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COLLEGE COURSES AND EDUCATIONAL FACILITATION OF THE GIFTED

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Study of Mathematically Precocious Youth
The Johns Hopkins University

ABSTRACT

Mathematically precocious junior high school students have been encouraged by SMPY to take college courses. To be eligible, the student should score at least 550 on the matematical part of the College Board's Scholastic Aptitude Test (SAT-M) as a seventh or eighth grader. A score of at least 400 on SAT-Verbal is also desirable. Courses should be taken for graded credit, preferably in the summer, and in the area of the individual's high ability. Many colleges and universities have proved willing or even eager to admit talented young students. The credits earned can be held in escrow for college later. In the last five years, 131 SMPY youths have taken 277 college courses and earned an over all GPA of 3.59, where 4=A and 3=B. Girls take fewer courses than boys and have a sightly lower GPA. Community colleges are a great deal easier for these students than either colleges of universities. These youths experience little social or emotional difficulty in the college classroom. A comparison group of considerably older high school students who took evening college courses did not do as well as the SMPY group (GPA 3.02 versus 3.59). This was probably due to the greater selectivity by SMPY on both ability and motivation to work in a college class.

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One of the goals of the Study of Mathematically Precocious Youth (SMPY) has been to help intellectually able students find challenging and worthwhile learning experiences. The importance of identifying and facilitating highly able students has been documented by Oden (1968), Stanley, Keating, and Fox (1974), Keating (1976), and others. SMPY believes that each talented youth needs to be stimulated to his or her fullest learning potential. With this objective in mind, SMPY first sought to identify a group of mathematically talented individuals who could then be given opportunities for academic advancement. Some 2800[1] mathematically talented junior high school students were identified through three talent searches. The last of these, conducted in January of 1974, included contestants from the entire State of Maryland. The participants were selected to have scored in the top two percentile of in-grade national norms on a standardized mathematics test. Seventy-three percent of those subsequently tested on the Scholastic Aptitude Test-Mathematical (SAT-M) scored at least 420 or better. This score represents the 57th percent of a random sample of male eleventh and twelfth graders. Most of the 2021 contestants in the talent searches who earned such a score were in the seventh and eighth grades when tested. A few were underage ninth and tenth graders -- i.e., students accelerated in school placement by a year or two.

Various methods of facilitation had been studied and were available to SMPY (Keating and Stanley, 1972; Stanley, 1973; Fox 1974; George and Denham, 1976; Stanley, 1976). Some of the methods that have been used successfully are subject matter acceleration, fast-paced mathematics classes, grade skipping, Advanced Placement Program examinations, entering college early (up to four years), and taking college courses for credit while still in junior or senior high school. The particular methods or combination of methods for accelerating a gifted child's educational progress depends, of course, on his or her specific abilities, interests, and academic opportunities.

SPECIFIC ADVANTAGES

The first question to consider, is why should SMPY encourage students to choose a college course rather than some other more traditional form of acceleration? One advantage is that college courses can be taken during the summer or at night, avoiding the scheduling problems that special in-school classes and subject matter acceleration entail. The credits earned from these college courses can be kept in escrow until the student attends college full-time. Furthermore, these college credits may serve a double purpose by also being counted toward high school graduation requirements. The Maryland State Department of Education recently endorsed this method of earning diploma credits, and other states probably have similar rulings. Taking a college course is particularly advantageous when the highly able individual is in an area where there are few other comparable students; this problem can be acute in rural regions. By enrolling in a local college or registering for a college correspondence course, the person can obtain the individualized acceleration that he or she needs. Precocious youths who are part-time college students also benefit by being able to interact with their intellectual peers without disturbing their social relationships with their agemates in school. In addition, for students who are planning to graduate early from high school, having sampled the atmosphere of a college campus will help the transition into the new academic format.

STUDENT ELIGIBILITY

The next question is, who should be allowed to take college courses before finishing high school? Even within SMPY's highly talented pool of mathematical reasoners there must be some type of criterion. The general rule of thumb which SMPY has used successfully is that the student in question should exceed in ability most of those students in the course he will be taking. By being abler than most of this classmates, the younger pupil can offset his relative lack of academic sophistication. The younger the student, then, the abler he must appear on aptitude tests such as the SAT-M or the Preliminary Scholastic Aptitude Test -- Mathematical (PSAT-M). The criterion used by SMPY has been that seventh and eighth graders should score at least 550 on the SAT-M (or 55 on the PSAT-M), and ninth and tenth graders should earn at least 500 (or 50 on the PSAT-M). In addition, a verbal score of at least 400 (40) on such tests as the Scholastic Aptitude Test-Verbal (SAT-V) or PSAT-V is desirable. While these scores may seem surprisingly low, data will be presented to show that students capable of earning such scores at a young age are indeed able to do well in college courses. Although the test score is the criterion *sine qua non,* it is important that the student also be screened on motivational attributes. Only those students who are truly interested, eager, and willing to work hard for a good grade should be encouraged to enroll for a college course.

