Gifted Child Quarterly
http://gcq.sagepub.com/

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Gifted Child Quarterly 2002 46: 265
DOI: 10.1177/001698620204600403

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ABSTRACT

A number of models are available for use in gifted education. The theory of successful intelligence, one such model, provides a basis for identification, intervention, and evaluation in gifted programs. This article describes the model, allowing practitioners and other interested parties to apply the model in a gifted education environment.

The article contains four main parts. The first part presents the theory of successful intelligence and data in support of it. The second part shows how to implement the model in schools and presents data in support of the success of its school implementation. The third part relates the theory of successful intelligence to other models of gifted education. The fourth part briefly draws some conclusions.

PUTTING THE RESEARCH TO USE

The theory of successful intelligence is useful in gifted education because it has clear and direct implications for identification, instruction, and assessment. With regard to identification, we have constructed various versions of a "Sternberg Triarchic Abilities Test" that measures analytical, creative, and practical skills. The first edition has two levels, one for grade 4 and one for high school. It measures the three abilities through multiple-choice items in each of the verbal, quantitative, and figural domains, plus the essay domain. A more recent version of this test is Internet administered (although its use is presently restricted to a research study we are doing). None of these tests is yet standardized.

With regard to instruction, we have published a book that explains how to teach for successful intelligence (Sternberg & Grigorenko, 2000). The main idea is to follow a set of principles, such as (a) teaching analytically, creatively, and practically to all students so they can (b) capitalize on strengths and (c) correct or compensate for weaknesses. The idea is to teach in ways that help students become analytical (by comparing and contrasting, evaluating, and judging), creative (by inventing, discovering, and exploring), and practical (by using, utilizing, implementing, and putting into practice).

With regard to assessing achievement, assessments should be done in the same way as instruction, with roughly equal emphasis on analytical, creative, and practical processing. The assessments also include memory-based items, often tested through multiple choice. Such items are included because analytical, creative, and practical processing relies on memory in order to be effective.

The theory of successful intelligence provides a model for identification, intervention, and evaluation in gifted programs. The goal of this article is to describe the model so that practitioners and others who might be interested in the theory will have a model for its application in the gifted education environment.

The Theory of Successful Intelligence

Definition of Successful Intelligence

Successful intelligence is the ability to succeed in life according to one's own definition of success, within one's sociocultural context, by capitalizing on one's strengths and correcting or compensating for one's weaknesses; in order to adapt to, shape, and select environments; through a combination of analytical, creative, and practical abilities (Sternberg, 1997a, 1999b, 1999c).

Kinds of Giftedness According to the Theory of Successful Intelligence

According to this theory, therefore, an individual is successfully intelligent by virtue of developing the skills needed to achieve success as she or he defines it. People who are gifted are those who are particularly well able to achieve such success. They do so by combining analytical, creative, and practical abilities. People may be gifted with respect to any one of these abilities or with respect to the way they balance the abilities in order to succeed.

People who are analytically gifted are particularly well able to analyze, judge, critique, compare and contrast, evaluate, and explain. They typically do well in school and on standardized tests. Tests of IQ measure largely analytical abilities, as well as memory abilities. These people have the kind of intelligence that is most likely to lead them to be labeled as *gifted* in school. The fact that they are well able to learn and analyze ideas does not necessarily mean that they are well able to come up with their own ideas or to apply what they have learned in everyday life.

A person who is creatively gifted is particularly well able to create, invent, discover, explore, imagine, and suppose. Conventional tests of intelligence do not really measure creative intelligence, nor are they intended to. Tests such as the Torrance Test (Torrance, 1974) measure creativity in somewhat restricted situations, but primarily the component of it that is related to fluency (rapid production of ideas). However, creativity is the ability to generate ideas that are novel, high in quality, and task appropriate. Therefore, to measure creativity, we typically use tasks that are somewhat different, such as writing short stories, drawing pictures, formulating advertisements, and solving novel scientific problems (Sternberg & Lubart, 1995; Sternberg & O'Hara, 2000).

A person who is practically gifted is particularly well able to use, utilize, apply, implement, and put into practice. Such a person shows intelligence in highly contextualized situations. The person may or may not be notable for his or her formal knowledge, but often is distinguished by his or her tacit knowledge, that is, knowledge of what one needs to know to succeed in an environment that usually is not directly taught and that often is not even verbalized. For example, a practically gifted individual might be aware of how his or her actions affect others and of the nonverbal signals others emit that show how they feel about things.

A person who is gifted in a balanced way may not be extremely high in analytical, creative, or practical intelligence. Rather, he or she may be particularly well able to balance the levels of the three abilities, knowing more precisely than most people when and how to use them.

Processes Underlying the Theory

According to the theory of successful intelligence (Sternberg, 1985, 1997a, 1999b), a common set of processes underlies all aspects of intelligence. These processes are hypothesized to be universal. For example, although the solutions to problems that are considered intelligent in one culture may be different from the solutions considered to be intelligent in another culture, the need to define problems and formulate strategies to solve these problems exists in any culture.

Metacomponents, or executive processes, plan what to do, monitor things as they are being done, and evaluate things after they are done. Examples of metacomponents are recognizing the existence of a problem, defining the nature of the problem, deciding on a strategy for solving the problem, monitoring the solution of the problem, and evaluating the solution after the problem is solved. In writing a paper, students need to recognize the existence of some problem (e.g., what does it mean to be gifted?), define the problem (e.g., define giftedness in terms of some old model, new model, or combination of old and new models), decide on a strategy to present the model in the paper, and so forth.

Performance components execute the instructions of the metacomponents. For example, inference is used to decide how two stimuli are related, and application is used to apply what one has inferred (Sternberg, 1977). Other examples of performance components are comparison of stimuli, justification of a given response as adequate although not ideal, and actually making the response. For example, a student writing a paper might need to infer the implications of a theory of giftedness for designing assessments of achievement.

