms from natural contexts. When completing the Analytical-Quantitative subtest, students are asked to say what number comes next in a series of numbers. In the Analytical-Figural subtests, students have to complete the missing entry in a figural matrix. In the Practical-Verbal subtest students have to resolve a set of vignettes depicting everyday problems. In the Practical-Quantitative subtest students have to solve everyday math problems. In the Practical-Figural subtest students have to answer questions related to route planning and use of maps. In the Creative-Verbal subtests students have to solve novel verbal analogies by using counterfactual premises. In the Creative-Quantitative subtest students are required to use novel number operations to solve presented math problems. Finally, in the Creative-Figural subtest students have to the rule of figural series to a new figure with different appearance, and complete the new series.

**Thinking styles.** Students completed the Thinking Style Questionnaire (Grigorenko & Sternberg, 1995; Sternberg, 1997b) regarding different strategies and ways people use to solve problems, to carry out tasks or projects, and to make decisions. Executive, legislative, and judicial thinking styles subscales were administered (15 items total). Students were asked to indicate how well each statement describes the way they typically do things at school or at home on a 7-point Likert scale, ranging from 1, *not at all well*, to 7, *extremely well*.

**Potential Success Factors Questionnaire.** The participants were administered the Potential Success Factors Questionnaire, and asked to rate importance of 17 characteristics to personal success and success at different stages in life: middle school, high school, college, and career. The assessment was developed based on theoretical conceptualizations of factors important to success as well as a series of student interviews. Students were asked to indicate the importance of each one of the following factors—Creativity, Physical Attractiveness, Connections, Determination, Luck, Problem-solving skills, Leadership, Ambition, Learning from Mistakes, Making the most of your strengths, Support Network, Self-confidence, Compensating for Weaknesses, Money, Risk-taking, and Wisdom—on a 5-point Likert scale, ranging from 1, *not important*, to 5, *very important*.

**Achievement Goal Questionnaire.** Participants responded to a questionnaire based on the 2x2 achievement goal framework of Elliot and McGregor (2001). This questionnaire consists of 12 items and is designed to measure four achievement goal orientations: mastery approach, mastery avoidance, performance approach, and performance avoidance. Participants were asked to rate each of the items on a 7-point Likert-type scale (1 represents *not at all true of me* and 7 represents *very true of me*).

**Implicit Theories of Intelligence.** Three items of the Implicit Theories of Intelligence Scale for Children (Dweck, 1999) were administered to students. This questionnaire is designed to measure students' fundamental assumptions about malleability of their intelligence: whether it is fixed or can be changed. Students were

asked to indicate how much they agree with each statement using 6-point Likert scale, ranging from 1, *strongly agree*, to 6, *strongly disagree*.

**Self-Perception Profile.** As a measure of students' self-concept, Harter's Self-Perception Profile for Children (Harter, 1985) was administered to elementary/middle school students and the Self-Perception Profile for Adolescents (Harter, 1986) was given to high school students. On each given item students had to choose one of the two behaviors that describes them best as well as indicate how well the chosen description fits their profile (whether it is *really true for me* or *sort of true for me*). Students received items from only two subscales of Harter's questionnaire: those assessing Scholastic Competence and those assessing Global Self-Worth. The questionnaire for elementary and middle school children consisted of 12 items and the high school questionnaire consisted of 10 items.

**Academic performance and test scores.** College students were asked to report their current college GPA as well as scores on the SAT, ACT, and GRE exams, as applicable.

**Assessments Administered to Parents (of Pre-k Through Grade 12 Students)**

**Demographics information.** Parents provided personal background information, including their ethnicity, age, and marital status, level of education, employment status and annual household income.

**Parent educational style.** Parents defined the number of hours per week they spent helping the child with schoolwork; the time spent reading with the child; solving math problems, doing creative activities; and doing scientific activities with their child. Parents were asked to estimate time they devote to each activity on a scale ranging from *less than 1 hour/week* to *10+ hours/week*.

**Parent's Rating Scale of Child's Actual Behavior.** Parents were asked to rate their child's actual behavior—how good their child is at schoolwork, how well-behaved, and so forth. Two scales of the Harter's Teacher's Rating Scale of Child's Actual Behavior (Harter, 1985) were administered to parents: Scholastic Competence and Behavioral Conduct. On each given item parents had to choose one of the two behaviors that best describes their child as well as indicate how well the chosen description fits their profile (whether it is *really true* or *sort of true*).

**Abilities ratings.** Parents rated their child's creative, analytical, and practical abilities on a 5-point Likert scale, ranging from 1, *extremely weak*, to 5, *extremely strong*.

**Adjective Check List.** 140 adjectives from Gough and Heilbrun's (1983) Adjective Check List (ACL) were used to assess students' personality profile. Parents were instructed to mark all adjectives that describe their child's personality. Originally, ACL was designed to measure 37 personality traits. In our study we administered 112 adjectives that were shown to be markers of the Big Five personality traits: Neuroticism,

Extraversion, Openness to Experience, Agreeableness, and Conscientiousness (John, 1990). In addition, the checklist included 30 adjectives from Gough's Creative Personality Scale (Gough, 1979).

**Thinking styles.** Parents were administered three subscales of the Thinking Style Questionnaire (Grigorenko & Sternberg, 1995; Sternberg, 1997b) designed to measure executive, legislative, and judicial thinking styles. Parents were asked to indicate how well each statement describes the way their child typically learns on a 7-point Likert scale, ranging from 1, *not at all well*, to 7, *extremely well*.

**Potential Success Factors Questionnaire.** Parents were asked to rate the importance of a list of 17 characteristics: Creativity, Physical Attractiveness, Connections, Determination, Luck, Problem-solving skills, Leadership, Ambition, Learning from Mistakes, Making the most of your strengths, Support Network, Self-confidence, Compensating for Weaknesses, Money, Risk-taking, and Wisdom. The parents indicated the importance of each given factor for personal success as well as success at different stages of life—middle school, high school, college, and career on a 5-point Likert scale, ranging from 1, *not important*, to 5, *very important*.

**Student background information.** Parents also provided specific background information regarding the students' participation in gifted programming, school-related and non school-related activities, and any academic or non academic awards their child had received.

**Assessments Administered to Teachers**

**Demographics information.** Teachers were asked to provide background information regarding themselves, including ethnicity, educational level, and their status as a teacher. They were also asked to indicate their experience teaching gifted students.

**Teaching style.** Teachers were asked to define their teaching style by indicating how many hours a week their students spent on homework for their class, how many hours per week they devote to language arts, mathematics, creative activities, and scientific explorations.

**Teacher's Rating Scale of Child's Actual Behavior.** For each child taught, teachers were asked to rate the child's actual behavior—good at schoolwork, behavior, memory, and so forth. Two scales of the Harter's Teacher's Rating Scale of Child's Actual Behavior (Harter, 1985) were administered: Scholastic Competence and Behavioral Conduct. On each given item teachers had to choose one of the two behaviors that best describes a student being assessed as well as indicate how well the chosen description fits their profile (whether it is *really true* or *sort of true*).

**Giftedness ratings.** Depending on the subject taught, teachers were asked to rate their students on the degree of verbal or mathematical giftedness. They were provided

with a definition of verbal or mathematical giftedness and asked to evaluate each student on a 5-point Likert scale, ranging from 1, *marginally gifted*, to 5, *extremely gifted*.

**Abilities ratings.** For each child taught, teachers were asked to rate the child's creative, analytical, and practical abilities on a 5-point Likert scale, ranging from 1, *extremely weak*, to 5, *extremely strong*.

**Adjective Check List.** Teachers selected from a list of 140 adjectives from Gough and Heilbrun's (1983) Adjective Check List (ACL) those adjectives that best described someone who they felt were a gifted student. Originally, ACL was designed to measure 37 personality traits. In our study we administered 112 adjectives that were shown to be markers of the Big Five personality traits: Neuroticism, Extraversion, Openness to Experience, Agreeableness, and Conscientiousness (John, 1990). In addition, the checklist included 30 adjectives from Gough's Creative Personality Scale (Gough, 1979).

**Thinking styles.** Teachers were asked to rate certain thinking styles as they are applied to gifted students with whom the teacher interacts. Subscales of the Thinking Style Questionnaire (Grigorenko & Sternberg, 1995; Sternberg, 1997b) designed to measure executive, legislative, and judicial thinking styles were administered. These items included rating of such skills as taking standardized tests, motivation, attentiveness, critical thinking, and exploration. Teachers were asked to indicate the applicability of each given item on a 7-point Likert scale, ranging from 1, *not at all well*, to 7, *extremely well*.

**Potential Success Factors Questionnaire.** Teachers were asked to rate the importance of a list of Success Factors—things that most people believe are important for being successful in life: Creativity, Physical Attractiveness, Connections, Determination, Luck, Problem-solving skills, Leadership, Ambition, Learning from Mistakes, Making the most of your strengths, Support Network, Self-confidence, Compensating for Weaknesses, Money, Risk-taking, and Wisdom. Teachers were asked to indicate the importance of each given factor for personal success as well as success at different stages of life—middle school, high school, college, and career on a 5-point Likert scale, ranging from 1, *not important*, to 5, *very important*.

**Implicit Theories of Intelligence.** Three items of the Theories of Intelligence Scale—Self Form for Adults (Dweck, 1999) were administered to teachers. This questionnaire is designed to measure teachers' fundamental assumptions about malleability of their intelligence: whether it is fixed or can be changed. Teachers were asked to indicate how much they agree with each statement using a 6-point Likert scale, ranging from 1, *strongly agree*, to 6, *strongly disagree*.

**Teachers' views on giftedness.** Teachers also indicated the qualities that they thought should be used to identify children for gifted programming.

### Information Collected From School and District Officials

**Standardized test scores.** Achievement test scores for all student participants were provided by the administrators in each participating school district or directly by school administrators. Students' math, reading, and writing standardized test scores were collected

## Procedure

### Preschool

Four early-childhood learning centers from the Greater New Haven (CT) area participated in the study. The Director of each center distributed informational materials, informed consent forms, and parental surveys to parents. Materials were available in both English and Spanish. Once parents gave signed informed consent and completed a parental survey, and with the permission of the Directors and individual teachers, students were assessed on school grounds during school hours. The assessments were done on an individual (one-on-one) basis and each session lasted from 60-90 minutes. Each child required a minimum of two sessions to complete the assessment battery. The assessments were conducted by PACE Center research personnel and graduate and undergraduate student aides who were thoroughly trained in the administration of the assessment battery. In addition, a subgroup of teachers was asked to complete a survey that typically took about 40-60 minutes to complete. A letter describing the project and an Informed Consent was provided for signature. Having returned a completed survey, each teacher received a PACE T-shirt.

### Middle School (Longitudinal)

#### *Year 1*

Teachers only participated in the participant nomination process. At each school, a group meeting was held involving teachers who taught fifth grade. Teachers were given an overview of the project and advised that they were being asked to participate in nominating students for the study. In this process, teachers were asked to nominate those students who they felt were verbally or mathematically gifted. They were also asked to randomly select students from their class lists who were not best described as gifted, but could be asked to participate in the study as a control group. There was no other information sought from the fifth grade teachers. Once students had been nominated by their teachers to participate in the project, parental mailing lists were obtained from the schools. Parents were mailed an explanation of the project and requested to sign an Informed Consent to allow their child to participate in the study. A self-addressed, postage-paid return envelope was provided for the return of the questionnaire to the investigator. There was no other information sought from the parents at that time.

Students were assembled in either the school cafeteria or a separate, spare classroom for group privacy. The Informed Consent had been signed by each student's parent previously and in addition students were given a student version of the consent

form to review and sign. Students were given a paper and pencil Assessment Packet and the investigator provided instructions for all parts of the assessment. Generally, the assessment took about 2 hours to complete. Students were not constrained to a certain time, except in the event of the Cattell Culture Fair Intelligence Test. At the conclusion of the testing, students were asked if they had any questions or comments (debriefed); and were given a Giftedness Project T-shirt and thanked for their participation.

***Year 2***

The students who had been assessed in grade 5 were contacted again the following year, when they were in grade 6. Each child participated in an interview session and in a group testing session. A separate, private room was used to interview each child individually. The Interviewer first reviewed the Informed Consent form and asked the student to sign it. A tape recorder was used to record the details of each interview—the tape was later converted into a text file for review/rating. At the conclusion of (and separate from) the Interview, each student was asked what type of "gift" they thought would be appropriate as a reward for their participation in the project. Interviews took, on average 15-30 minutes, depending on the verbal abilities of the student. All interviews were conducted by the same investigator.

Students were put in groups and brought to the school cafeteria—and were asked to sit at separate tables. An Informed Consent was handed out, reviewed and signed by all participants. Paper and pencil assessment packets were distributed and instructions provided for each part of the assessment. In addition, students were pulled out by researchers one by one to complete the Oral Creative Story task, which required them to dictate their story into a tape recorder. Students were given 15 minutes to speak the story. The recordings were later transcribed into a text document. It took between 60-90 minutes to complete all parts of the assessment. At the conclusion of the testing, students were asked if they had any questions or comments (debriefed); and were given a pass to a local movie theatre and thanked for their participation.

Two types of teachers were surveyed regarding the student participants—Language Arts (English, Reading) and Mathematics. In some cases more than one teacher in each discipline was surveyed, depending on how many teachers interacted consistently with the participants. Generally, the teachers surveyed were those named by the students in the Student Questionnaire. A survey form for each student was put in a separate envelope with a return, postage-paid envelope (to the Investigator) and placed in the teacher's school mailbox so they could complete the survey at their leisure. A letter describing the project and an Informed Consent form was provided for signature. The principal of the school was also aware of the process. While some teachers chose not to participate, most did. The survey typically took about 40-60 minutes to complete, depending upon how many students that teacher had to rate.

A mailing list was developed of all of the parents of student participants. A Parent Questionnaire was mailed to the parents' homes and the mailing included a brief letter describing the program, an Informed Consent form and a return, postage-paid envelope for the completed questionnaire. It was explained that the researchers needed to

have parental input regarding the parents' opinions and their perspective of certain characteristics of their child. If a particular school district had a large percentage of Hispanic participants, a Spanish language version of the questionnaires was also provided to all parents. The questionnaire took about 40 minutes to complete.

***Year 3***

Students who participated in years 1 and 2 when they were in grade 5 and 6, respectively, were once again contacted when they reached grade 8. Students were assembled in either the school auditorium or the school cafeteria for group privacy. The Informed Consent form was first reviewed and signed by each student. Students were given a paper and pencil Assessment Packet and the investigator provided instructions for all parts of the assessment. Generally, the assessment took about 2 hours to complete. In one of the schools tested, a 2 hour block of time was not available, so the investigators split the assessment into 2 one hour blocks, using two separate days. *In the event that some students could not finish the assessment, the investigators returned, usually the following day*. Students were not constrained to a certain time, except in the event of the Cattell Culture Fair Intelligence Test. At the conclusion of the testing, students were asked if they had any questions or comments (debriefed); and were given a pass to a local movie theatre and thanked for their participation.

Teachers and parents were given the same paper and pencil assessment materials they were given when the students were in sixth grade[1].

**Middle School (Cross-sectional) and High School**

***Nominations***

Middle and high school students were selected for participation in the study based upon a teacher nominations meeting. A typical nominations meeting included a presentation of the project's description and objectives, followed by a set of specific instructions on how to nominate students. Additionally, as a guideline, teachers were given a description of a typically highly gifted student. Math and Language Arts teachers were asked to nominate students from their respective class rolls on mathematical and verbal giftedness respectively. The nominations process consisted of three steps.

First, in their class lists teachers placed an "HG" designation next to those students that they believed were "gifted" based on the "highly gifted student" definition they had been provided. Second, teachers in their class lists placed an "MG" ("moderately gifted") next to the names of those students who did not get an "HG" in the first step, and yet judged these students to be capable of excelling and realizing their potential. Finally, teachers nominated the third (control) group for participation in the project. Among those students who were not nominated as either moderately gifted or highly gifted teachers randomly selected one third of their class list and identified those

[1] Parents were asked to rate the importance of a different list of Success Factors: Creativity, Physical Attractiveness, Connections, Determination, Luck, Problem-solving skills, Leadership, Ambition, Learning from Mistakes, Making the most of your strengths, Support Network, Self-confidence, Compensating for Weaknesses, Money, Risk-taking, and Wisdom.

students as a "C" for "control group." If a teacher selected a student who was in a Talented and Gifted (TAG) program or in AP classes, this student would be further identified by placing letter "P" or "AP," respectively, in front of the student's name. Once the names of the nominated students were received, the school mailed each parent a packet containing a return, postage-paid envelope, a parental consent form, a brief letter describing the project, and sample assessment items.

***Student Assessments***

Students participated in the study on the condition that their parents signed the consent form. Those students of 18 years old were allowed to participate without their parents/guardians' permission and were asked to sign their own consent form. In addition to parental consent, consent forms were obtained from all students participating in the project. Students were assessed in groups and assembled in either the school auditorium or the school cafeteria depending on group size. Participants were given paper and pencil assessments and the investigator provided instructions for all parts of the assessment. While the Cattell test (Cattell & Cattell, 1973) was timed, the main portion of the assessment was not. For the most part, students were able to complete all given questionnaires in a single, 2-hour testing session. In cases where schools could not provide a 2-hour block for the testing, two 1-hour sessions were conducted on different days of the week. The time span between these sessions did not involve more than 3 days. To thank students for their participation in the study, each participant received a movie pass to a local theater.

***Parent Assessments***

One week after students were assessed, surveys were mailed to their parents along with a brief letter describing the project and a return, postage-paid envelope. If a particular school district had a large percentage of Hispanic participants, a Spanish language version of the questionnaires was also provided to all parents. The average amount of time required to complete the parent assessment was around 40 minutes.

***Teacher Assessments***

On the day of student testing, teacher assessments were distributed to teachers who had nominated their students. In case this was not possible, teacher surveys were mailed to teachers along with a return, postage-paid envelope after student assessments. A letter describing the project and an Informed Consent was provided for signature. The survey typically took about 40-60 minutes to complete, depending upon how many students that teacher had to rate. Having returned a completed survey, each teacher received a PACE T-shirt.

**College**

Students taking undergraduate psychology classes at the California State University, San Bernardino, and at San Francisco State University were recruited by their professors to participate in the study in exchange for a class credit. Students were instructed that their respective professors would not have access to their test results and that they would get a credit regardless of their performance on the test. Assessments

were administered using an online testing battery (via the Web) and took about 40 minutes to complete. Students were given a link to the website with the testing battery and were instructed to complete the survey in one session, at their convenience. After consenting to completing the survey, students proceeded to answer test questions at their own pace, with the exception of the Cattell tests, where the time allowed to solve presented problems was limited according to instructions provided in the Cattell test manual (Cattell & Cattell, 1973).

## Results and Discussion

### Data Preparation

All data for this study were collected, entered, and checked for errors and internal consistency using a standardized data flow procedure. First, once the hard copies of the assessments were received, they were visually checked for completeness; if any problems were noted, they were referred to the data manager. Second, all participants were randomly assigned a unique 8-10 digit identification number according to the developed schema ID system. The first three digits of the identification number designated the school district of the participant and the next two to three digits the school of the participant. All information linking student[2], parent, and teacher names to their respective ID's as well as linking student ID's to their respective parent and teacher ID's was stored in a password protected Excel document. Once an identification number was assigned to a participant, all hard copies of the assessments were labelled with this number and all identifying information (such as participant name) was removed from the assessment booklet.

Next, Excel data entry templates and coding manuals were developed for each group of participants: preschool students, middle school students, high school students, college students, parents, and teachers. Each coding manual links items found in the assessment battery to variable heading found in Excel template as well as specifies values that should be entered for each variable. All collected data were assigned to trained coders to enter. All responses to open-ended questions and creativity assessments were assigned to trained coders to rate. Once completed files were returned by the coders, they were checked for accuracy and completeness by data management personnel. At least 10% of all the data entered were checked for completeness and accuracy. Any irresolvable problems noted were referred to the data manager for clarification. Subsequently, more sophisticated range checking and internal consistency checking procedures were performed by transferring the data entered in Excel into a statistical programming package (SPSS). Any problems noted with the data were later resolved by checking the hard copies of the assessments. Procedures to guard against the catastrophic loss of data were followed: Data files were regularly archived onto hard drives, magneto-optical disk as well as web server.

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[2] No names were collected for the college students' cohort.

## Results and Discussion

### Interrater Reliability Analysis

For all assessments requiring ratings of open-ended response, we developed a scoring rubric, as described below for each assessment type.

**Student Future Goals.** Participants in the Transitions in the Development of Giftedness project were given an open-ended Student Future Information Questionnaire concerning their future plans. Students had to list their goals for the next year, for the next 5 years, and for the next 10 years.

