Using Talent Searches to Identify and Meet the Educational Needs of Mathematically Talented Youngsters

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Regional talent searches have been available since Julian Stanley developed the Talent Search model in the early 1970s, and over 200,000 students per year nationwide take advantage of the opportunities these university-based programs offer. The above-level testing offered by regional talent searches is useful in (a) identifying mathematically talented students, (b) tailoring educational recommendations to the abilities of the students, and (c) providing challenging educational opportunities for the students. Important considerations and concerns, as well as a discussion of the benefits, are explored in this article.

The need to develop a reliable method of identifying academically talented students was recognized by Julian Stanley when he founded the Study of Mathematically Precocious Youth (SMPY) at Johns Hopkins University (Stanley & Benbow, 1986). Stanley's Talent Search, developed in conjunction with SMPY, is a systematic program designed to invite high-achieving seventh graders to participate in above-level testing. This special testing aids in the further assessment of their abilities and achievement. The Talent Search provides much more than just a way to identify talented students (Cohn, 1991). The use of above-level testing instruments provides guidance for developing appropriate educational plans for gifted students. Much valuable research has been conducted using data collected by SMPY and other talent searches following Stanley's lead (Swiatek, 1993). The purpose of this paper is to discuss some of the benefits of talent searches and how they are helpful when planning curricula for mathematically talented students.

Why Search for Mathematical Talent?

A school's mathematics curriculum is designed to meet the needs of the majority of pupils. To accomplish this, school personnel assess the abilities and achievement levels of their students and develop programs that will facilitate the students' learning. The school's general curriculum, designed for the average child in that school, will not be appropriate for an exceptionally talented learner. Obviously, the more exceptional the student's ability, the greater the need to make changes in the curriculum in order to meet that child's educational needs.

A recent U.S. Department of Education report (1997) noted that the "mathematics curriculum from grades five through eight may be a weak link in the U.S. educational system" (p. 16). Data from the Third International Mathematics and Science Study suggested that the middle school mathematics curriculum in the United States "is significantly less challenging than curricula in other countries" (p. 16). This "dumbing-down" of the mathematics curriculum is especially harmful to children who are exceptionally able in mathematics and find themselves in classes where the pace is much too slow and they have already mastered the concepts.

As a result of the current situation in the nation's schools, educators and parents must consider some essential questions when making decisions regarding modification of the mathematics curriculum for talented children. Just what ability does the child demonstrate? How much does this child's ability, achievement, and educational need differ from the "average"? How should the curriculum be modified in order to "match" the child's educational needs? These questions have concerned many researchers and educators (e.g., Robinson & Robinson, 1982), and talent searches can be very helpful when attempting to answer these and other questions.

The Testing Process

The testing process in a talent search begins with the administration of a nationally normed achievement test such as the Iowa Tests of Basic Skills, done as part of the school's regular testing program. Students scoring at or above the 95th percentile on the

Composite or Math Total, Vocabulary, Reading, Language Total, or Science subtest are recommended for further testing. These students have done so well on tests developed for their age group that they have reached the "ceiling" of the test. They have answered all or almost all of the items correctly, and the test does not contain enough difficult items to measure their abilities accurately or measure their full achievement in that area.

The second step in the testing process is the administration of an above-level test, one that was normed on students two to five grade levels above the grade placement of the child being tested (Assouline & Lupkowski-Shoplik, 1997). An above-level test containing more difficult items (and therefore having a higher ceiling) allows students to demonstrate their mastery of more advanced concepts. Above-level tests also spread out the scores of able students, helping to differentiate talented students from exceptionally talented students. This information is important for good educational planning.

