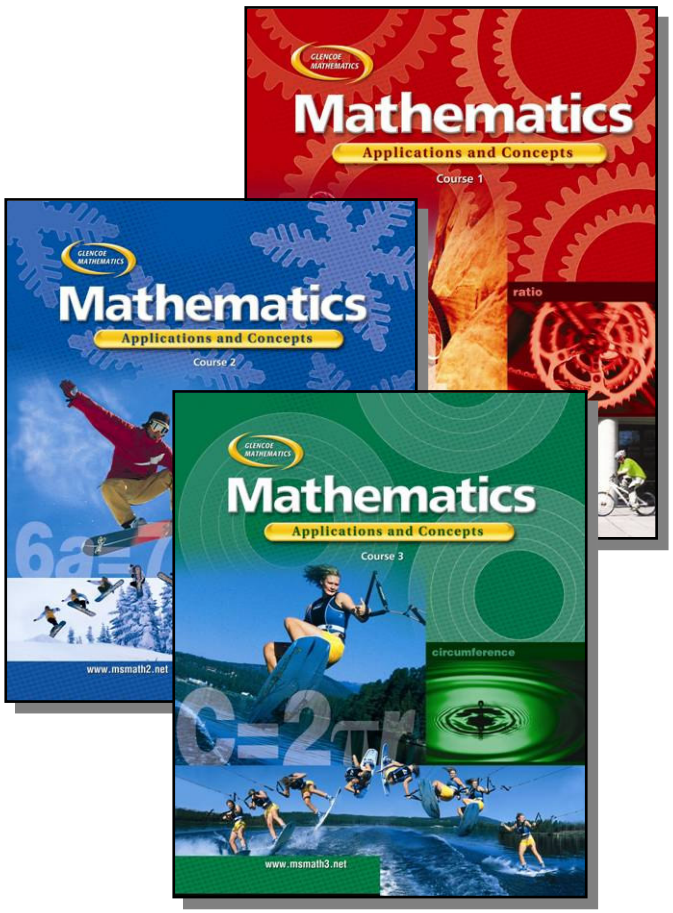
GLENCOE MATHEMATICS

RESEARCH SUMMARY FOR

Mathematics: Applications and Concepts, Course 1-3



The McGraw-Hill Companies

Mc Graw Hill Glencoe

Study Objective and Methodology

This study measures the effectiveness of *Mathematics: Applications and Concepts ©2004*, a middle school algebra program published by Glencoe/McGraw-Hill.

Teachers who participated in this study administered a pre-test prior to teaching Chapter 4, Algebra: Linear Equations and Functions from *Mathematics: Applications and Concepts ©2004*. To assess student progress, a post-test was administered after the chapter was taught. The results of these tests, which appear in the appendix, are included in this report.

All of the participating teachers currently use an earlier version of the Glencoe program.

Approximately 581 students in Grades 6, 7, and 8 participated in this research. Most (81 percent) were in Grade 7. The students were enrolled in five schools: one in an urban community, two in suburban communities, and two in rural communities. The schools were located in five states: Colorado, Indiana, Michigan, Missouri, and Oklahoma.

Forty-nine percent of the participating students were boys and 51 percent were girls. Twenty-two percent were minorities.

Throughout this report, the primary measure of student performance is "Gap Reduction Percentages" (GRPs). GRPs reflect the degree to which students have succeeded in closing the gap between the average pre-test score and a perfect score, as reflected by the post-test. Specifically, GRPs are calculated using the following formula:

$$\text{GRP} = \frac{\text{Average post-test score} - \text{Average pre-test score}}{100\% - \text{Average pre-test score}}$$

A GRP of 0 percent means that student performance did not improve from pre-test to post-test. A GRP of 50 percent means that students have closed half the gap between the average pre-test score and a perfect score. For example, an average pre-test score of 50 percent followed by an average post-test score of 75 percent yields a GRP of 50 percent. In other words, the gap between the average pre-test score and a perfect score has been closed by half. Of course, a GRP of 100 percent means that the gap between the average pre-test score and a perfect score has been eliminated entirely.

