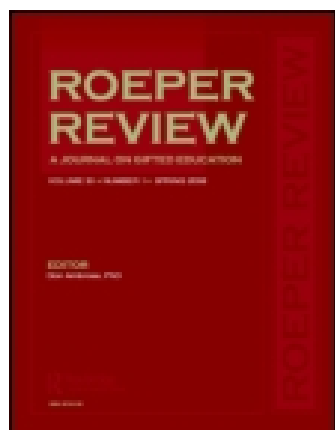


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## Roeper Review

Publication details, including instructions for authors and subscription information:  
<http://www.tandfonline.com/loi/uror20>

### A decade of longitudinal research on academic acceleration through the study of mathematically precocious youth

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Published online: 20 Jan 2010.

To cite this article: Mary Ann Swiatek (1993) A decade of longitudinal research on academic acceleration through the study of mathematically precocious youth, *Roeper Review*, 15:3, 120-124, DOI: [10.1080/02783199309553484](https://doi.org/10.1080/02783199309553484)

To link to this article: <http://dx.doi.org/10.1080/02783199309553484>

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- manuscripts suggest the following critical policy implications:
- Acceleration is useful, particularly when judiciously applied to individuals, but not critical to academic success and career advancement. Overall, acceleration offers a beneficial option to highly exceptional or otherwise inappropriately placed students.
  - Test scores, while performing an important role in identifying potential in young children, play an increasingly diminished part in explaining mature versions of creative accomplishment. Demonstrated special talent, personality variables, passionate interest, and opportunities loom larger than test performance in differentiating developmental outcomes among gifted adolescents and adults.
  - Opportunities are not meted out in an egalitarian manner. Those gifted individuals less likely to enroll in advanced courses or special programs due to distorted self-images need appropriate guidance to correct for underachievement.
  - The application of various statistical and data collection procedures to new longitudinal studies as well as to the re-analysis of earlier or contemporary data sets offers a promising area for exploration.

## Conclusion

It is indeed time for a change. It is time to recognize the need to study individuals over years and decades. It is time to recognize the shortcomings of cross-sectional "snapshot" research in illuminating the development of giftedness and in providing definitive justifications for our educational efforts. The fledgling state of the repeated measures literature in gifted education, as demonstrated in this issue, highlights the variety and promise of longitudinal research for the field. Gathering the existing literature in collections such as this special journal issue and the forthcoming book of longitudinal studies is an important step in encouraging wider use of longitudinal methodologies in gifted education. Most important are increasing numbers of researchers willing to make the commitment to longitudinal study, and equipped with adequate funding and sophisticated designs. Thus armed, we can better understand the sequential and causal patterns of giftedness that are our fundamental interest and the empirical basis for our educational practice.

Reid, B D (1991, June) National research needs assessment process *The National Research Center on the Gifted and Talented Newsletter*, 1 (1), 8-9

# A Decade of Longitudinal Research On Academic Acceleration Through the Study of Mathematically Precocious Youth\*

Mary Ann Swiatek

*Over the past decade, several longitudinal studies pertaining to the education of intellectually gifted students were produced through the Study of Mathematically Precocious Youth (SMPY). One area that was emphasized, in keeping with SMPY's history, is academic acceleration. SMPY's studies, which consider various groups of students, methods of acceleration, and types of outcomes, support acceleration as an educational method. Their results are in keeping with the work of other authors in this area. In this article, the subjects, methods, and outcomes of SMPY's studies are described and plans for future research are outlined.*

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Academic acceleration can be defined as "[educational] flexibility based on individual abilities without regard for age" (Paulus, 1984, p. 98). Noted methods of acceleration include early entrance to school, grade-skipping, fast-paced classes in certain subjects, college courses for high-school students, and advanced placement in certain subjects (Copley, 1961; Gold, 1982). Across methods, acceleration is the subject of much discussion in the educational and psychological literature (see review by Benbow, 1991). Some authors express concern about difficulties that might be faced by accelerated students (e.g., Jung, 1954; Miller, 1980; Smith, 1984). Others note that acceleration, when studied empirically, is shown to benefit students academically without showing an association with psychosocial difficulties (see Kulik & Kulik, 1991, 1992). Several studies of accelera-

tion, which are unique due to the longitudinal design employed, were produced through the Study of Mathematically Precocious Youth (SMPY). The most recent of these studies are the focus for this article.