**Student Future Goals: High School Students.** High school students' goals and future plans were rated on three different scales: Category, Explicit Motivation, and Ten-year Goal for Happiness. To provide a rating on a Category scale, each goal students listed had to be classified into one of the following mutually exclusive 10 categories: Academic, Sport, Religious, Social, Artistic, Personal, Financial, Romantic/Family, Career, and Technical/Military. Explicit Motivation scale categorizes students' responses into one of the following three groups: Mastery Motivation, Performance Motivation, and Non-Specific Motivation. Ten-year Goal for Happiness scale asks the rater to assess whether the student listed happiness, contentedness, etc. as their 10-year goal. The scoring rubric was developed by a research assistant after reviewing a sample of 120 high school students' responses to the Future Goals Information Questionnaire. Two trained raters who were undergraduate students majoring in psychology were assigned to the rating task. The raters underwent several hours of training with the research assistant who designed the scale for scoring high school future goal. The raters then rated an identical set of 40 students' goals. Afterwards, interrater reliability analysis was performed to gauge raters' consensus. Table 3 specifies interrater reliability estimates for high school students' future goals. These numbers are well within the acceptable level of accuracy. After reaching agreement, the raters were assigned the rest of the 219 students' responses, which were split between the two raters with a 30% overlap to confirm raters' agreement throughout the rating process. The overlap data confirmed high reliability of ratings (see Table 4).

Another pair of raters was trained by project director and research assistants to score high school responses received during additional data collections. The raters were given a set of 30 students' goals. Comparable high level of agreement was reached on all aspects of the scoring rubric as well, which allowed assigning the remaining 98 high school goals to each rater individually.

Table 4

Interrater Reliability Estimates for Student Future Goals: High School Students

| | Raters 1 and 2 | | | | Raters 3 and 4 | |
|---|---|---|---|---|---|---|
| | *Agreement* | | *Overlap* | | *Agreement* | |
| | % agreement | kappa | % agreement | kappa | % agreement | kappa |
| Goal Category | 98.25 | .98 | 97.76 | .98 | 75.17 | N/A |
| Explicit Motivation | 100 | 1.00 | 99.50 | .99 | 83.11 | N/A |
| Ten-year Happiness Goal | 100 | 1.00 | 100 | 1.00 | 100 | 1.00 |

**Student Future Goals: Middle School Students.** The scoring rubric for middle school student future goals and plans was developed on the basis of the similar rubric for the high school students. A sample of 150 student responses was analyzed by a research assistant. Based on this analysis, a Category scale was retained in the rubric, and the number and the description of categories were modified. Each goal that middle school students listed had to be classified into one of the following mutually exclusive 12 categories: Personal Development/Improvement, Societal/Environmental Change, Interpersonal Improvement/Development, Happiness Aspirations, Career/Professional Aspirations, Academic Aspirations, Romantic/Family Aspirations, Competitive Aspirations/Ambition, Athletic Aspirations/Sports, Interests and Recreations, Financial Aspirations, and Religious/Spiritual Aspirations. Two raters were assigned to the rating task. Both were experienced raters who were involved in a number of previous projects. An initial training session took place, where raters gained familiarity with the rubric and learned about their new task from a research assistant of the Project's research team. Following the training session, the raters completed a total of 40 individual ratings for agreement. Interrater reliability analysis was conducted and revealed that both raters reached agreement on the scoring rubric after the first practice run of individual scorings, reflecting that both shared a common understanding of the rubric. Overall, raters agreed with each other when assigning goals to a certain category 96.88% of the time, with Cohen's kappa at .98. After reaching agreement, the raters were assigned the rest of 851 student's responses to rate individually with a 30% overlap to confirm raters' agreement throughout the rating process. The overlap data confirmed high reliabilities of ratings, with Cohen's kappa at .99 and percent agreement at 98.18%.

**Parent's Report of Student Activities and Awards.** Student background information was collected from parents who participated in the Transition in the Development of Giftedness Project. Parents were presented with open-ended questions regarding the types of activities their children take part in, as well as the awards they may have received. Raters' task was to rate the responses to following open-ended questions presented to parents: (a) In what school related activities does your child participate (academic or nonacademic)? (b) In what non-school related activities does your child

participate (academic or nonacademic)? (c) Please list any academic awards your child has ever received. (d) Please list any nonacademic awards your child has ever received. Parent's responses received different ratings based on the following criteria. Each school related activity and each non-school related activity listed by a parent had to be classified into one of the following mutually exclusive 11 categories: Gifted and Talented programs, Math and Science, Language Arts, Sports and the Outdoors, Performing and Fine Arts, Part-time Work, Skills Development and Enrichment Programs, Community Service, Tutoring and Mentoring, Religion and Culture, and Special interests. In addition, raters had to evaluate whether parents listed any academic or nonacademic awards received by their children that fall under each of the following 8 categories: Academic Achievements, Math and Science, Language Arts, Sports and Fitness, Performing and Fine Arts, Student Conduct, Community Service, and Education, Enrichment and Special Interests (Miscellaneous). A set of 277 parent responses was initially reviewed by one of the project's research assistants, who then developed 11 categories for activities and 8 categories for awards. After a series of discussions with the project team, the scoring rubric was finalized. The scoring of parental responses was broken down into two portions: one pair of raters reached agreement on student activities and the other on student awards. The first pair scored student activities listed by their parents. The research assistant who developed the rubric was paired up with another research assistant who is also an experienced rater. Both raters met to discuss issues related to the rubric's interpretation. After initial agreement meeting both raters were assigned to rate a set of 64 parental responses. Interrater reliability analysis revealed that both raters reached agreement on all scales of the scoring rubric after completing the first round of individual scorings with an average percent agreement of 72.39% and an average Cohen's kappa of 0.62. Since an acceptable level of agreement was reached, the two raters were assigned the rest of the 655 parents' responses to rate individually. The second pair of experienced raters who participated on a number of other projects scored students' awards. An initial training session took place between the two, during which the raters were introduced to the rubric and had the opportunity to ask questions, to ensure that both share a common understanding regarding the rubric's interpretation. Following the training session, both raters were assigned to rate a set of 64 parental responses. Interrater reliability analysis revealed that both raters reached agreement on all aspects of the rubric, reflecting that both shared a common understanding of the interpretation of the award scale. The agreement results are summarized in Table 5. Since an acceptable level of agreement was reached, the two raters were assigned the rest of the 655 parents' responses to rate individually.

The relatively lower kappa for "Service" awards is most likely due to the very low overall number of service awards reported by our sample.

Table 5

Interrater Reliability Estimates for Parent's Report of Student Awards

| *Awards* | *% agreement* | *kappa* |
|---|---|---|
| Academic | 96.88 | 0.890 |
| Math | 93.75 | 0.855 |
| Language Arts | 96.88 | 0.937 |
| Performing Arts | 84.38 | 0.579 |
| Sports | 96.88 | 0.932 |
| Conduct | 87.50 | 0.667 |
| Service | 84.38 | 0.200 |
| Miscellaneous | 87.15 | N/A |

**College Students Open-ended Questionnaire.** As part of the Transitions in the Development of Giftedness Project, information was collected about college students' career interests and future plans. Six hundred twenty-four college students who participated in the project completed an online questionnaire regarding their career aspirations. Raters were asked to rate students' responses to several open-ended questions regarding their academic background, career interests, and future goals. Specifically, raters were given the task to rate college students' responses to the following open-ended questions (a) What is your major? (b) If you plan to go to graduate or professional school, what would you like to study? (c) What did you do before entering college/university? (d) What kind of career do you plan to have? (e) If you have received academic awards, please list them. (f) If you have received nonacademic awards, please list them. (g) Please list your goals for the next year, and (h) Please list your goals for the next 5 to 10 years. The process of development of the scoring rubric scale went as follows: After reviewing a sample of 152 college students' responses, rating scales for the first 4 questions listed above were developed by the Transitions in the Development of Giftedness project assistant. Ratings scales for students' academic and nonacademic awards were adopted from those used to rate the responses of parents of middle and high school students who participated in the Transitions in the Development of Giftedness project. These parents were asked to provide background information about their children, including open-ended questions regarding the academic and nonacademic awards their children may have received. The scales were modified to include students' responses regarding academic and nonacademic awards that have been received during school and/or in college. A scoring rubric for student future goals was adapted from the one developed for the middle school students who participated in the Transitions in the Development of Giftedness Project. However, the rating scale for the "academic aspirations" category was modified to include future academic goals relevant to college students (e.g., "entering graduate school" instead of "entering an academic school" used with middle school students). Two raters were assigned to the rating task. Both are experienced raters who were involved in a number of previous projects. An initial training session took place, where raters gained familiarity with the rubric and learned about their new task from a research assistant of the Project's research team.

Following the training session, the raters completed a total of 75 individual ratings for agreement. Interrater reliability analysis was conducted and revealed that both raters reached agreement on all scales of the scoring rubric after the first practice run of individual scorings, reflecting that both shared a common understanding of the scoring rubric. Since the raters reached an agreement on all scales of the scoring rubric after the first practice run, they were assigned the rest of 549 student's responses to rate individually. Interrater reliability estimates are indicated in Table 6. High levels of both consistency and consensus reliability estimates were reached for all scales of the scoring rubric used to rate the open-ended college items.

Table 6

Interrater Reliability Estimates for Open-ended College Items

| *Item* | *% agreement* | *kappa* |
|---|---|---|
| Current major | 96.87 | 0.937 |
| Anticipated major | 87.50 | N/A |
| Pre-College activities | 87.50 | N/A |
| Career Plans | 82.61 | N/A |
| Academic Awards | | |
| -- Academic Achievements | 100 | 1.000 |
| -- Language Arts | 100 | 1.000 |
| -- Math and Science | 100 | 1.000 |
| -- Student Conduct | 93.75 | 0.636 |
| Nonacademic Awards | | |
| -- Language Arts | 92.31 | 0.629 |
| -- Student Conduct | 92.31 | 0.629 |
| -- Performing and Fine Arts | 100 | 1.000 |
| -- Sports and Fitness | 84.62 | 0.690 |
| -- Community Service | 100 | 1.000 |
| -- Miscellaneous | 84.62 | 0.694 |
| Student Future Goals | | |
| -- Next 1 year | 85.71 | N/A |
| -- Next 5-10 years | 84.31 | 0.797 |

**Teacher Views on Giftedness.** To identify teachers' views on giftedness, school teachers who participated in the Transitions in the Development of Giftedness project were presented with the following open-ended question: What qualities do you think should be used to identify children for gifted programming? As part of the process of developing the scoring criteria, a set of 84 teacher responses was reviewed numerous times by one of the project's research assistants to identify the major categories which form teacher's view on giftedness. Eight categories—Creativity, Motivation, Intelligence, Academic Achievements, Practical skills, Personality Characteristics, Special Abilities, and Recommendations—were identified in this process and the scoring

rubric was finalized. The research assistant who developed the rubric was paired up with another experienced rater to score teacher views on giftedness. Both raters met to discuss issues related to the rubric's interpretation. Following this meeting, which allowed for questions and clarifications, the raters were assigned the task of individually scoring a set of 30 teachers' responses for agreement purposes. The interrater reliability analysis conducted after the first round of individual scoring revealed that the raters did not reach the acceptable level of agreement; both the raters met to work out the concerns they had regarding the scoring criteria and to clarify issues related to the rubric's interpretation. Following the completion of the second round of individual rating task, interrater reliability analysis was conducted and revealed that reliability estimates were acceptable with a Cohen's kappa of .68 and an overall percent agreement of 75.83%. These results suggest that both raters shared a common understanding of the teachers' views of the rubric's interpretation. Considering the good agreement, the rater was given the remaining set of teachers' responses, which consisted of views listed by 185 teachers.

**Written Creative Stories From a Title.** As one of the creativity measures, a number of participants in the project were given the following instructions:

> For this task, we want you to write a creative short story. Your story must be based on *one* of the titles on this page. Please choose *one* of the titles for your story. You may use the title however you wish in your story, but you cannot use any of the other titles in your story. Please try to make your story as creative as possible. You will have 15 minutes[3] to imagine and write your story.

Participants were given five titles to choose from: *Two Chatting Spiders*, *A Banana with Many Peels*, *The Reading Dragon*, *A Spotted Creature*, or *The Fishing Moose*. Creative stories were scored on the following four dimensions: Originality, Complexity, Emotionality, and Task Appropriateness (Descriptiveness). The scoring rubric was adapted from the Rainbow Project (Sternberg & the Rainbow Project Collaborators, 2006), which also used written stories from a title as a measure of creativity. However, rating scales were modified to adequately capture the differences in prompts used in both projects. Complexity, Emotionality, and Task Appropriateness scales underwent only minor changes. The Originality scale had to be developed from scratch, since participants in this project were writing stories on a different set of titles than participants in the Rainbow project.

Middle and high school students' written stories were rated by two trained raters who had undergone extensive training to reach a common consistent understanding of the creativity constructs, as well as to establish reliability. Interrater-reliability was calculated on a set of 100 stories used for training purposes (*reaching agreement*) and on 30% of the total number of stories collected (*overlap*[4]). As indicated in Table 7, interrater reliability analysis demonstrated that high levels of both consistency and

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[3] Participants were allowed to go over 15 minutes if they needed more time to finish their creative story.
[4] 30% of all stories were rated by both raters to make sure that they continued consistently to apply rating scales once training was completed

consensus reliability estimates were reached for all four scales of the scoring rubric used to rate creative written stories from a title.

Table 7

Interrater Reliability Estimates for Written Creative Stories From a Title: Middle and High School Students

| | *Reaching agreement* | | | *Overlapping stories* | | |
|---|---|---|---|---|---|---|
| | r | % agreement | kappa | r | % agreement | kappa |
| Originality | .98 | 95 | .93 | .99 | 98.7 | .98 |
| Complexity | .96 | 92.5 | .89 | .96 | 90.9 | .87 |
| Emotionality | .95 | 90 | .88 | .91 | 88.3 | .83 |
| Task Appropriateness/ Descriptiveness | .95 | 87.5 | .83 | .95 | 89.6 | N/A |

Another pair of experienced raters evaluated the creativity of college students' stories. The raters underwent a similarly extensive training. Each rater took an identical set of 40 students' stories to rate as a practice run and to gain a better understanding of the range of creative stories. After several rounds of agreement process during which any points of disagreement were discussed, acceptable level of consistency and consensus reliability estimates was reached on all 40 stories (see Table 8). Once the raters reached an agreement on all scales of the scoring rubric, the rest of the 365 stories were split between them so that each rater had to rate his or her individual subset of stories. However, 30% of all stories were rated by both raters to make sure that they continued consistently to apply the rating scales. A high level of interrater reliability was maintained throughout the overlapping subset of the college students' written creative stories.

Table 8

Interrater Reliability Estimates for Written Creative Stories From a Title: College Students

| | r | % agreement | kappa |
|---|---|---|---|
| Originality | .63 | 63.2 | .50 |
| Complexity | .94 | 89.5 | .85 |
| Emotionality | .97 | 92.1 | .89 |
| Task Appropriateness/Descriptiveness | .87 | 73.7 | .63 |

**Written Creative Stories From a Picture.** As one of the creativity measures, a number of participants in the Transitions in the Development of Giftedness project were given a set of 5 different pictures and the following instructions:

> For this task, we want you to write a creative short story. Your story must be based on *one* of the pictures in this packet. Please choose *one* of the pictures for your story. You may use the picture however you wish in your story, but you cannot use any of the other pictures in your story. Please try to make your story as creative as possible. You will have 15 minutes to imagine and write your story.[5]

Creative stories were scored on the following four dimensions: Originality, Complexity, Emotionality, and Task Appropriateness (Descriptiveness). The scoring rubric that was developed for written creative stories from a title was used as a basis for designing a rubric for scoring written creative stories from a picture. This approach was implemented because pictures used in this task corresponded with the titles used for the previously described task. However, scoring points for Originality and Task Appropriateness (Descriptiveness) scales were adjusted so that they were apt at reflecting the nature of the task at hand (writing a story about a picture, where the exact title of the story was not given to participants who completed this task). The same trained raters that worked with creative written stories from a title also rated the set of creative written stories from a picture. Both raters scored all 61 students' stories. As indicated in Table 9, interrater reliability analysis demonstrated that a high level of both consistency and consensus reliability estimates was reached for all four scales of the scoring rubric used to rate creative written stories from a picture.

Table 9

Interrater Reliability Estimates for Written Creative Stories From a Picture

| | r | % agreement | kappa |
|---|---|---|---|
| Originality | .98 | 96.7 | N/A |
| Complexity | .95 | 91.8 | .88 |
| Emotionality | .93 | 91.8 | .87 |
| Task Appropriateness/Descriptiveness | .98 | 95.1 | .93 |

Note: All correlation and kappa coefficients were significant at .001 level

**Oral Creative Stories From a Title.** As one of the creativity measures, a number of participants were given the following instructions:

> For this task, we want you to dictate a creative short story into your recorder. Your story must be based on *one* of the titles at the bottom of the page. Please

[5] Participants were allowed to go over 15 minutes if they needed more time to finish their creative story.

> choose *one* of the titles for your story and circle that title. You may use the title however you wish in your story, but you cannot use any of the other titles in your story. Please try to make your story as creative as possible. Do not tell the story that you told before. You will have 10 minutes to imagine your story. Then, you'll have 5 minutes to tell your story into your recorder.[6]

The titles were the same as for the written story. Oral creative stories from a title were scored on the same four dimensions as written creative stories from a title discussed above: Originality, Complexity, Emotionality, and Task Appropriateness (Descriptiveness). However, scoring points for ratings scales underwent minor changes to address the differences between oral and written modes of story telling. All oral stories were transcribed by the transcribing agency before they were given to raters to judge their creativity. The same trained raters that worked with creative written stories from a title rated the set of creative oral stories from a title. Both raters scored an overlapping set of 20 students' stories, and then each rater individually scored 20 and 21 stories respectively. As indicated in Table 10, interrater reliability analysis demonstrated that a high level of both consistency and consensus reliability estimates was reached for all four scales of the scoring rubric used to rate oral creative stories from a title.

Table 10

Interrater Reliability Estimates for Oral Creative Stories From a Title

| | r | % agreement | kappa |
|---|---|---|---|
| Originality | 1.00 | 100 | 1.00 |
| Complexity | .91 | 90 | .84 |
| Emotionality | .79 | 80 | .63 |
| Task Appropriateness/Descriptiveness | .82 | 85 | .74 |

Note: All correlation and kappa coefficients were significant at .001 level

**Oral Creative Stories From a Picture.** As one of the creativity measures, a number of participants were given a set of 5 different pictures and the following instructions:

> For this task, we want you to dictate a creative short story into your recorder. Your story must be based on *one* of the pictures in this packet. Please choose *one* of the pictures for your story. You may use the picture however you wish in your story, but you cannot use any of the other pictures in your story. Please try to make your story as creative as possible. Do not tell the story that you told before. You will have 10 minutes to imagine your story. Then, you'll have 5 minutes to tell your story into your recorder.[7]

[6] Participants were allowed to go over 15 minutes if they needed more time to finish their creative story.
[7] Participants were allowed to go over 15 minutes if they needed more time to finish their creative story.

Oral creative stories from a title were scored on the same four dimensions as other creative stories discussed above: Originality, Complexity, Emotionality, and Task Appropriateness (Descriptiveness). All oral stories were transcribed by the transcribing agency before they were given to raters to judge their creativity. The same trained raters that worked with creative written stories rated the creative oral stories. Both raters scored an overlapping set of 23 students' stories, and then each rater individually scored 23 and 20 stories respectively. As indicated in Table 11, interrater reliability analysis demonstrated that a high level of both consistency and consensus reliability estimates was reached for all four scales of the scoring rubric used to rate oral creative stories.

Table 11

Interrater Reliability Estimates for Oral Creative Stories From a Picture

| | r | % agreement | kappa |
|---|---|---|---|
| Originality | .96 | 91.3 | .87 |
| Complexity | .93 | 86.9 | .81 |
| Emotionality | .93 | 91.3 | .86 |
| Task Appropriateness/Descriptiveness | .92 | 86.9 | N/A |

Note: All correlation and kappa coefficients were significant at .001 level

**Creative Collage Task.** As one of the creativity measures, a number of participants were given 2 sets of stickers (total of 80 stickers with different sizes, colors, and shapes) and the following instructions:

> Please select one topic you are interested in from the four topics listed below, and make a collage to represent this topic on the other side of this sheet of paper. Feel free to use materials we provided; you can use as much or as little material as you like in your design, but please use only these materials. When you make your collage, be as creative as possible. Please circle the one topic that you are going to use in your collage.

Participants could choose among 4 topics: *silliness*, *happiness*, *my home*, and *my dream*. Collages were scored on the following 10 dimensions: Abstractness, Symmetry, Originality-Frequency, Originality-Predictability of Execution, Novel Use of Material, Likeability, Craft, Expressiveness, Relatedness, and Complexity. The development of the scoring scales for creative collages was based on the rubric used in Project Rainbow, but went through a lengthy process of multiple revisions. For each of the four collage titles, raters went through a series of agreement meetings during which they discussed any points of disagreement that they had about the creativity of the collages. Between 46 and 55 collages were used each time to establish agreement among raters. As a result of the agreement process, acceptable levels of consistency and consensus reliability estimates were reached for all titles (see Table 12).