The GRP was formulated to measure performance because percentage change, a more typical measure, is unduly influenced by the pre-test score. For example, a post-test score of 90 percent yields a percentage change of only 12 percent if the pre-test score is 80 percent. By contrast, a post-test score of 40 percent yields a percentage change of 33 percent if the pre-test score is 30 percent. In these examples, a ten percentage point increase yields very different and potentially misleading percentage change figures. GRPs attempt to eliminate this variability which occurs because high pre-test scores minimize the possibility of significant percentage changes, while low pre-test scores all but ensure them.

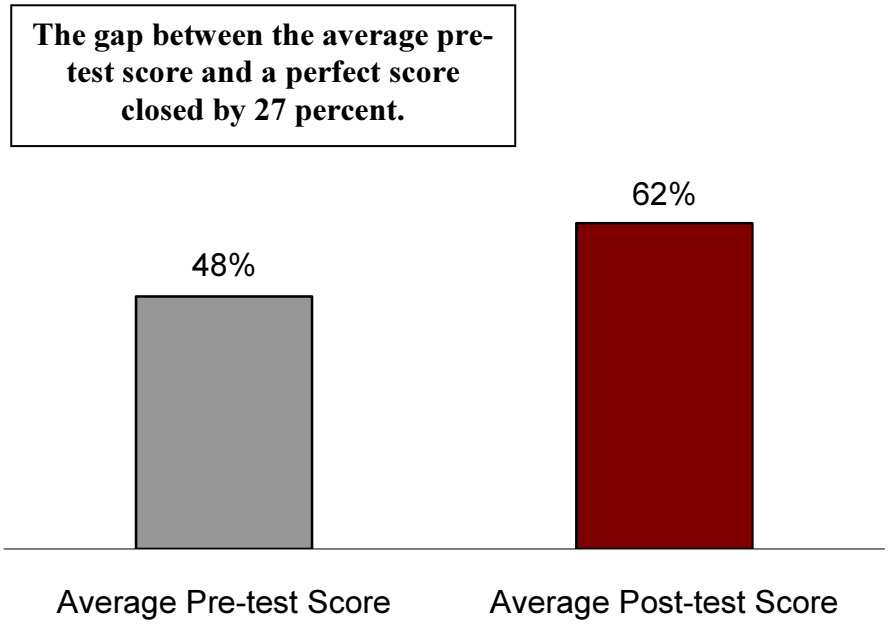
Consider another example. Average pre- and post-test scores of 20 percent and 80 percent, respectively, yield a percentage change of 300 percent and a GRP of 75 percent. Average pre- and post-test scores of 60 percent and 90 percent, respectively, yield a much lower percentage change of 50 percent, but the same GRP of 75 percent. The latter is true because in both cases, the gap between the average pre-test score and a perfect score closed by three-quarters.

Top-line Results

- The research indicates that test scores significantly increased among students using *Mathematics: Applications and Concepts ©2004*.
- Roughly three out of four students earned higher scores after using the Glencoe program.
- The program was equally effective with:
    - Boys and girls; and
    - Minority and non-minority students.
- Overall, the gap between the average pre-test score and a perfect score closed by 27 percent. Stated differently, on average, scores increased 29 percent after students used the Glencoe program.

"The program takes the material at a perfect pace."

"This was an exceptional chapter."



Overall Performance

Five hundred eighty one students at five middle schools completed pre- and post-tests. Students were tested only on Chapter 4, Algebra: Linear Equations and Functions.

An analysis was performed on the pre- and post-test scores to determine the GRP – the extent to which the gap between the average pre-test score and a perfect score was closed by the post-test.

A test of significance (t-test) was used to determine whether the results from the post-test are significantly different from the pre-test results (i.e., a difference large enough not to be expected by chance). On average, **the resulting t-test value indicates that the scores from the post-test are significantly higher than the pre-test scores.** The results of the t-test can be found in Table 1(T).