TAKING THE COURSE

After the student is judged to be capable of handling a college course, how does he go about it? The persons with whom SMPY works usually register for credit in extension and summer school courses with the regular student body. Most educators may be surprised to learn how many institutions of higher learning are willing to accept young students for college courses on a part-time basis. Many deans and faculty members realize that high intellectual ability is not geared to an age-in-grade lockstep pattern. This awareness of individual differences has caused a considerable number of colleges and universities to open their doors to the intellectually talented student even though he is only 10-14 years old.

An excellent example of such an institution is The Johns Hopkins University. The Evening College and Summer Sessions sponsor a "High School Scholars Program" for students who have completed the eleventh grade with a B average or better. In addition, the Hopkins program will accept junior high school students if they have demonstrated prerequisite ability with test scores and have appropriate letters of recommendation. In the Maryland and Washington D.C. area over twenty colleges and universities are willing or even eager to accept these students. Inquiries by students and their parents will show that many colleges throughout the country will help the gifted child; one need only ask. Often it is advisable, though, to approach the appropriate subject-matter specialist, such as the head of the mathematics department, before going to the registrar or director of admissions.

In reference to the actual taking of a course, the SMPY staff feels that the only way a highly able student should take the course is for graded credit, not for audit or pass-fail. Graded credit emphasizes the real nature of the course and prevents the student from taking it lightly or slacking off when the initial novelty of a college course diminishes. It should also be noted that the students whom SMPY sponsors receive no special consideration from the teacher. Success or failure should be due to the student's independent efforts relative to the other college students. This may sound harsh, but the SMPY students have been capable of attaining success through their own abilities, giving them a greater sense of accomplishment. Also, it is usually preferable that the teacher of the college course be unaware that a young person has been enrolled in the class. Otherwise, the teacher may tend either to "baby" or to bully the youth.

Another major advantage of taking a course for graded credit is that the individual will probably be able to transfer the credits earned from these courses when he or she starts college full-time. SMPY has had several students who entered college with sophomore standing as a result of having taken 30 or more college credit hours while still in high school. Relevant to the transferral of credits, it should be pointed out that this may be easier if the course is taken from a four-year institution rather than from a two-year college.

The best time for taking a college course is undoubtedly the summer. Not only does this avoid scheduling problems with the junior and senior high school, but it also allows the student to devote his or her energies full-time to what can be a demanding experience. If the course is taken during the school year, late-afternoon or evening courses are preferable for scheduling reasons.

Some thought should also be given to considering what course would be particularly appropriate for a talented junior high school student entering the college world for the first time. The best procedure appears to be to start the youth off in the area of his greatest ability. In this way he can build up confidence in doing well in the familiar courses before being more adventurous in others. For SMPY students this usually means beginning with a course in mathematics or computer science. The course chosen can be either an acceleration of the normal school curriculum, such as college algebra, or an addition, such as computer programming.

SMPY STUDENTS

In the preceding sections we discussed some points that are relevant to a highly talented high school student who wants to take a college course. In this section, the actual accomplishments of the SMPY students will be discussed. The staff of SMPY has advised and encouraged many individuals to take advantage of this form of academic facilitation. In particular, the top scorers in the 1974 Maryland Mathematics Talent Search were awarded one tuition-free college course. These 41 tuition waivers were donated by twelve colleges and universities located throughout the State of Maryland and Washington, D.C.

Over the five years of SMPY's existence, 131 different youths (principally 7th, 8th, and 9th graders) have taken 277 college courses. These total up to 871 credit hours, in sheer credit terms the equivalent of more than seven bachelor's degrees. The total figures break down to 24 girls having taken 32 courses (or 12% and 107 boys having taken 245 courses (or 88%). The largest number of these students took only one course each (79, or 29%), but others took several courses. One of the boys has taken twelve. Sixty-seven percent (or 185) of the courses were taken during the summer months.

Of the 277 courses taken, the grades earned were as follows: 180 A's (65%); 84 B's (30%); 10 C's (4%);2 D's (1%); 1 F (less than 1%).

This means that 95% of all the grades received were honor grades. The overall grade point average (GPA) for these junior and senior high school students was 3.59. On a standard four-point scale, these youths have achieved an A- overall average. Of course, these high grades have probably been influenced somewhat by general college grade inflation. However, one can use for a standard of comparison that the Dean's List usually requires 3.50 and that at The Johns Hopkins University election to membership in Phi Beta Kappa requires a cumulative GPA of at least 3.70.