Table 12

Mean Interrater Reliability Estimates for Creative Collage Task

| | N | Cronbach's Alpha | Pearson's r | Percent Agreement | Cohen's kappa |
|---|---|---|---|---|---|
| Title 1: Silliness | 50 | .96 | .91 | 83 | .76 |
| Title 2: Happiness | 55 | .96 | .90 | 85.5 | .78 |
| Title 3: My Home | 53 | .94 | .87 | 85.1 | .74 |
| Title 4: My Dream | 46 | .91 | .83 | 83.7 | .72 |

**Hypothesis Testing**

Once we had established that the assessments could be reliably scored, we proceeded to test the hypotheses regarding conceptions of giftedness at different stages: preschool, middle school, high school and college. As a reminder, here are our initial hypotheses, first outlined in section Research Questions and Hypotheses:

1. Creative and practical abilities will be of increasing importance to giftedness, with increasing age and across domains; in contrast, the importance of analytical abilities will remain across ages but will decrease relative to that of creative and practical abilities.
2. Members of underrepresented minority groups will, on average, score relatively higher on measures of creative and practical abilities than on measures of analytical abilities, whereas members of the majority group will, on average, show a reverse pattern.
3. Consistent with past results, students will show greater knowledge with increasing age, highly gifted students will show proportionately more knowledge with increasing age relatively to gifted students, and gifted students will show proportionately more knowledge with increasing age relative to ungifted students.
4. The importance of the legislative style of thinking will increase with age in tandem with the importance of creative giftedness; the importance of the executive style, associated with memory learning, will decrease.
5. Willingness to defy convention, surmount obstacles, take sensible risks, tolerate ambiguity, and develop self-efficacy will become more important to giftedness with increasing age.
6. Students who are more highly motivated by their teachers and coursework will be more likely to be identified as gifted than students who are not as highly motivated.
7. A supportive environment will be important to identification of giftedness at all ages.

We will explore these hypotheses one by one, considering each age group separately before drawing conclusions.

## Hypothesis 1

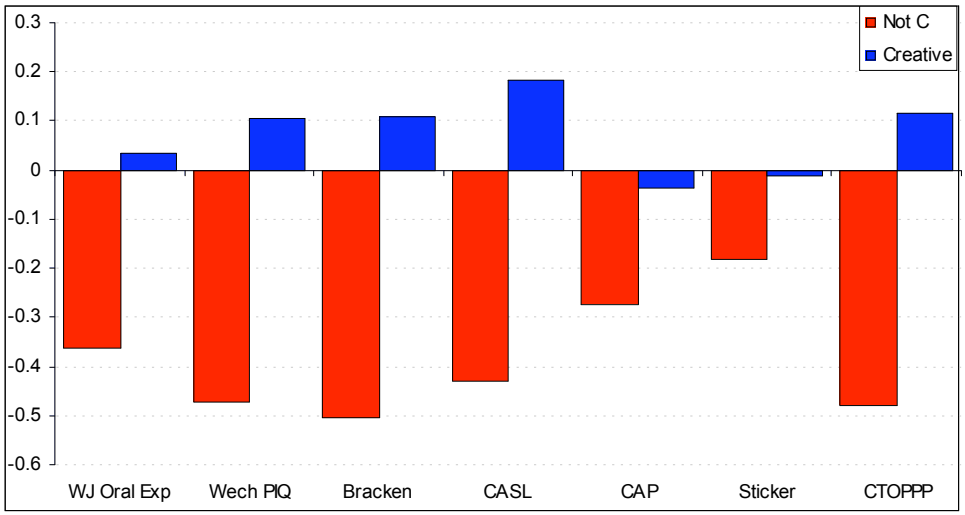
**Creative and practical abilities will be of increasing importance to giftedness, with increasing age and across domains; in contrast, the importance of analytical abilities will remain across ages but will decrease relative to that of creative and practical abilities.**

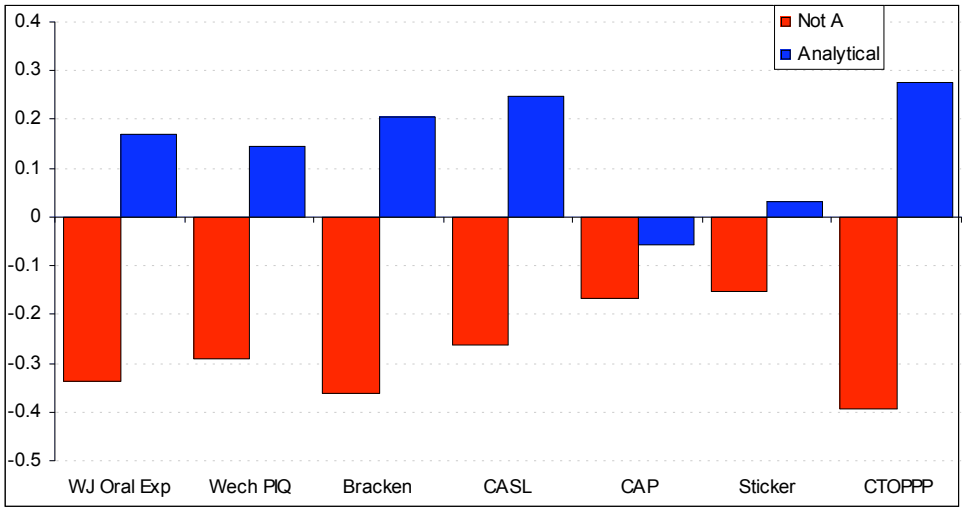
### Preschool

We first wanted to establish whether the three types of abilities (creative, practical, analytical) can be distinguished at an early age. Data from the preschool children do indicate that parents are sensitive to the gifts of their children. Parents were asked to rate their children's gifts in terms of creative, analytical, and practical skills on a 5-point scale. Children who received the highest scores (4 or 5) were considered gifted, and children who received scores of 1 to 3 were considered not gifted. Based on parental ratings, children were divided into groups of

- high versus low creative skills (labeled Creative and Not C, respectively),
- high versus low analytical skills (labeled Analytical and Not A, respectively)
- high versus low practical skills (labeled Practical and not P, respectively)

Figure 2 shows the scores of the children who were considered gifted in each of these three areas on the different assessments that were directly administered to them. In nearly all cases, children rated as high in creative skills performed better than those students rated (by their parents) as low in creative skills. Differences reached significance for Woodcock-Johnson Oral Expression ($t(75) = -1.99$, $p = .05$), Wechsler Performance IQ ($t(75) = -2.90$, $p < .005$), Bracken School Readiness ($t(75) = -2.39$, $p < .05$), CASL Language Proficiency ($t(63) = -2.56$, $p < .05$), and CTOPPP Phonological Awareness ($t(75) = -2.60$, $p < .05$). The same is true for analytical skills. Differences reached significance for Woodcock-Johnson Oral Expression ($t(74) = -2.53$, $p < .05$), Wechsler Performance IQ ($t(74) = -2.21$, $p < .05$), Bracken School Readiness ($t(74) = -2.54$, $p < .05$), CASL Language Proficiency ($t(62) = -2.17$, $p < .05$), and CTOPPP Phonological Awareness ($t(75) = -3.23$, $p < .005$). Practical skills, as rated by parents, do not seem to differentiate those students who perform well and those who perform less well on the different assessments, although there was a significant difference for the CASL Language Proficiency ($t(73) = -2.00$, $p = .05$ and trends for Bracken School Readiness ($t(73) = -1.94$, $p = .056$) and CTOPPP Phonological Awareness ($t(73) = -1.74$, $p = .085$).



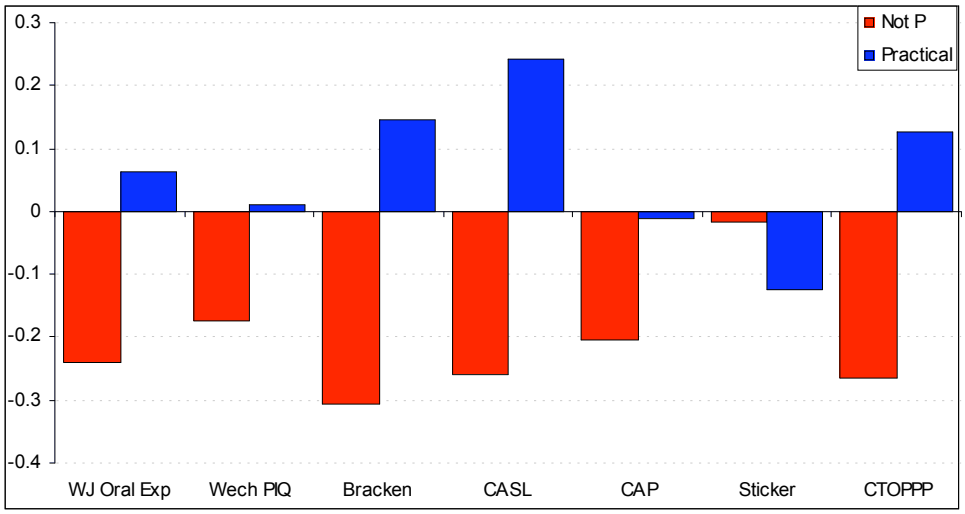




Figure 2. Pre-k student performance (z-scores) broken down by groups of students rated (by their parents) as either high or low on creative, analytical, and practical skills.

Table 13 and Figure 3 indicate that the distinction between creative, analytical, and practical skills may be difficult to tease out in early childhood, at least as rated by parents. In fact, the three ratings might just indicate degree of overall giftedness. Table 13 indicates how many children were identified by their parents as gifted in zero, one, two, or three areas. Figure 3 shows the assessment scores of children who were rated as

Table 13

Number of Children Identified by Parents as Gifted in Zero, One, Two, or Three Areas—Analytical, Practical, and Creative

| Number of areas of giftedness (as rated by parents) | Type of giftedness | Number of Children Identified |
|---|---|---|
| No area of giftedness | No area of giftedness | 18 |
| One area of giftedness | Creative giftedness | 14 |
| | Analytical giftedness | 2 |
| | Practical giftedness | 3 |
| Two areas of giftedness | Creative + Analytical giftedness | 6 |
| | Creative + Practical giftedness | 5 |
| | Analytical + Practical giftedness | 2 |
| Three areas of giftedness | Creative + Analytical + Practical | 26 |

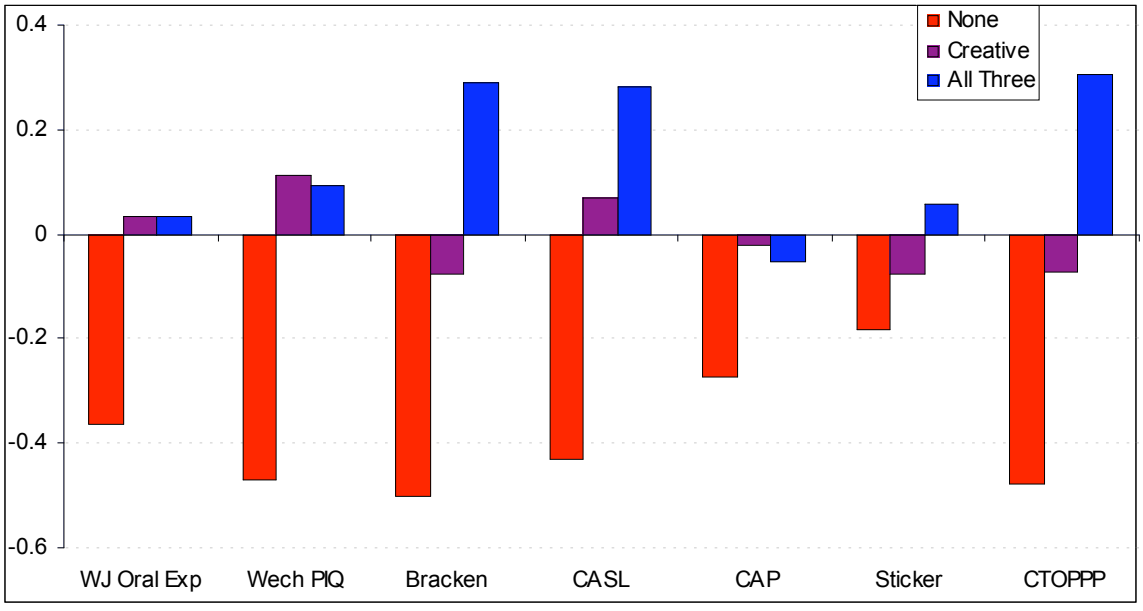



Figure 3. Student performance (z-scores) on the different assessments broken down by groups based on parent ratings of areas of giftedness.

- Having no creative gifts ($n$ = 25), labeled *None* on the figure
- Having gifts in all three areas ($n$ = 26), labeled of *All Three* on the figure
- Having gifts in the area of creativity—alone or combined with other areas ($n$ = 25), labeled *Creative* on the figure

Differences were significant for Wechsler Performance IQ ($F(2, 72) = 2.77$, $p < .05$, None < (Creative = All Three)), Bracken School Readiness ($F(2, 72) = 4.09$, $p < .05$, None < All Three), CASL Language Proficiency (Trend; $F(2, 72) = 2.86$, $p = .065$, None < All Three), and CTOPPP Phonological Awareness ($F(2, 72) = 4.34$, $p < .05$, None < All Three).

**Middle School (Longitudinal)**

To explore this hypothesis, we considered three groups of students: not gifted, gifted in the verbal domain (Gifted V), and gifted in the quantitative domain (Gifted Q). For each group, we calculated the relative importance of analytical skills as compared to practical and creative skills by subtracting the standardized creative and practical scores from the standardized analytical scores: The higher the number, the more analytical skills define the group. As we can see in Figure 4, in all cases, the relative importance of analytical skills decreases as the students get older. In fact, by grade 8, practical skills become more defining of both not gifted and gifted-verbal groups. For the Gifted Q group, analytical and practical skills are of equal importance. For all three groups, creative skills are just as defining of the group as are analytical skills by grade 8. For all comparisons, differences not only hold true for gifted groups, but also for the not gifted group. This supports the hypothesis that analytical skills remain predictive of group status. Statistical differences from zero are present for not gifted practical grade 8 ($t(15) = -2.34$, $p < .05$) and creative grade 5 ($t(13) = 2.12$, $p = .054$), for Gifted V practical grade 8 ($t(22) = -1.83$, $p = .081$) and creative grade 5 ($t(22) = 3.94$, $p < .001$), and for Gifted Q creative grade 5 ($t(21) = 5.45$, $p < .001$). Statistical differences from grade 5 to grade 8 are present for Gifted V practical ($t(22) = 2.48$, $p < .05$) and creative ($t(22) = 3.19$, $p < .005$), and for Gifted Q creative ($t(21) = 2.94$, $p < .01$).

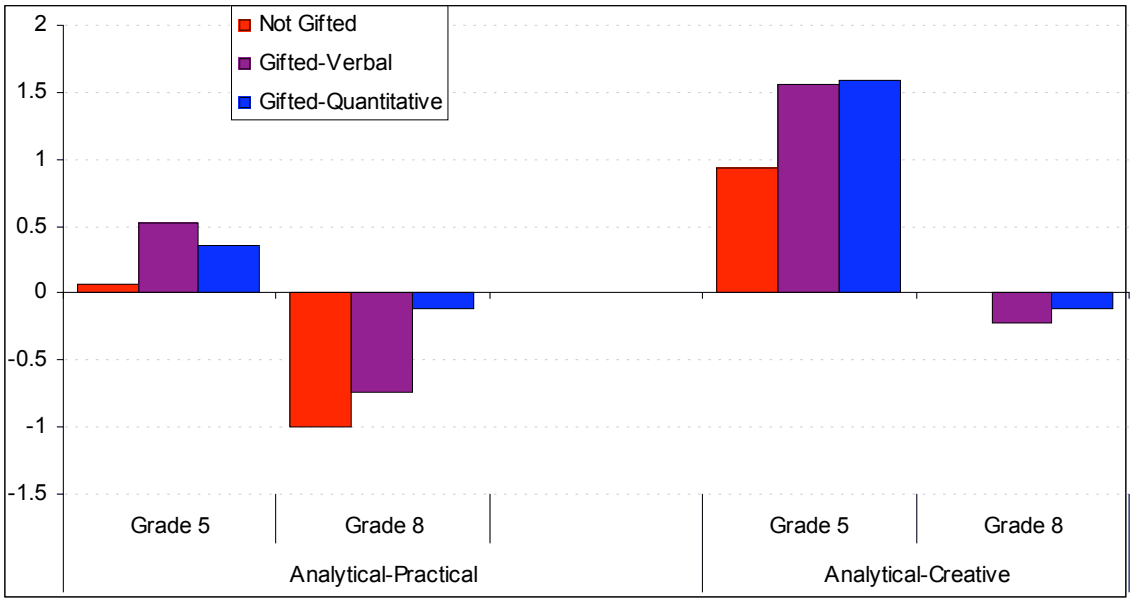



Figure 4: Importance of types of skills over time.

Figure 5 shows the results of the STAT analytical, practical, and creative subtests for each of the ability groups (not gifted, Gifted V, and Gifted Q), over time.

Interestingly, it is not the case that analytical scores begin relatively high and remain relatively high over time for gifted groups. The converse is actually true. All three groups' analytical scores decrease from grade 5 to grade 8, and significantly so for the two gifted groups ($t(13) = 0.44$, ns for not gifted, $t(22) = 5.30$, $p < .001$ for Gifted V, and $t(21) = 3.30$, $p < .005$ for Gifted Q). Creativity scores increase, and practical skills increase for the not gifted group, although these differences are not significant.

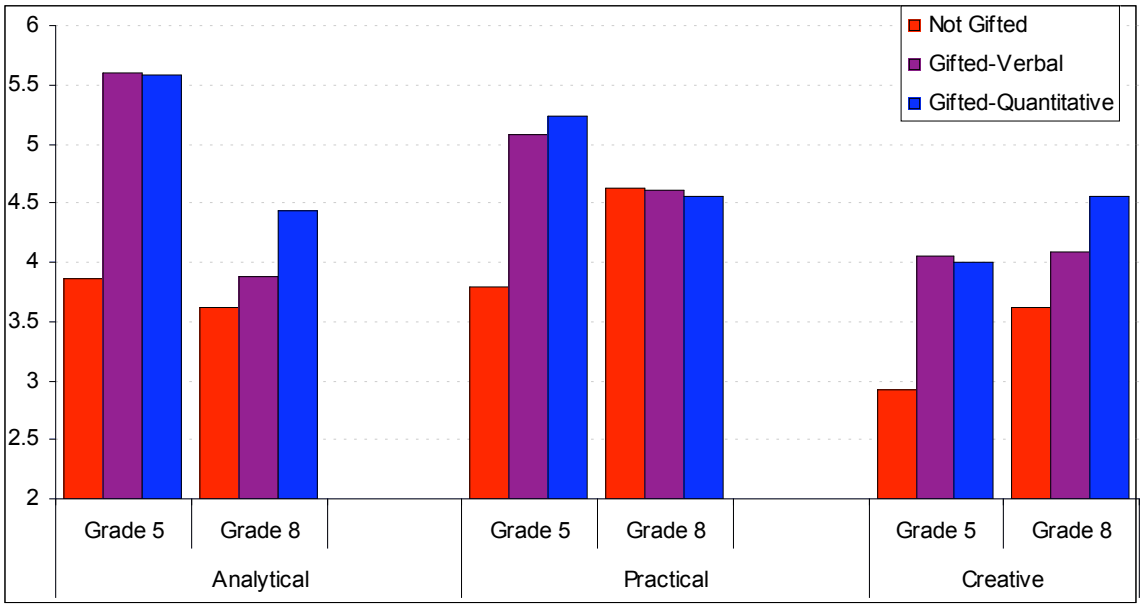



Figure 5. Results of the STAT analytical, practical, and creative subtests for each of the ability groups.

**Middle School (Cross-sectional)**

The middle school cross-sectional data show different patterns of abilities for not gifted, moderately gifted, and highly gifted individuals, even though the standard analytical and verbal Cattell and Mill Hill show that gifted children obtain higher scores than not gifted children (See Figure 6). Students were classified as moderately gifted based on their parental report. Students were classified as highly gifted based either on their parental report and/or by being in a gifted program in school (i.e., if a child was in a TAG program in school but not considered gifted by his/her parents, the child would still be included in the gifted group). Analytical skills are highest in the moderately gifted group, while both gifted groups have higher practical skills than the not gifted group. Creative skills increase with level of giftedness. This suggests a qualitative difference between the moderately gifted and highly gifted individuals; to be gifted, one must possess good analytical skills. To be considered highly gifted, one must go beyond traditional definitions of giftedness and possess practical and creative skills in addition to the analytical ones.