Table 1(T) Total	n	Average Pre-test Score	Average Post-test Score	
All students	581	48%	62%	$t(580) = 18.232$, $p < .05$

GRP and Gender

Improvement from pre-test to post-test for boys and girls as measured by GRP was tested for a significant difference using a t-test. The results are listed in Table 2(T). On average, **boys and girls closed the gap between the average pre-test score and a perfect score almost equally.**

Table 2(T) Gender	n	Average Pre-test Score	Average Post-test Score	Average GRP	
Boys	284	46%	61%	28%	
Girls	297	49%	64%	29%	$t(579) = 0.060$, $p > .05$

GRP and Race

Improvement from pre-test to post-test for minority and non-minority students as measured by GRP was tested for a significant difference using a t-test. The results are listed in Table 3(T). On average, **minority students and non-minority students closed the gap between the average pre-test score and a perfect score almost equally.**

Table 3(T) Race	n	Average Pre-test Score	Average Post-test Score	Average GRP	
Minority	127	45%	58%	24%	
Non-minority	454	48%	64%	31%	$t(579) = 1.295$, $p > .05$

School A

School A is a public, rural middle school in Indiana. Approximately 20 percent of the families in the school district fall below the poverty line. Approximately three percent of the students are minorities.

Two teachers from School A participated in this research. Teacher A-1 has 34 years of experience and has taught math for six. All of her students are in Grade 7. Half (50 percent) are female and half (50 percent) are male. These students are 12 to 14 years old, and six percent are minorities. Her colleague, Teacher A-2, has 13 years of experience and has taught math throughout his career. All of his students are in Grade 7. Four out of nine (44 percent) are female and five out of nine (56 percent) are male. These students also are 12 to 14 years old, and three percent are minorities.

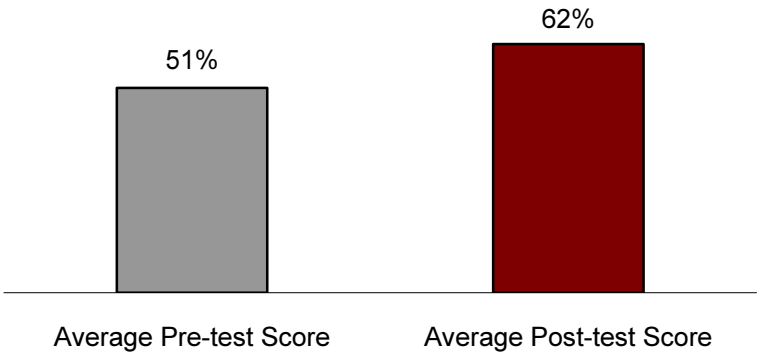
Overall Performance

At School A, approximately 143 students completed pre- and post-tests. The results from each participating teacher are listed in Table 1(A). **Students at School A closed the gap between the average pre-test score and a perfect score by 22 percent.**

Table 1(A) Teacher	Number Of Students	Average Pre-test Score	Average Post-test Score	Pre-test Gap (100% - Average)	Post-test Gap (100% - Average)	GRP
A-1	66	50%	56%	50%	44%	12%
A-2	77	52%	67%	48%	33%	31%
School A	143	51%	62%	49%	38%	22%

A test of significance (t-test) was used to determine whether the results from the post-test are significantly different from the pre-test results (i.e., a difference large enough not to be expected by chance). The resulting t-test value indicates that, on average, **the scores from the post-test are significantly higher than the pre-test scores.** The results of the t-test can be found in Table 2(A).

Table 2(A) Total	n	Average Pre-test Score	Average Post-test Score	
School A	143	51%	62%	$t(142) = 7.105$, $p < .05$



School B

School B is a public, urban middle school in Oklahoma. Approximately 31 percent of the families in the school district fall below the poverty line. Approximately 68 percent of the students are minorities (36 percent African-American).

The participating teacher at School B has 12 years of experience and has taught math for five. All of her students are in Grade 8. Half (50 percent) are female and half (50 percent) are male. These students are 13 to 15 years old, and 72 percent are minorities.

