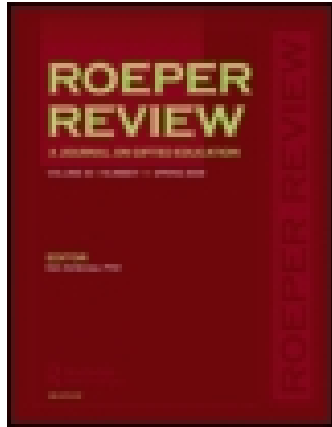


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A baker's dozen of years applying all four aspects of the study of mathematically precocious youth (SMPY)

Julian C. Stanley^a

^a Professor of Psychology and Director of the Study of Mathematically Precocious Youth (SMPY), The Johns Hopkins University, Baltimore, Maryland, 21218

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and free time, and a greater understanding of the other students and staff, all seemed to help enhance the resident students' sense of belonging and understanding of others and themselves.

The younger students made the greatest gains in self-concept as shown by the Self-Esteem Inventory scores. The younger students' capacity to be influenced by outside forces was greater than that of the older students who had formed firmer attitudes and were less adaptive concerning those attitudes.

The responses to the student attitude form supported the findings of the Me Scale and the Self-Esteem Inventory. Students were asked to rate the major components of the program which included differentiation of instruction, supervision of students, recreation, classes offered, campus facilities, and gained self-understanding. The students rated all components highly which reflects very positive attitudes toward the program. This positive attitude toward the major components of the program as indicated by the students' ratings, helped students gain the most from the program and helped enhance students' self-concepts.

The students' writing samples revealed an increase in using positive adjectives to describe their personality. This more subjective measure supports the findings of the objective measures used.

The results of the project indicate that homogeneously grouped gifted participants in a 2-week GSI program did experience significant improvements in self-concept as measured by the Me Scale (Feldhusen) and the Self-Esteem Inventory (Coopersmith). The student attitude form and the student writing samples' findings supported the findings from the self-esteem inventories. Programs such as the GSI Green Bay program, designed for gifted students, help students gain in self-esteem and in establishing educational and personal goals in accordance with their potential.

Based on this research, it is suggested that schools establish goals and objectives in the cognitive and affective realm which help students gain an understanding of themselves and others within the school. The results of a 2-week GSI experience indicate that through focusing on the creation of a sense of belonging, and through relating to other gifted students, self-esteem can be enhanced. The constant provision of these components in a school setting may provide for permanent patterns of self-actualization for gifted students within a school. The following components are suggested for further research:

1. Established goals and objectives in the cognitive realm to provide for challenging academic experiences as well as a system of rewards for meeting those challenges.
2. Established affective goals and objectives which will provide the gifted with opportunities to deal with psychological needs.
3. Provision of high empathy gifted teachers, sensitive to and understanding of gifted students.
4. Provision of opportunities to relate with and be stimulated by other gifted students in hopes that students will build a sense of community and belonging to a group in which gifted is "normal."

The gains in self-concept as related to a 2-week GSI program may be temporary or permanent; however, the same provision for gifted as those provided by the GSI experience, duplicated throughout students' Kindergarten through Grade Twelve educational career would most probably have a permanent impact upon gifted students' self-concepts and therefore upon their patterns of self-actualization. Further research using control and experimental groups, as well as a group larger than 37 is needed to substantiate this hypothesis. However, enough evidence has been gained from this study to support the establishment of gifted programs, both within and outside of school. Enhancing the confidence and self-understanding of gifted students will lead to better use of individual abilities and will ultimately be reflected in individual and societal gains.

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A Baker's Dozen of Years Applying All Four Aspects of the Study of Mathematically Precocious Youth (SMPY)

Julian C. Stanley

Since its inception in 1971, the Study of Mathematically Precocious Youth (SMPY) has expanded from a local program serving 19 mostly seventh graders to a national program with an enrollment of 1600. This article discusses trends experienced during the thirteen-year period and their implications for the program's future.

Julian C. Stanley is Professor of Psychology and Director of the Study of Mathematically Precocious Youth (SMPY) at The Johns Hopkins University, Baltimore, Maryland 21218. He thanks Camilla Persson Benbow and Barbara S.K. Stanley for helpful suggestions concerning this article, and The Spencer Foundation for its generous grants to SMPY, 1971-84.