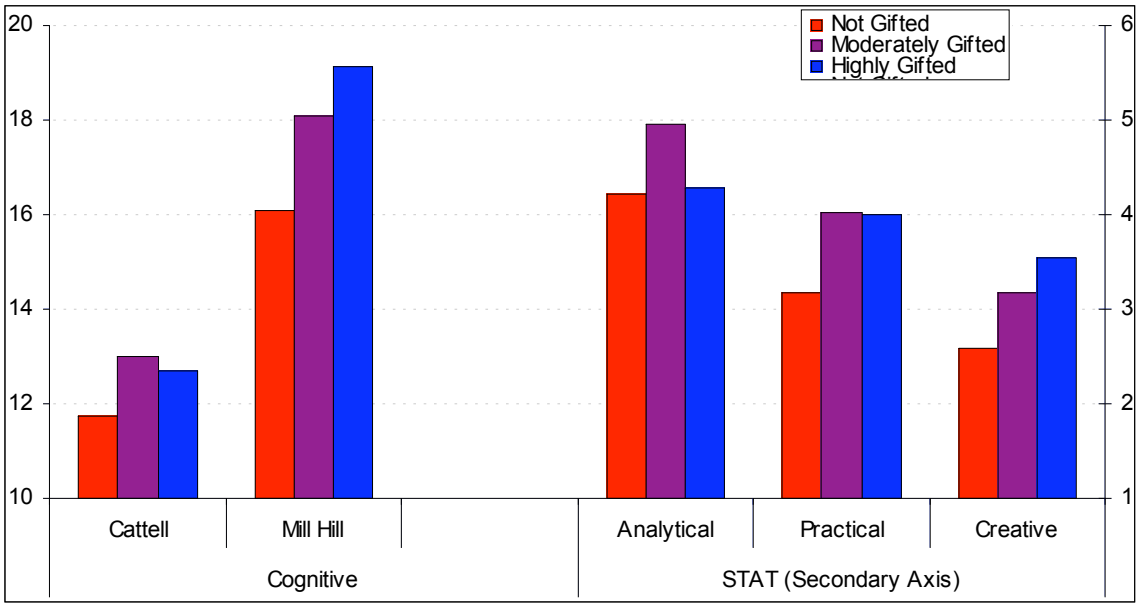



Figure 6. Assessment results for not gifted, moderately gifted, and highly gifted middle school students (cross-sectional sample).

Figure 7 shows the difference between analytical skills and other skills; higher numbers indicate relatively higher analytical skills. The composite score Analytical-Practical was created by subtracting the total standard score on the practical subtest from the total standard score on the Analytical subtest. The composite score Analytical-Creative was created by subtracting the total standard score on the creative subtest from the total standard score on the Analytical subtest. Both composite scores then represent the amount by which the Analytical score is higher than Practical and Creative scores. The group for whom analytical skills are the least dominant is the highly gifted group. An ANOVA of these three domains within-subjects and level of giftedness between-subjects shows a main effect for domain ($F(2, 1402) = 152.37$, $p < .0001$; A > P > C), a main effect for level of giftedness ($F(2, 701) = 33.37$, $p < .0001$; NG < (MG = HG)), and an interaction ($F(4, 1402) = 8.99$, $p < .0001$). There is a main effect for the Cattell ($F(2, 680) = 12.94$, $p < .0001$; NG < (MG = HG) and for the Mill Hill ($F(2, 666) = 31.00$, $p < .0001$; NG < MG < HG). For the difference scores, all bars are significantly different from zero except Highly Gifted Analytical-Practical.

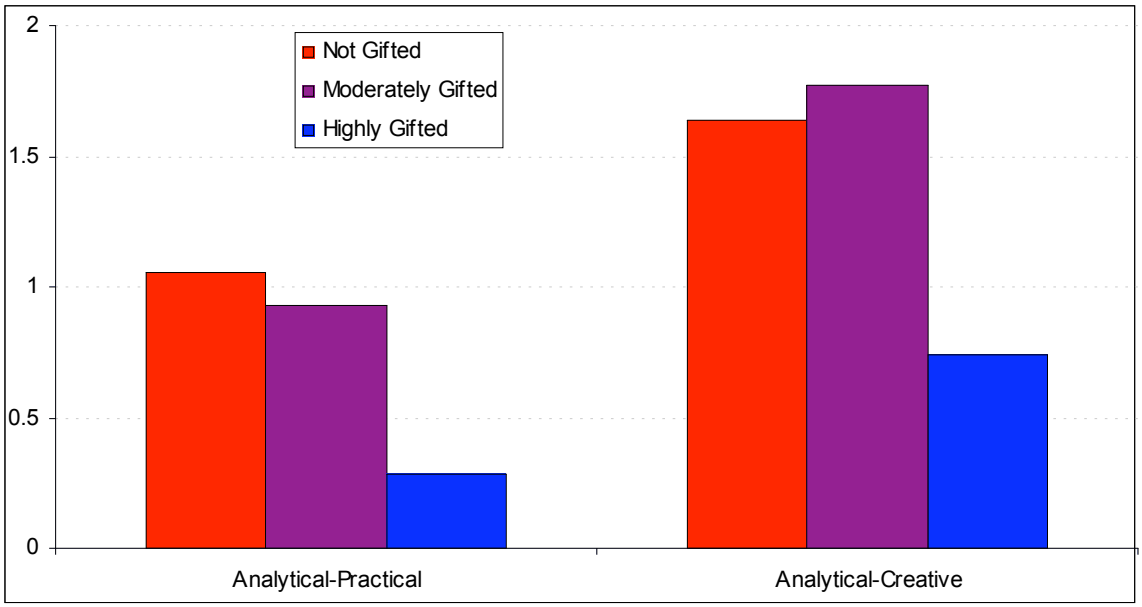



Figure 7. Composite analytical-practical and analytical-creative skills for the 3 middle school ability groups.

**High School**

The high school cross-sectional data show different patterns of abilities for not gifted versus gifted individuals, but do not distinguish the moderately gifted individuals from the highly gifted individuals. Students who were classified as gifted by parent report but were not in a school gifted program were called moderately gifted. Students who were classified as gifted by parental report and were in a school gifted program were called highly gifted. This difference in classification was necessary because of the way the data were collected, and may account for the difference in pattern from the middle school students. For all comparisons, gifted students had higher scores than not gifted students (see Figure 8). Figure 9 shows the difference between analytical skills and other skills; higher numbers indicate relatively higher analytical skills. Here, the more highly gifted an individual, the less practical skills dominate analytical skills (the NG bar is significantly different from zero). Creative skills and analytical skills do not differ across the three ability groups (i.e., bars are not significantly different from zero).

An ANOVA of these three domains within-subjects and level of giftedness between-subjects shows a main effect for domain ($F(2, 762) = 3.32$, $p < .5$; P > C), a main effect for level of giftedness ($F(2, 381) = 16.92$, $p < .0001$; NG < (MG = HG)), and no interaction. There is a main effect for the Cattell ($F(2, 355) = 16.35$, $p < .0001$; NG < (MG = HG) and for the Mill Hill ($F(2, 361) = 20.62$, $p < .0001$; NG < (MG = HG)).

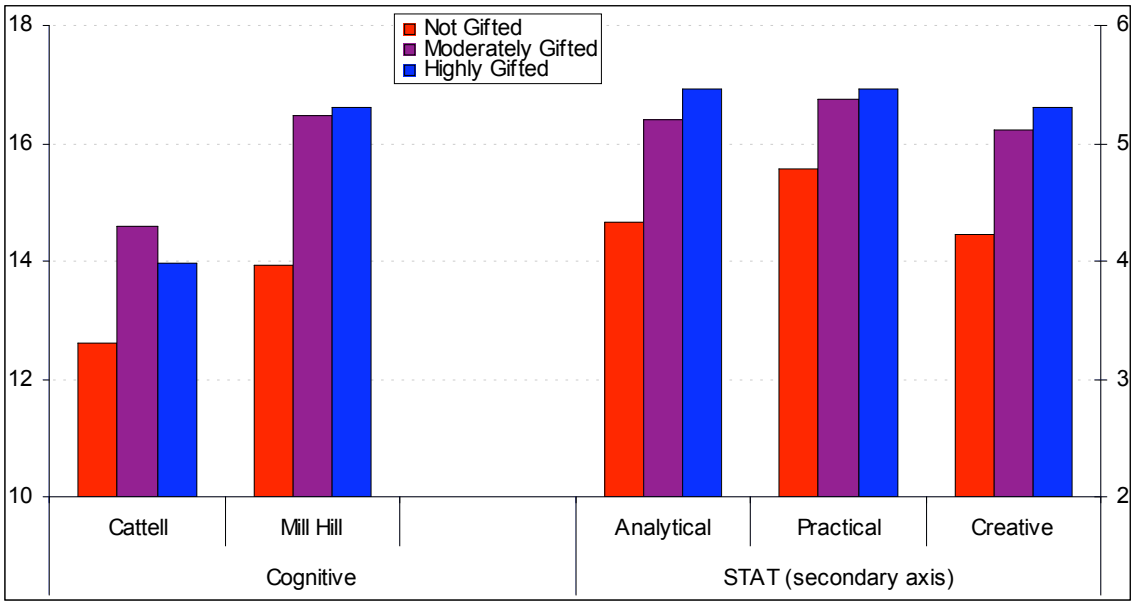



Figure 8. Assessment scores for high school students, broken down by ability grouping.

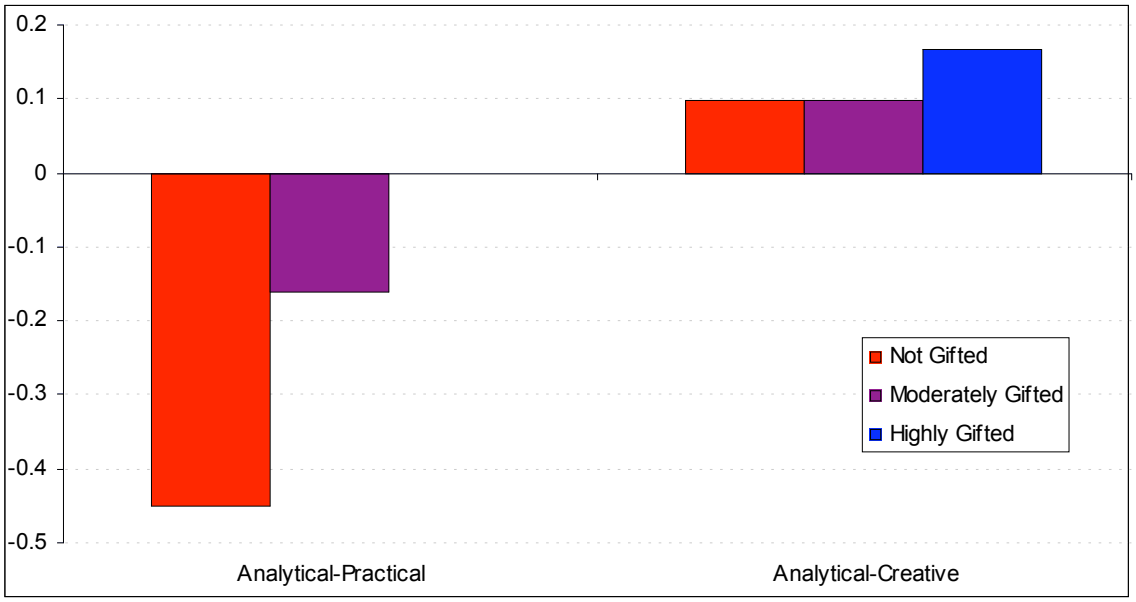



Figure 9. Composite analytical-practical and analytical-creative scores by ability grouping.

**College**

College students were defined slightly differently than younger students because parental reports are no longer particularly reliable. Instead, the students themselves reported whether they had ever been in gifted programs. Further, due to time constraints, the STAT was not administered to college students. Analytical, practical, and creative abilities were measured using the Cattell, College Student Questionnaire, and Creative Story Task, respectively. Scores on the three tests were standardized so that they could be compared.

The college-student cross-sectional data show different patterns of abilities for not gifted versus gifted individuals. For all comparisons, gifted students had higher scores than not gifted students (see Figure 10). Figure 11 shows the difference between analytical skills and other skills; higher numbers indicate relatively higher analytical skills. Gifted individuals still have a relative advantage for analytical skills, while not gifted individuals have relatively higher practical and creative skills. Differences in levels of advantage for practical skills are statistically significant for both groups. That is, numbers are different than zero, in opposite directions ($t(223) = -2.26$, $p < .05$ for not gifted, and $t(108) = 3.07$, $p < .005$ for gifted). Differences in levels of advantage for creative skills are not significant, although there is a trend for gifted individuals ($t(108) = 1.71$, $p = .091$).

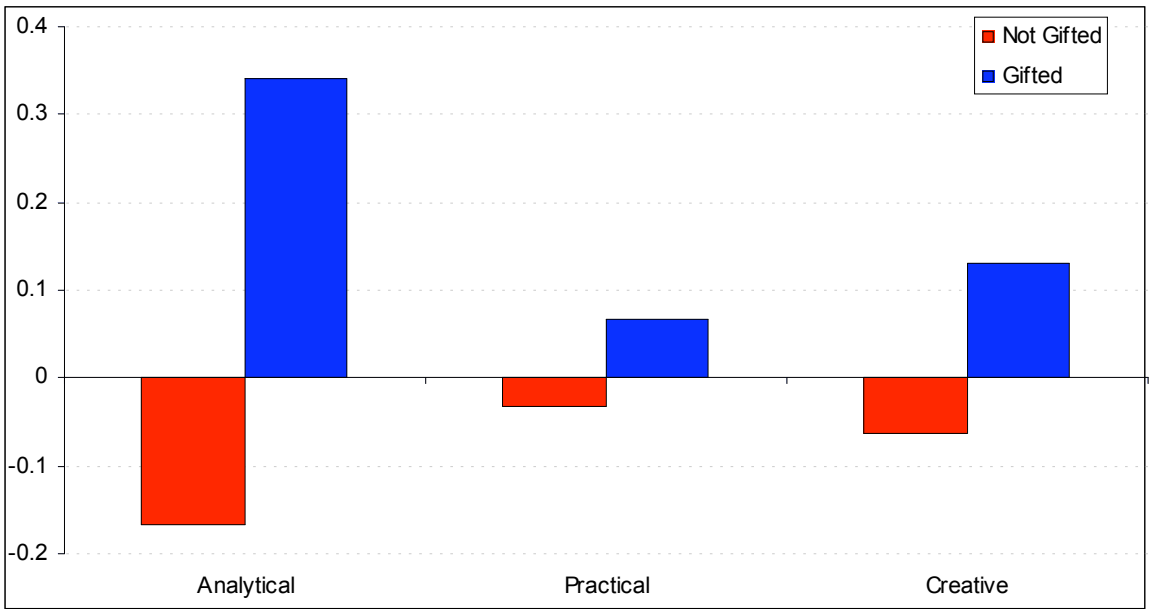



Figure 10. STAT z-scores for college students by ability grouping.

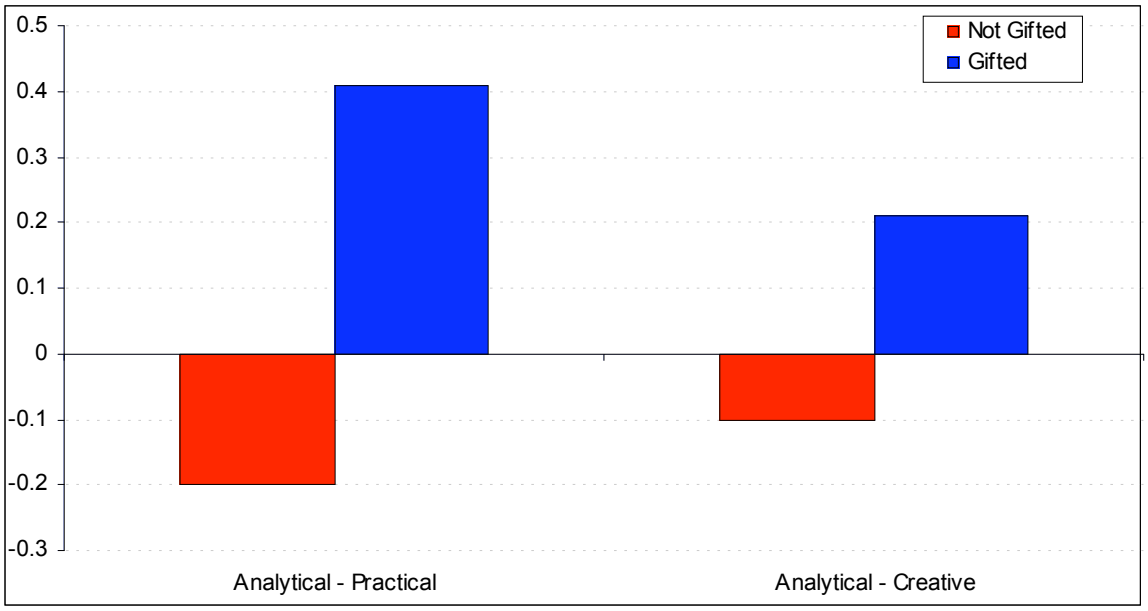



Figure 11. Composite analytical-practical and analytical-creative scores by ability grouping.

*In sum*, for the first hypothesis, we can conclude that (a) it is difficult to distinguish analytical, practical, and creative abilities from each other at the earliest stages, but (b) by middle school they can be well distinguished, and, in line with our hypothesis, we see a decrease in the importance of analytical skills versus practical and creative skills from grade 5 to grade 8. (c) At the high school level we see an increase in the importance of creative skills. (d) Yet, at the college level all three types of abilities distinguish gifted from not gifted students. Thus, although our general hypotheses with regard to the increasing importance of creative and practical skills across the life-span has been confirmed, there is a substantial amount of developmental fluctuation that deserves further investigation.

## Hypothesis 2

**Members of underrepresented minority groups will, on average, score relatively higher on measures of creative and practical abilities than on measures of analytical abilities, whereas members of the majority group will, on average, show a reverse pattern.**

### Preschool

For the preschool sample, we specifically targeted preschools with a high number of underrepresented minority groups. In this sample we have 18 preschoolers of European-American ancestry, and 58 preschoolers of usually underrepresented minorities. Because we did not sample according to giftedness or type of giftedness, the

relative ratio of majority and minority preschoolers in each gifted category is a test of Hypothesis 2. Figure 12 represents the proportion of preschoolers who were classified as creatively, analytically, and practically gifted by their parents. Creativity is the most common classification for both majority- and minority-group preschoolers. Analytical and practical giftedness are endorsed less often by parents, especially for parents of majority preschoolers.

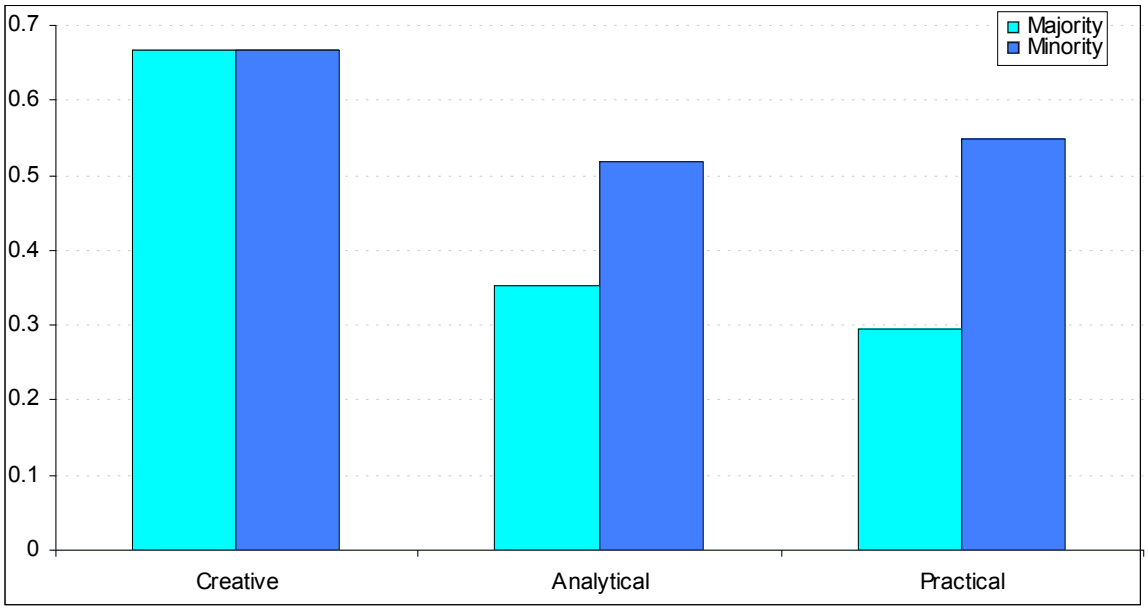



Figure 12. Proportion of preschool children identified as gifted in creative, analytical, and practical domains, by ethnicity.

Figure 13 represents the percentage of preschoolers who were classified as either (a) having none of the three types of giftedness, (b) being creatively gifted only, or (c) possessing all three types of giftedness, as defined for Hypothesis 1. With this breakdown, it is clear that minority-group preschoolers are not more often identified as gifted, they are just more often identified as gifted in all three categories than are students from majority-group backgrounds. This could mean that parents of these minority-group children are less sensitive to the quality of their children's giftedness, or that all three types of giftedness are manifesting themselves before their parents rate them as gifted. Either way, practical and analytical skills appear to be more prominent in the minority group than in the majority group, while creative skills far outweigh analytical and practical skills for all students, regardless of ethnic background. This could be a bias on the part of parents in the way they view the skills of their young children (i.e., young children may have more opportunity to express creative than other types of gifts), or a true manifestation of giftedness in preschoolers—creative skills are the ones most applicable and useful in preschool.