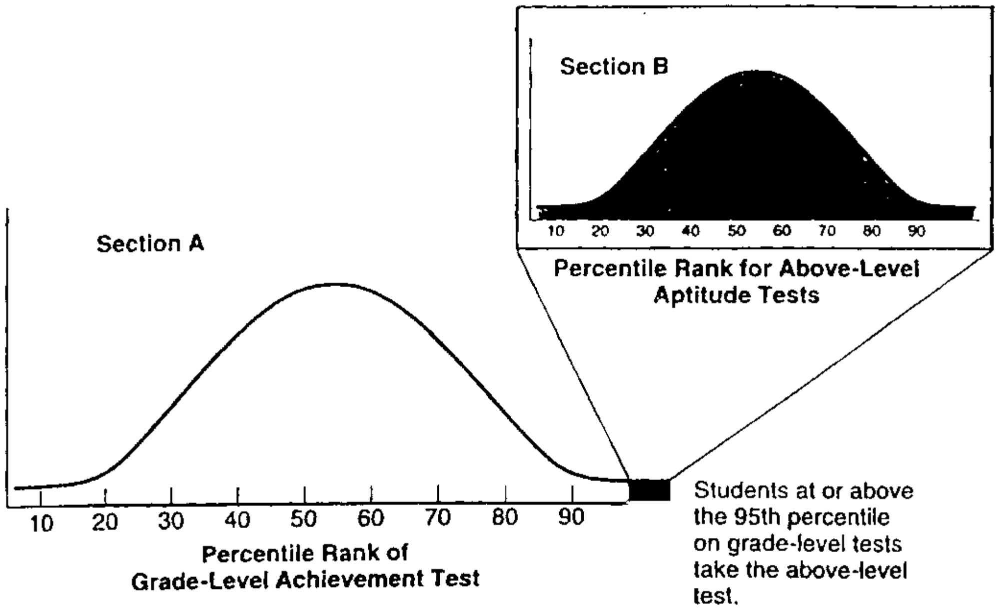
Talent searches utilize a variety of above-level tests. Talented seventh graders take the Scholastic Assessment Test (SAT, now the SAT-I) or the American College Testing Program (ACT) (Sawyer & Brounstein, 1988). In addition, research has shown the effectiveness of the EXPLORE test as an above-level test for identifying talented elementary school aged children (Colangelo, Assouline, & Lu, 1994). (See Appendix A for a list of regional talent searches.)

Using the Above-Level Test Results

The extent of the mathematical ability and achievement of the students who score at or above the 95th percentile on a grade-level achievement test varies considerably. For one student, a grade-level test may have accurately measured all that he or she knows, and the above-level test score is low, perhaps just above chance. For another student, the grade-level test does not have a high enough ceiling, and the above-level test shows rather dramatically that the student has exceptional ability and achievement, as evidenced by a high score when compared to the older norm group. The above-level test spreads out the scores of those students who had been clustered at the top of the grade-level test and creates a new distribution of scores resembling a bell curve. (See Figure 1.)

The degree of acceleration and/or enrichment needed by the talented students is indicated by their performance on the above-level test. For example, compare the Metropolitan Achievement Test scores of two students who took the test while in third grade (see Table 1). They seemed to be of similar ability and

Figure 1. *Above-level test score distribution for students scoring high on grade-level test.*



Note: From "Talent searches: A model for the discovery and development of academic talent" by S. G. Assouline and A. Lupkowski-Shoplik (1997). In N. Colangelo & G. A. Davis (Eds.), *Handbook of Gifted Education (2nd ed.).* (pp.170-179). Copyright 1997 by Allyn & Bacon. Reprinted with permission.

achievement since they both earned mathematics scores in the 99th percentile. However, the two students took the EXPLORE as an above-level test through the Carnegie Mellon Elementary Student Talent Search, and their EXPLORE-Mathematics scores were quite different. "Michael" earned a scale score of 11 (out of a possible 25), placing him at the 26th percentile when compared to eighth graders. "Anthony's" scale score of 22 placed him at the 96th percentile compared to eighth graders. The students' abilities appeared to be identical on the grade-level test, but the above-level EXPLORE testing revealed a very different picture. Unfortunately, both students were placed in the regular classroom for mathematics. Although they are in gifted programs at their respective schools, these programs stress enrichment unrelated to the core subjects. Both Michael and Anthony need to receive additional challenges in mathematics. Michael needs additional enrichment in mathematics, including participating in contests and competitions, being grouped with other talented students for mathematics instruction, and perhaps compacting a course sequence by taking 2 years of mathematics in 1 year. Anthony's needs in mathematics are even more pronounced. He would benefit from all of the options suggested for Michael, plus individually paced instruction during the school year or summer, as well as course-skipping or grade-skipping, if all academic areas are advanced.