Knowledge-acquisition components are used to learn how to solve problems or simply to acquire declarative knowledge in the first place (Sternberg, 1985). Selective encoding is used to decide what information is relevant in the context of one's learning. Selective comparison is used to bring old information to bear on new problems. And selective combination is used to put together the selectively encoded and compared information into a single and sometimes insightful solution to a problem. For example, in reading before writing a paper, a student would have to selectively encode what information is relevant for the paper and what information is not.

Although the same processes are used for all three aspects of intelligence universally, these processes are applied to different kinds of tasks and situations depending on whether a given problem requires analytical thinking, creative thinking, practical thinking, or a combination of these kinds of thinking. Data supporting the theory cannot be presented fully here, but are summarized elsewhere (Sternberg, 1977, 1985a; Sternberg et al., 2000).

Intelligence as Developing Expertise

Successful intelligence is viewed as a form of developing expertise (Sternberg, 1998a, 1999b). In other words, it is not a fixed entity, but a flexible and dynamic one. All intelligence tests measure only an aspect—typically a limited aspect—of developing expertise. Developing expertise is defined here as the ongoing process of the acquisition and consolidation of a set of skills needed for a high level of mastery in one or more domains of life performance. Good performance on intelligence tests requires a certain kind of expertise, and, to the extent this expertise overlaps with the expertise required by schooling or by the workplace, there will be a correlation between the tests and performance in school or in the workplace. But, such correlations represent no intrinsic relation between intelligence and other kinds of performance. Rather, they represent overlaps in the kinds of expertise needed to perform well under different kinds of circumstances.

There is nothing privileged about the intelligence tests or any other tests of abilities. One could as easily use, say, academic achievement to predict intelligence-related scores. According to this view, although ability tests may have temporal priority relative to various criteria in their administration (i.e., ability tests are administered first and, criterion indices of performance, such as grades or achievement test scores, are collected later), they have no psychological priority. All of the various kinds of assessments are of the same kind psychologically. What distinguishes ability tests from other kinds of assessments is how the ability tests are used (usually predictively), rather than what they measure. There is no qualitative distinction among the various kinds of assessments. All tests measure various kinds of developing expertise.

Conventional tests of intelligence and related abilities measure achievement that individuals should have accomplished several years back (see also Anastasi & Urbina, 1997). Tests such as vocabulary, reading comprehension, verbal analogies, arithmetic problem solving, and the like are all, in part, tests of achievement. Even abstract-reasoning tests measure achievement in dealing with geometric symbols, skills taught in Western schools (Laboratory of Comparative Human Cognition, 1983; Serpell, 2000). One might as well use academic performance to predict ability-test scores. The problem regarding the traditional model is not in its statement of a correlation between ability tests and other forms of achievement, but in its proposal of a causal relation whereby the tests reflect a construct that is somehow the cause of, rather than merely temporally antecedent to, later success. The developing-expertise view in no way rules out the contribution of genetic factors as a source of individual differences in who will be able to develop a given amount of expertise. Many human attributes, including intelligence, reflect the covariation and interaction of genetic and environmental factors. But, the contribution of genes to an individual's intelligence cannot be directly measured or even directly estimated. Rather, what is measured is a portion of what is expressed, namely, manifestations of developing expertise, the kind of expertise that potentially leads to reflective practitioners in a variety of fields (Schon, 1983).

The upshot of this view is that successful intelligence, and giftedness in it, is not wholly inborn (see also Callahan, 2000; Grigorenko, 2000; Sternberg & Grigorenko, 1997). Genetic factors interact with environmental ones to produce variable levels of developing expertise. Good schools help children maximize their development of such expertise.

Overall Structure of the Theory of Successful Intelligence

The overall structure of the theory of successful intelligence is shown in Figure 1. The figure shows how components are applied to experience and then to real-world decisions about how to respond to environmental challenges.

Components of intelligence (metacomponents, performance components, knowledge-acquisition components) are interactive: Metacomponents activate performance components and knowledge-acquisition components, which then provide feedback to the metacomponents. When the components are applied to relatively familiar kinds of problems for which the structure is abstracted (i.e., the problem solver knows more or less what to expect), the components reflect analytical abilities.

Creative abilities are invoked when the components are applied to relatively novel kinds of problems and problem situations. What start out as relatively novel kinds of problems and problem situations eventually may become automatized, so that they require little processing effort. Reading, driving, and holding a phone are examples of automatized actions.

Practical abilities are invoked when one applies the components to experience in order to adapt to, shape, and select environments. In other words, one confronts problems of how to change oneself to suit the environment, change the environment to suit oneself, or simply find a new environment in which to apply one's skills.

People may be gifted in one of these areas, two of them, or in all three (or, of course, in none of them). But, their areas of giftedness may develop with time because the abil-