The Study of Mathematically Precocious Youth (SMPY) began at The Johns Hopkins University on 1 September 1971 as the direct result of a five-year grant of \$266,100 to Julian C. Stanley by the then-new Spencer Foundation of Chicago. This enabled Dr. Stanley and his staff, consisting mainly of Lynn H. Fox, Daniel P. Keating, and Lois S. Sandhofer, to launch a major talent search in March of 1972. They then started a fast-paced mathematics class for seventh graders in June of 1972. The first journal article about the study (Keating & Stanley, 1972) appeared during the first grant year. By the third grant year a widely reviewed, favorably received book edited by Stanley, Keating, and Fox (1974) had set forth the rationale of the study and its initial results.

That volume, entitled *Mathematical Talent, was subtitled Discovery, Description, and Development*. This indicated the first three of the four D's that

have guided SMPY ever since its inception. Those four D's are as follows:

1. *Discovery*, finding youths who reason extremely well mathematically. In 1976 this was extended to include excellent verbal reasoning ability.
2. *Description*, studying the characteristics of the mathematically (or verbally) highly apt.
3. *Development*, providing special educational opportunities for those youths.
4. *Dissemination*, promulgating throughout the country and abroad the principles, practices, programs, and techniques developed by SMPY.

Thirteen years later there had been 11 annual talent searches, and plans were well underway for the twelfth to be conducted in January of 1985. The number of young students, mostly seventh-graders, participating in the searches grew from 450 in 1972 to 20,000 in 1984. The area covered expanded from the Baltimore-Washington area to all the states from Virginia through Maine, including West Virginia, plus much of the West, Alaska, Hawaii, and parts of Canada.

Enrollment in the summer programs rose from 19 students in 1972 to about 1600 in 1984. Whereas until 1980 all persons taking fast-paced academic courses during the school year or summer commuted to the Johns Hopkins campus or other sites, during the summer of 1984 there were 1507 three-week residential course enrollments.

On 1 July 1979, after planning by Dr. Stanley with Johns Hopkins President Steven Muller, the newly created Office of Talent Identification and Development (OTID) began under Provost Richard P. Longaker. Several years later its name was changed to the Center for the Advancement of Academically Talented Youth (CTY). CTY conducts the regional talent searches and the educational programs. Its present director is Dr. William G. Durden, who is also an assistant professor of German (part-time) at Johns Hopkins. By January of 1984 OTID and CTY had conducted the seventh through eleventh talent searches, 1980-84, and the summer programs from 1980 onward.

CTY also conducts a continual international search for persons who score at least 630 on the verbal part of the College Board's Scholastic Aptitude Test (SAT-V) before their thirteenth birthday. Only 5 percent of college-bound male high-school seniors and 4

percent of college-bound female high-school seniors score that well.

Emergence of the "700-800M Before Age 13" Group

In November of 1980 Dr. Stanley began seeking nationally those students who before their thirteenth birthday score at least 700 on the mathematical part of the College Board's Scholastic Aptitude Test (SAT-M). An examinee could qualify after becoming 13 by earning an extra 10 points for each month or fraction of a month beyond the thirteenth birthday, up to the maximum possible, 800, the day the youth became 13 years 10 months old. For the SAT-V search, the top possible age for qualifying is 14 years 5 months. Those extra 10 points per month come hard, however, so few qualify this way. Only 5 percent of college-bound male high-school seniors and 1 percent of college-bound female high-school seniors score in the top range (700-800) on SAT-M. On the basis of all its experience since 1971, SMPY estimates that about 1 in 5000 boys and 1 in 60,000 girls would score that high before age 13. The national birth group in 1968 was about two million boys and two million girls, so it should have contained about 400 such boys and 35 girls. This is a very rough approximation, based on various converging lines of evidence, but in any event the expected numbers are quite small.

For example, the 15,500 students who took the SAT in CTY's January of 1983 talent search consisted of a few more girls than boys. This group yielded 31 boys and 2 girls who met or exceeded the 700M criterion: 1 in 250 of the boys and 1 in about 3900 of the girls. Yet the boys and girls in the talent search were at least of upper 5 percent ability for their age group. This works out to 1 in 5000 of the age group for the boys. For the girls it is 1 in 78,000, but the number of girls (2) is so small that one cannot put much faith in the specific proportion it generates.

The search for "700-800M Before Age 13" scorers was carried on via several of the regional talent searches, parent-teacher advocacy groups for the intellectually talented, and considerable media coverage. The group was closed for study after the results of the October, 1983 SAT testing were known. Henceforth, only females and siblings of the present members will be added. All other persons who meet the criterion in the November, 1983 SAT testing or thereafter will be served by CTY rather than SMPY.

During the less than three academic years of the SAT-M 700-800 search a total of 269 boys and 23 girls qualified. Of these mathematically highly remarkable young students, 38 boys and 2 girls also scored at least 630 on SAT-V before age 13. For the 700-800M group itself the sex ratio is approximately 12:1 (Benbow & Stanley, 1983).