The normal academic load for a college year is 30 credits. This means that these youths have earned over 29 years of college credit with an honors average. Obviously, gifted junior and senior high school students *are* capable of handling college courses well. It is sad to think that in the normal course of events these students would not have had this opportunity to find out how much they can do when challenged. It is also disturbing to think that a student who could earn an A in a college mathematics course at age 12 or 13 should be forced, nevertheless, to sit through a slow-paced junior high school course being taught material far below his ability level, most of which he already knows or can learn almost instantaneously.

The next step will be to consider some specific aspects of this impressive academic record. The first area to discuss is sex differences. There does appear to be a sex difference in grade-point average, although it is not statistically significant. The boys earned an average of 3.61, whereas the girls earned 3.44. This relative lack of difference in GPA is somewhat surprising, since there is a significant difference in their original SAT-M scores. In the mathematics contests that SMPY ran there was a definite discrepancy between the highest scores achieved by the girls and the boys. In the group that took college courses the average SAT-M score was 626. The boys, however, had an average of 632, while the girls had an average of 581 ($.01 < p < 02$).

Confirmation of the 500 criterion SAT-M score can also be found in these data. As can be seen from Table 2, students who did taken courses after scoring below 500 (often without either our knowledge or approval) did not do as well as students with scores over 500. With scores over 500, though, there does not seem to be a strong association between higher scores and higher grades. This is due partially, of course, to the restricted range of grades, and the tendency for the abler students to take more difficult courses.

Another question is whether the students who took courses at less selective institutions did better than those who took them at more selective schools. To investigate this, an assumption was made that institutions became progressively more selective in the following order: community (junior) colleges, colleges, and universities. As can be seen from Table 3, the students who took their courses at the community colleges received the highest average GPA (3.79). Probably the courses at these two-year colleges were too easy for these students. Their mean SAT-M score of 624 probably greatly exceeded the ability level of many of the college students they were competing against. Only a small difference is evident between the GPA's earned at colleges (3.58) and at universities (3.55). Although these grade-point averages are lower than those received at the community colleges, they are still high enough to qualify for the Dean's List. There are no appreciable differences in the average SAT-M score by institution: community colleges, 624; colleges, 625; and universities, 627. The point to be made here is not to underestimate the abilities of a gifted junior high school student and put him into a community college class on the assumption that this will be difficult enough. A talented youth needs to interact with other students who are as able as he is himself.

The final point deals with how well students did in various kinds of courses. They were selected, of course, specifically for their mathematical ability. Not too surprisingly, they did best when taking college mathematics courses (GPA 3.72), as shown in Table 4. The courses taken were not only the easier ones such as college algebra and trigonometry, but also the more advanced ones such as Calculus I, II, and III, differential equations, probability theory, number theory, and vector analysis. The next best GPA was achieved in the computer sciences (3.70). These courses ranged from the introductory computer programming course to integrated circuits, minicomputers, and assembly language. The most popular course with these students was introductory computer programming. Seventy-one of the 131 individuals took this course. Forty-seven (66%) made A's; 21 (30%) made B's; and the other three made C's.

The other three areas in which courses were taken (natural sciences, humanities, social sciences) clustered together with respect to average GPA's but at a lower level: 3.38, 3.35, and 3.30, respectively. The courses in the natural sciences were mainly introductory ones in such areas as astronomy, biology, biogenetics, chemistry, electrical engineering, geology, oceanography, physics, and zoology. The humanities courses were in English literature, foreign languages, music, and philosophy. The lowest overall GPA was obtained in the social sciences. Again, the courses were mainly introductory ones in anthropology, economics, history, political science, psychology, and sociology. There were in addition a few advanced courses such as national income analysis and executive privileges of the president. The point is that if such students take courses in the area of their greatest ability, here mathematics and computer science, they can expect to earn approximately an A- average. If they take courses outside of this area they tend to average a B+. Adding a criterion of verbal reasoning ability would probably help to predict which individuals will be able to do especially well in areas outside of their specialty.