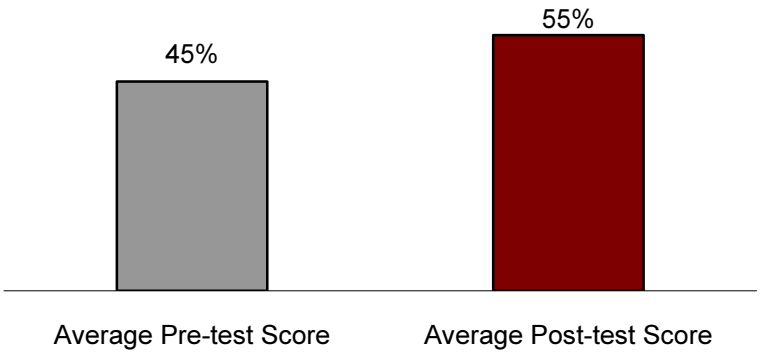
Overall Performance

At School B, approximately 105 students completed pre- and post-tests. The results of these tests are listed in Table 1(B). **Students at School B closed the gap between the average pre-test score and a perfect score by 18 percent.**

Table 1(B) Teacher	Number Of Students	Average Pre-test Score	Average Post-test Score	Pre-test Gap (100% - Average)	Post-test Gap (100% - Average)	GRP
B-1	105	45%	55%	55%	45%	18%

A test of significance (t-test) was used to determine whether the results from the post-test are significantly different from the pre-test results (i.e., a difference large enough not to be expected by chance). The resulting t-test value indicates that, on average, **the scores from the post-test are significantly higher than the pre-test scores.** The results of the t-test can be found in Table 2(B).

Table 2(B) Total	n	Average Pre-test Score	Average Post-test Score	
School B	105	45%	55%	$t(104) = 4.582, p < .05$



School C

School C is a public, suburban middle school in Missouri. Approximately two percent of the families in the school district fall below the poverty line. Approximately 33 percent of the students are minorities (27 percent African-American).

Two teachers from School C participated in this research. Teacher C-1 has 13 years of experience and has taught math throughout her career. The majority of her students are in Grade 7 (91 percent). Four out of nine (44 percent) are female and five out of nine (56 percent) are male. Among these students, 32 percent are minorities. Her colleague, Teacher C-2, has 15 years of experience and has also taught math throughout her career. All of her students are in Grade 7. Five out of nine (56 percent) are female and four out of nine (44 percent) are male. Among these students, 28 percent are minorities.

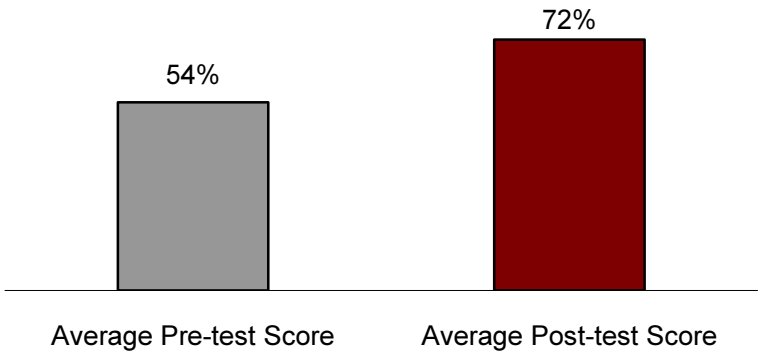
Overall Performance

At School C, approximately 59 students completed pre- and post-tests. The results from each participating teacher are listed in Table 1(C). **Students at School C closed the gap between the average pre-test score and a perfect score by 39 percent.**

Table 1(C) Teacher	Number of Students	Average Pre-test Score	Average Post-test Score	Pre-test Gap (100% - Average)	Post-test Gap (100% - Average)	GRP
C-1	34	60%	74%	40%	26%	35%
C-2	25	46%	71%	54%	29%	46%
School C	59	54%	72%	46%	28%	39%

A test of significance (t-test) was used to determine whether the results from the post-test are significantly different from the pre-test results (i.e., a difference large enough not to be expected by chance). The resulting t-test value indicates that, on average, **the scores from the post-test are significantly higher than the pre-test scores.** The results of the t-test can be found in Table 2(C).