## The Study of Mathematically Precocious Youth

Julian C. Stanley founded SMPY in 1971 at The Johns Hopkins University. Through the study, he pioneered the talent search model for the identification of gifted young people. This model offers junior high school students the opportunity to take the Scholastic Aptitude Test (SAT). To qualify for a talent search, students must score in the top few percentile ranks on a grade-appropriate standardized test. Because of the difficulty of the SAT (which was de-

\*Special thanks are extended to Camilla P. Benbow for her helpful comments and suggestions in the preparation of this manuscript

signed for use with high school seniors), young gifted students' scores spread across a greater range than is possible with junior high level tests, thereby allowing highly gifted adolescents to be distinguished from moderately gifted students. The individuals who are identified as highly gifted (i.e., who perform exceptionally well on the SAT) are then informed of special academic opportunities and encouraged to challenge themselves intellectually. To validate the talent search procedure, among other reasons, one of the first projects undertaken by SMPY was the longitudinal study of students identified as highly gifted.

Additional groups of gifted individuals were added to the longitudinal study in subsequent years. SAT score requirements for inclusion in the study varied over time; therefore, each of the subject groups differs from the others in terms of ability level as well as historical cohort and geographical location. Table 1 summarizes the composition of the five cohorts currently being studied.

To achieve this aim, follow-up surveys are periodically sent to the research subjects. These self-report surveys address academic and psychosocial issues, attitudes and interests, family background, and future plans. They include open-ended, multiple-choice, and Likert-type response formats, as well as requests for specific, quantitative information (e.g., test scores). To date, Cohorts 1, 2, and 3 have been surveyed at the age of 18 (an age that approximately coincides with high school graduation). Cohorts 1 and 2 also have been surveyed at the age of 23 (after college graduation). The after-college survey of members of Cohort 3 is now underway, as in a survey of Cohort 1 at about age 33. Currently, it is from the after-high school and after-college surveys that SMPY obtains the majority of the data for its studies.

The diversity of the topics covered in the longitudinal questionnaires allows a variety of research topics to be pursued. To date, issues studied range from psychosocial adjustment (e.g., Richardson & Benbow, 1990; Swiatek & Benbow, in press) to possible gender

mic acceleration. The research in this area deals with acceleration in general (i.e., students who accelerate their educations, regardless of the methods used) as well as specific types (e.g., fast-paced mathematics classes). Further, it addresses students' development in both academic and psychosocial areas.

## Acceleration Studies

**Cohort 1.** One subgroup of Cohort 1 has been followed up twice. This subgroup is comprised of participants in SMPY's first fast-paced mathematics class (named the "Wolfson class" after its teacher). In 1983, Benbow, Perkins, and Stanley evaluated the 16 students (9 males, 7 females) who took the class during its first year. These sixth-to-tenth-graders qualified for the class by scoring at the 99th percentile on the mathematics subtest of the Academic Promise Test (APT). The evaluation focused on academic achievements and attitudes, drawing information from the after high school follow-up survey and a brief self-report questionnaire that was designed specifically for Wolfson qualifiers. Swiatek and Benbow (1991a) conducted the second follow-up, which involved 37 of the 44 students who completed the Wolfson class during either its first or its second year (26 males and 11 females). In the second year, students qualified by first scoring at least 500 on the SAT-M and 400 on the SAT-V, then scoring at least at the 48th percentile on the Educational Testing Service Cooperative Mathematics Algebra I test. Academic and psychosocial data for this follow-up were drawn from the after-college survey. Students who qualified for the Wolfson class but did not complete it were used as a comparison group in both follow-up studies (N = 10 males and 7 females in the first study; N = 35 males and 23 females in the second study).

A psychosocially-oriented study of Cohort 1 was conducted by Richardson and Benbow (1990). They correlated extent of grade-skipping and subject acceleration with social interaction, self-acceptance/identity, self-esteem, and locus of control among several hundred accelerated individuals.

**Cohort 2.** Brody and Benbow (1987) compared both academic and psychosocial outcomes at age 18 among four groups of Cohort 2 students (total N = 510), separated according to the extent of their acceleration. Because this study

**Description of SMPY longitudinal research subject groups**

Descriptive information	Cohort				
	1	2	3	4	5
Identification Dates	1972-1974	1976, 1978, 1979	1980-1983	1986-present	Present <sup>a</sup>
Geographical Region	Maryland	Maryland	Maryland	Iowa	National
Qualifying SAT Scores	390M or 370V	550M 580V 58 TSWE 500M and 430V 500M and 1000C 2(M)+V≥1330	700M or 630V	500M or 400V or 930 C <sup>b</sup>	---
Ability Level (top)	1.00%	0.50%	0.01%	0.050%	---
Approximate # of Subjects	2,220	750	650	1,020	900
Approximate Response Rates					
Age 18	97%	83%	83%	---	---
Age 23	63%	81%	---	---	---
Gender Ratio (male:female)	1:6:1	2:3:1	3:1	1:3:1	1:1