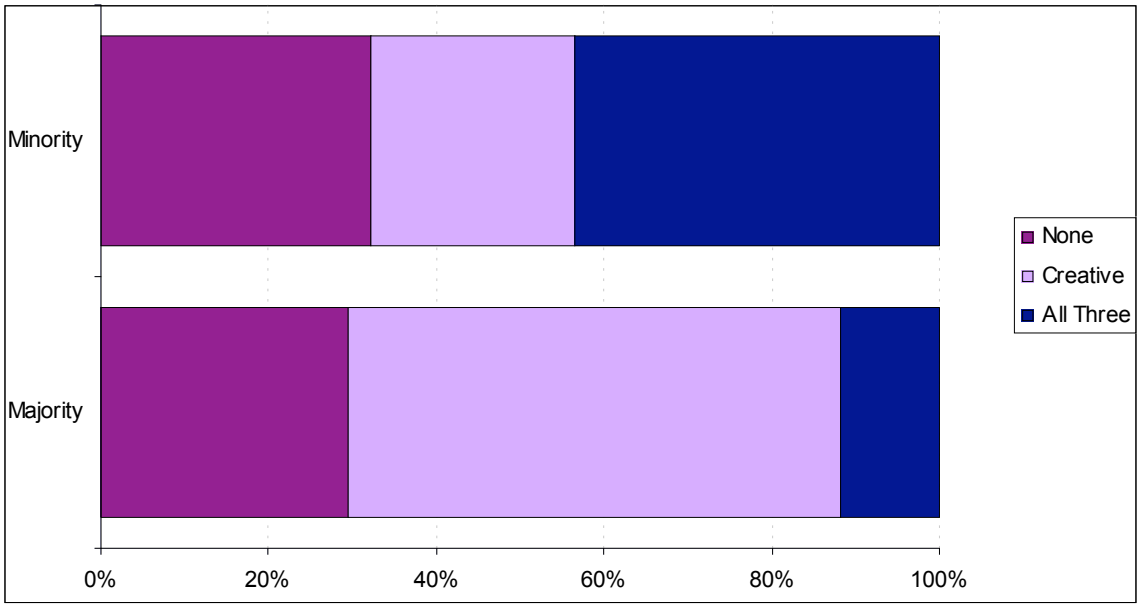



Figure 13. Percent of preschool children identified as not gifted, gifted in the creative domain, or gifted in all three domains within majority and minority groups.

**Middle School (Longitudinal)**

Sixty-four middle school students were tested in both fifth grade and eighth grade. Of these, 23 were nominated by teachers as being verbally gifted, 25 were identified as mathematically gifted, and 16 were not nominated as gifted. Fifteen of these 64 were underrepresented minorities, defined here as of non-European descent (African-American, Hispanic-American, Asian-American, and "Other"). Children who declined to report their ethnicity were considered, conservatively, as not being members of an underrepresented minority group.

Of the total longitudinal sample, only 29% of students fell into the minority category, but the underrepresented minorities were disproportionately included in the not gifted group. In all, 44% of the students classified as not gifted were in the underrepresented minority group whereas only 23% of the students classified as gifted were in the underrepresented minority group. Furthermore, underrepresented minorities were more likely to drop out from year 1 to year 3. By year 3, 23% of the total sample fell into this category, still disproportionately not gifted, 31% versus 21%.

Figure 14 shows the relative importance of analytical skills to practical and creative skills for European-Americans (majority-group) and underrepresented minorities, respectively. The relative importance was calculated by subtracting standardized creative and practical scores from standardized analytical scores: The higher the number, the more the relative importance analytical skills have, that is, the higher the students' analytical scores were relative to creative and practical scores.

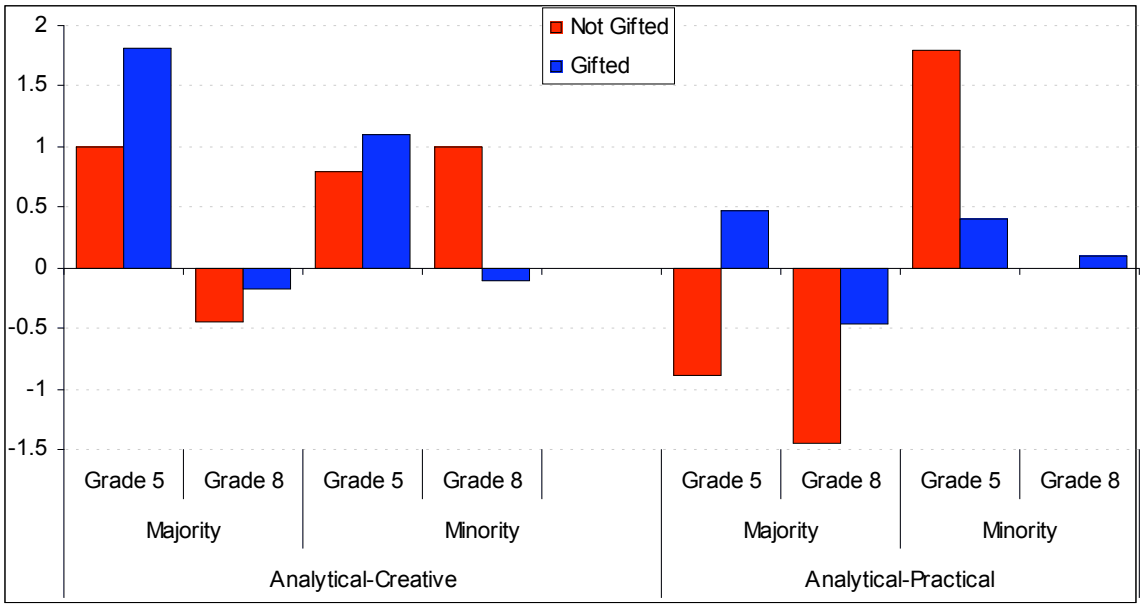



Figure 14. Relative importance of creative and practical skills versus analytical skills over time, for minority- and non-minority-group students, respectively.

Members of underrepresented minority groups do show a relative increase in the importance of creative skills—but only for students identified as gifted. Minority-group students who are not identified as gifted not only show a relative importance of analytical skills nearly equal to that of majority-group students not identified as gifted; in addition, they do not show the decrease in importance of analytical skills from the fifth to the eighth grade, as all the other groups do.

A similar distinctive pattern of performance of the not gifted minority students is present for the relative weight of analytical skills over practical skills. Here, minority-group students who are not identified as gifted do show a decrease in the relative importance of analytical skills over time, but at both time points, the relative importance of analytical skills actually exceeds that of the majority-group students not identified as gifted. Practical skills show an increasing relative weight from grade 5 to grade 8 (a trend for both gifted and not gifted individuals), but overall, majority- and minority-group students identified as gifted do not differ in the weight of analytical over practical skills.

**Middle School (Cross-sectional)**

Data from parents and/or teachers were available to classify 707 middle school students as not gifted, moderately gifted, or highly gifted. Of these, 217 were nominated as being moderately gifted, 196 were nominated as being highly gifted or were in school gifted programs, and 294 were not classified as gifted. In all, 286 of these 707 were members of underrepresented minority groups, defined here as non-European in descent (African-American, Hispanic-American, Asian-American, and "Other"). Children who

declined to report their ethnicity were considered, conservatively, as not members of an underrepresented minority group.

While 41% of the total study sample was composed of minority-group students, these underrepresented minorities were disproportionately included in the not gifted group. In all, 55% of the students classified as not gifted were in the underrepresented minority group whereas only 31% of the students classified as moderately gifted were in the underrepresented minority group and 29% of the students classified as highly gifted were in the underrepresented minority group.

Figure 15 shows the overall analytical, practical, and creative abilities of European-American and minority students in the three categories of giftedness. All students had relatively higher scores on analytical skills than on practical skills, and practical skills in turn were relatively higher than creative skills ($F(2, 1396) = 156.63$, $p < .0001$). Gifted students at both levels (highly and moderately gifted) had higher scores than not gifted students ($F(698) = 28.12$, $p < .0001$). This was true for both majority and minority students; however, the pattern for each group was different (Giftedness x Domain, $F(4, 1396) = 3.46$, $p < .01$; Ethnicity x Domain, $F(2, 1396) = 12.96$, $p < .0001$; Three-way Interaction, $F(4, 1396) = 3.50$, $p < .01$).

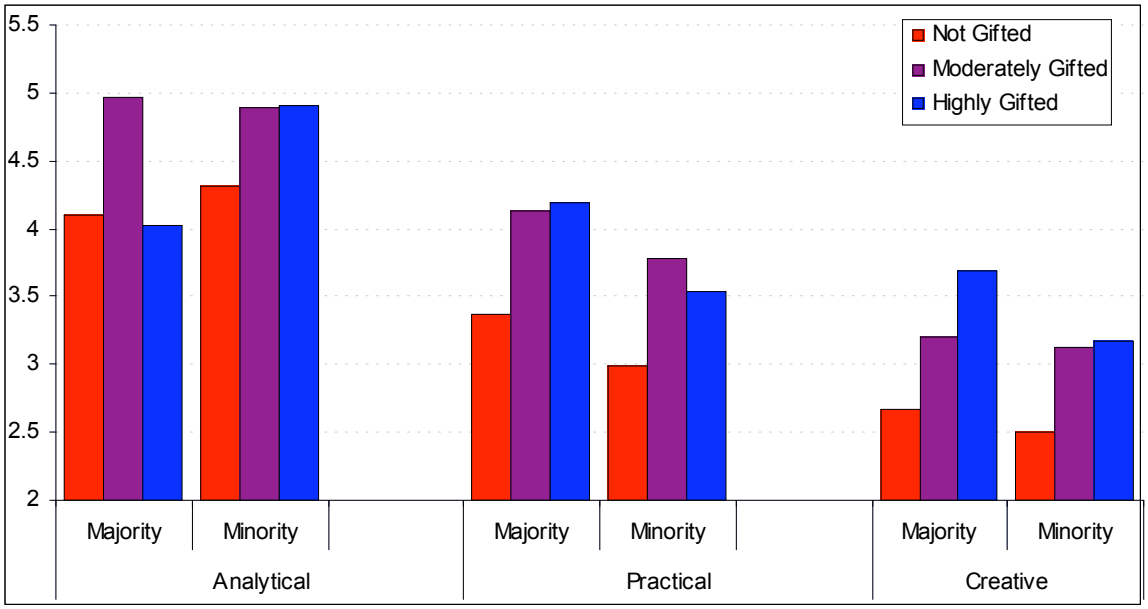



Figure 15. Scores on STAT analytical, practical, and creative tasks, by giftedness and ethnicity—middle school.

Figure 16 shows the relative importance of analytical skills to practical and creative skills for the majority and minority groups, respectively. The relative importance was calculated by subtracting creative and practical scores from analytical

scores: The higher the number, the greater the relative importance of analytical skills, and the higher the students' analytical scores were relative to creative and practical scores.

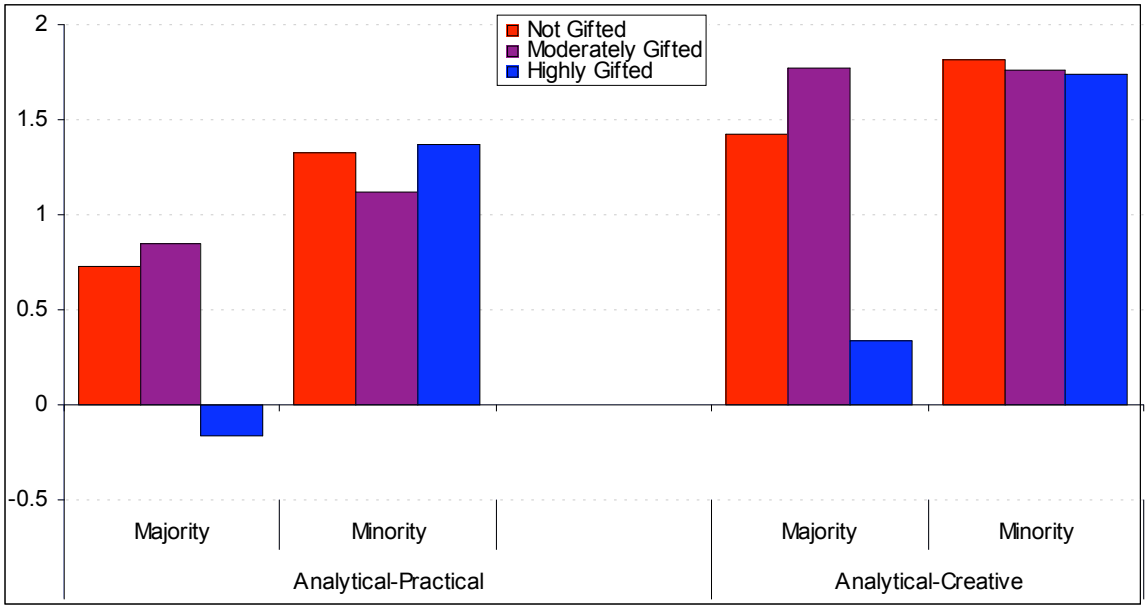



Figure 16. Relative importance of creative and practical skills versus analytical skills over time, for minority- and non-minority-group middle school students, respectively.

In this sample analytical skills are relatively higher than practical and creative skills for all groups except highly gifted students in the majority group. For this group, both creative and practical skills are just as important as analytical skills. This is in line with the findings of the fifth grade longitudinal data because the students in this cross-sectional study were in the fifth and sixth grades. For the difference scores, all the bars are significantly different from zero except the two bars for the Highly Gifted group.

**High School**

Data from parents and/or teachers were available to classify 384 high school students as not gifted, moderately gifted, or highly gifted. Of these, 175 were nominated as being moderately gifted, 54 were nominated as being highly gifted or were in school gifted programs, and 155 were not classified as gifted. In all, 111 of these 384 were members of underrepresented minority groups, defined here as non-European in descent (African-American, Hispanic-American, Asian-American, and "Other"). Children who declined to report their ethnicity were considered, conservatively, as not members of an underrepresented minority group.

A total of 29% of the study sample were minority children, but contrary to the middle school sample, minority-group students were not disproportionately included in the not gifted group. Indeed, 32% of the students classified as not gifted were in the underrepresented minority groups, whereas 24% of the students classified as moderately gifted were in the underrepresented minority groups and 35% of the students classified as highly gifted were in the underrepresented minority groups. Chi squares of giftedness status for each ethnicity group were not significant.

Figure 17 shows the overall analytical, practical, and creative abilities of European-American and minority students in the three categories of giftedness (highly, moderately, and not gifted). All students had higher scores on practical skills than on creative skills ($F(2, 756) = 3.36$, $p < .05$), with analytical skills falling in between. Gifted students at both levels had higher scores than not gifted students ($F(2, 378) = 15.03$, $p < .0001$). This was true for both majority and minority students. Minority students scored lower overall than majority students ($F(1, 378) = 35.58$, $p < .0001$).

None of the interactions between these variables was significant, which indicates that all groups showed the same basic pattern of performance.

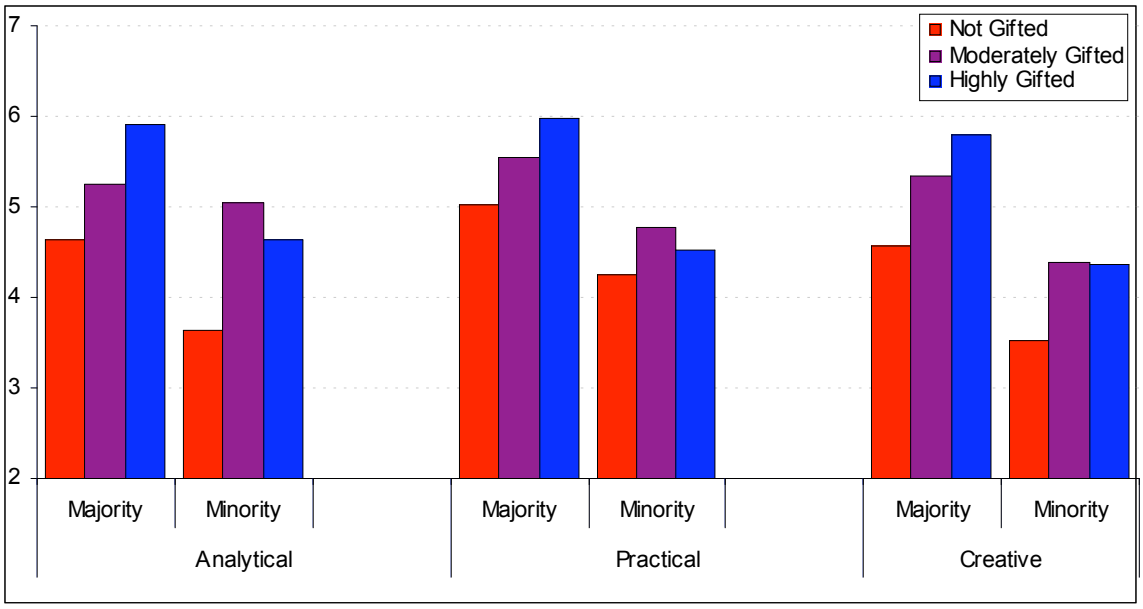



Figure 17. Scores on STAT analytical, practical, and creative tasks, by giftedness and ethnicity—high school.

Figure 18 shows the relative importance of analytical skills to practical and creative skills for the majority and minority groups, respectively. The relative importance was calculated by subtracting standardized creative and practical scores from standardized analytical scores: The higher the number, the greater the relative

importance of analytical skills, and the higher the students' analytical scores were relative to creative and practical scores.

The only bar that is significantly different from zero is the one for minority-group not gifted students. This group showed relatively greater importance of practical skills than analytical skills.

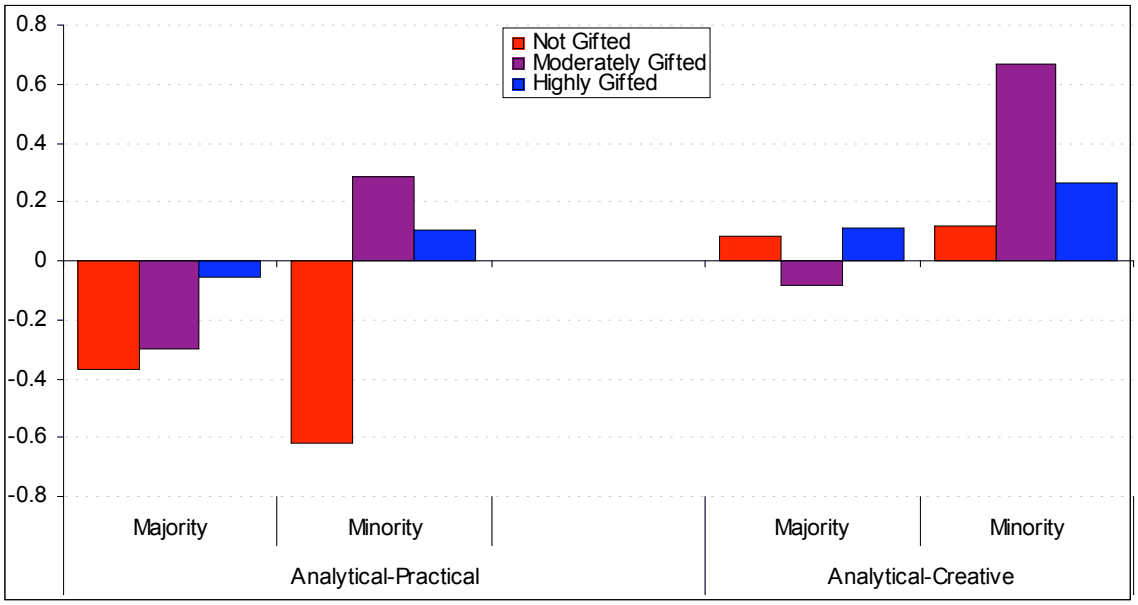



Figure 18. Relative importance of creative and practical skills versus analytical skills over time, for minority- and non-minority-group high school students, respectively.

**College**

A total of 317 college students were included in this analysis. Of these, 109 were nominated as being gifted, and 208 were not classified as gifted. In all, 196 of these 317 were underrepresented minorities, defined here as non-European in descent (African-American, Hispanic-American, Asian-American, and "Other"). Students who declined to report their ethnicity were considered, conservatively, as not members of an underrepresented minority group.

In all, 62% of the study sample were minority-group students. A total of 68% of the students classified as not gifted were members of underrepresented minorities whereas only 52% of the students classified as gifted were members of underrepresented minorities. A Chi-square for the expected number of majority- and minority-group students in the gifted group is significant (Chi-square (1) = 12.16, $p < .0005$).

