# 5 *Fast-Paced Mathematics Classes for a Rural County*

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## Abstract

*A fast-paced mathematics program adapted from the SMPY model was developed to meet the needs of mathematically talented students in a rural county. After meeting screening requirements, eighth-grade students are selected on the basis of PSAT scores. Combining enrichment and acceleration, the program offers weekly two-hour evening classes in mathematics to students who take related classes during the day. The entire precalculus sequence as well as computer science can be completed at the end of three years in this program. Calculus can then be pursued for college credit, free of charge, at the local community college. The use of pre- and post-tests with appropriate review sessions enables the students' progress to be monitored closely. Approximately 25 percent of each year's initial program enrollment completes the three-year program, through computer science. Thus SMPY's model works fairly effectively even when the number of students is small.*

Charles County is a rural county located on the Southern Maryland peninsula approximately thirty-five miles southeast of the District of Columbia. In 1968 the student population was 11,692; according to the 1980 census it was then 17,641. The average county student's intelligence quotient (I.Q.) on the Cognitive Ability Test is 102.5. Only about 8 percent of the county's senior-high-school population is college bound.

# Development of a Fast-Paced Mathematics Program

Because a target group of 24 Charles County students were identified as mathematically talented in SMPY's 1974 talent search (Keating 1976), a "Fast-Math Program" was developed to meet their needs. This program was modeled after the SMPY fast-paced accelerative mathematics classes (Fox 1974; George & Denham 1976). The goal was to prepare these mathematics students for college.

## STUDENT SELECTION

The first class consisted of students from the SMPY 1974 talent search. These students had initially scored in the top 2 percent nationwide on the mathematics subtest of a standardized achievement test (Keating 1976). Then, in the talent search, as seventh- or eighth-graders, the students took the College Board's Scholastic Aptitude Test-Mathematics. Charles County students scoring at least 400 on SAT-M, a score that is 10 points above the mean for a national high-school sample of eleventh- and twelfth-graders (CEEB 1978), were invited to join the class.

During the subsequent years it was decided that any eighth-grade student meeting these requirements would be an eligible participant: (1) scored in the upper 4 percent (using national norms) on a standardized mathematics achievement test; (2) received *A*s on classroom tests; (3) had an intelligence quotient of 130 or better; and (4) was recommended by the classroom teacher and school guidance counselor on the basis of maturity. Parental permission was also required. Participants satisfying these requirements are given the Preliminary Scholastic Aptitude Test. Any eager and willing student who scores at least forty on the mathematics portion and thirty-six on the verbal section of the PSAT and has a combined mathematics and verbal score of eighty or greater is invited. There is, however, some leeway in these requirements.

## THE PROGRAM

The program is a combination of enrichment and acceleration. Students are offered a special two-hour-per-week course beginning with algebra I. This is followed by algebra II, college algebra, and computer science. Simultaneously, during their regular school day, the students are offered geometry, trigonometry, and analytic geometry. Hence at the end of three years the students have satisfied all the prerequisites for calculus. A flow chart of the sequence of classes is shown in figure 5.1.

The weekly two-hour class is held outside the regular school session, and no limit is placed on the duration of the course. A pre-test is given in

FIGURE 5.1. Flow Chart for Sequence of Courses in the Charles County Fast-Math Program

| | Year 1 | Year 2 | Year 3 | Year 4 |
|---|---|---|---|---|
| Day Class | Algebra I | Geometry | Trigonometry, Analytic Geometry | Free |
| Evening Class, First Semester | | Algebra II | Computer Science | Calculus |
| Evening Class, Second Semester | Algebra I | College Algebra | Computer Science | Calculus |

which content weaknesses are noted. The teacher then covers the content for the course, giving special emphasis to the students' weak areas. When the teacher decides that sufficient time has elapsed for mastery of the course content, a post-test is administered. Usually between ten and twelve weeks is sufficient time to master the material. This model also recognizes that a student may drop out of the Fast-Math Program. If that occurs at any level, the student just continues with his or her daytime class schedule without embarrassment or loss of sequentiality.