<sup>a</sup>Subjects for Cohort 5 are being identified during graduate school attendance and will be followed in the future  
<sup>b</sup>ACT scores also are accepted for Cohort 4 (see Swiatek, 1992)  
M = SAT-Math      V = SAT-Verbal      C = SAT Composite score

Table 1

The long-term goal of the SMPY longitudinal study is to better understand gifted individuals and the development of their abilities and achievements.

differences in brain functioning (O'Boyle & Benbow, 1990). One of the topics to which SMPY devotes considerable empirical research effort is acade-

focuses upon extent, rather than type of acceleration, several different methods of acceleration are represented.

After-college data collection for Cohort 2 is now nearly complete; therefore, research on the longer-term outcomes of acceleration can include members of this group. There are already two studies using Cohort 2 after-college data. One study used only accelerated students (across accelerative methods) to search for nonintellectual factors that differentiated those who were satisfied with their educational experiences from those who were not satisfied (Swiatek & Benbow, in press). In this study, members of Cohorts 1 (N = 575) and 2 (N = 201) were used as separate subject groups in order to replicate findings. The other study drew subjects from both cohorts to compare a group of 107 individuals (69 males and 38 females) who were accelerated enough to enroll in college at least one year earlier than average with a group who had not accelerated, but was matched with the first group in terms of ability (as measured by the SAT, taken at age 13) and gender (Swiatek & Benbow, 1991b).

from others.

At this time, Cohorts 1 and 2 are the most common sources of subjects for SMPY's acceleration research. Variables frequently considered are listed in Table 2. As identification and follow-up procedures continue, the numbers and types of gifted subjects available for longitudinal study will increase, as will the time period over which their academic and personal development can be considered.

## Study Results

### Academic outcomes of acceleration

SMPY's research, described above, suggests that acceleration is often an effective way to meet the academic needs of gifted students (Benbow, Perkins, & Stanley, 1983; Brody & Benbow, 1987; Kolitch & Brody, in press; Richardson & Benbow, 1990; Swiatek & Benbow, 1991a, 1991b, in press). Across academic variables, accelerated students appear to have some advantage (see Swiatek & Benbow, 1991a, 1992b). Comparisons of individual variables, however, rarely

yield significant differences; both accelerated and unaccelerated students demonstrate high levels of academic achievement.

The lack of large academic differences between groups can be viewed as evidence that acceleration is not necessary to ensure high academic achievement among gifted students. Such an interpretation, however, overlooks the effects of methodology on the results of studies

in this area. First, when average-ability comparison groups are used, the accelerated students are younger than are the comparison students, yet they equal the older students in academic achievement. Second, the academic performance of accelerated gifted students might be less impressive, as well as unnecessarily longer and slower if those students were required to remain in a lock-step academic program. Ethical considerations render it impossible to design a study in which gifted subjects are randomly assigned to either accelerated or unaccelerated groups; it would be unethical to deprive interested students of the opportunity to accelerate simply for research purposes. Also, SMPY and others maintain that students who do not wish to accelerate should not be forced to do so (e.g., Benbow, 1991). Given these facts, the research results most clearly show that students who choose to accelerate do not suffer academically as a result of this decision, but that they gain speed in their educational preparation.

In addition, SMPY's findings with regard to academic achievement temper two frequently stated concerns about acceleration. The first concern is that there are gaps or weaknesses in what students learn through accelerated coursework (see Hildreth, 1966; VanTassel-Baska, 1989). The gifted accelerates studied by SMPY do not demonstrate any such difficulties. Rather, their strong performance at advanced levels of study attests to their understanding of previous material (see Swiatek & Benbow, 1991a, 1992b).

The second concern is that accelerated students may work too hard and "burn out" on academics (Compton, 1982). SMPY's findings also do not support this possibility. Rather, the gifted accelerates studied complete college and attend graduate school in numbers that exceed the national average. A more specific finding is that, during the first year of college, over 90% of a group of SMPY participants who were accelerated in mathematics express plans to major in mathematics or science (Kolitch & Brody, 1992). Also, students who completed the Wofson class participated in college-level math and science at levels that were at least equal to qualifiers who did not complete the course (Swiatek & Benbow, 1991a). These findings suggest that accelerated students do maintain interest and involvement in educational pursuits.

Thus, SMPY's research suggests that acceleration does not harm gifted students academically, but that it often helps them establish interests and build a strong foundation for future learning. These conclusions are consistent with those of other researchers (see Benbow, 1992). Academic outcomes do not provide a complete picture of the gifted accelerate, however. Psychosocial outcomes also are a necessary component of research in the area of gifted education.