Undoubtedly, a larger number of girls would qualify if they were more intrepid about retaking SAT after making a score not greatly lower than 700M. Boys seem somewhat more eager than girls to qualify for the group. Several of them have taken the SAT many times before reaching the criterion, but it is more usual for a person to qualify the first or second time he or she tries. Often, the successful second try comes after the youth has been in a fast-paced mathematics class. "Sharpening one's mind" on some quick-moving elementary algebra and geometry seems to raise scores, sometimes dramatically. For example, at age 9 years 1 month a girl in Illinois scored 480M. After studying mathematics for awhile the next summer she scored 700M 19 days before her tenth birthday, thereby becoming the youngest female and the fourth-youngest person to qualify for the group.

In addition to helping students make use of SMPY's various educational options, CTY and SMPY offer them many services. Among these are a special testing session where the student's specific abilities and value profiles are evaluated, and special "mentoring-by-mail" in precalculus and advanced placement calculus, biology, chemistry, physics, and other subjects. A special weekend was also conducted for the "700M" girls in an attempt to help them understand better their educational and career options and provide encouragement and support for their study of mathematics and science. The girls were also exposed to several possible role models, a need that many young females express.

SMPY's national search for youths who reason extremely well mathematically (as contrasted with CTY's, whose critical score for being mathematically apt is 500M before age 13) is conducted from Baltimore, Maryland, but the 292 qualifiers are spread unevenly across the country. E.g., 43 reside in California and 42 in Maryland. Some states are larger than others and may have a greater density of such talent. The major differentiating factors may, however, be the effectiveness of the regional talent searches in attracting mathematically talented participants and the

interest in intellectual talent within states such as Michigan. The latter often leads to the formation of advocacy groups, identification efforts at the state department of education level, and media coverage of items concerning the "gifted" such as this special, national talent search. (Suitably qualified professionals may obtain from SMPY a roster of members of the group who reside in their state or region.)

Socioeconomic Aspects of the 700-800M Group

As soon as questionnaire responses by the group are complete they will be studied in more detail for the ethnic background of the youths and the education and occupation of their parents. These excellent mathematical reasoners vary in many respects, but some features are already apparent:

1. Their parents tend to be rather well educated, typically at least through the baccalaureate, but not at the most selective colleges and universities in the country.
2. Many of them are engineers, data processors, applied scientists, practicing physicians, or lawyers. Some are college professors, but not usually at the most selective colleges and universities.
3. The familiar dictum, "From shirtsleeves to shirtsleeves in three generations," may apply. Many of the heavily foreign-background (especially Asian-American), largely middle-class youths who fill the roster seem to have the "fire in the belly" motivation that will probably carry them to substantial academic achievements at early ages.

Future Treatment of the 700-800M Group

By concentrating much of his time in the future on this group of manageable size, under 300, Dr. Stanley plans to study ways in which the special educational opportunities offered by SMPY and CTY affect its members' academic, social, and emotional development. Special attention will be paid to those who accelerate their educational progress greatly, versus those who do not. Also, attempts will be made to understand better why some of the qualifiers take little advantage of the smorgasbord of special educational alternatives suggested to them. To what extent are parental attitudes involved? How do

non-accelerates fare in the long run?

The follow-up of this prime group by Dr. Camilla P. Benbow is meant to extend well beyond its members' entry into full-time professional life. Major questionnaire studies are underway. Also, Dr. Stanley has met with several regional subsets of the 300 for massive educational counseling.

Other Follow-Up Studies

Because SMPY's talent searches and special classes both began in 1972, many of the earlier students have gone far up the educational ladder, several of them through the Ph.D., M.D., J.D., or M.B.A. degree. Systematic periodic follow-ups of those who scored at least fairly well in each talent search are conducted when enough time has elapsed for them to complete high school, again when they should be through college, again when they have had time to complete graduate school, and so on through their professional lives. These follow-ups are done in waves, by age cohorts. Results of following up students from the first three talent searches through high school and into college are contained in the Benbow and Stanley (1983) volume.

A massive follow-up of those students who have had time to complete college is in progress. That will enable the staff of SMPY to study the effectiveness of its various procedures as well as the educational development of intellectually talented students from the seventh grade to the graduate training stage.

Besides following up most of the participants in the talent searches, SMPY studies special groups such as the ablest third of the December 1976 talent-search group. Those youths had been tested much more fully and offered special opportunities. They have been asked to complete a questionnaire, the Allport-Vernon-Lindzey Study of Values, the Adjective Checklist, and the Bem Sex Role Inventory. These will allow SMPY to complete an in-depth analysis of this group's achievement and factors relating to it as well as studying the stability and predictability of the value structure and sex-role orientation of seventh graders.