The testing phase in the talent search is an important first step, but the talent search process does not stop here. Next, one must determine what educational opportunities are appropriate for the student. As a result of over 25 years of research regarding talent searches and experience in planning educational programs for mathematically talented students, some guidelines have emerged. Appendix B combines information from Cohn (1991); from Van Tassel-Baska, Fields, & Olszewski-Kubilius (1997) for talented students who have taken the SAT in seventh grade; and from Lupkowski-Shoplik and Piskurich (1998) for students participating in an Elementary Student Talent Search. Thus, the test results give specific information that helps guide these talented students to appropriately challenging experiences.

Benefits of Participation in a Talent Search

As illustrated with the cases of Michael and Anthony, talent search results are useful for many reasons. Some of the benefits are listed below.

Benefit 1: Educational Diagnosis

Above-level tests administered under the auspices of a talent search offer a higher ceiling for academically talented students. Therefore, they measure the students' abilities more accurately than grade-level tests do. The cases of Michael and Anthony illustrate this clearly. Once the student's abilities are measured accurately, it is possible to make specific recommendations for their educational programs.

Benefit 2: Educational Recommendations Tailored to the Abilities of the Student

As described in Appendix B, researchers have developed recommendations for students scoring at particular levels. The recommendations represent a continuum of modifications that best match a child's demonstrated ability and achievement and range from enrichment options to honors courses to acceleration (Cohn, 1991; Olszewski-Kubilius, 1998). The goal is to match the level and pace of the curriculum to the child's needs by finding the "optimal match" (Robinson & Robinson, 1982).

Benefit 3: Educational Opportunities Provided by University-Based Talent Searches

Talent search participants may access a range of opportunities, including summer programs, weekend programs, correspondence courses, and online programs (Olszewski-Kubilius, 1998). These university-

Table 1
Grade-Level Test Scores and Above-Level Test scores of Two Students.

Test	Michael	Anthony
Grade-Level Test, Third grade		
Metropolitan Achievement Test, Math Concepts	99th percentile	99th percentile
Metropolitan Achievement Test, Math Problems	99th percentile	99th percentile
Metropolitan Achievement Test, Math Total	99th percentile	99th percentile
Above-Level Test, Fourth grade		
EXPLORE-Mathematics	Scale score=11	Scale score=22
(percentile compared to eighth graders)	(26th percentile)	(96th percentile)

sponsored programs offer students the chance to study topics that might not be offered at their home schools. Residential summer programs offer the opportunity to live together with like-minded students, study a subject intensively for several weeks at a pace matched to their abilities and achievements, and possibly earn school credit for the work they have completed.

Benefit 4: Self-Knowledge

Students learn more about themselves by participating in a talent search (Cohn, 1991). Students are in a better position to make important choices, such as which college to attend or which career to pursue, if they have information about their achievement and abilities. Specially designed educational programs allow them to explore topics of interest in more depth and at an appropriate pace.

Benefit 5: Honors, Awards, and Scholarships

Some talent searches also recognize students' outstanding talents with honors, awards, and scholarships (Cohn, 1991). For example, some colleges and universities that sponsor talent search testing also offer scholarships, so students may attend college courses while they are still in high school.

Benefit 6: Appropriate Educational Information

Talent searches provide newsletters and other printed material to participants, so students and their families are aware of educational opportunities, research findings, and scholarships. Research has shown that talent search participants pursue more rigorous courses of study than nonparticipants, participate in more extracurricular educational opportunities, and accelerate their education to a greater degree (Olszewski-Kubilius, 1998). Brody (1998) found a positive impact of talent searches at the college level. Since talent searches have encouraged students to pursue more challenging coursework before graduating from high school, participants enter college better prepared and ready for even more challenges. Colleges have responded by offering more rigorous courses of study for these exceptional young men and women.

How Have Schools Used the Talent Search Model?

Students participating in a talent search and a subsequent summer program sometimes have difficulty assimilating themselves back into their home schools. The level and pace of the typical school curriculum is often not challenging enough for these bright students. Southwestern Michigan educators recognized this problem and created a systematic program of followup (McCarthy, 1998). The Academically Talented Youth Programs (ATYP), based at Kalamazoo College, developed a collaborative K-12/higher education model in cooperation with 50 local school districts.