SOCIAL AND EMOTIONAL DEVELOPMENT

Besides academic considerations, a major concern of parents and educators about placing young persons in college courses is that these students may encounter difficulties of a social nature in a college classroom. The individuals might become lost in a group much older than they are -- or even worse, be pointed out as freaks. Fortunately, SMPY's experience has been that these things rarely happen. The students' comments indicate overwhelmingly that the courses were considered pleasant and stimulating. One of the few complaints noted, for example, was that there wasn't enough thermodynamics in a basic physics class. A brief essay relevant to this point appeared in the *Intellectually Talented Youth Bulletin* (Smith, 1975), the monthly newsletter put out by SMPY; it was written by a student who had just completed an introductory course in computer science. The reaction he describes seems to be fairly typical: "My classmates, I think, were a little confused by me; unsure if I was what I looked like or just a somewhat diminutive college student. Finally, one accosted me on the stairs, asking me what grade I was in. He seemed amazed that I was in the eighth grade and taking algebra: 'They didn't do that when I was in school.' "

Other studies done by researchers working with SMPY have pointed out that often the teacher and regular college students cannot even identify these young students (e.g., Keating, Wiegand, and Fox, 1974). When told who the students are, they usually agree that the 10-14 year old junior high school students had been well assimilated into the class. The success of these young students may be due to the fact that they are highly self-selected for interest and willingness to work. It had been demonstrated elsewhere (Haier and Denham, 1976) that they are well adjusted and capable of handling social adaptations that most of their agemates would find difficult. Also as was mentioned before, college courses offer the student the compromise of learning with his intellectual peers while maintaining social relationships with students his own age.

THE JOHNS HOPKINS HIGH SCHOOL SCHOLARS PROGRAM

SMPY was fortunate to find on its own campus a comparison group for these talented youths. The Johns Hopkins University Evening College and Summer Sessions supports a program, described before, that allows certain senior high school students to take college courses. To be eligible these students must have completed the eleventh grade with at least a B average. These individuals are, of course, considerably older on the average than those from the SMPY program.

The following figures are based on courses taken through this program for the academic years 1973-74 and 1974-75. In these two years 64 students (38 boys and 26 girls) took advantage of the opportunity. They took 100 courses in all, or approximately 1.6 per student. The grade-point average for this older group was 3.02, which is B on a four-point scale. The boys in this program again did better than the girls (3.11 versus 2.86) but earned all the D's (2) and F's (2).

The difference in average GPA between the Scholars Program and SMPY's (3.02 versus 3.59) is probably a product of the selection criteria. Although the SMPY group is on the average four years younger than the high school juniors, they have been selected on a much more rigorous criterion. To be able to make a B average when a junior in high school requires considerably less ability than to make a score of 550 on the SAT-M when an eighth grader.

CONCLUSION

Facilitating the academic programs of highly talented students is crucially important. Through college courses, able pupils can gain a means of developing their intellectual processes by working with their academic peers. If they have been sufficiently screened for ability and interest, certain gifted individuals this age *can* perform well academically in a college class without social trauma. College courses offer the opportunity to expand the individuals' intellectual horizons far beyond the limits of a junior or senior high school class.

Also, the credits they earn will benefit them later when they enter college and help accelerate their progress through higher education. By finishing their education sooner, they will reach the professional and business worlds earlier and have longer use of their talents as independent and creative individuals, instead of marking time in a slow, age-bound lockstep that tends to kill motivation.

[1] Of the 2800 students, 287 entered through a verbal contest and hence were not chosen specifically for their mathematical ability.

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Table 1: Course Grades for SMPY Students by Sex

	A	B	C	D	F	No. of Courses Taken	GPA	N	Mean SAT-M Score*
Boys	163	72	7	2	1	245	3.61	107	632
Girls	17	12	3	0	0	32	3.44	24	581
Total	180	84	10	2	1	277	3.59	131	626
% of Total	65	30	4	1	0	100			

*SAT-M scores unavailable for five courses.

Table 2: Grade-Point Average by SAT-M Score

SAT-M Score	Grade Point Average	No. of Courses Taken*	% of Courses Taken
400-449	2.00	1	0
450-499	3.26	13	5
500-549	3.59	19	7
550-599	3.57	41	15
600-649	3.53	66	24
650-699	3.75	70	26
700-749	3.53	39	14
750-800	3.73	23	9

*SAT-M scores WERE unavailable for five courses.

Table 3: Grade-Point Average and SAT-M Score by College Type

Type of College	Grade Point Average	Mean SAT-M Score*	No. of Courses Taken	% of Courses Taken
Community College	3.79	624	33	12
College	3.58	625	125	45
University	3.55	627	119	43
Total	3.59	626	277	100

*SAT-M scores were unobtainable for 5 courses.

Table 4: Grade-Point Average by Type of Course

Type of Course	Grade Point Average	Mean SAT-M Score*	No. of Courses Taken	% of Courses Taken
Mathematics	3.72	619	110	39.7
Computer Science	3.70	644	83	30.0
Natural Sciences	3.38	635	47	17.0
Humanities and Fine Arts	3.35	622	17	6.1
Social Sciences	3.30	583	20	7.2
Total	3.59	626	277	100.0

*SAT-M scores unavailable for five courses.