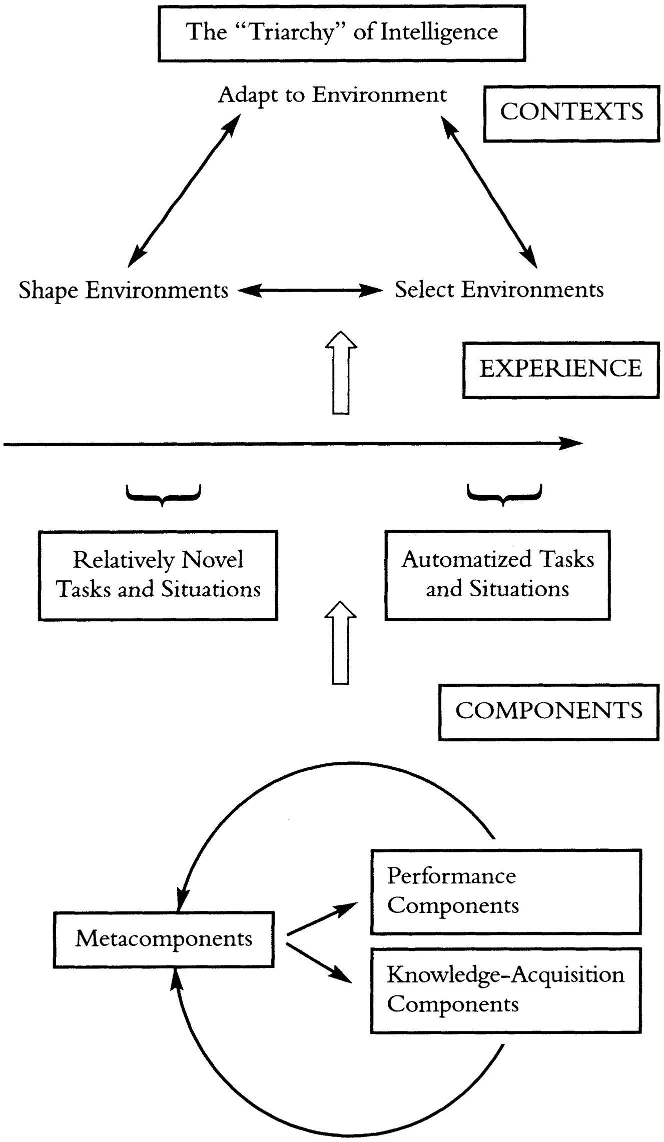

Figure 1. Structure of the theory of successful intelligence: The "triarchy" of intelligence.

ities are forms of developing expertise. With the right kind of schooling and home socialization, a person can develop his or her abilities further than in an environment that is limiting of opportunities for intellectual development.

Is the Theory Empirically Supported?

Gifted education is replete with theories that, however attractive they may be, have little or no *predictive* empirical validity data to support them as a whole. These theories basically express the armchair speculations of their authors. The theories are akin to arguments in philosophy or literature that can be supported by argumentation or by selective citations to past literature, but have not been shown to predict anything, a requirement for a theory to be scientific. There is nothing wrong with literary or philosophical claims; they simply are different in kind from scientific claims. When we use a new drug on children, we would want the usefulness and safety of the drug to have been demonstrated through scientific research, not speculation, however imaginative and persuasive that speculation might be. Why should we have different standards for educational programs? We propose our theory here because it has been shown to be supported scientifically. Some of the evidence is summarized below. More detailed accounts can be found elsewhere (Sternberg, 1985, 1997a, 1999a; Sternberg et al., 2000).

In one study (Sternberg, Grigorenko, Ferrari, & Clinkenbeard, 1999), we used the so-called Sternberg Triarchic Abilities Test (STAT; Sternberg, 1993) to investigate the internal validity of the theory (in other words, whether the division into analytical, creative, and practical abilities is justifiable). The test comprised 12 subtests and was taken by 326 high school students, primarily from diverse parts of the United States, identified as gifted by their schools. Analytical, creative, and practical abilities were each measured by four subtests, three multiple-choice tests and one essay test. The multiple-choice tests, in turn, involved, respectively, verbal, quantitative, and figural content. Consider the content of each test:

1. Analytical-Verbal: Figuring out meanings of neologisms (artificial words) from natural contexts. Students see a novel word embedded in a paragraph and have to infer its meaning from the context.
2. Analytical-Quantitative: Number series. Students have to predict what number should come next in a series of numbers.
3. Analytical-Figural: Matrices. Students see a figural matrix with the lower right entry missing. They have to determine which of the options fits into the missing space.
4. Practical-Verbal: Everyday reasoning. Students are presented with a set of everyday problems in the life of an adolescent and have to select the option that best solves each problem.
5. Practical-Quantitative: Everyday math. Students are presented with scenarios requiring the use of math in everyday life (e.g., buying tickets for a ballgame) and have to solve math problems based on the scenarios.
6. Practical-Figural: Route planning. Students are presented with a map of an area (e.g., an amusement park) and have to answer questions about navigating effectively through the area depicted by the map.
7. Creative-Verbal: Novel analogies. Students are pre-

sented with verbal analogies preceded by counterfactual premises (e.g., money falls off trees). They have to solve the analogies as though the counterfactual premises were true.

8. Creative-Quantitative: Novel number operations. Students are presented with rules for novel number operations, for example, "flix," which involves numerical manipulations that differ as a function of whether the first of two operands is greater than, equal to, or less than the second. Participants have to use the novel number operations to solve presented math problems.
9. Creative-Figural: In each item, participants are first presented with a figural series that involves one or more transformations. They then have to apply the rule of the series to a new figure with a different appearance and complete the new series.

Correlations between pairs of these tests depend on what scores one uses. In our study of 199 high school students (Sternberg, Grigorenko, Ferrari, & Clinkenbeard, 1999), raw simple correlations were .47 between analytical and creative tests, .41 between analytical and practical tests, and .37 between creative and practical tests. In general, multiple-choice tests tended to correlate more highly with each other (median r = .52) than did essay tests (median r = .21). However, when we used structural-equation modeling to control for method and error variance, the correlational picture changed, with correlations for the latent abilities of -.07 between analytical and creative, .00 between analytical and practical, and .06 between creative and practical abilities.