At this point the fast-math student who has completed the Fast-Math Program has also completed the mathematics course offerings at the high-school level. Calculus is not a part of the high-school mathematics curriculum in Charles County. So, at the conclusion of their three-year program, as high-school juniors, fast-math students take calculus, free of charge, for college credit at the Charles County Community College.

Currently five classes are following this model with teachers who have competency in the content area, who are flexible in presenting the subject, and who can creatively motivate the minds of the students in an atmosphere of productivity without being repetitive.

## THE TESTING PROGRAM AND FOLLOW-UP PROCESS

The importance of pre-tests and post-tests has been mentioned. The Cooperative Mathematics Tests (CMT) series developed by the Educational Testing Service in Princeton, New Jersey, are used in the pre-testing and post-testing program. Pre-test results serve as a guide in the selection and development of the mathematics content for the class, and post-test results are used for evaluation. The mathematics specialist assumes the responsibility for post-testing. Thus objective decisions can be made regarding whether certain students should continue in the program. For grading purposes, achievement at the ninety-third percentile or better on the forty-item CMT series is equivalent to an *A* grade; eighty-seventh percentile or better is equivalent to a *B*; and a seventy-fifth percentile or

better is equivalent to a *C*. This performance puts the students in the seventy-fifth through ninety-ninth percentiles on national norms of students who have taken the course for an entire year.

Following each test students attend a review session conducted by the specialist in which all test items that were missed by four or more students are explained in detail. The grades are then sent to parents and to home-based schools to be placed on students' permanent records. A Carnegie unit of credit is received by students upon successful completion of each course.

Standards for the course are determined using the raw score and the national norm. If these standards are not met by 80 percent of the class a follow-up reteaching session is immediately initiated. The specialist enters as teacher and reviews with the group the total content area for that course. This review takes four to eight weeks. At the end of this session CMT Form B is administered. The scoring and standards for this second test are identical to those for the first. Those students who fail to meet the expected achievement level are advised to leave the Fast-Math Program.

## EVALUATION

A review of the successive fast-math groups of Charles County indicates that the goals of the program have been reached. Flow charts of the progress made by the first three groups (which began classes in 1974, 1975, and 1976) can be seen in tables 5.1, 5.2, and 5.3. The most successful class was the first; approximately 40 percent of its initial enrollment completed the program (see table 5.1). Most of the drop-outs left at the first semester of the calculus level of the program. The remainder of the drop-outs from the class occurred because, unlike the first year, when the students are self-motivated and highly motivated by their parents, the second year finds many parents considering it a chore to transport their children on a weekly

TABLE 5.1. Progress of the First Fast-Math Class in Charles County

| Step in Selection | Criteria | Total Students | Mean | Standard Deviation | Percentage Proceeding to Next Step |
|---|---|---|---|---|---|
| Entered algebra I | SAT-M $\geq$ 500 | 23 | 520.00 | 54.51 | 100.0 |
| Algebra I: post-test | CMT $\geq$ 28/40 | 23 | 33.34 | 4.10 | 100.0 |
| Geometry: post-test | CMT $\geq$ 58/80 | 22 | 47.65 | 10.13 | 95.6 |
| Algebra II: post-test | Grade *A, B* | 22 | | | 95.0 |
| Trigonometry: post-test | Grade *A, B, C* | 21 | | | 91.3 |
| Analytic geometry: post-test | Grade *A, B* | 20 | | | 84.7 |
| College algebra: post-test | Grade 28/40 | 20 | 24.2 | 5.96 | 84.7 |
| Computer science: post-test | Grade *A, B* | 20 | | | 84.7 |
| Entered calculus | Grade *A, B* | 14 | | | 60.8 |
| Calculus: post-test | Grade *A, B* | 9 | | | 39.1 |