Students are first identified in sixth to eighth grade. They spend most of their time in their regular schools, but one afternoon a week they attend special classes on the college campus. ATYP students usually complete the 4-year precalculus sequence (algebra I, algebra II, geometry, and trigonometry) in 2 years with 180 hours of instruction. This is one fourth of the instructional time allotted in high school classrooms. Students meet weekly during the school year and complete 5 to 10 hours of homework between meetings. They move at an accelerated rate and in greater depth than they would experience in typical high school classes. The ATYP classes replace the students' regular school math courses. This model has been replicated at other schools (McCarthy, 1998).

One school district recognized that mathematically talented students' abilities are evident in elementary school and developed a special in-school program to address their needs. The North Hills School District, near Pittsburgh, Pennsylvania, developed its own two-step talent search procedure and related math mentor program. Fourth and fifth grade Metropolitan Achievement Test results are reviewed each spring. Students scoring in the top 3% (local norms) on the Math Total are recommended for above-level testing. These students take the mathematics sections of the Comprehensive Testing Program series (Level E, which was normed on sixth to eighth graders).

The top-scoring students are then invited to participate in a mentor-paced mathematics program, resulting in the students being accelerated at least 1 year in mathematics. Students meet with their mentor in small groups during the school day. The meetings occur twice a week for 1 hour each time, and the mentor travels to their home school to meet with the students. The district recently hired a "secondary math mentor" to continue working with these students as they progress through the secondary grades. The mathematics that students study with their mentor replaces the regular mathematics requirements, and their report cards and permanent records reflect their participation in this special program (personal communication, Francesca McTighe, July 1998). (See Lupkowski and Assouline, 1992.)

The Appalachia Model Mathematics Program (MMP) (Miller, Mills, & Tangherlini, 1995) is another example of the appropriate use of the talent search model, which has been combined with a comprehensive, individualized, and coherent program for delivery of mathematics instruction to talented students. This program employs diagnostic testing followed by prescriptive instruction, the DT-PI model (Lupkowski & Assouline, 1992). Key components of the instructional approach are flexible pacing, which is modified according to the student's class performance, and the creation of a linear curriculum that better meets the needs of talented students. As a result, students identified as having high ability in mathematics make dramatic gains in mathematics.

Important Considerations and Concerns

Although there are many benefits to participation in a talent search, there are also some concerns. First, school personnel sometimes believe that talent searches are only for "super-talented" students, and "we don't have any of those in our school." Talent searches are designed for students in the top 5% of their age group in at least one area. A student does not have to qualify in all subject areas, but only in one area (for example, math). Thus, many more than 5% of the school population could participate and could benefit from talent search opportunities. In fact, in some school districts, more than half of the students qualify. Also, many of the students who participate in testing and are successful in talent search summer programs have not been identified for their school's gifted programs, possibly because they do not demonstrate the characteristics of the "all-around" gifted student. Many school gifted programs require that students have high scores in the language arts, which eliminates students who have a specific talent in math or science. It is discouraging to realize that many students who are eligible for talent search services are denied the opportunity to participate, simply because school personnel choose not to tell their students about this program.

For students who do participate, teachers do not always know how to use the information gleaned from a talent search. They may have unreasonable expectations or feel intimidated by a student who demonstrates exceptional ability. Unfortunately, differentiation of instruction for these students is seldom a reality when they are placed in a regular classroom (Archambault et al., 1993). In addition, compacting of the curriculum should be done by a teacher who has been trained in the technique, although few teachers have been specifically trained to teach gifted learners.

Students may be quite talented in mathematics but not be equally able in other areas. Therefore, participation in talent searches should be offered to all children who qualify based on criteria using scores from achievement testing, not from IQ testing. As mentioned above, some students with great mathematical potential have not been identified as gifted. The MMP described previously now provides above-level testing for students who do not qualify under the IQ testing requirement for mathematical ability, since they have evidence to suggest that "high ability in mathematical reasoning is somewhat discrete from general intelligence as measured by IQ tests" (Miller et al., 1995, p. 141).

Although subject-matter acceleration has been advocated for students who are extremely talented in mathematics, acceleration is sometimes misused. In an effort to find a "match" between the curriculum and the student, the easy answer of simply placing the student in a class with older students is often implemented. This can be problematic for many reasons, including inappropriate pacing, lack of formal operational thought processes on the part of the young student (Lupkowski & Assouline, 1992), and a mismatch between the social and emotional development of the gifted student and the older students.