We found that a confirmatory factor analysis on the data was supportive of the theory of successful intelligence, yielding separate and uncorrelated analytical, creative, and practical factors. The lack of correlation was due to the inclusion of both essay and multiple-choice subtests. Although multiple-choice tests tended to correlate substantially with multiple-choice tests, the correlation of multiple-choice tests with essay tests was much weaker; similarly, essays correlated with each other (although not as strongly as multiple-choice tests correlated with each other), suggesting the presence of substantial method variance. We found the multiple-choice analytical subtest to load most highly on the analytical factor, but the essay creative and practical subtests loaded most highly on their respective factors. Thus, ideally, measurement of creative and practical abilities probably should be accomplished with other kinds of testing instruments that complement multiple-choice instruments.

We have now developed a revised version of this test, which, in a preliminary study of 53 college students, shows outstanding internal and external validation properties. This test supplements the creative and practical measures described above with performance-based measures. For example, creative abilities are additionally measured by having people write and tell short stories, do captions for cartoons, and use computer software to design a variety of products. Practical skills are measured additionally by an everyday situational-judgment inventory and a college-student tacit-knowledge inventory. These tests require individuals to make decisions about everyday problems faced in life and in school. We found that the creative tests are moderately correlated with each other and the practical tests are highly correlated with each other. The two kinds of tests are distinct from one another, however. An exploratory factor analysis revealed separate analytical, creative, and practical factors. Interestingly, the performance-based assessments tend to cluster separately from multiple-choice assessments measuring the same skills (similar to our earlier findings that essay measures tended to be distinct from multiple-choice measures). These results further suggest the need for measuring not only a variety of abilities, but also for measuring these abilities through various modalities of testing.

In a second and separate study, conducted with 3,278 students ranging in grade level from upper elementary to high school in the United States, Finland, and Spain, we used the multiple-choice section of the STAT to compare five alternative models of intelligence, again via confirmatory factor analysis. A model featuring only a general factor of intelligence fit the data relatively poorly. The theory of successful intelligence, allowing for intercorrelations among the analytic, creative, and practical factors, provided the best fit to the data (Sternberg, Castejón, Prieto, Hautamäki, & Grigorenko, 2001).

In sum, studies with large numbers of participants in three different countries have supported the theory of successful intelligence. Other studies in other countries, such as Russia and Kenya, have also supported the distinction between academic-analytical and practical abilities (e.g., Grigorenko & Sternberg, 2001; Sternberg et al., in press). We thus believe we have solid (as well as peer-reviewed) empirical data that support the theory of successful intelligence.

Applying the Theory of Successful Intelligence in Gifted Programs

Identification of Children for Successful Intelligence

Because it is very easy to identify children as gifted simply by using an IQ test or its equivalent, program supervisors may be tempted to use IQ tests exclusively in identification. To many people, they give an appearance of objectivity, fairness, reliability, and validity that other measures may not easily match. For a variety of reasons, this appearance is deceptive (Gardner, 1983; Sternberg, 1997a). We believe, however, that IQ tests and their equivalents can provide *one among several* useful bases for identification. While they provide useful information, in many cases, about children's analytical abilities, they say little or nothing about creative and practical abilities (Sternberg, 1985, 1997a, 1999b).

To identify gifted students in terms of the theory of successful intelligence, we prefer to use a variety of measures:

- standardized tests of memory and analytical abilities (tests of IQ, SAT, ACT, SSAT, etc.);[1]
- standardized tests of achievement that measure more developed memory and analytical competencies (such as the Iowa Tests of Basic Skills or the Stanford Achievement Tests);
- teachers' grades and comments, which assess memory and analytical abilities, as well as motivational and other variables relevant to achievement;
- STAT (Sternberg Triarchic Abilities Test), as described above, a nonstandardized test that can be used in conjunction with other measures but never alone, which measures analytical, creative, and practical abilities;
- evaluations of existing products, projects, and portfolios for analytical, creative, and practical skills;
- SI Student Questionnaire, which is a questionnaire for students regarding their preferences and skills (see Table 1);
- SI Teacher Questionnaire, which is comparable to the SI Student Questionnaire, except that evaluations are done by teachers instead of students (see Table 1); and
- tasks created by teachers, such as having students write stories or reports, draw pictures, create advertisements, solve novel problems, solve practical problems, and so forth.

We believe that converging measures such as those above provide a better basis for identification than can any one measure. There is no magic formula for combining information from these eight converging operations. Rather, each district must decide for itself how to weigh the various criteria for assessing giftedness. In our view, the assessments are of roughly equal importance, and we suspect little would be gained by a weighting scheme. But, we do not at the present time have data to bear out this claim.

Instruction and Assessment of the Achievement of Gifted Children for Successful Intelligence

We combine instruction and assessment of achievement into one section in this article because we believe that instruction and assessment ought to be of one piece—instruction must match assessment and vice versa. More generally, identification, instruction, and assessment all must match. If identification does not match instruction and assessment, then one may end up with children who are identified for one set of abilities failing because the instruction and assessment do not match their strengths. If instruction does not match assessment, children very quickly come to view the instruction as a game and start paying attention only to what they will be assessed on, not what is done in the classroom. Ultimately, children should think to learn so that they learn to think, and they can learn equally from classroom instruction and from classroom assessments.

Teaching and assessing achievement for successful intelligence involves three basic sets of ideas. These sets of ideas include a set of principles, a set of techniques, and a set of skills to be developed.

Principles of teaching and assessing for successful intelligence. There are seven main principles of teaching for successful intelligence (Sternberg, 1998b). These principles must be adhered to in all instruction and assessment:

- The goal of instruction is the creation of expertise through a well and flexibly organized, easily retrievable, knowledge base.
- Instruction should involve teaching for analytical, creative, and practical thinking, as well as for memory learning.
- Assessment should also involve analytical, creative, and practical, as well as memory components.
- Instruction and assessment should enable students to identify and capitalize on their strengths.
- Instruction and assessment should enable students to identify, correct, and, as necessary, compensate for weaknesses.
- Instruction should help students (a) adapt to the environment (change themselves to suit the environment better), (b) shape the environment (change the environment to suit them better), and (c) select new environments.
- Good instruction and assessment integrate, rather than separate, all of the elements of intelligence.

