Is Summer School Effective for Remediation in Algebra I?

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For students who failed Algebra in 1994-95, repeating the course in summer school was as effective as repeating the course the next school year in improving students' knowledge. End-of-Course test scores improved for both groups (with no significant differences between the groups), and students who took the course during summer school were more likely to pass than those repeating the course during the regular school year.

Successful completion of Algebra I is now a requirement for graduation (General Statute 115C-81, adopted in 1996). In 1993-94, 10.11% of our graduates did not pass Algebra I prior to graduation. Analyses are being conducted now to update these figures for more recent students. Students who do not pass Algebra I receive a Certificate of Attendance instead of a diploma.

What is the best way to help students master Algebra I after initial failure? Is summer school as effective as repeating the course during the regular school year? This Research Watch summarizes the results of a dissertation that focused on the success of WCPSS students who failed Algebra I in 1994-95 and re-took it during the 1995 summer school session or the 1995-96 regular school year (Alford, 1999). Success was defined by three measures of student learning: pass/fail rates, NC End-of-Course (EOC) test scores, and final letter grades. We hope these results can influence both summer school policy and instruction during the year.

What Do We Know about Remedial Mathematics in Summer School?

There is a dearth of research specifically regarding remedial mathematics programs within summer school (Ascher, 1988; DeLong, 1992). Moreover, diversity in scope, goals, size, content, duration, evaluation, and participants makes it difficult to accurately describe the status of summer school programs in the United States (Heyns, 1986).

Summer schools, at best, were found to have mixed effectiveness in improving student achievement in various studies (Carruthers, 1991; North Carolina Department of Public Instruction, 1988; Austin Independent School District, 1983; District of Columbia Public Schools, 1983; and Albuquerque Public Schools, 1985).

However, in a study of public secondary summer schools in the Midwest, summer schools were found to be efficient and productive if they have effective components in the areas of administration, teaching, and learning (DeLong, 1992).

Marcia Alford, who also served as Director of Summer School Programs for several years in WCPSS, observed the following similarities and differences in the way Algebra I is taught during the summer and during the year (personal communication, March, 2000).

- Both cover the full North Carolina curriculum.

- Flexibility and pacing vary. Pacing is faster for the easier beginning material during the summer compared to the regular school year. On the other hand, summer school is less flexible in that teachers are provided with day-to-day guides of material to cover, quizzes and tests to use, and a suggested formula for computing grades; regular school year teachers have more freedom to use their judgment in these areas.

- Class sizes are typically smaller during summer school. For Alford's dissertation study, the average class size was 19 rather than approximately 28 during the regular school year.

- The time allotted to the course is greater during the regular school year (approximately 175 hours as opposed to about 75 hours in summer school). However, Algebra I meets only 55 minutes a day during the year rather than five hours a day in the summer. Thus, summer school provides a much more intensive focus on one subject at a time.

- Although teachers in both settings tend to use a mixture of teaching methods, summer school teachers are less likely to use straight lecture with such a long time block. (The dissertation reported here focused on students' knowledge of Algebra I and obtained too little data on teaching strategies to truly study differences in methods or time allotments to various methods.)

- The mix of students is more homogeneous in the summer, with only students who failed the course eligible to participate.

Methodology and Data[1]

Alford's (1999)-dissertation study compared summer school and regular school year outcomes for students repeating Algebra. The variables examined are as follows.

- Three different measures of performance served as outcome variables: pass/fail rates course letter grades, and Algebra I End-of-Course (EOC) Mathematics Test scores. The May 1995

[1] The data were analyzed with Generalized Linear Modeling (GLM), t-tests, Chi-squared procedures, and Cochran-Mantel-Haenszel methods to test for similarities between the two groups and differences in outcomes.

EOC scores served as the pretest; May 1996 EOC scores from summer school or regular year served as the posttest.

- Descriptive variables that were examined include the type of school session during which remediation programs were taken (summer school or regular school year), gender, ethnicity, socioeconomic status (SES), special programs category, grade level, and the 1995 EOC score.