Table 5: Course Grades for Johns Hopkins Scholars Program by Sex

	A	B	C	D	F	No. of Courses Taken	GPA	N
Boys	28	23	10	2	2	65	3.11	38
Girls	6	17	12	0	0	35	2.86	26
Total	34	40	22	2	2	100	3.02	64
% of Total	34	40	22	2	2	100		

EXCERPTS FROM ITYB

The *Intellectually Talented Youth Bulletin* ITYB is published during each of the nine months of the school year, September through May, and in July. Its editor, Cecilia H. Solano, is also the Assistant Director of the Study of Mathematically Precocious Youth (SMPY) that Professor Julian C. Stanley conducts in the Department of Psychology at The Johns Hopkins University, Baltimore, Maryland 21218. The printed ITYB grew out of SMPY's mimeographed newsletter. ITYB began officially with the first issue of Vol. 1 in September of 1974. The subscription price is $5.00 per year. Back issues are available at $0.50 each, $2.50 for five, and $5.00 for ten. A sample issue will be sent free upon request.

Below are reproduced several articles that have appeared in ITYB. Some of the others are of a more didactic nature, telling about such things as the Advanced Placement Program examinations, various careers, and SMPY programs. A monthly mental puzzle is also featured. Increasingly, ITYB is being directed at coordinators of programs for the gifted across the country and at university professors who help prepare teachers of the gifted. Though it tends to emphasize the discovery, study, and utilization of mathematical talent, the majority of its offerings are broader than that.

TERMAN MEMORIAL SYMPOSIUM PAPERS

Presented here are the abstracts of papers given at the Lewis M. Terman Memorial Symposium on Intellectual Talent, which was organized by Professor Julian C. Stanley and chaired by Professor J.W. Getzels of the University of Chicago at The Johns Hopkins University on 6-7 November 1975. These papers, supplemented by others by Robert S. Albert, Kathleen M. Montour, Phyllis B. Ohanian, E. Paul Torrance, and George S. Welsh, are scheduled to appear in 1977 in a volume entitled *The Gifted and the Creative: Fifty-Year Perspective,* edited by Julian C. Stanley, William C. George, and Cecilia H. Solano and probably to be published by The Johns Hopkins University Press. It will be Vol. 3 of SMPY's *Studies of Intellectual Precocity* (SIP). The 232-page Vol. 1 of SIP, entitled *Mathematical Talent: Discovery, Description, and Development* and edited by Julian C. Stanley, Daniel P. Keating, and Lynn H. Fox, appeared in 1974. The 364-page Vol. 2, entitled *Intellectual Talent: Research and Development* and edited by Daniel P.

Keating, appeared in 1976. Both volumes are available from The Johns Hopkins University Press, Baltimore, Maryland 21218, in paperbound ($2.95 and $3.95, respectively) and hardcover ($10.00 and $16.50) editions.

Stanley, Julian C.; George, William C.; and Solano, Cecilia H. (eds.) In press (by the time this issue appears). *The gifted and the creative: Fifty-year perspective.* Probably to be published by The Johns Hopkins University Press in 1977. Based largely on the papers presented at the Lewis M. Terman Memorial Symposium on Intellectual Talent at Johns Hopkins on 6-7 November 1975. Abstracts of those papers appear below.

BACKGROUND AND HISTORY OF THE GIFTED CHILD MOVEMENT

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The gifted child movement is seen as a part of humanistic psychology.* Humanistic psychology, the legacy of William James, embraces first a broad humanism; second, the measurement of individual differences; third, intelligence and gifted children; fourth, creativity; fifth, development, and possibly sixth, parapsychology. These areas are connected by a sense of the dignity of man, by development, by measurement, and by concern for the unusual.

The first phase of Terman's *Genetic Studies of Genius* (1925-59) was epoch-making in its importance for developmental psychology. The GSC vindicated longitudinal research and established a case for genetic influences, dispelled myths about gifted children, and laid the basis for later extensions by Oden, Sears, and others. The precision of the Stanford-Binet Intelligence Scale and the statistical procedures used afforded a strong foundation. Minor flaws included consideration of intelligence as one-dimensional and neglect of socioeconomic status, creativity, and ethnic aspects.

Since Terman's day much attention has shifted to creativity as a major variable and gifted children as the most likely potential pool. Recent developments along these lines hold promise for increasing creative production. (E.g. see the contributions by Michael Torrance, and Welsh to this volume.)