Figure 19 shows the overall analytical, practical, and creative abilities of European-American and minority-group students in the gifted and not gifted groups. Gifted students had higher scores than not gifted students ($F(1, 313) = 12.03$, $p < .0001$). This was true for both majority and minority students. Minority-group students scored lower overall than majority-group students ($F(1, 313) = 5.34$, $p < .05$).

None of the interactions between these variables was significant, which indicates that all groups showed the same basic pattern of performance.

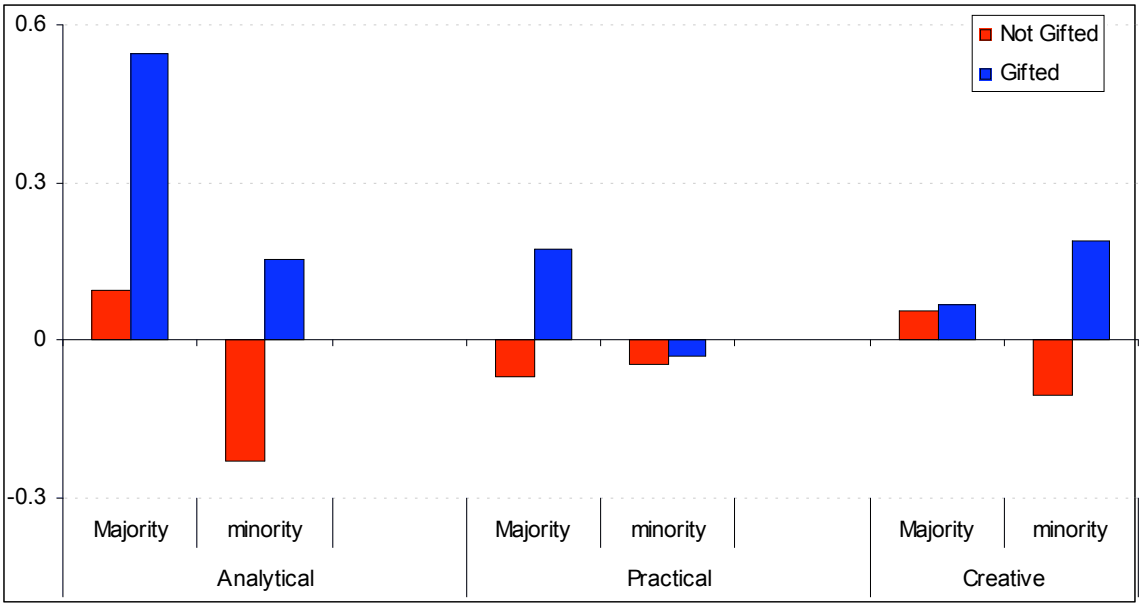



Figure 19. Scores on STAT analytical, practical, and creative tasks, by giftedness and ethnicity—college.

Figure 20 shows the relative importance of analytical skills to practical and creative skills for the majority and minority groups, respectively. The relative importance was calculated by subtracting standardized creative and practical scores from standardized analytical scores: The higher the number, the greater the relative importance of analytical skills, and the higher the students' analytical scores were relative to creative and practical scores.

Analytical skills are significantly higher than practical and creative skills for majority-group gifted students. Conversely, minority not gifted students showed a significant relative advantage for both practical and creative skills. For the difference scores, all the bars are significantly different from zero except the two bars for the Highly Gifted group. The remainder of the bars were not significantly different from zero.

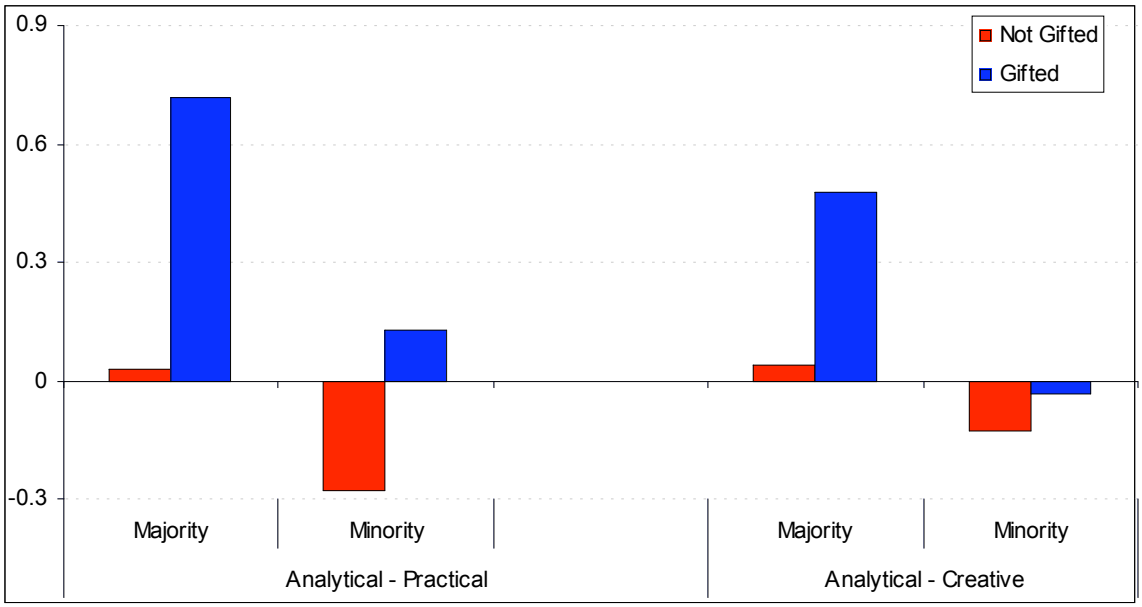



Figure 20. Relative importance of creative and practical skills versus analytical skills over time, for minority- and non-minority-group college students, respectively.

*In sum*, for the second hypothesis, we note that (a) at an early age, all children are identified as mainly creative, regardless of minority status, (b) but by middle school, the increase of the relative importance of creative skills is greater in gifted minority-group than in gifted majority-group students. The relative importance of practical and creative skills (versus analytical skills) continues for minority-group students in high school and college, but this time it is not for the gifted students, only for the not gifted groups.

## Hypothesis 3

**Consistent with past results, students will show greater knowledge with increasing age, highly gifted students will show proportionately more knowledge with increasing age relative to moderately gifted students, and gifted students will show proportionately more knowledge with increasing age relative to not gifted students.**

### Preschool

This hypothesis cannot be explored at the very early stages.

### Middle School (Longitudinal)

As Figure 21 shows, it is not universally the case that test scores increase with increasing age. It is likely that tests of achievement rather than ability would be more sensitive to knowledge for the test of this hypothesis. For example, raw score (but not

standard score) on a receptive vocabulary test might rise, along with raw scores on word decoding, spelling, mathematical skills, and tests in specific knowledge domains covered in school, such as biology, chemistry, geography, and history.

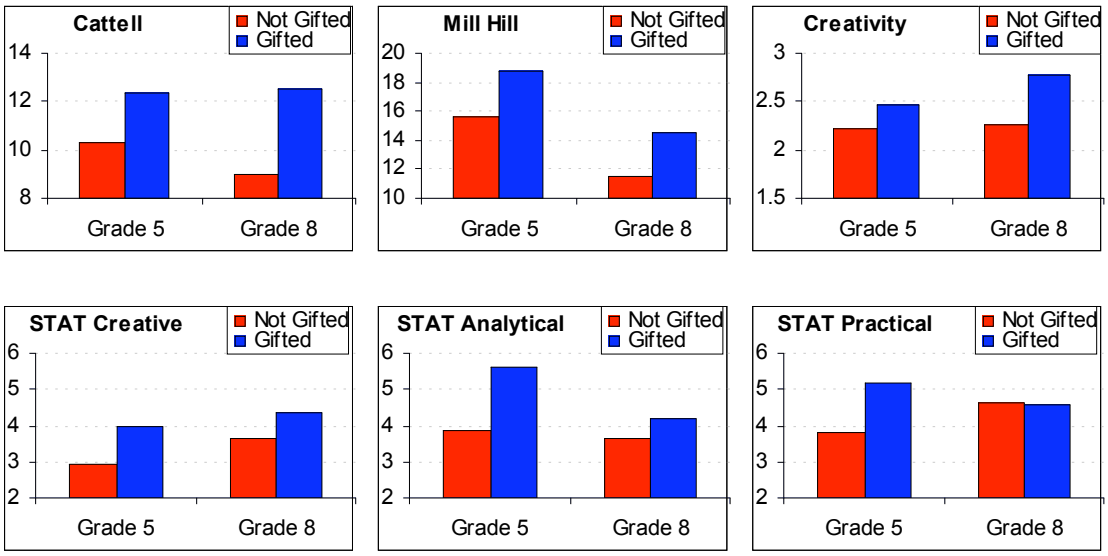



Figure 21. Assessment scores over time.

The different graphs in Figure 21 show that, in sum, gifted students perform better than not gifted students on all six tasks. Students perform better in eighth grade than in fifth grade on creativity, and worse in eighth grade than in fifth grade on the Mill Hill and STAT Analytical tasks. Gifted students perform better in eighth grade than in fifth grade on the Creativity task but worse in eighth grade than in fifth grade on the STAT Analytical and STAT Practical tasks. Not gifted students perform better on the STAT Practical task and worse on the Cattell task. While gifted students overall perform better than not gifted students, it is likely that the relative differences and changes based on group and time are due to regressions of the scores toward the mean performance on each task.

**Middle School (Cross-sectional) and High School**

It is not possible to compare the raw data between the middle school and high school groups, because high school students received a more advanced form of the tests. It is possible, however, to compare the amount by which the gifted middle school students outperform the not gifted middle school students, and the amount by which the gifted high school students outperform the not gifted high school students.

Data in both groups of students (middle and high school) were standardized to a mean of zero and a standard deviation of one, and combined into one database. Figure 22 shows the standardized scores on a number of tasks for middle school and high school

students in the three levels of giftedness. Figure 23 shows the difference scores. Scores for the not gifted group were subtracted from the scores of each gifted group. While the graph indicates some variability, a MANOVA shows that overall there was no increase in the advantage of either moderately gifted or highly gifted students over not gifted students from middle school to high school. In all cases except for collage creativity (which was a trend), not gifted students were outperformed by both gifted groups (which did not differ from each other) both in middle school and in high school.

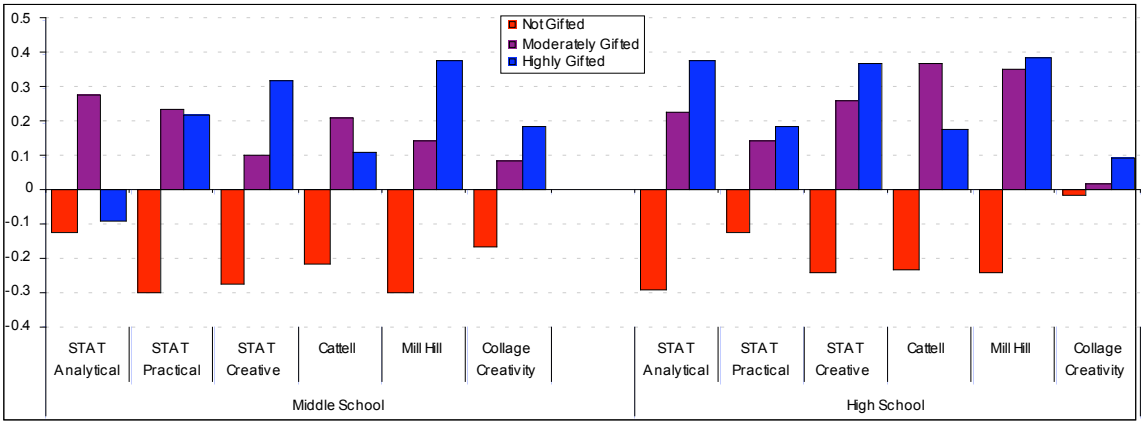



Figure 22. Assessment scores of middle school and high school students, by level of giftedness.

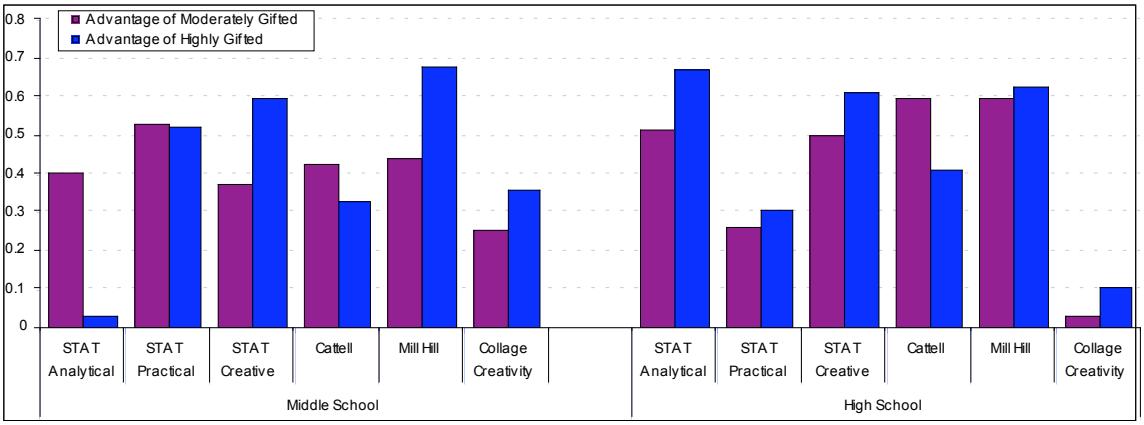



Figure 23. Relative advantage by of moderately and highly gifted students on test scores of middle school and high school students.

## College

For brevity and to increase student cooperation, tasks that could be used to address this hypothesis were not administered to college students.

*In sum*, as per our hypothesis, gifted students outperform not gifted students at both the middle and high school levels.

## Hypothesis 4

**The importance of the legislative style of thinking will increase with age in tandem with the importance of creative giftedness and the importance of the executive style, associated with memory learning, will decrease.**

### Preschool

Thinking styles can not be reliably assessed at such an early age, so this hypothesis was not explored at the pre-k level.

### Middle School (Longitudinal)

Figure 24 shows the relative importance of the legislative thinking style to the practical thinking style for gifted and not gifted groups over time. These numbers are standardized executive scores subtracted from standardized legislative scores; the higher the number, the greater the importance of legislative skills compared to executive skills. For individuals classified as gifted, the legislative thinking style is more important even in fifth grade, and increases in importance (nearly doubles the difference) from fifth to eighth grade. However, the scores for individuals not classified as gifted do not change, and the executive thinking style remains more important than the legislative thinking style. This supports the hypothesis that legislative thinking style not only grows more important with age, but does so in concert with giftedness.

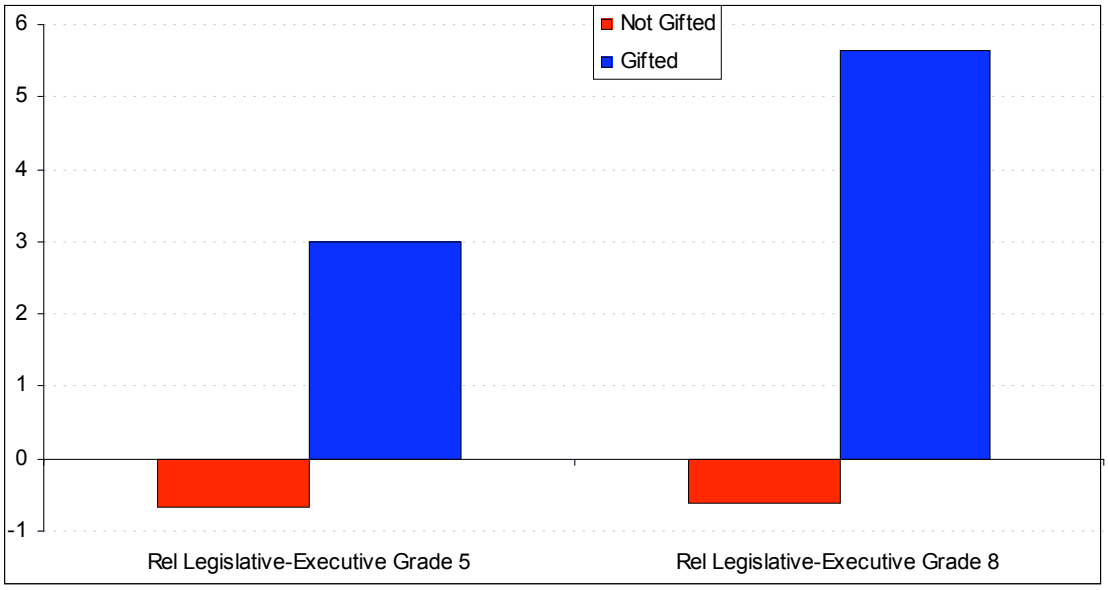



Figure 24. Relative importance of the legislative thinking style to the practical thinking style for gifted and not gifted groups over time.

**Middle School (Cross-sectional)**

Figure 25 shows the relative importance of the legislative thinking style to the practical thinking style for not gifted, moderately gifted, and highly gifted groups. These numbers are executive scores subtracted from legislative scores; the higher the number, the greater the importance of the legislative thinking style compared to the executive thinking style. For all ability groups, the legislative thinking style is more prominent than the executive thinking style. All bars are significantly different from zero. Although legislative scores increase with the level of giftedness, these differences are not significant.

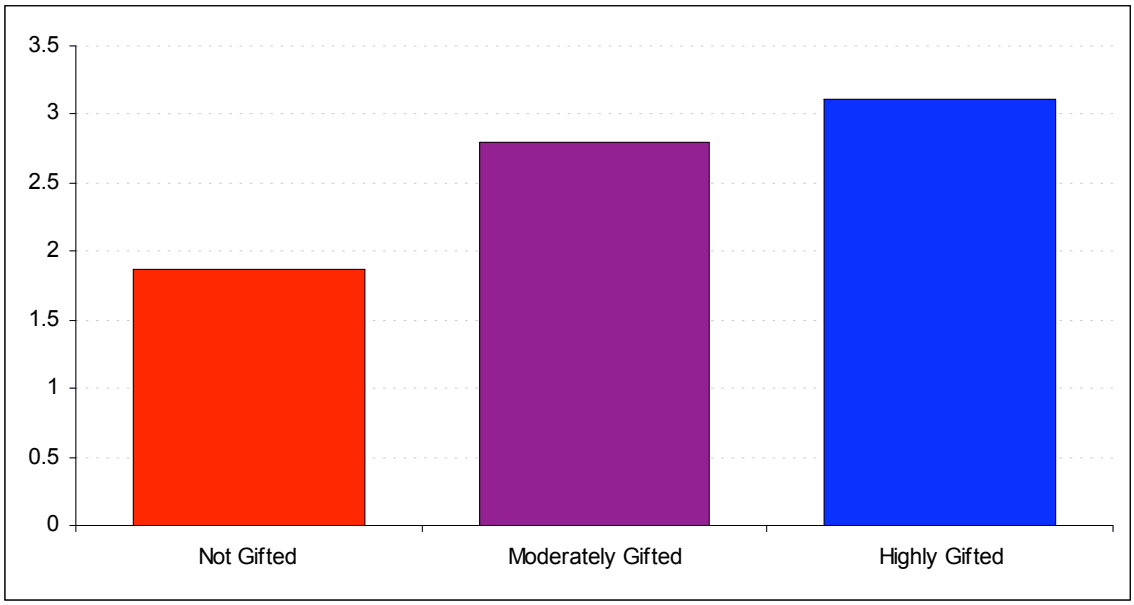



Figure 25. Relative importance of the legislative thinking style to the executive thinking style for not gifted, moderately gifted, and highly gifted groups—middle school.

**High School**

Figure 26 shows the relative importance of the legislative thinking style to the executive thinking style for not gifted, moderately gifted, and highly gifted groups at the high school level. These numbers are executive scores subtracted from legislative scores; the higher the number, the greater the importance of a legislative thinking style compared to an executive style. For all groups, legislative skills are more prominent than executive skills. All bars are significantly different from zero. Although gifted students show greater prominence for legislative skills than not gifted students, these differences are not significant. As was the case in middle school, we see here that although legislative scores increase with the level of giftedness, these differences are not significant.

