

One Small Step for the Mathematically Gifted

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An awareness seems to be emerging among educators that amid the present preoccupation with basic skills, minimum essentials and competency testing, a neglected minority in the schools are the talented students. However, in an inflationary economy, austere school budgets leave few resources for special programs. In Minnesota, a recent program demonstrated that some needs of certain mathematically talented pupils could be accommodated with modest provisions. The outcomes of that program have implications for mathematics educators elsewhere.

OVERVIEW OF THE MTYMP

The Minnesota Talented Youth Mathematics Project (MTYMP) is a program of the Minnesota State Department of Education. It was established as one phase of the Minnesota Component of the Multi-State Proposal for Gifted and Talented Students and was funded with a total budget of less than \$12,000. During its first year, 1976-77, 65 seventh, eighth and ninth grade pupils earned credit for two years of high school algebra in 29 weekly two-hour classes held outside the regular school day.

The MTYMP offered three special fast-paced mathematics classes, two in the Minneapolis-St. Paul metropolitan area and one in Duluth. These classes were modeled on similar accelerated classes offered by the Study of Mathematically Precocious Youth (SMPY) conducted at Johns Hopkins University (See Stanley, Keating and Fox, 1974; Keating, 1976). The SMPY is the most extensive recent program for mathematically talented youth, and the MTYMP is the first replication of the SMPY classes.

The MTYMP is coordinated by a part-time project director and is under the supervision of the Gifted Education Coordinator of the Minnesota State Department of Education. An advisory committee of 13 educators determines policy for the MTYMP, selects the MTYMP teachers, and assists in pupil selection and program implementation. The following decisions by the advisory committee helped shape the first MTYMP classes:

Participant Selection

The identification and selection of the MTYMP pupils began with a talent search during which qualified students were given a difficult test of

mathematical ability. As demonstrated by Stanley in the SMPY, ability tests designed for the students' respective grade levels are inadequate for extremely gifted pupils because the ceilings on such tests are too low. However, ability tests designed for senior high school or college students have been effective in helping to identify the extremely talented.

The population of primary interest were seventh and eighth graders since they have limited opportunities to study algebra in their home schools. However, since the number of qualified participants was initially unknown, the first talent search also was opened to ninth graders who had not yet completed Algebra I in order to assure a sufficient pool of perspective students. All public, parochial and private schools in the Twin Cities and Duluth metropolitan areas were invited to nominate for the talent search pupils with a score at or above the 97th percentile on an in-grade standardized test of mathematical ability or achievement. Over 500 pupils in the Twin Cities and another 150 in Duluth took part.

These pupils took the School and College Ability Test (SCAT), Series II, Form 2A (Educational Tests Service, 1973) and the top scoring pupils were invited to participate in the MTYMP. Forty-eight Twin Cities pupils (12 girls, 36 boys) accepted the invitation (25 seventh and eighth graders formed one class and 23 ninth graders formed the other). The Duluth class consisted of seventh, eighth and ninth graders (3 girls, 14 boys).

Curriculum

The general goal of the MTYMP was to accelerate the mathematics learning of extremely gifted junior high school students by providing them with the opportunity to complete two years of high school mathematics during one year of junior high school. After consultation with the MTYMP teachers, it was determined that the curriculum would offer a unified approach to Algebra I and Algebra II. Pupils received copies of both tests, but topics covered in the texts were developed in a unified fashion according to an instructional sequence determined by the teachers.

Pupils received lengthy assignments to complete between classes. Home schools of the pupils were asked to provide time for the pupils to work on these assignments during the school day, and schools were further advised that MTYMP pupils should not be required to enroll for the regular grade level mathematics courses. Arrangements with the home schools further stipulated that the MTYMP pupils would be required to score at the 88th percentile on a nationally standardized test of Algebra I and Algebra II as a criterion for being granted credit in the two courses by the home school.

Teacher Selection

The selection of teachers for the MTYMP classes was a high priority concern of the advisory committee. The committee determined that the teachers should be secondary school mathematics teachers and that interested persons should apply for the positions. No potential teachers were solicited by the committee.

Notices were sent to all junior and senior high schools in the two areas describing the positions and enumerating criteria which included successful experience in a variety of secondary mathematics positions and experience teaching mathematically talented students. Twenty-nine teachers who applied for the three positions were screened by the advisory committee. One junior high and two senior high school teachers were selected. In addition, three teaching assistants were hired to assist the teachers with paper grading, record keeping, individual student help, and other classroom duties.