As seventh graders the students in this follow-up had not only taken the complete SAT and certain self-report inventories already mentioned, but also several specific ability measures, thus, interesting longitudinal analyses are possible. As far as the staff of SMPY is aware, there are no studies of the stability and predictability of the value structure and sex-role orientation of

seventh-graders. Sex-role orientation is particularly relevant to concerns about sex equity. The Adjective Checklist data will help SMPY understand better the role of personality structure in educational development and decision-making.

Over the years, participants in SMPY's first fast-paced mathematics class (1972-73) have been studied repeatedly as they grew older. They could be divided into four groups: those who completed the entire precalculus program quite successfully, those who completed it less well, those who dropped out at the end of the first ten summer meetings, and those offered the chance to enroll in June of 1972 but who for various reasons declined. This quasi-experimental design permits many interesting and revealing comparisons. They appear in *Academic Precocity*. The quest is never done, however, for now the students, most of whom were seventh-graders during the 1972-73 school year, have had time to graduate from college and enter graduate school. One received his Ph.D. degree in December of 1981, whereas at least one is a year behind the age-in-grade academic progression. All the students in this special study are being followed up using the same questionnaire that is sent to the students who have completed college.

Other special groups SMPY has studied consist of persons who entered and graduated from college young. Entering college early is one of SMPY's prime options for intellectually advanced students. In order to evaluate this procedure as early as possible, which seems desirable, Drs. Stanley and Benbow compiled a list of all 36 early (by at least three years) graduates in Johns Hopkins' history. The success of these early graduates in their professional lives turned out to be remarkable. For an article about this, see Stanley and Benbow (1983c). Also see Stanley (in press).

Four fast-paced college-level calculus classes have also been studied and reports about success of their students published. The latest of these appears in *Academic Precocity*, as does a study of SMPY's first fast-paced chemistry and physics college-level classes.

The follow-ups will be continued, at an accelerated rate, because they will be essential to the evaluation of SMPY's various efforts to help intellectually talented youths educationally. As a side benefit they provide much-needed data for several research projects that are more "basic" in orientation.

The value of the longitudinal research coming out of SMPY was recognized

officially several years ago: Drs. Benbow and Stanley won an award in the human development category from Division E of the American Educational Research Association for Benbow and Stanley (1982).

Educational Counseling

Besides following up former talent-search participants and persons who have been in SMPY's special educational programs, the staff (especially Dr. Stanley) provides much educational counseling by mail, telephone, and face-to-face. Over the years Dr. Stanley has had a firm rule that every letter to him from an SMPY protégé will be answered promptly by him. Other letters are usually answered, also. If not, the writer is sent materials that seem responsive to the questions asked. Approximately 1000 packets of informational materials are mailed during each year to requesters from all over the world.

Probably one of the chief reasons for SMPY's success and speed of dissemination of its findings is that a part of the university (i.e., SMPY) works directly with the intellectually talented youth himself or herself. This removes barriers to communication that often occur when a university person or agency tries to benefit students by going through the bureaucracies of their school systems. It also encourages the students to take charge of making their own educational decisions at an early age, 12 or less. The model seems powerful, though of course in actual practice it is not always easy to persuade some parents to relinquish much control of the educational decision process for their children. If, however, a parent writes Dr. Stanley about his or her child, he usually writes a letter back to the youth and starts it by saying, "Please thank your mother [or father] for her [or his] interesting, informative letter . . ." If the parent persists in writing several times, Dr. Stanley may add as an enclosure to the return letter to the youth a brief memorandum entitled "Youths Plan for Themselves." Thus, the youth gradually realizes that the desired relationship is directly from SMPY to him or her, and vice versa.

Among the best mechanisms for communicating with young people and their parents seems to be a several-hour symposium-style question-and-answer exchange between Dr. Stanley and them. Another seems to be the formal speech at an annual awards ceremony for persons who have scored high in a talent search.

Conclusion

We of SMPY look forward to learning scientifically more and more about "youths who reason extremely well mathematically," a crucially important talent pool for the sciences, mathematics, and other academic fields that demand great quantitative ability. We wish our time and facilities permitted us to extend the studies to a related group, youths who reason extremely well mechanically, spatially, and non-verbally. Clearly, much research, development, and service are needed from those interested in special intellectual talents. Precocious youths and society would benefit greatly from markedly increased support of efforts in the areas mentioned.

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