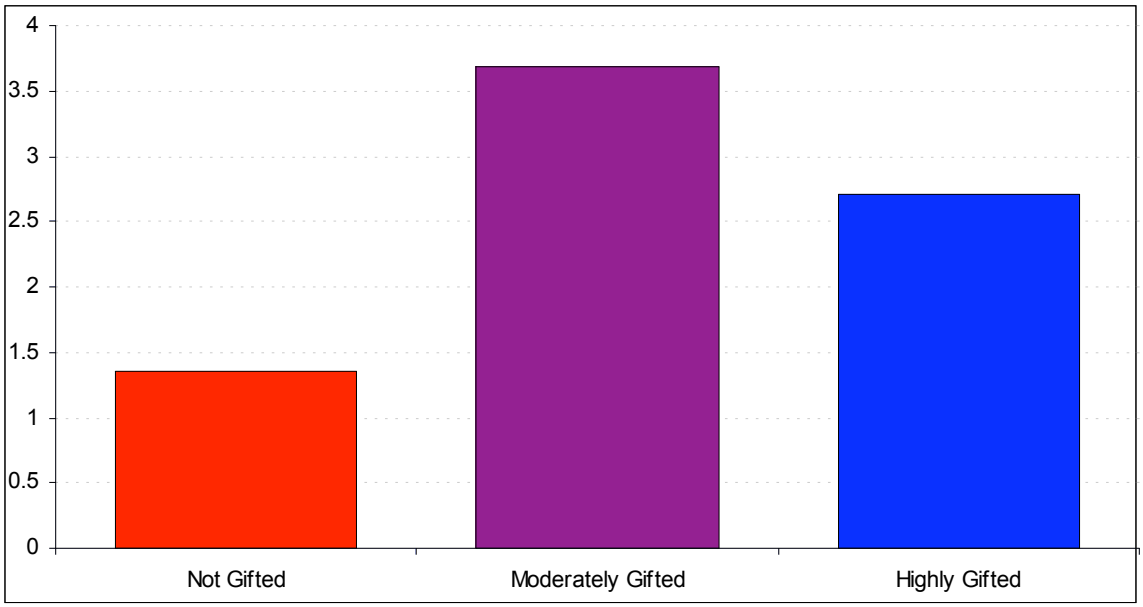



Figure 26. Relative importance of the legislative thinking style to the executive thinking style for not gifted, moderately gifted, and highly gifted groups—high school.

**College**

For brevity and to increase cooperation, the thinking-styles questionnaire was not administered to college students.

*In sum*, as per our hypothesis, we note that the relative importance of the legislative thinking style versus an executive thinking style increases when tracking middle school students from fifth through eighth grade.

## Hypothesis 5

**Willingness to defy convention, surmount obstacles, take sensible risks, tolerate ambiguity, and develop self-efficacy will become more important to giftedness with increasing age as creativity becomes more and more important with respect to the field and less and less important with respect merely to one's school peers or oneself.**

**Preschool**

This hypothesis cannot be explored at such an early age.

**Middle School (Longitudinal)**

This hypothesis was not explored with the longitudinal middle school sample.

**Middle School (Cross-sectional)**

Students rated the importance of three of these traits (surmounting obstacles, developing self efficacy, and risk-taking) to their success at different life stages. Figure 27 shows the amount by extent to which gifted students rated these qualities more highly than not gifted students. Highly gifted students rated the trait of surmounting obstacles more highly than did not gifted students ($t(313) = -2.11$, $p < .05$). They also rate the trait of developing self-efficacy more highly than did not gifted students ($t(320) = -2.20$, $p < .05$). Neither gifted group values risk-taking more highly than not gifted groups; both actually value risk-taking less than not gifted students, although not significantly.

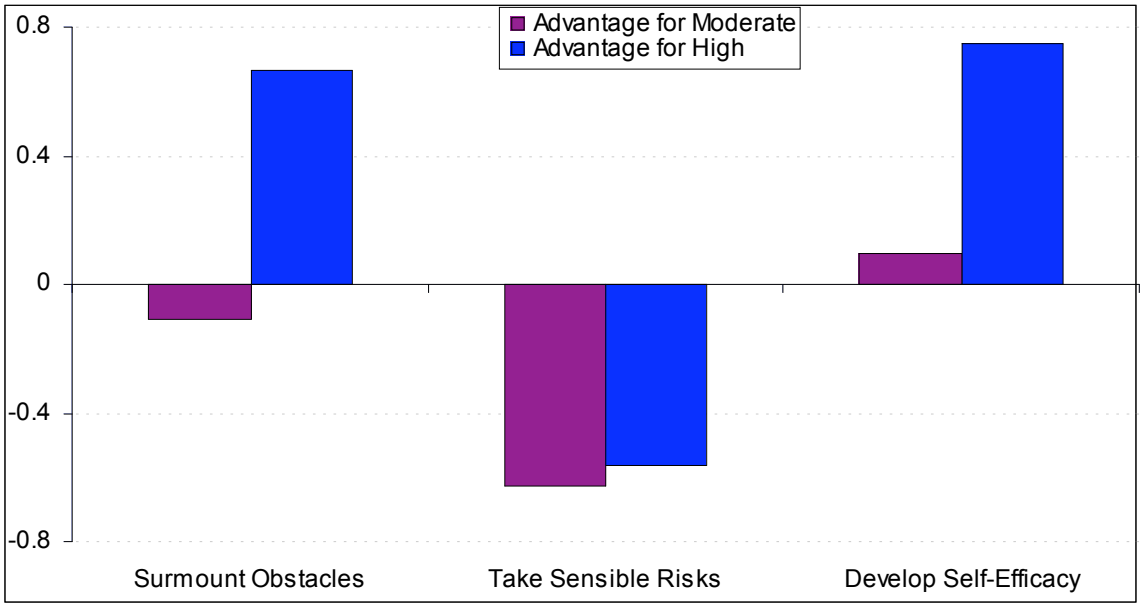



Figure 27. Relative importance of three personal values for moderately and highly gifted students compared to not gifted middle school students.

**High School**

Students rated the importance of three of these traits to their success at different life stages. Figure 28 shows the amount by which gifted students rate these qualities more highly than not gifted students. None of the differences were significant, although one is in the same direction as was found for middle school students. Highly gifted students value risk taking less than not gifted students.

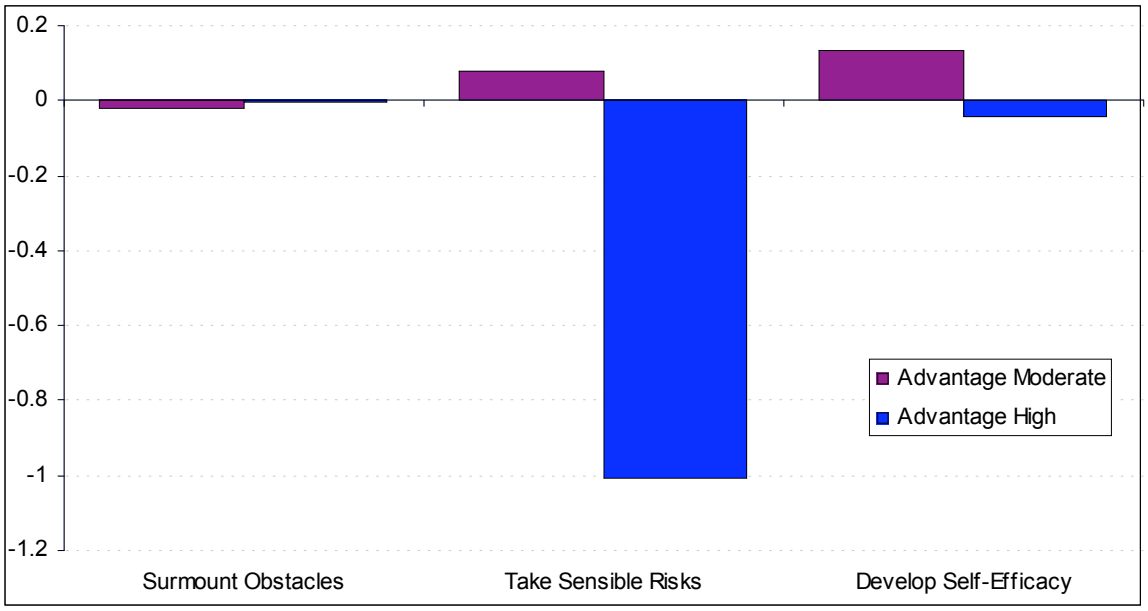



Figure 28. Relative importance of three personal values for moderately and highly gifted students compared to not gifted high school students.

**College**

For brevity and to increase cooperation, the values questionnaire was not administered to college students.

*In sum*, at the middle school level, two traits are more important for gifted than for not gifted students: "surmounting obstacles" and "developing self efficacy."

## Hypothesis 6

**Students who are more highly motivated by their teachers and coursework will be more likely to be identified as gifted than students who are not as highly motivated.**

**Preschool**

This hypothesis cannot be explored at as early an age.

**Middle School (longitudinal)**

Figure 29 shows that fifth grade students who have been identified as gifted show more of a mastery approach and (nearly) significantly less ($F(1, 62) = 3.81$, $p = .055$) of a mastery avoidance achievement goal framework in fifth grade. There is a relationship between goal orientation (here serving as a measure of motivation) and likelihood of

being identified as gifted. By eighth grade (Figure 30), the differences are still apparent, but none are significant.

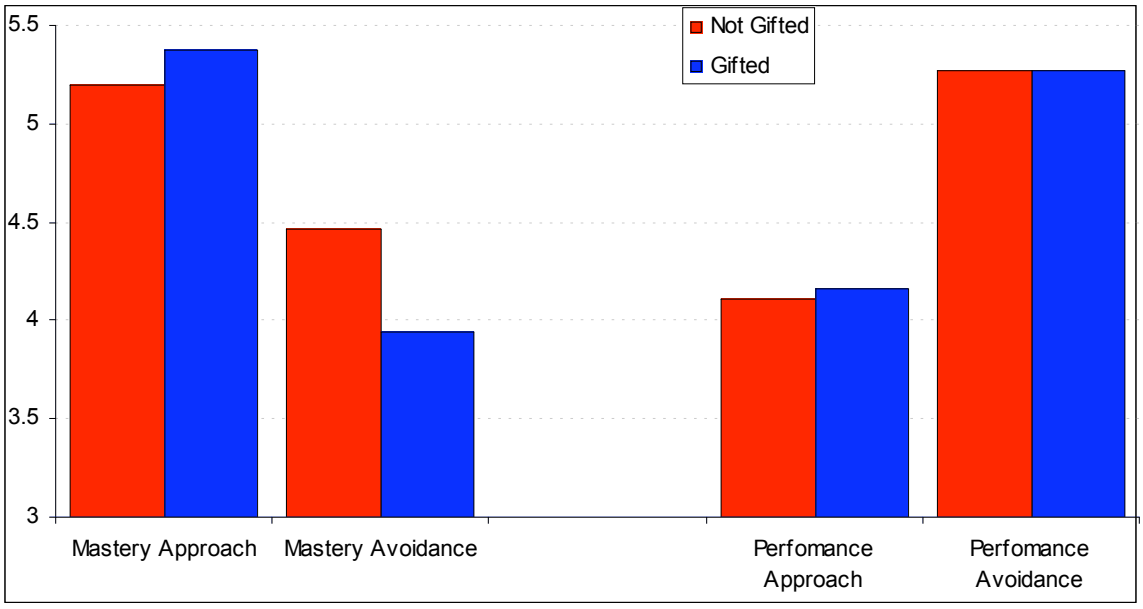



Figure 29. Mastery/performance approaches in gifted and not gifted students in fifth grade.

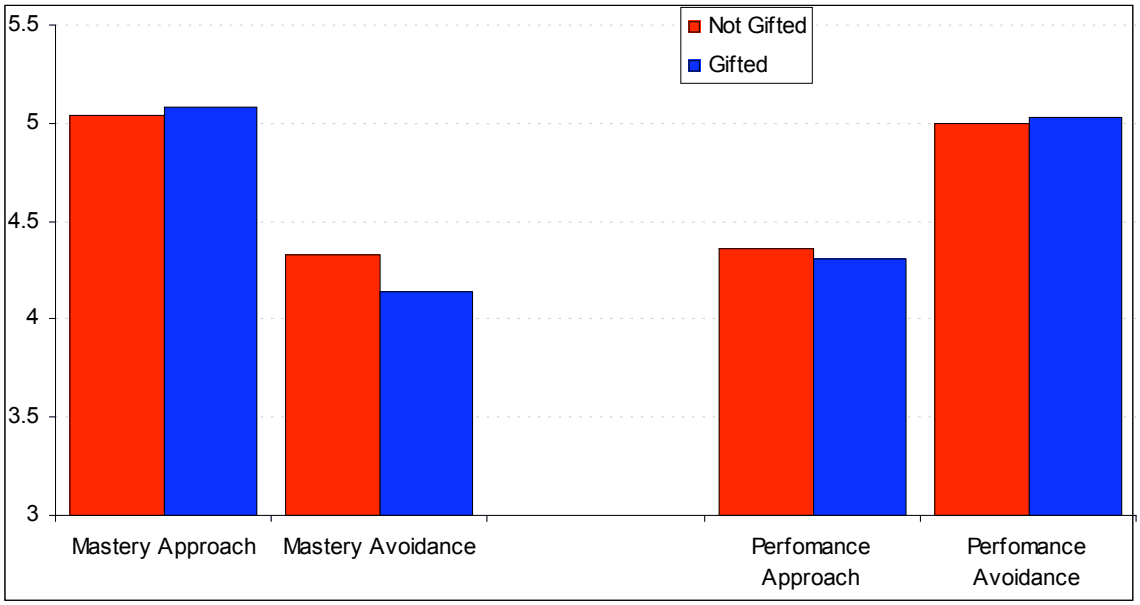



Figure 30. Mastery/performance approaches in gifted and not gifted students in eighth grade.

**Middle School (Cross-sectional)**

Figure 31 shows that students who have been identified as highly gifted show significantly more ($F(2, 575) = 4.73$, $p < .01$) of a mastery approach and less of a mastery avoidance achievement goal framework. There is a relationship between goal orientation (here serving as a measure of motivation) and likelihood of being identified as gifted.

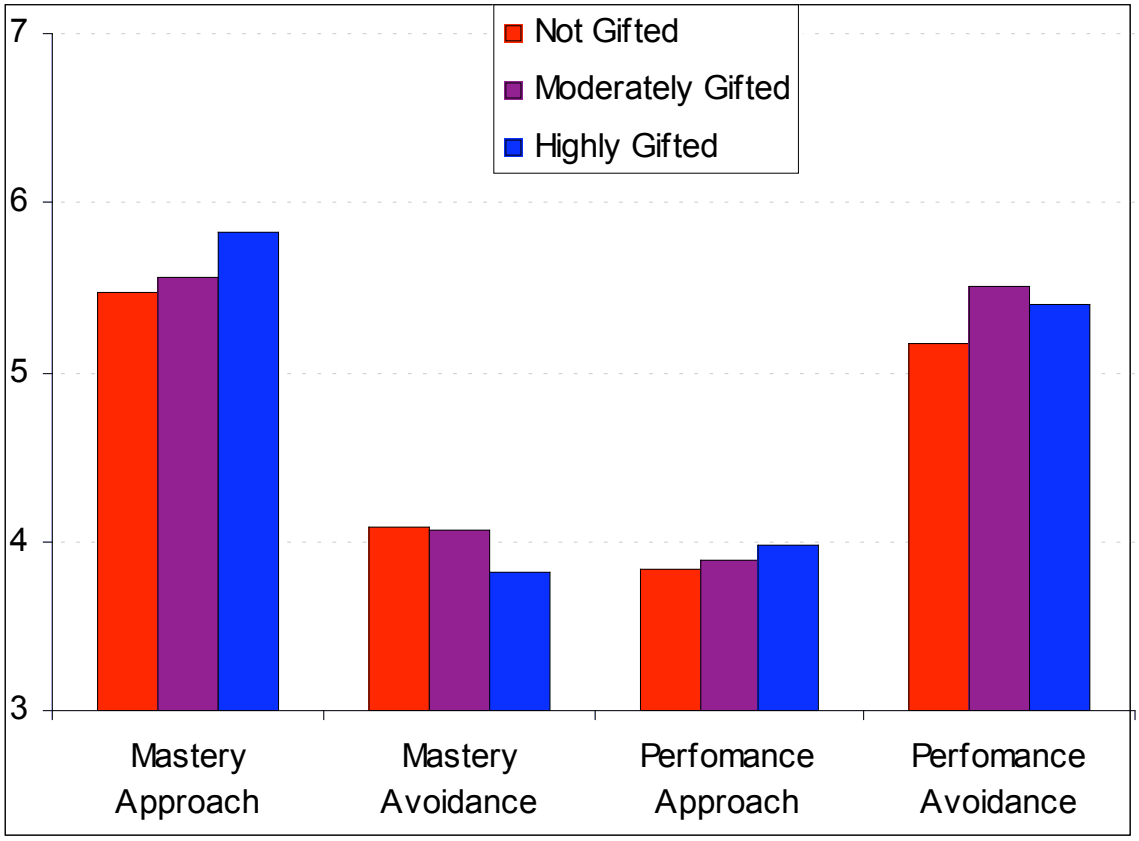



Figure 31. Mastery/performance approaches in not gifted, moderately gifted, and highly gifted middle school students.

**High School**

Figure 32 shows that students who have been identified as highly gifted show significantly more ($F(2, 379) = 5.01$, $p < .01$) of a mastery approach and less of a mastery avoidance achievement goal framework. Students who are not gifted show less of a performance approach and significantly more performance avoidance ($F(2, 379) = 4.82$, $p < .01$). There is a relationship between goal orientation (here serving as a measure of motivation) and likelihood of being identified as gifted.

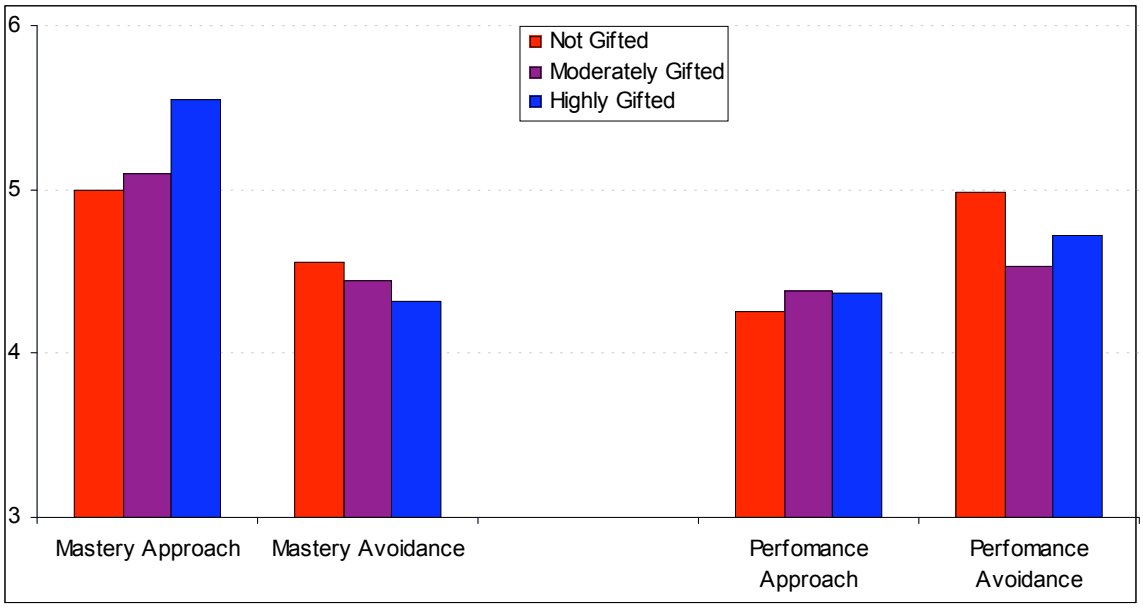



Figure 32. Mastery/performance approaches in not gifted, moderately gifted, and highly gifted high school students.

**College**

For brevity and to increase student cooperation, the thinking styles questionnaire was not administered to college students.

*In sum*, using goal orientation as a proxy for motivation, we note that, as per our hypothesis, highly motivated students are more likely than less motivated students to be perceived as gifted, both at the middle and high school levels.

## Hypothesis 7

**A supportive environment will be important to identification of giftedness at all ages.**

**Preschool**

Figure 33 shows the amount of support preschool children receive from their parents. Regardless of classification scheme for giftedness (analytical, practical, creative), preschool children who are classified as gifted receive more support—interact more with their parents on schoolwork, reading, math, science, creative, and extracurricular activities—than preschool children who are not classified as gifted.

This could be interpreted either as the necessity for parents to interact with their children to perceive their gifts, or as the positive influence on early, sustained interactions with parents for the development of gifts in children.