All students receive all kinds of instruction (analytical, creative, and practical). Such instruction helps students capitalize on strengths and correct or compensate for weaknesses.

Pedagogical techniques in teaching for successful intelligence. We have found in our various research and development projects that, when teachers initiate, monitor, and evaluate their teaching behavior in terms of an easy-to-learn set of cues, it is easier for them to adopt successfully the principles of teaching for successful intelligence (Sternberg, 1998b; Sternberg & Grigorenko, 2000). We have found that teachers feel more comfortable and unthreatened when we emphasize to them that these are all cues that they know how to use and probably have used. What we provide is a framework to balance their teaching (including instruction and assessment) for successful intelligence. Examples are given here for some of the cues in each of the domains of reading/language arts, mathematics, and science:

1. For emphasis on analytical thinking:
   a. *Analyze* (1) the plot of a story, (2) a mathematical word problem, (3) a scientific theory.
   b. *Evaluate* (1) the meaning of a poem; (2) whether an arithmetic problem, such as one requiring multiplication of decimals, has been solved correctly; (3) whether a simple experiment, such as dropping a heavy object and a light object off a tower on a windy day to see whether they land at the same time, tests what it is supposed to test.
   c. *Compare and Contrast* (1) two characters in a story, such as Tom Sawyer and Huckleberry Finn; (2) mathematical operations (e.g., addition and subtraction); (3) two approaches to analyzing scientific data (e.g., qualitative and quantitative).
   d. *Explain* (1) the meaning of a word such as *exempt*; (2) why a mathematical problem, such as a word problem, can be solved in a certain way; (3) a scientific principle such as the law of conservation of energy.
2. For emphasis on creative thinking:
   a. *Create* (1) a poem; (2) a mathematical word problem of a certain kind (e.g., mixture); (3) a theory to explain a natural phenomenon, such as rainbows.
   b. *Design* (1) a visual representation of the sequence of events in a story, such as "The Giver"; (2) a test measuring the material you have studied in mathematics, such as multiplication of fractions; (3) an experiment to test a hypothesis about a physical phenomenon, such as effects of gravity on objects of different weights.
   c. *Imagine* (1) how a given story might have ended had it been written 100 years later; (2) what computation would be like if we used a base-12, rather than base-10, system of numeration; (3) how bees communicate with each other.

Table 1

Student/Teacher SI Questionnaire

Read the list below and tick off the activities you [your student] like[s] doing. Do not tick off the activities you [your student] do[es] not like to do.

Analytical
- Analyzing characters when reading or listening to a story
- Comparing and contrasting points of view
- Criticizing the quality of work
- Thinking clearly and analytically
- Appealing to logic
- Evaluating various points of view
- Judging people's behavior
- Explaining difficult problems to others
- Solving logical problems
- Making inferences and deriving conclusions
- Sorting and classifying
- Thinking about things

Creative
- Designing new things
- Coming up with ideas
- Using imagination
- Playing "make-believe" and "pretend" games
- Thinking of alternative solutions
- Noticing things people usually tend to ignore
- Thinking in picture and images
- Inventing (new recipes, words, games)
- Supposing that things were different
- Thinking about what would have happened if . . .
- Composing (new songs, melodies)
- Enjoying acting and role-playing

Practical
- Taking things apart and fixing them
- Learning through "hands-on" activities
- Making and maintaining friends
- Understanding and respecting others
- Putting into practice things that have been learned
- Resolving conflicts
- Advising friends on their problems
- Convincing someone to do something
- Learning by interacting with others
- Applying knowledge
- Working and being with others
- Adapting to new situations

Now, go back through the list and, after each statement, indicate how well you believe you [your student] do[es] the particular activity specified. You should mark *E* for *Excellent, VG* for *Very Good, G* for *Good, F* for *Fair,* and *P* for *Poor.*

   d. *Suppose* (1) Johnny Tremaine fought for the British (How might the story have ended?); (2) mathematics had not been invented (How would our world be changed?); (3) the ozone layer becomes depleted (What changes can we then expect?)
3. For emphasis on practical thinking:
   a. *Use* (1) a lesson from *Treasure Island* in your own life; (2) principles of compound interest to determine how much money you would make if you placed a certain amount of money in a savings account at a given rate of interest; (3) what you know about the speed of sound to discuss problems with supersonic transport.
   b. *Apply* (1) your knowledge of phonics to sound out a new word, such as *exacerbate*; (2) your knowledge of arithmetic to compute how much more you will have to pay for front-section seats than for back-section seats to a football game; (3) what you learned about testing water to the water in your own home.
   c. *Implement* (1) a practical plan for improving your understanding of difficult texts (e.g., seeking main ideas, summarizing, etc.); (2) the Pythagorean theorem in figuring out how much time you will save by taking a route to a destination that is a hypotenuse of a triangle; (3) what you know about nutrition by designing a menu for a week that is nutritious and that you would be able to follow.
   d. *Put into Practice* (1) Tom Sawyer's persuasion technique for convincing people to do things that they might otherwise not want to do (e.g., whitewashing a fence); (2) what you have learned about percentages to figure out what the discount is on an item of sale merchandise (such as a portable radio); (3) what you know about nitrates and nitrites to decide whether you want to buy foods with high levels of these substances as preservatives.

Teaching for successful intelligence also involves standard teaching for memory, with prompts, such as (a) *recall* (e.g., who, what, where, when, why, how), (b) *summarize,* (c) *recognize,* (d) *choose from among the options,* (e) *list*, and (f) *identify*.

