

Eye on Evaluation



Evaluation and Research Department
Wake County Public School System, Raleigh, NC

E&R Report No. 96E.08
April, 1996

Should Students Take Algebra I in Middle School?

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Summary

About 40% of WCPSS students who take Algebra I in middle school do not enroll in the higher level courses expected of them in high school.

Algebra I is typically a ninth grade course but can be taken in middle school by students who want to complete more advanced math coursework, such as Advanced Placement Calculus, before they graduate from high school. Completion of Algebra I in seventh grade enables a student to complete two years of calculus prior to graduation. The number of WCPSS students taking Algebra I in middle school has increased in recent years.

Early enrollment in Algebra I may be counter-productive if a student experiences early frustration or failure and subsequently avoids academic paths that require higher level math skills.

In this study, 19-34% of the WCPSS students who enrolled in Algebra I in middle school did not earn a final grade of A or B, and 12-17% repeated the course. Four years after completing Algebra I, only 41% actually took Advanced Placement Calculus.

Iowa Algebra Aptitude Test and NC End-of-Grade Math Test scores are not adequate predictors of success in Algebra I. Teachers and parents need to consider a variety of indicators before choosing an accelerated course of study. Additional indicators might include a student's problem solving skills and whether or not the student is planning for a career that will benefit from early enrollment in college level mathematics courses while still in high school.

The North Carolina Standard Course of Study identifies Algebra I as a course typically taken by ninth-grade students. During the past five years in WCPSS, a growing number of students have chosen to take Algebra I in middle school, sometimes as early as sixth grade. The decision to enroll in Algebra I in middle school has important consequences for students, and some students may have difficulty in high school mathematics because they began the high school course sequence too early. This publication reviews some of the data compiled in a study of the performance of students who took Algebra I in middle school in 1990-91 and 1993-94.

Algebra I is the first of three mathematics courses required for admission to the University of North Carolina system, and the only higher mathematics course required statewide for high school graduation. Mastery of Algebra I concepts is considered crucial for success on the Scholastic Assessment Test (SAT) and in subsequent higher level mathematics courses.

Middle school enrollment in Algebra I grew rapidly from 940 students in 1990-91 to 2,044 students in 1993-94. In 1993-94 and 1994-95, approximately 5% of all seventh grade students and 30% of all eighth grade students took Algebra I.

There is a risk that students who enter Algebra I too early may experience frustration or failure, may get “turned off” by the challenges of higher mathematics courses, or may find themselves forced to enroll in courses that are more advanced than their interests require. At the end of fifth grade, students usually register for one of three sixth-grade mathematics courses: 6th Grade Math, Advanced 6th Grade Math, or Accelerated Math. Students who take Accelerated Math in sixth grade usually take Algebra I in seventh grade. Students who take Advanced 6th Grade Math usually take Algebra I in eighth grade. As shown in this report, some students who enter the Advanced Math or Accelerated Math course sequence might have been more successful in high school mathematics if they had delayed entry into Algebra I for an additional year.

Success Rates For Students Taking Algebra I In Middle School

The Middle School Course Guide stresses that middle school Algebra I is for students who have demonstrated “exceptional facility in mathematics.” Students who do not earn a final grade of A or B in Algebra I in middle school are often advised to repeat the course before progressing to Geometry or Algebra II. As shown in Table 1:

- Approximately 20% of both seventh grade and eighth grade Algebra I students in 1990-91 did not receive a final grade of A or a B;
- From 12% to 17% of middle school Algebra I students repeated the course the following year;
- In 1993-94, seventh grade Algebra I enrollment expanded to 353 students and the percentage *not* receiving an A or B remained at 19%, but eighth grade enrollment expanded to 1,580, and the percentage *not* receiving an A or B grew to 34%.

Table 1. Percentage of Algebra I Cohort Who Are Unsuccessful

	N	Final Grade Not A or B	Repeat Algebra. I
1990-91 Grade 7	102	19%	17%
1990-91 Grade 8	840	21%	12%
1993-94 Grade 7	353	19%	12%
1993-94 Grade 8	1,580	34%	16%

As shown, the large increase in middle school Algebra I enrollment between 1990-91 and 1993-94 was accompanied by an increase in the number of students who failed to earn an A or B in the course and may not have been well prepared for advanced mathematics courses in high school.

Math Courses Taken After Algebra I

Tables 2 and 3 summarize the math courses taken during the past five years by middle school students who took Algebra I in 1990-91. The recommended course path is shown in bold type, and leads students to Advanced Math/Pre-Calculus followed by Advanced Placement Calculus. As shown, about 60% of both the seventh grade and eighth grade 1990-91 Algebra I cohorts were taking Advanced Mathematics in 1993-94, three years after Algebra I. In 1994-95, about 54% of the seventh grade cohort and 39% of the eighth grade cohort were taking AP Calculus. About 40% of both cohorts either repeated a math course during the four years or moved out of honors courses and enrolled in Algebra III.