- 58 students in the study attempted remediation during the 1995 summer session; 89 students attempted remediation during the 1995-1996 regular school year.

How Do These Algebra I Summer School Students Compare to Regular Year Students?

- Results revealed no significant differences in the two groups with respect to various pretest measures such as the eighth grade EOG Mathematics scale scores and Iowa Algebra Aptitude Test scores; 1995 Algebra I EOC scale scores; special education categories; free- and reduced-price lunch; gender; ethnicity; or grade level.

- Students were **significantly less likely to fail Algebra during the 1995 summer school session** (8.9%) than during the 1995-1996 regular school year (42.3%). This result did not change after controlling for the other independent variables.

Pass/Fail Rates for
Students Repeating Algebra I

Group	Statistic	Fail	Pass	Total
Summer	Frequency	5	51	
	Percent	8.9%	91.1%	56
Regular Year	Frequency	33	45	
	Percent	42.3%	57.7%	78
Total	Frequency	38	96	
	Percent	28.4%	71.6%	134

Note: Chi-square probability level 0.001

- There was **no significant difference** (based on a t-test at the .05 level) **in the mean posttest Algebra I EOC test scores** between summer school students and regular school year students. This result did not change after controlling for the other independent variables.

- The 1995 Algebra I scale score was the most important positive factor in predicting posttest scale scores, i.e., success or failure in remediation.

Algebra I EOC Test Scores Before and After Remediation

Group	# Students	Pretest Mean	Posttest Mean	Standard Deviation
Summer	58	46.52	56.12	5.48
Regular Year	77	45.72	53.95	8.00

Note: t-test probability level 0.0635

- Summer school students were **significantly more likely to receive Bs and Cs** as grades (62.5%) than regular school year students (33.3%).

- Overall, summer school students had **significantly higher grades** in remediation than students in the regular school year. This result did not change after controlling for the other independent variables.

Algebra I Letter Grades

Group	Statistic	A	B	C	D	F	Total
Summer	Frequency	0	8	27	16	5	
	Percent	0%	14.3%	48.2%	28.6%	8.9%	56
Regular Year	Frequency	0	4	22	19	33	
	Percent	0%	5.13%	28.2%	24.4%	42.3%	78
Total	Frequency	0	12	49	35	38	
	Percent	0%	9.0%	36.6%	26.1%	28.4%	134

Note: Cochran-Mantel-Haenszel probability level 0.001

Summary of Findings

- WCPSS students who failed Algebra I and attempted remediation either during the 1995 summer school session or the 1995-1996 regular school year were very similar in terms of special education status, free/reduced-price lunch status, gender, ethnicity, and 1995 EOC test scores.

- Students were significantly more likely to ***pass*** Algebra I when they repeated the course during the 1995 summer school session than during the regular school year. Summer school students were significantly more likely than regular school year students to receive Bs and Cs and were less likely to receive Fs. Students repeating Algebra I during the summer school session had significantly higher letter grades than students who repeated Algebra I during the regular school year.

- Analyses of mean Algebra I EOC test scores between summer school students and regular school year students revealed similar scores, but slightly higher for summer school (56.1)

than regular school year student's (53.9). Differences in scores were not statistically significant.

Conclusions

This study showed that a significantly higher percentage of students passed Algebra I and made higher grades when it was taken in summer school rather than in the regular school year. At the same time, EOC scores indicate similar levels of learning in both settings, even though summer school provides fewer hours of instruction. This result suggests that summer school is an effective option for students to receive credit for Algebra I, which is now a graduation requirement. Policies and administrative procedures should be structured to provide continued support for the high school summer school program for Algebra I.

One policy implication for instruction during the year is the possibility of a shorter version of Algebra I for those repeating the course (either during or outside the regular school day). Instructional techniques and pacing might be adjusted to serve these students more appropriately. Further study of differences in instructional techniques used in summer school versus the regular year would be helpful.

Finally, it is not known how well students who repeat Algebra I in summer school and the regular school year perform on subsequent mathematics courses. A follow-up study on these students would help determine whether summer school remediation is effective in preparing students for higher-level mathematics courses.

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