In scoring materials, we devise rubrics that are appropriate to the subject matter and grade level being assessed. There is no one generalized rubric that will apply to all kinds of products because different products require different knowledge and skills. Thus, although we work with teachers to formulate rubrics, neither we nor anyone else can provide a "one-size-fits all" rubric.

Processes to be developed through teaching for successful intelligence. Instruction and assessment should involve utilization, at various times, of all seven of the metacomponents of the problem-solving cycle: (a) problem identification, (b) problem definition, (c) formulation of problem-solving strategies, (d) formulation of mental and external representations and organizations of problems and their associated information, (e) allocation of resources, (f) monitoring of problem solving, and (g) evaluation of problem solving.

Instruction should also involve utilization, at various times, of at least six performance components, including (a) encoding of information, (b) inference of relations between chunks of information, (c) mapping of higher order relations among relations, (d) application of information and relations between chunks of information, (e) comparison of alternatives, and (f) response.

Finally, instruction should involve utilization, at various times, of at least three knowledge-acquisition components, including (a) selective encoding (distinguishing relevant from irrelevant information), (b) selective comparison (relating old information to new information), and (c) selective combination (putting together disparate pieces of information to reach a conclusion).

Optimal instruction is in the zones of (a) relative novelty and (b) automatization for the individual. What is relatively novel or ready for automatization differs from one individual to another.

Processes always act on mental representations. Instruction and assessment should take into account individual differences in preferred mental representations, including verbal, quantitative, and figural, as well as modalities for input (visual, auditory, kinesthetic) and output (written, oral, performance-based).

Does the theory result in improved instructional outcomes? Just as many theories in the gifted education field lack solid empirical support, so too many theories used as the basis for instructional intervention have little or no solid and peer-reviewed empirical data showing that they work in the classroom. Teachers' satisfaction with programs based on the theories or even students' satisfaction with such programs are important, but do not in themselves constitute solid empirical support. Teachers or students may enjoy a program that does not, in fact, produce better outcomes than conventional programs or even satisfactory instructional outcomes.

In one set of studies, we explored the question of whether conventional education in school systematically discriminates against children with creative and practical strengths (Sternberg & Clinkenbeard, 1995; Sternberg, Ferrari, Clinkenbeard, & Grigorenko, 1996; Sternberg, Grigorenko, Ferrari, & Clinkenbeard, 1999). Motivating this work was the belief that the systems in schools strongly tend to favor children with strengths in memory and analytical abilities.

We used the Sternberg Triarchic Abilities Test, as described above. The test was administered to 326 children around the United States and in some other countries who were identified by their high schools as gifted by any standard. Children were selected for a summer program in (college-level) psychology if they fell into one of five ability groupings: high analytical, high creative, high practical, high balanced (high in all three abilities), or low balanced (low in all three abilities). Students who came to Yale were then divided into four instructional groups. Students in all four instructional groups used the same introductory-psychology textbook (a preliminary version of Sternberg [1995]) and listened to the same psychology lectures. What differed among them was the type of afternoon discussion section to which they were assigned. They were assigned to an instructional condition that emphasized memory, analytical, creative, or practical instruction. For example, in the memory condition, they might be asked to describe the main tenets of a major theory of depression. In the analytical condition, they might be asked to compare and contrast two theories of depression. In the creative condition, they might be asked to formulate their own theory of depression. In the practical condition, they might be asked how they could use what they had learned about depression to help a friend who was depressed.

Students in all four instructional conditions were evaluated in terms of their performance on homework, a midterm exam, a final exam, and an independent project. Each type of work was evaluated for memory, analytical, creative, and practical quality. Thus, all students were evaluated in exactly the same way.

Our results suggested the utility of the theory of successful intelligence. First, we observed when the students arrived at Yale that the students in the high creative and high practical groups were much more diverse in terms of racial, ethnic, socioeconomic, and educational backgrounds than were the students in the high-analytical group, suggesting that correlations of measured intelligence with status variables such as these may be reduced by using a broader conception of intelligence. Thus, the kinds of students identified as strong differed in terms of populations from which they were drawn in comparison with students identified as strong solely by analytical measures. More importantly, just by expanding the range of abilities we measured, we discovered intellectual strengths that might not have been apparent through a conventional test (Sternberg, Ferrari, Clinkenbeard, & Grigorenko, 1996).

We found that all three ability tests—analytical, creative, and practical—significantly predicted course performance. When multiple-regression analysis was used, at least two of these ability measures contributed significantly to the prediction of each of the measures of achievement. Perhaps as a reflection of the difficulty of de-emphasizing the analytical way of teaching, one of the significant predictors was always the analytical score. However, in a replication of our study with low-income African American students from New York, Deborah Coates of the City University of New York found a different pattern of results. Her data indicated that the practical tests were better predictors of course performance than were the analytical measures, suggesting that what ability test predicts what criteria depends on both population and mode of teaching. Most importantly, there was an aptitude-treatment interaction whereby students who were placed in instructional conditions that better matched their pattern of abilities outperformed students who were mismatched (Sternberg, Ferrari, Clinkenbeard, & Grigorenko, 1996). In other words, when students are taught in a way that fits how they think, they do better in school. Children with creative and practical abilities, who are almost never taught or assessed in a way that matches their pattern of abilities, may be at a disadvantage in course after course, year after year.

In a follow-up study (Sternberg, Torff, & Grigorenko, 1998a, 1998b), we looked at learning of social studies and science by third graders and eighth graders. The 225 third graders were students in a very low-income neighborhood in Raleigh, North Carolina. The 142 eighth graders were students who were largely middle to upper-middle class studying in Baltimore, Maryland, and Fresno, California. In this study, students were assigned to one of three instructional conditions. In the first condition, they were taught the course that basically they would have learned had we not intervened. The emphasis in the course was on memory. In a second condition, they were taught in a way that emphasized critical (analytical) thinking. In the third condition, they were taught in a way that emphasized analytical, creative, and practical thinking. All students' performances were assessed for memory learning (through multiple-choice assessments) and analytical, creative, and practical learning (through performance assessments).