Table 2. Percentage of Seventh Grade Algebra I Students Who Took Various Math Courses in Subsequent Years

Grade 7 1990-91		Grade 8 1991-92		Grade 9 1992-93		Grade 10 1993-94		Grade 11 1994-95	
N=102		N=100		N=97		N=85		N=76	
Alg I	100	Alg I	17	Alg I	1	Alg I	0	Alg I	0
		Geom H	83	Geom	7	Geom	5	Geom	0
				Geom H	9	Geom H	0	Geom H	0
				Alg II	23	Alg II	7	Alg II	3
				Alg II H	55	Alg II H	11	Alg II H	0
				Alg III	1	Alg III	15	Alg III	8
				AdvM/PreC	4	AdvM/PreC	58	AdvM/PreC	7
						Intro CM	1	Intro CM	25
						AP Calculus	4	AP Calculus	54

Table 3. Percentage of Eighth Grade Algebra I Students Who Took Various Math Courses in Subsequent Years

Grade 8 1990-91		Grade 9 1991-92		Grade 10 1992-93		Grade 11 1993-94		Grade 12 1994-95	
N=840		N=830		N=802		N=711		N=659	
Alg I	100	Alg I	12	Alg I	1	Alg I	<0.5	Alg I	0
		Geom.	33	Geom	8	Geom	1	Geom	<0.5
		Geom H	54	Geom H	3	Geom H	0	Geom H	0
		Alg II	0	Alg II	28	Alg II	8	Alg II	<0.5
		Alg II H	1	Alg II H	58	Alg II H	3	Alg II H	0
				Alg III	<0.5	Alg III	26	Alg III	10
				AdvM/PreC	1	AdvM/PreC	60	AdvM/PreC	5
						Intro CM	<0.5	Intro CM	45
						AP Calculus	1	AP Calculus	39

Notes regarding course names: H indicates honors levels for Geometry and Algebra II.
 Adv M/PreC is Advanced Math, the honors level course following Alg. II H.
 Intro CM is Introduction to College Math, an honors level alternative to Calculus.

Predicting Success in Algebra I

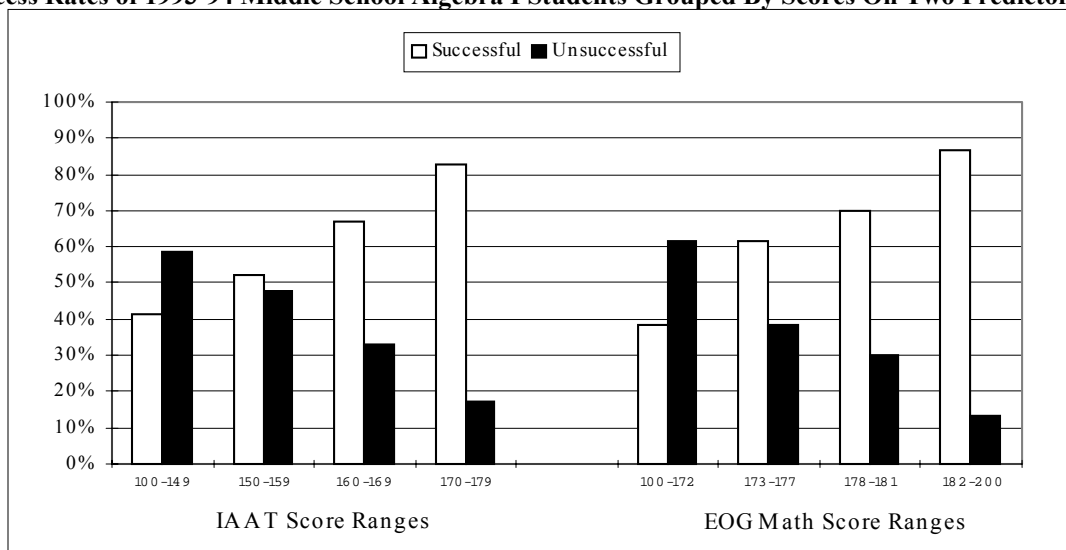
Screening for placement in Algebra I in middle school currently relies heavily upon the results of the Iowa Algebra Aptitude Test (IAAT), which is taken near the end of sixth or seventh grade Accelerated Math, and by eighth and ninth grade students who have not yet taken Algebra I. Parents and teachers of fifth-grade students often use the results of the North Carolina End-of-Grade (EOG) test when considering whether or not to enroll a child in Accelerated Math. Regrettably, as shown below, neither test serves as a very good predictor of success in Algebra I.

Statistical correlations between the IAAT or EOG and the Algebra I End-of-Course test (one measure of a student's success in Algebra I) were moderately positive, ranging from .36 to .49. However, we can see in Figure 1 that placement decisions based solely upon the predictor tests would have inappropriately excluded many low-scoring students who went on to be successful, while including high-scoring students who were subsequently unsuccessful.

For both predictor tests, the proportion of students who were successful in Algebra I (defined as a final grade of A or B followed by enrollment in Geometry the following year) increased as scores rose on the predictor test. However, some students in the top range of scores on the predictor tests were unsuccessful in Algebra I, and a large percentage of the students who scored

in the bottom two ranges were ultimately successful. Reliance solely on the pretest scores would block some students from the course who may be successful, while encouraging other students who would probably benefit from waiting an additional year.

Figure 1.
Success Rates of 1993-94 Middle School Algebra I Students Grouped By Scores On Two Predictor Tests



Limitations and Recommendations

Interpretation of the data presented in this report should be limited by the observation that lack of success in high school may be due to a variety of factors unrelated to a student's aptitude or achievement in mathematics. Motivation, community, family, and socio-economic factors were not studied. Correlations between the predictor tests and EOC test scores may actually be higher than reported because of the truncated distribution of the predictor test scores. Even with these restrictions, several recommendations seem appropriate:

Teachers and counselors can help students and parents decide when to begin Algebra I by:

- Advising them to study the high school course sequence and consider the long-range impact of early entry into Algebra I;
- Helping them consider indicators of math proficiency that go beyond standardized test scores such as a child's performance on problem solving tasks that indicate sophistication in problem solving and abstract reasoning.

In addition, WCPSS can respond to the increased interest in early entry into Algebra I by:

- Considering whether alternative instructional approaches might be more successful with younger algebra students (e.g. the Process Algebra approach already used in some schools);
- Developing improved screening checklists or decision-making guides to assist fifth-grade and middle school teachers as they communicate with students and parents.