**Psychosocial outcomes of acceleration**  
SMPY's research on the psychosocial aspects of academic acceleration also

### Variables commonly studied by SMPY with regard to academic acceleration

Academic Variables	
Educational level	National rank of graduate program
Educational aspirations	Proportion of graduate math/science majors
College attendance	Proportion of students creating an original invention or process
National rank of college attended	Proportion of students authoring published material
Grade-point average	Proportion of students having a probable publication in preparation
Proportion of undergraduate math/science majors	Proportion of students contributing to a research project
Proportion of undergraduates taking elective math/science courses	
Proportion of students earning undergraduate honors and/or awards	
Graduate school attendance	
Psychosocial Variables	
Self-esteem	Life style expectations
Locus of control	Personality characteristics
Extracurricular activities	Value orientations

Table 2

**Cohort 3.** Kolitch and Brody (1992) investigated math preparation for college among 43 mathematically gifted members of Cohort 3 (30 males and 13 females) who were in their first year of college at the time of the study. Many of their subjects were accelerated in math. Because the after high school survey of Cohort 3 was not complete at the time of the study, a special self-report survey was used to collect data on math-related coursework, grades, Advanced Placement (AP) exam scores, extracurricular activities, and encouragement

has yielded encouraging results. The students studied express high levels of satisfaction with college (Swiatek & Benbow, 1991b) and with their accelerative experiences (Swiatek & Benbow, in press). In fact, the study attempting to identify nonintellectual factors related to satisfaction with acceleration encountered difficulties because the vast majority of accelerated students were satisfied (i.e., there was restriction of range in satisfaction scores; Swiatek & Benbow, in press).

Comparisons between accelerated and unaccelerated students show no differences in locus of control (Brody & Benbow, 1982; Swiatek & Benbow, 1991b) or various personality characteristics (Brody & Benbow, 1987). Although very highly accelerated students may be somewhat less involved in extracurricular activities than are other students (Brody & Benbow, 1987), accelerated students as a group are involved in about the same number of pursuits as are unaccelerated students (an average of approximately 2.3 distinct types of activities during college; Swiatek & Benbow, 1991b).

Results regarding self-esteem are less clear-cut. In some SMPY studies, self-esteem scores are slightly lower among accelerated students than among non-accelerates (Richardson & Benbow, 1990; Swiatek & Benbow, 1991a), while other studies detect no differences (e.g., Swiatek & Benbow, 1991b). It is important to note, however, that both accelerates and non-accelerates receive scores that indicate positive self-esteem and differences are minute. The small differences that are found may be explained by Festinger's (1954) social-comparison theory: slight decreases in self-esteem may occur because accelerates are exposed to higher ability comparison groups than are non-accelerates (see Swiatek & Benbow, 1991a). Thus, SMPY's research indicates that concerns about negative psychosocial effects of acceleration may be unfounded.

Accelerates appear to be equal to non-accelerates in the psychosocial areas that were investigated. The one exception to this generalization may be self-esteem (Richardson & Benbow, 1990; Swiatek & Benbow, 1991a), but any differences in this area are small and can be explained by social comparison theory (see Festinger, 1954).

**General conclusions regarding acceleration** Because all subjects in research on acceleration are willing participants, conclusions are necessarily somewhat

limited. As noted above, ethical considerations prevent more comprehensive research designs. This limitation does not hinder the application of research results, however, because willingness is an important factor in deciding whom to accelerate (Benbow, 1991). Given this caveat, several conclusions regarding academic acceleration can be drawn.

Acceleration is an educational option that is inexpensive to implement, requires little specialized training for teachers, and can be used in most educational settings to meet the learning needs of many gifted students (Benbow, 1991; Feldhusen, 1990; VanTassel-Baska, 1990). SMPY's results regarding acceleration outcomes are consistent with those of other authors. There is no evidence that acceleration harms willing students either academically or psychosocially (cf. Kulik & Kulik, 1991, 1992; Schneider, Clegg, Byrne, Ledigham, & Crombie, 1989). Moreover, it may help gifted individuals to establish a foundation for advanced learning, maintain interest and involvement in academic activities, and earn extra time that can be used for the development of a career (cf. Dweck & Elliot, 1983; Feldhusen, 1989; Locke, Shaw, Saari, & Latham, 1981; Whitmore, 1980; Zilli, 1971). Therefore, SMPY's long-standing (since 1971) advocacy of acceleration for gifted students who want to participate is consistent with the research literature. As advocacy continues, plans are being made for the further development and utilization of the SMPY research base.