As expected, we found that students in the successful-intelligence (analytical, creative, practical) condition outperformed the other students in terms of the performance assessments. One could argue that this result merely reflected the way they were taught. Nevertheless, the result suggested that teaching for these kinds of thinking succeeded. More important, however, was the result that children in the successful-intelligence condition outperformed the other children even on the multiple-choice memory tests. In other words, to the extent that one's goal is just to maximize children's memory for information, teaching for successful intelligence is still superior. It enables children to capitalize on their strengths and to correct or to compensate for their weaknesses, and it allows children to encode material in a variety of interesting ways.

We have now extended these results to reading curricula at the middle school and the high school level. In a study of 809 middle school students and 432 high school students, we taught reading either for successful intelligence or through the regular curriculum. At the middle school level, reading was taught explicitly. At the high school level, reading was infused into instruction in mathematics, physical sciences, social sciences, English, history, foreign languages, and the arts. In all settings, students who were taught for successful intelligence substantially outperformed students who were taught in standard ways (Sternberg, Grigorenko, & Jarvin, 2001).

Obstacles to the Use of the Theory of Successful Intelligence

When any new proposal is made for gifted education (or any other form of education), there are always potential objections to its use. What are some of the main objections and our responses to them?

True giftedness is a function of general intelligence, not of successful intelligence (or other kinds of intelligences proposed in recent theories). We have been asked many times what we believe giftedness "really" is. This question presupposes that giftedness *really* is something. It is not. It is a societal invention. What constitutes giftedness in a hunting and gathering culture will differ from what constitutes giftedness in modern society. In a preliterate society, superior skills for reading will have no bearing on giftedness because no one reads. Each society invents giftedness as a label to reward those who do particularly well in whatever the society values. They may be especially strong in solving abstract, school-like problems, be especially creative, be especially good in following orders, be (seemingly) exceptionally strong in magical skills, or whatever. Giftedness is not a single thing. It is what we make it out to be. Creative and practical skills are at least as relevant for success in many societies today as are memory and analytical skills. The rapid change in the world renders creative flexibility a key to survival (as many businesses find out every day), and the need to adapt to, shape, and select environments renders practical skills always important. The label of *giftedness,* therefore, should take into account creative and practical skills because *everyone* needs them. Other kinds of skills are not needed by everyone and, therefore, are perhaps better viewed in the realm of talents.

Statewide tests only measure memory and, to some extent, analytical thinking. Therefore, teaching for creative and practical skills can be self-defeating. Our data as described above show that teaching for successful intelligence improves achievement relative to conventional instruction and instruction for critical thinking pretty much without regard to how that achievement is measured. Students instructed for successful intelligence even do better on memory tests than do students instructed in alternative ways. The instruction works successfully across grade levels and subject-matter areas. There are several reasons why the instruction is particularly effective. It enables students to learn material in multiple ways (analytically, creatively, and practically), so that the material is more easily retrieved later on. It enables students to capitalize on strengths and to correct or compensate for weaknesses in their learning, so that they learn more. And the instruction simply is more motivating to students and teachers alike, increasing the effectiveness of the learning/teaching process.

There is no standardized test for successful intelligence, whereas there are standardized tests for general intelligence (g). Testing has driven the agenda for gifted (and other forms of) education for so long that gifted educators have sometimes forgotten that testing should be in the service of an educational agenda, rather than the educational agenda being in the service of testing. We have pilot tests, mentioned above, that we use in our research, and we are working (for the second time) with a testing company to produce standardized measures. However, tests are not a panacea, whether they are our tests or someone else's. Standardized tests can be used in conjunction with products, projects, and portfolios that show children's analytical, creative, and practical skills.

Teaching and assessing for successful intelligence requires a whole new set of skills, which teachers of the gifted cannot be expected to have acquired. On the contrary, we believe that the skills are ones that all good teachers have, but often are afraid to use. There is no teaching technique that we recommend (Sternberg & Grigorenko, 2000) that will be totally alien to any good teacher. Rather, teachers are so often rewarded for teaching only for memory and occasionally for analytical skills that they cease using their full repertoire of teaching skills. We work with a charter school, the Sanger Academy in Sanger, California, based on the theory of successful intelligence. The teachers have, for the most part, ordinary backgrounds in teaching. What makes them successful is some knowledge about the theory of successful intelligence and how to apply it, but even more, their dedication and drive in realizing the model for instruction and assessment in their classrooms.

The successful-intelligence model disenfranchises the traditionally gifted, favoring students gifted in other ways. This criticism is simply incorrect. Analytical giftedness is roughly equivalent to traditional giftedness and is measured by the same kinds of tests that have been traditionally used for identification of the gifted. The successful-intelligence model augments, rather than replaces, the traditional model.

Relation of the Theory of Successful Intelligence to Other Models of Gifted Education

The theory of successful intelligence is, of course, only one of many models used for gifted education. We attempt here to review briefly some major alternative models and to relate them to the theory of successful intelligence. At the same time, it is not possible to review all such models. For more comprehensive reviews, please see Sternberg and Davidson (1984) and Heller, Mönks, Sternberg, and Subotnik (2000).

The g-Based Model

The theory of successful intelligence is not wholly incompatible with the theory of general abilities (Gallagher & Courtright, 1984; Jensen, 1998; Spearman, 1927), nor is it wholly compatible. The theory of successful intelligence is based on the notion that so-called general ability is a part of intelligence, but not all of it. In particular, what is typically called general ability is largely analytical ability. But, giftedness can occur in other kinds of skills, especially in creative and practical ones. Thus, the *g*-based model deals with part, but not the whole story, of intellectual giftedness.