Table 2(C) Total	n	Average Pre-test Score	Average Post-test Score	
School C	59	54%	72%	$t(58) = 6.735$, $p < .05$



School D

School D is a public, suburban middle school in Colorado. Approximately three percent of the families in the school district fall below the poverty line. Approximately seven percent of the students are minorities.

The participating teacher at School D has 12 years of experience and has taught math throughout his career. All of his students are in Grade 7. Half (50 percent) are female and half (50 percent) are male. These students are 12 to 14 years old, and 12 percent are minorities.

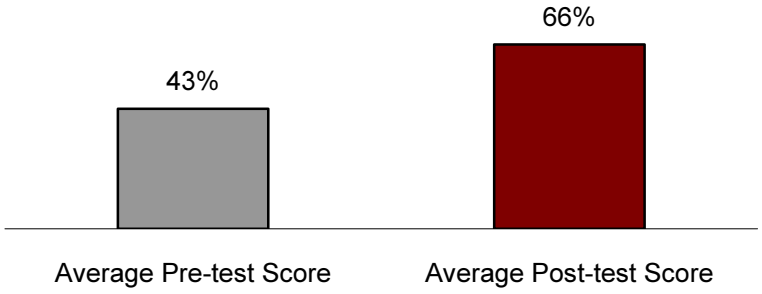
Overall Performance

At School D, approximately 74 students completed pre- and post-tests. The results of these tests are listed in Table 1(D). **Students at School D closed the gap between the average pre-test score and a perfect score by 40 percent.**

Table 1(D) Teacher	Number Of Students	Average Pre-test Score	Average Post-test Score	Pre-test Gap (100% - Average)	Post-test Gap (100% - Average)	GRP
D-1	74	43%	66%	57%	34%	40%

A test of significance (t-test) was used to determine whether the results from the post-test are significantly different from the pre-test results (i.e., a difference large enough not to be expected by chance). The resulting t-test value indicates that, on average, **the scores from the post-test are significantly higher than the pre-test scores.** The results of the t-test can be found in Table 2(D).

Table 2(D) Total	n	Average Pre-test Score	Average Post-test Score	
School D	74	43%	66%	$t(73) = 10.025$, $p < .05$



School E

School E is a public, rural middle school in Michigan. Approximately 19 percent of the families in the school district fall below the poverty line. Approximately four percent of the students are minorities.

Three teachers from School E participated in this research. Teacher E-1 has 32 years of experience and has taught math throughout her career. All of her students are in Grade 7. Two-thirds are female (65 percent) and one-third is male (35 percent). These students are 11 to 13 years old, and 14 percent are minorities. Her colleague, Teacher E-2, has 16 years of experience and has also taught math throughout her career. All of her students are in Grade 7. Half (51 percent) are female and half (49 percent) are male. These students are 12 and 13 years old, and five percent are minorities. Their colleague, Teacher E-3, has five years of experience. All of her students are in Grade 7. Half (49 percent) are female and half (51 percent) are male. These students are 11 to 13 years old, and seven percent are minorities.

Overall Performance

At School E, approximately 200 students completed pre- and post-tests. The results from each participating teacher are listed in Table 1(E). **Students at School E closed the gap between the average pre-test score and a perfect score by 30 percent.**

Table 1(E) Teacher	Number Of Students	Average Pre-test Score	Average Post-test Score	Pre-test Gap (100% - Average)	Post-test Gap (100% - Average)	GRP
E-1	79	51%	66%	49%	34%	31%
E-2	80	52%	63%	48%	37%	23%
E-3	41	29%	54%	71%	46%	35%
School E	200	47%	63%	53%	37%	30%

A test of significance (t-test) was used to determine whether the results from the post-test are significantly different from the pre-test results (i.e., a difference large enough not to be expected by chance). The resulting t-test value indicates that, on average, **the scores from the post-test are significantly higher than the pre-test scores.** The results of the t-test can be found in Table 2(E).

Table 2(E) Total	**n**	**Average Pre-test Score**	**Average Post-test Score**	
School E	200	47%	63%	$t(199) = 13.290$, $p < .05$