OUTCOMES OF THE MTYMP

An extensive evaluation report (House, 1977) prepared for the State Department of Education concluded that the MTYMP was successful in achieving its goal of accelerating the algebra learning of very talented junior high school pupils. The following are some of the findings included in that report:

Readiness to Study Algebra

The question was raised of pupil readiness for studying algebra since many of the participants would skip one or two years of junior high school mathematics and, therefore, might lack certain essential knowledge or skills. To assess this readiness, a diagnostic test was administered at the first class period. The test selected was the Minneapolis Public Schools Minimum Essentials Test, Elementary Algebra, Semester I. An item analysis of pupil performance on this test enabled the MTYMP teachers to identify any topics of pre-algebra or of an introductory nature which needed development in class before proceeding with the integrated algebra curriculum.

Algebra Achievement

The instruments selected as criterion tests for granting credit in algebra were the Cooperative Mathematics Tests (Educational Testing Service, 1964) of Algebra I (COOP-I) and Algebra II (COOP-II). Both are 40 item tests, and for both tests a raw score of 30 corresponds to the required 88th percentile criterion.

The COOP-I test was administered in the spring and all 65 pupils at-

tained the 88th percentile. In fact, all but two attained the 95th percentile, and three-fourths of the entire group were at the 99th percentile on national norms.

The COOP-II criterion test was administered to 63 pupils on June 2, and 57 attained the required 88th percentile score. The six who did not were allowed to take a retest later using a parallel form of the COOP-II, and all six met the requirement. Only two pupils in the classes did not earn credit in Algebra II: one seventh grade boy who chose to drop from the MTYMP after earning credit in Algebra I and an eighth grade boy who dropped the course after a personal injury.

Course Grades and Credits

In addition to the achievement measures from the COOP tests, pupils were graded on their homework, weekly tests and class participation. Written progress reports were mailed to parents at the end of each ten weeks. Table 1 reports pupil progress as measured by the teachers' final grades in Algebra I and Algebra II.

TABLE 1
GRADES EARNED BY MTYMP PUPILS

	Final Grades					
	Algebra I			Algebra II		
	A	B	C	A	B	C
MTYMP-Twin Cities (7/8)	24	1	0	16	6	1
MTYMP-Twin Cities (9)	23	0	0	17	6	0
MTYMP-Duluth	17	0	0	15	2	0

DISCUSSION

The MTYMP program demonstrated that it is possible to accelerate the mathematics learning of highly capable junior high school pupils, and it lends additional support to the earlier findings of the SMPY. As such, it offers one alternative for extremely talented students. Several more specific findings also are significant.

First, the 527 pupils who took part in the Twin Cities talent search represented 72 public and non-public junior high schools, only one-third of the total of such schools. This was attributed to the extremely short time between the announcement of the talent search and the SCAT administration, an unavoidable situation brought about by receipt of funding after the beginning of the school year. Hence, the potential pool of talented pupils appears to be significant.

Further, seven schools (10 percent) accounted for 192 pupils or 36 percent of the talent search. These seven schools each sent between 21 and 49 pupils with qualifying scores. These numbers suggest that individual schools and local districts also should consider programming alternatives for the gifted.

A priority concern of the MTYMP was to attract qualified girls for the classes. Although 47 percent of the Twin Cities talent search participants were girls, only 25 percent of the MTYMP-Twin Cities pupils were female despite the decision by the advisory committee that whenever selection decisions were necessary between pupils with equal SCAT scores, consideration would be given to girls. In the MTYMP-Duluth class, 18 percent were girls.

From a curricular perspective, the MTYMP demonstrated that the unified approach to Algebra I and II can be a viable alternative for these students. It also suggests a need to identify and/or develop appropriate curriculum materials to facilitate this approach.

Since the pupils in the program have demonstrated a high level of mastery of algebra at an early age, it also appears that many of the regular high school mathematics courses will be inappropriate for them. Special attention will be needed to assure that appropriate alternatives are available to the students. Such alternatives may include arrangements for enrolling in mathematics in nearby senior high schools or colleges.

The MTYMP is by no means the only alternative for gifted pupils, nor does it claim to be such. However, it does represent one approach which could be implemented at minimal cost in dollars and time. Whatever its limitations, the MTYMP is significant in demonstrating that there are large numbers of mathematically gifted pupils whose needs can and should be met.

REFERENCES

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UNDERSEA NEUTRINO DETECTOR

An international group of scientists and engineers announced that there were no technical barriers to building an undersea neutrino detector in Hawaiian waters. One possible site is on the ocean floor some 35 miles north of the island of Maui.

Neutrinos are elementary particles which puzzle physicists. They interact so weakly that it is almost impossible to detect them or to gather information about them. They have no mass and no electrical charge.

The neutrinos can come from a number of sources but scientists are particularly interested in those coming from supernova explosions or from cosmic rays.

Scientists believe they can observe neutrinos by building a detector deep undersea to get away from all possible light. One scientist said putting the detector deep under water is similar to using the ocean as a pair of dark glasses to look at the sun.