The Theory of Multiple Intelligences

Gardner (1983, 1993, 1999) has proposed a theory of multiple intelligences, which posits distinct linguistic, logical-mathematical, spatial, musical, bodily-kinesthetic, naturalist, interpersonal, intrapersonal, and possibly existential intelligences. Although we have some disagreements with his theory (as he does with ours), we view our work as basically complementary, in that Gardner's theory specifies domains in which intellectual gifts may operate, whereas the theory of successful intelligence specifies kinds of processes. Thus, the theories could be integrated. For example, one might speak of analytical, creative, and practical processing of information in domains such as the linguistic domain (e.g., analytical—analyze a poem; creative—write a poem; practical—discuss the implications of a poem for everyday life) or the musical domain (e.g., analytical—analyze a musical score; creative—write a musical score; practical—play a musical score in a way that will make "emotional" contact with your audience).

The Schoolwide Enrichment Model

Renzulli and Reis (Renzulli, 1984; Renzulli & Reis, 2000) have proposed a model for schoolwide enrichment based on the notion that a gifted individual displays above-average ability, high task commitment, and creativity. Renzulli and Reis have distinguished in this model between schoolhouse giftedness, or the kind of giftedness that leads to success in school, and creative-productive giftedness, or the kind of giftedness that makes more of a difference in terms of contributions of adults to their domains of inquiry.

In the Schoolwide Enrichment Model, a distinction is made among three kinds of enrichment in the classroom. Type I enrichment is designed to expose students to material not ordinarily covered in the curriculum. Type II enrichment involves students in the pursuit of independent inquiries in self-selected areas. These inquiries, however, represent more traditional kinds of learning experiences, such as reading and classroom-based ones. Type III enrichment involves independent projects and the creation of new products.

Our model is, again, largely complementary to that of Renzulli and Reis. Their model specifies "ability," without specifying exactly what goes into this construct. One might plug the theory of successful intelligence into this "slot." Their model also includes a creativity component, into which one might plug our investment theory of creativity (Sternberg & Lubart, 1995). The three kinds of teaching are compatible with the theory of successful intelligence, and, indeed, in some of our instructional projects, we have explicitly used the three types in order to teach better analytical, creative, and practical processing skills.

The Differentiated Model of Giftedness and Talent (DMGT)

The DMGT, proposed by Gagné (1999, 2000), argues that one can and should distinguish between natural abilities and systematically developed skills. High levels of natural abilities lead to giftedness, whereas high levels of systematically developed skills lead to talents. The former include abilities such as intellectual, creative, socioaffective, and sensorimotor abilities. The latter include fields such as academics, arts, business, leisure, social action, sports, and technology.

We probably place more of an emphasis on environment for both gifts and talents than does Gagné, but, in general, we have few quibbles with his model. His intellectual, creative, and socioaffective abilities seem to correspond quite closely to our analytical, creative, and practical abilities (Sternberg, 1985), and his list of fields clearly is not meant to be complete. Whether one wishes to use the terms *gifts* and *talents* in this way seems to us largely a matter of semantics and is of no great import to us; we do not object to this particular distinction. We do believe, however, that so-called "natural" abilities are a matter of developing expertise, and, hence, these abilities can be developed into various talents (in the ways he uses those terms); therefore, we do not see the distinction as being quite so clear as he makes it. What constitutes a field will differ from one society to another (Csikszentmihalyi, 1996), and the ways in which one expresses abilities will also differ from one society to another, so that the same expressions that are seen as intelligent in one culture may be seen as unintelligent in another (Sternberg et al., 2001).

From our point of view, *talents* are more important than *abilities*, in the way the terms are used in this model. The reason is that talents refer largely to realized abilities, and it is what a person does with his or her abilities, ultimately, that will determine whether or not he or she has a contribution to make. High intellectual abilities, in and of themselves, seem inadequate as a basis for giftedness because so many people with such abilities squander them and, therefore, do not, in our view, deserve the label of *gifted*. The issue here is not merely semantic because schools may allocate their special-education resources on the basis of how this label is assigned.

Conclusion

The theory of successful intelligence provides a proven model for gifted education. The model has implications for identification, instruction, and assessment of achievement. All three should be viewed in terms of analytical, creative, and practical abilities. The results of diverse studies suggest that the theory of successful intelligence is valid as a whole and provides successful interventions in classrooms.

Adopting any new model for the identification, instruction, and assessment of gifted children is time-consuming and potentially difficult. Yet, we believe that the evidence supporting the model of successful intelligence is sufficient to suggest that adoption will be well worth the effort.

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End Note

1. Note that, because we view all tests of abilities as tests of developing expertise, tests of abilities inevitably measure both achievement and abilities. It is impossible to separate the two kinds of measures cleanly.

Author Note

Preparation of this article was supported by Grant REC-9979843 from the National Science Foundation and by a government grant under the Javits Act Program (Grant No. R206R000001) as administered by the Office of Educational Research and Improvement, U.S. Department of Education. Grantees undertaking such projects are encouraged to express freely their professional judgment. This article, therefore, does not necessarily represent the positions or the policies of the U.S. government, and no official endorsement should be inferred. Information about the Sanger Academy, which uses the successful-intelligence model, can be obtained from Kenneth Garcia, Principal, Sanger Academy, 1905 Seventh St., Sanger, CA 93657. Requests for information should be sent to Robert J. Sternberg, Director, Yale Center for the Psychology of Abilities, Competencies, and Expertise, Yale University, P.O. Box 208358, New Haven, CT 06520-8358.