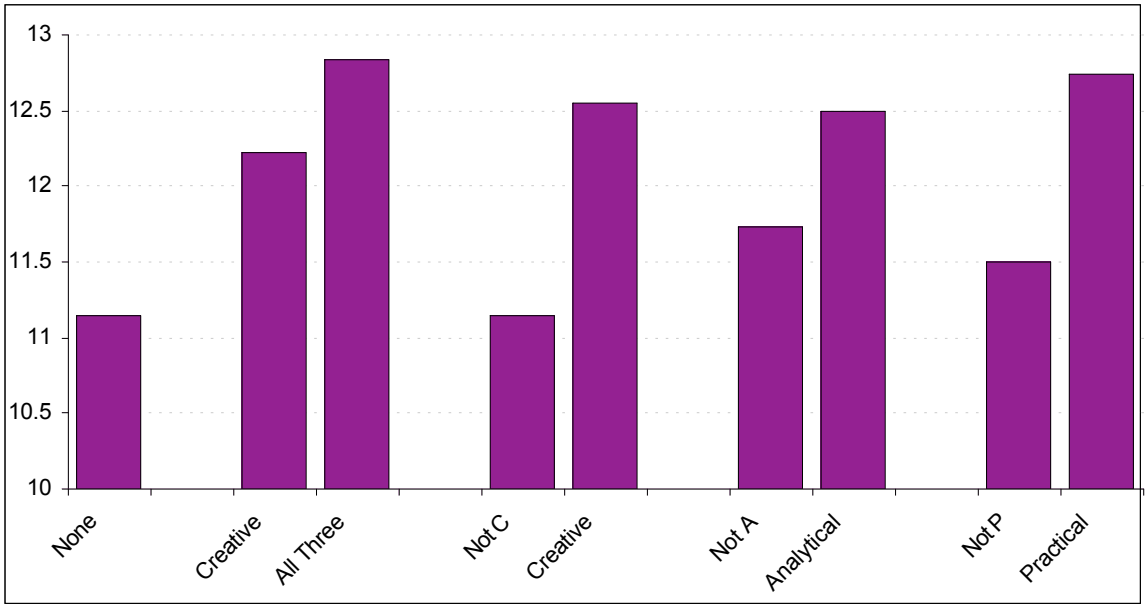



Figure 33. Amount of parental support of children in preschool by giftedness category.

**Middle School (Longitudinal)**

Hypothesis 7 is not supported. For nearly all types of support, for both sixth and eighth grade parent interviews, students who are identified as gifted actually receive less support from their parents. Plotted in Figure 34 are the difference scores between amount of support received by gifted and not gifted students from their parents in various domains of parent support. Higher numbers indicate that not gifted students receive more support than gifted students. None of these differences are statistically significant. (Note: Fewer children were included in this analysis because fewer children had parent interviews in sixth and eighth grades; 10 not gifted and 36 gifted in sixth grade, 14 not gifted and 43 gifted in eighth grade.)

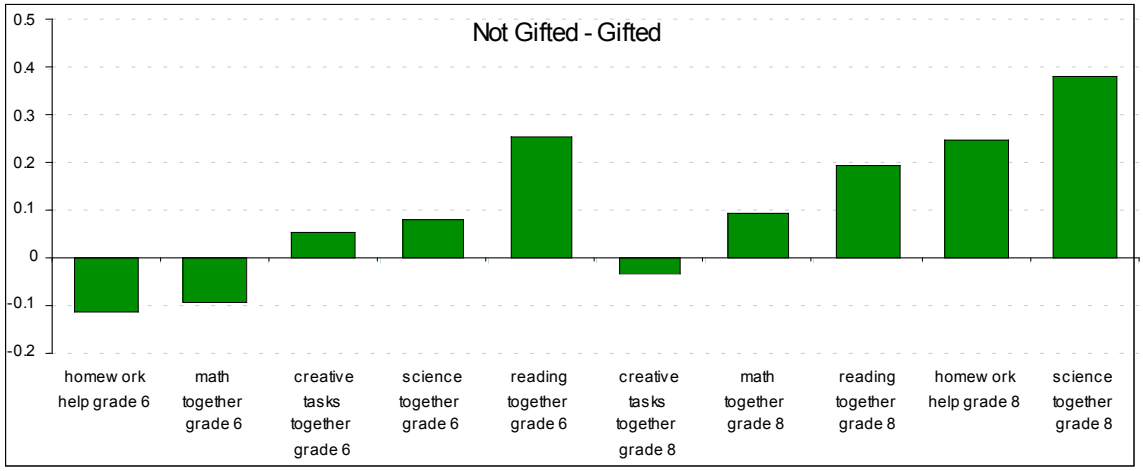



Figure 34. Difference in amount of parental support of children in sixth and eighth grades who are and are not classified as gifted.

While Figure 34 shows difference scores between groups, Figure 35 shows change scores over time. For both gifted and not gifted groups, the amount of parental support received decreases from sixth to eighth grade ($F(1, 41) = 14.01$, $p < .001$). As children progress through school, their own motivation plays a greater and greater role in their learning. Greater parental support for not gifted children in middle school may reflect the greater need for support of these children.

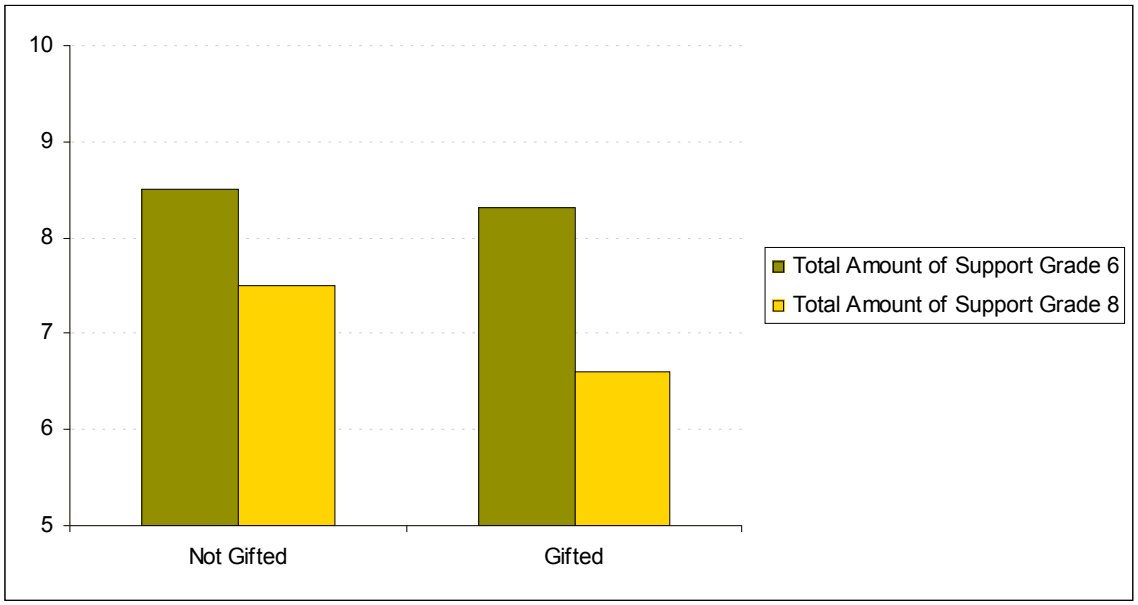



Figure 35. Change in amount of parent report from sixth to eighth grades for gifted and not gifted individuals.

**Middle School (Cross-sectional)**

Hypothesis 7 is not supported. For all types of support, students who are identified as gifted actually receive less support from their parents. In fact, moderately gifted students receive statistically marginally significantly less support in math ($t(225) = 1.86$, $p = .065$) and highly gifted students receive statistically significantly less support on their homework ($t(230) = 2.11$, $p < .05$). Plotted in Figure 36 are the difference scores between amount of support received by gifted and not gifted students from their parents in various domains. Higher numbers indicate that not gifted students receive more support than gifted students.

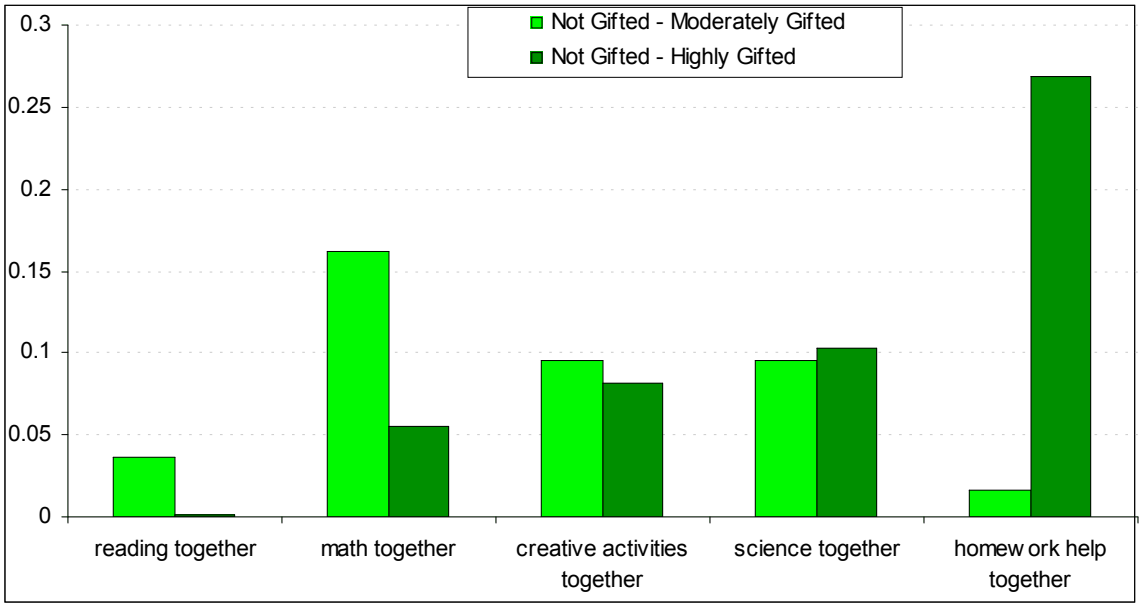



Figure 36. Difference in amount of parental support of children in middle school who are and are not classified as gifted.

Figure 37 shows the total support received by each group. None of the differences are significant.

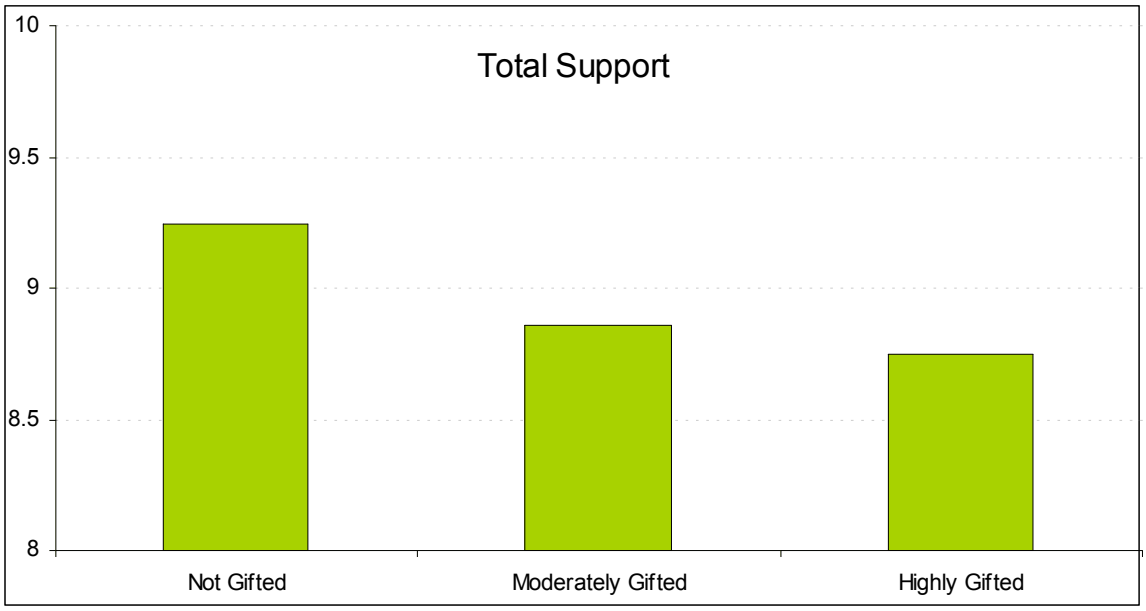



Figure 37. Total amount of parent report received by not gifted, moderately gifted, and highly gifted individuals in middle school.

**High School**

Hypothesis 7 is not supported. For all types of support, there is no difference between the amount of students that gifted and not gifted children receive from their parents. Plotted in Figure 38 are the difference scores between amount of support received by gifted and not gifted students from their parents in various domains. Higher numbers indicate that not gifted students receive more support than gifted students. None of the differences are significant.

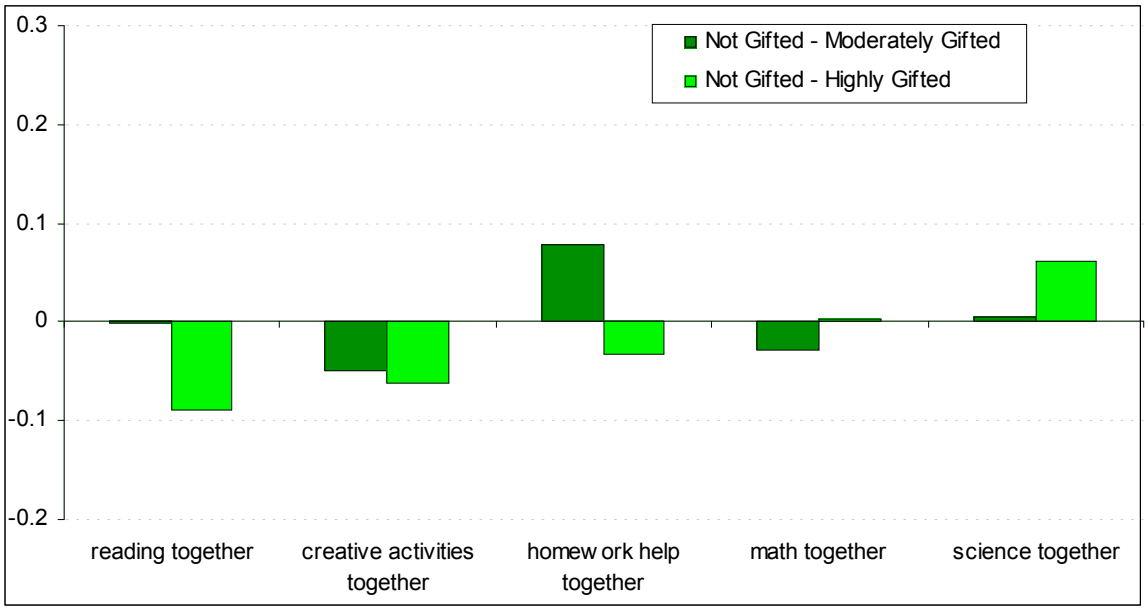



Figure 38. Difference in amount of parental support of children in high school who are and are not classified as gifted.

Figure 39 shows the total support received by each group. None of the differences are significant.

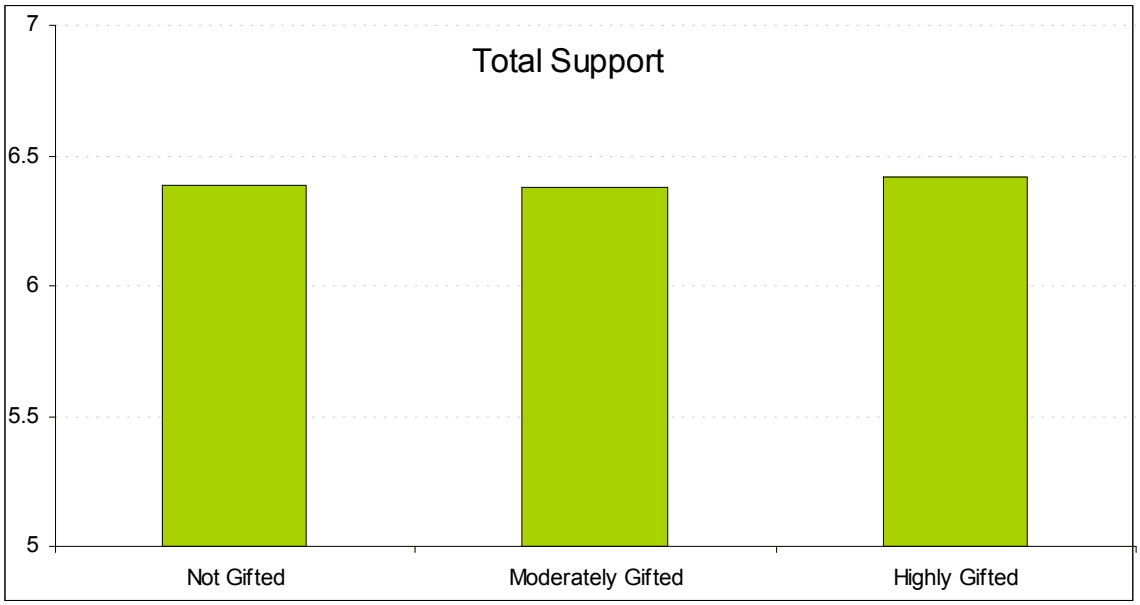



Figure 39. Total amount of parent report received by not gifted, moderately gifted, and highly gifted individuals in middle school.

**Cross-grade Comparison**

Although Hypothesis 7 is not supported within each subject group, across all groups, a pattern emerges. Figure 40 shows the total amount of support received by gifted (both moderately and highly) and not gifted students from their parents. The overall level of support received by students decreases significantly from preschool through high school ($F(4, 747) = 57.42$, $p < .0001$). Each subsequent level is significantly lower than the one before, with the exception of high school; there is no significant difference between the total amount of support received from parents in eighth grade and in high school. Further, there is an interaction between grade level and giftedness ($F(4, 747) = 3.01$, $p < .05$). Post-hoc tests show that gifted preschoolers receive significantly more support from their parents ($t(66) = -2.02$, $p < .05$). Gifted fifth graders receive marginally significantly less support from their parents ($t(178) = 1.86$, $p = .068$). Gifted eighth graders receive less support from their parents, but the difference is not significant.

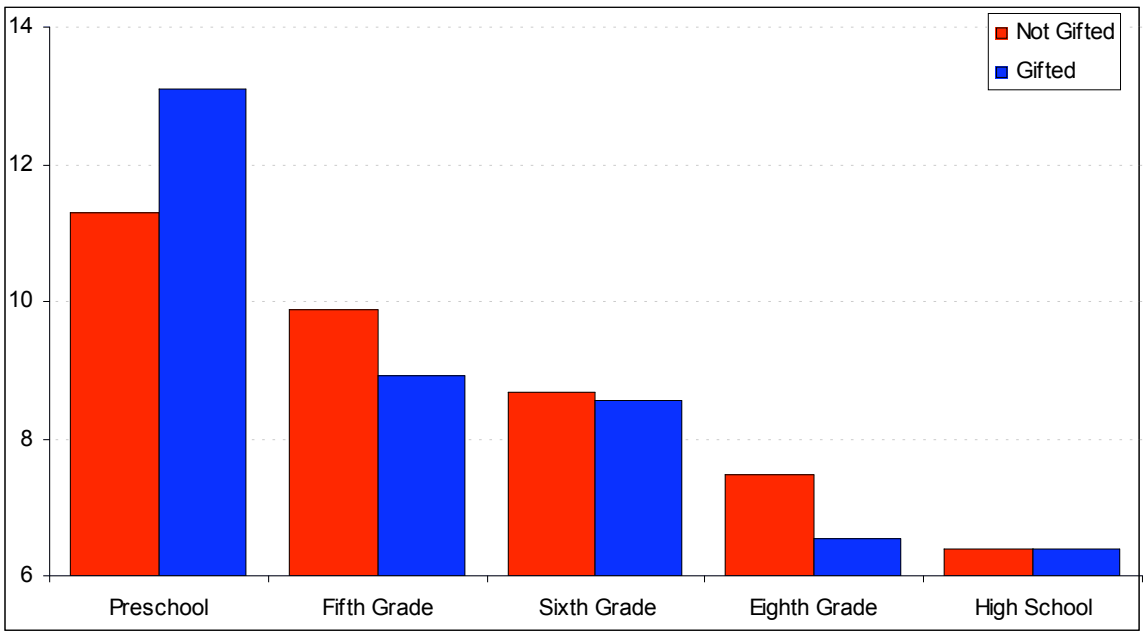



Figure 40. Total amount of parental support received by gifted and not gifted children from preschool to high school

These findings indicate that more parental support is associated with more giftedness. There are two possible reasons that the difference is in the expected direction for preschoolers: (a) Parents were the ones judging their children's giftedness, which could lead to a circular finding (more involved parents are more likely to consider their children gifted) and (b) giftedness in toddlers might be more of a precocity, which can be affected by parent teaching and environmental exposure to new experiences and challenges. The pattern is opposite to the one predicted in the rest of the groups. Gifted

children are less likely to have higher levels of parental support. Two reasons for this finding are that (a) children who are receiving more parent support are doing so because they need it to perform adequately in school and (b) gifted children are functioning more like older children, who are also (in this comparison) receiving less parental input. By high school, the amount of input is so low that there is probably a floor effect; what differences may exist cannot be measured with the current test.

### College

Parental support is no longer a valid variable for college students. Not only are college students out on their own, but also the data from high school students suggests that parent-reported support has decreased to the point of nonexistence.

*In sum*, a supportive family environment is important at the preschool level, but ceases to be so in middle school and thereafter.

## Conclusion

In conclusion, preschool children who are identified as gifted do perform better on a number of cognitive and achievement tasks, but the distinction between analytical, creative, and practical skills is not yet clear. The difference is clearer during middle and high school, when creative and practical abilities are becoming more important relative to analytical skills, especially for underrepresented minority students. Legislative thinking style becomes more prominent with development, whereas the importance of the executive thinking style decreases. Finally, students who are more motivated are more likely to be identified as gifted.

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