Other problems associated with university-based talent searches include the fees assessed (typically $50-$60 for testing and up to several thousand dollars for summer programs) and the fact that talent searches are best at identifying students who are already high achievers, not those who are underachieving or who have limited proficiency in the English language (Olszewski-Kubilius, 1998).

Conclusion

For over a quarter of a century, talent searches have been instrumental in changing the way students talented in mathematics are identified, described, perceived, and educated. Over 200,000 students per year participate in these talent searches. Millions of students have benefited from the research and new understandings and techniques that have resulted. It is a continuing challenge to expand and develop talent searches and the programs that serve talented students so that the benefits are truly available to all who need them.

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Appendix A
University-based Talent Searches

Program	Address and Web Site	Type of Talent Search
Center for Academic Precocity	College of Education, Arizona State University Box 872711, Tempe, AZ 85287-2711 (602) 965-4757 www.asa.edu/educ/cap/	Middle school/junior high talent search for Arizona students.
Academic Talent Search	California State University (Sacramento) 6000 J St., Sacramento, CA 95819-6098 (916) 278-7032 http://edweb.csus.edu/projects/ATS/	Talent Searches for elementary and middle school students offered for northern California students.
Carnegie Mellon Institute for Talented Elementary Students	Carnegie Mellon University 4902 Forbes Ave. #6261 Pittsburgh, PA 15213 (412) 268-1629 http://outreach.mac.cc.cmu.edu/c-mites/cmites.html	Elementary Student Talent Search for 3rd - 6th graders offered in Pennsylvania.
Talent Identification Program	Duke University, Durham, NC 27708 (919) 684-3847 www.tip.duke.edu/	Elementary and middle school talent searches offered in many states.
Iowa Talent Search	Iowa State University, W172 Lagomarcino Hall Ames, IA 50011; (515) 294-1772 www.iastate.edu/~opptag-info/	7th grade talent search offered in Iowa.
Institute for the Academic Advancement of Youth	Johns Hopkins University, 3400 N. Charles St. Baltimore, MD 21218 (410) 516-0337 www.jhu.edu/~gifted/index.html	Talent searches for 2nd through 8th graders offered in many states.
Center for Talent Development	Northwestern University, 617 Dartmouth Pl. Evanston, IL 60208 (847) 491-3782; http://ctdnet.acns.nwu.edu/	Talent searches for 3rd - 8th graders offered in many states.
Rocky Mountain Talent Search	The University of Denver Denver, CO 80208 (303) 871-2983; www.du.edu/education/ces/rmts.html	Talent search for 6th - 9th graders offered in many states.
The Belin-Blank Center	The University of Iowa, 210 Lindquist Center Iowa City, IA 52242 (319) 335-6196; www.uiowa.edu/~belinctr/	Elementary Student Talent Search for 3rd - 6th graders offered in many states.
Halbert Robinson Center for the Study of Capable Youth	The University of Washington Box 351630 Seattle, WA 98195 (206) 543-4160 http://weber.u.washington.edu/~cscy/	Talent searches for 5th - 8th graders offered in Washington State.

Appendix B

Guidelines for Students Who Have Taken Above-Level Tests

A. EXPLORE-Mathematics scale score 1-13 (taken in 4th grade) OR SAT-Mathematics score of 200-500 (taken in 7th grade)

Academic counseling and educational planning

In school enrichment, contests and competitions

Supplemental course work with enrichment oriented summer programs

Algebra I in 7th grade, AP Calculus in 11th grade, and college level math courses in 12th grade

B. EXPLORE-Mathematics scale score 14-20 (taken in 4th grade) OR SAT-Mathematics scores of 510-630 (taken in 7th grade)

Academic counseling and educational planning

Curriculum compacting (for example, taking two years of math in one year)

Fast-paced summer classes in mathematics

Algebra I in 6th grade, A.P. Calculus in 10th grade, and college level math courses in 11th and 12th grades

C. EXPLORE-Mathematics Scale score 21-25 (taken in 4th grade) OR SAT-Mathematics scores of 640-800 (taken in 7th grade)

All of the options listed in Column B, plus:

Individualized program of study, using a Diagnostic Testing - Prescriptive Instruction approach in mathematics

Consider grade acceleration, early entrance to high school, taking college classes early

Mentorships for advanced study in mathematics