## Future Directions

The SMPY longitudinal study is currently located in the Office of Precollegiate Programs for the Talented and Gifted (OPPTAG) at Iowa State University. Through continuing research efforts, the gifted students identified in the 1970s and early 1980s will be studied throughout their adult lives. In addition, new groups (cohorts) of gifted students are being established for longitudinal study. Thereby, the currency of the SMPY study will be maintained.

One of the new groups is now being identified through the annual Iowa Talent Search (ITS). This group of gifted students is different from earlier groups in terms of historical cohort and geographical area. SMPY also is identifying and incorporating into its longitudinal study a group of individ-

uals who are enrolled in the nation's top graduate programs in mathematical and scientific areas. These students meet the criteria for high achievement in mathematical and scientific areas set forth in SMPY's past research (i.e., Benbow & Arjmand, 1990), but they may or may not have been identified as gifted through a talent search program (or any other program). These students will provide a comparison group for better evaluation of the talent search procedure. In addition, the different identification process will allow results to be generalized beyond talent search participants.

The future of SMPY includes many exciting and promising research possibilities. It is hoped that a greater understanding of gifted individuals will follow from the longitudinal studies that have been and will be conducted. Academic acceleration is one of the focal areas of study, but there are many others. The better we, as professionals, can understand the development of gifted individuals, the better equipped we will be to serve this important population.

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## All Rivers Lead to the Sea: A Follow-up Study of Gifted Young Adults

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*Students who had entered the University of Washington's Early Entrance Program (EEP) between 1977 and 1986 were asked to participate in a follow-up study, along with two comparison groups who had taken part in previous research efforts: non-accelerated National Merit Scholarship finalists ("NATS"), and students who had qualified for the EEP but had proceeded to high school instead ("QUALS") Return rates were 56% EEPers (n=61), 71% NATS (n=27), and 56% QUALS (n=36) Most respondents were satisfied with their decision to accelerate or not accelerate their secondary education EEPers had entered graduate school in significantly greater numbers than had either the NATS or QUALS, although QUALS' educational aspirations are as high as EEPers'. In attitudes, interests, and values, group similarities far outweighed differences; where significant differences occurred, however, EEPers tended to resemble NATS more than QUALS Limitations of the study and implications for school choice are discussed*

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Although radical acceleration has long been a controversial issue in the education of gifted adolescents, a growing body of evidence strongly supports its enhancement of some students' academic performance (Daurio, 1969; Kulik & Kulik, 1984). Brody and Stanley (1991) reviewed the research on several groups of early entrants and reported positive overall effects of acceleration for the majority of accelerants. For example, accelerated students were more likely to be high achievers in college, to graduate, and to attend graduate school than were their regular age peers. They also found that the majority of students who participated in the Study for

Mathematically Precocious Youth (SMPY) and who entered Johns Hopkins University or another college/university at least one year early performed as well academically as regular age students, had higher educational aspirations, and had "greater perceived use of educational opportunities" (p. 112).

Given the preponderance of evidence favoring acceleration, why does the controversy persist? A careful reading of the literature suggests that it centers around students' social and emotional development (Cornell, Callahan, Bassin, & Ramsay, 1991). Although Brody and Stanley could find no evidence that "negative social or emotional problems...result from the accelerative experience" (1991, p. 112), many educators, parents, psychologists, and counselors fear that acceleration will deprive young people of the critical social experiences they will need to create healthy, well-functioning, and successful lives. Because high school is considered a normalizing experience on the road to responsible adulthood, students are urged to remain with their agemates regardless of differential ability, motivation, or special needs. Not all students heed this advice, however. Some accelerate their secondary education and enter college from one to several years early through special programs available at a number of colleges and universities (Robinson & Noble, 1992); others, who participate in the Early Entrance Program at the University of Washington (UW), elect to skip high school altogether.

Since 1977, the Early Entrance Program (EEP) has enabled highly capable adolescents in western Washington state to enroll in college before age 15, typically after the 7th or 8th grade. Each year up to 15 students are selected for the EEP on the basis of several criteria: scores on the Washington PreCollege Test (similar to the SAT) and the Stanford-Binet IV; a 20-minute essay; achievement test records; class grades; teacher recommendations; extensive interviews with students and their families; and students' own motivation and willingness to undertake a rigorous academic adventure. Once admitted to the program they attend the self-contained Transition School on the UW campus for one academic year, taking fast-paced courses in English, mathematics, history, and physics, and acquiring the skills, habits, attitudes, and knowledge they will need when they graduate the following autumn to full-time university status. The EEP is structured and organized to furnish students with a diverse peer group, an active academic

Article submitted April, 1992.  
Revision accepted October, 1992