TABLE 5.2. Progress of the Second Fast-Math Class in Charles County

| Step in Selection | Criteria | Total Students | Mean | Standard Deviation | Percentage Proceeding to Next Step |
|---|---|---|---|---|---|
| Entered algebra I | PSAT-M ≥ 40 | 20 | 45.86 | 4.64 | 100.0 |
| | PSAT-V ≥36 | | 40.71 | 3.73 | |
| Algebra I: post-test | CMT ≥ 28/40 | 20 | 30.76 | 4.88 | 65.0 |
| Algebra II: post-test | CMT ≥ 26/40 | 13 | 29.92 | 4.94 | 65.0 |
| Geometry: post-test | CMT ≥ *A, B, C* | 13 | | | 45.0 |
| Trigonometry: post-test | Grade *A, B, C* | 9 | | | 35.0 |
| Analytic geometry: post-test | Grade *A, B* | 7 | | | 35.0 |
| College algebra: post-test | Grade 28/40 | 7 | 20.91 | 3.82 | 35.0 |
| Computer science: post-test | Grade *A, B* | 5 | | | |

TABLE 5.3. Progress of the Third Fast-Math Class in Charles County

| Step in Selection | Criteria | Total Students | Mean | Standard Deviation | Percentage Proceeding to Next Step |
|---|---|---|---|---|---|
| Entered algebra I | PSAT-M ≥ 40 | 16 | 28.76 | 4.73 | 100.0 |
| | PSAT-V ≥36 | | | | |
| Algebra I: post-test | CMT ≥ 28/40 | 16 | 33.07 | 3.64 | 87.5 |
| Algebra II: post-test | CMT ≥ 26/40 | 14 | 25.75 | 6.13 | 56.2 |
| Geometry: post-test | CMT ≥ *A, B, C* | 9 | | | 25.0 |
| Trigonometry: post-test | Grade *A, B, C* | 4 | | | 25.0 |
| College algebra: post-test | Grade 28/40 | 4 | 24.0 | 5.93 | 25.0 |
| Computer science: post-test | Grade *A, B* | 4 | | | |

basis to the class site, which is in excess of twenty miles from their homes.

While some of the students in the first class were college bound, their academic goals did not include a high level of mathematics. The preferred course was to enter the community college prior to setting fixed goals for future careers. Of the nine students who completed the calculus course, six students (one girl and five boys) attended a four-year college. Of the remaining three students, one girl attended community college, one girl married, and one boy entered the family business.

Originally seventh- and eighth-grade students were permitted to enter the program. Early in the development of the program, however, we found that many of the seventh-grade students dropped out while taking algebra II. Therefore at present only eighth-grade students are screened for this program. This accounts for the drop-out rate of the second class between algebra I and algebra II. There is also a significant rate of dropping-out between algebra II and college algebra (see figure 5.1). Both are evening courses. These students are also taking geometry in their day-time mathematics classes. The main cause of dropping the program for the

second class is peer pressure. Recognizing the opposite sex for the first time, not wanting to appear smarter than the boyfriend, and participation in sports are some of the other reasons given for dropping out. Approximately 5 percent of the student drop-outs are due to the individual's inability to cope with the content area or his or her unwillingness to work alone. The remaining classes follow the same pattern. In the second and third classes no students pursued calculus as part of this program. However, several students were college bound.

Each year this county has an average of eight students who complete the program through computer science, which is approximately 25 percent of the initial enrollment for that particular group. Charles County feels that this is a sufficient return for the investment in the program.

## Summary

"In retrospect the following five items seem needed for a successful class: (1) the identification of qualified, mathematically oriented, and highly apt students through appropriately difficult tests of mathematical and verbal reasoning ability and prerequisite achievement; (2) the selection of a bright, dynamic, assertive teacher who can create an atmosphere of fun and productivity while introducing the mathematical reasoner to challenging materials at a rapid-fire pace; (3) compatible learning styles between student and teacher; (4) the development of good study habits, learning new materials by doing homework well; and (5) voluntary participation and self-motivation by the students" (George 1976). All five of these ingredients can be found in the Fast-Math Program in Charles County. We are giving the students a better foundation in the knowledge of mathematics than they previously received. Our county is raising its standards so that we are reasonably equal to our peers in other counties in the state of Maryland and even in the nation. As a result, we have broadened our own educational system.

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