THE EFFECTS ON STUDENT ACHIEVEMENT OF USING HOMEWORK AND TEST SCORES FOR DETERMINING GRADES

by 2214

ARTHUR ERNEST SCHWIETHALE, JR.

B.S., Kansas State Teachers College, Emporia, 1962

A MASTER'S REPORT

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

College of Education

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1971

Approved by:

J. Harvey Littrell

Major Professor

TABLE OF CONTENTS

Page

LIST OF TABLES iii

Chapter

1. INTRODUCTION 1
2. REVIEW OF RELATED LITERATURE 4
3. PROCEDURES 7
4. RESULTS 11
5. SUMMARY 21

BIBLIOGRAPHY 23

APPENDIXES 26

A. Objectives 27
B. Post-Tests 29

LIST OF TABLES

Table		Page
1.	Factors Used to Determine Students' Grade .	10
2.	Means, Standard Deviation, and Intercorrelations Among the Variables for Class A .	12
3.	Means, Standard Deviation, and Intercorrelations Among the Variables for Class B .	13
4.	Means, Standard Deviation, and Intercorrelations Among the Variables for Class C .	14
5.	Means, Standard Deviation, and Intercorrelations Among the Variables for Class D .	15
6.	Treatment Means, Analysis of Variance and Analysis of Covariance for Unit 1 Test .	16
7.	Treatment Means, Analysis of Variance and Analysis of Covariance for Unit 2 Test .	18

Chapter 1

INTRODUCTION

During the past decade, education has experienced many changes. These changes are brought about as our nation discovers new things, thus demanding that schools educate people to fulfill the needs of our nation. The student of today needs to learn where and how he may obtain facts rather than to learn all of the facts that are set before him. This causes the teacher to change his role from teaching facts to teaching the student how to apply the knowledge that he has learned to his life.

Within the rapidly changing curriculum of the secondary school are found many structures that are not traditional in nature. Team-teaching, continuous progress, individualized instruction, independent study, and the non-graded plan are only a few of the non-traditional structures that are emerging in education today. But with an instructional organization, there is the problem of evaluating the abilities and achievements of the student.

There is widespread and increasing vocal unrest across the nation regarding student achievement, but the furor has

been directed mainly at the traditional grading system.[1] Typically, the teacher will average a few scores of test and homework papers, and then make his evaluation.

This study was designed to determine the effects of using homework and/or test scores in determining student grades on student achievement in mathematics.

The study was conducted at South Junior High School, Salina, Kansas, during a seven-week period at the end of the school year. The sample consisted of four classes of eighth grade mathematics students. These classes had been taught by the author for the entire year. All classes studied the same two units from their textbook. The first unit lasted four weeks and the second unit three weeks.

The composition of two of the classes had been the same throughout the entire school year. The composition of the other two was the result of a reorganization at the beginning of the second semester.

The author was part of a team-teaching section consisting of English, history, and mathematics. At the beginning of the second semester, the teachers of this team regrouped the students. This was done because the teachers felt that there was a group of twenty-five students needing remedial work

---

[1]Wesley J. Dale, "Concerning Grading and Other Forms of Student Evaluation" (A talk presented during a panel on Grading and Other Evaluations of Student Achievement during the Ninth Annual Meeting of the Council of Graduate Schools in the United States, December 4-6, 1969, Washington, D.C.)

in these subjects. The regrouping was made on the basis of their first semester grades for these subjects. The top two classes of this regrouping were used in this study.

The first class (class A) had both homework and test scores used to determine their grades for a unit. The second class (class B) had only test scores used to determine their unit grades. This class had homework, but it was not used in determining the unit grade. The third class (class C) had only homework used to determine their unit grades, although they took tests. The fourth class (class D) did homework and took tests, but neither were used to determine their unit grades. Their grades were determined by agreement in a teacher-student conference.

Each class was given a pre-test over the unit just prior to beginning the unit. After studying the unit, they were given a post-test. The post-tests were used to measure student achievement.

Chapter 2

REVIEW OF RELATED LITERATURE

A close scrutiny of the conventional marking system divulges many weaknesses. For instance, does the mark of A in a subject mean that the student is excelling in relation to his own potential or in comparison to the other students in the class? Is this A comparable to an A in other classrooms in the same school and to an A given in other schools in the same community? Actually, the mark of A means different things in different sections of the country and even in different schools in the same section, as well as in different classrooms and in different subjects in the same school.

Universally, students' marks which are given by teachers are influenced by factors other than their academic performance. The major influencing factors are penmanship, conduct, participation, and attendance.[2]

It is felt that grades do not accurately reflect either performance, or even potential for performance.[3] Many are familiar with the great variations among teachers in their

---

[2]B. Frank Brown, The Nongraded High School (Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1963), p. 178.

[3]David S. Sparks, "Grading and Student Evaluation" (A talk presented during a panel on Grading and Other Evaluations of Student Achievement during the Ninth Annual Meeting of the Council of Graduate Schools in the United States, December 4-6, 1969, Washington, D.C.).

degree of faith in grading practices. Generally, teachers and students in the natural sciences have more confidence in the objectivity, and hence the accuracy, of conventional grades than do those in the humanities and social sciences where grades are more likely to contain elements of subjectivity.

Students and the public tend to take grades at face value, and rightly so. They know that many of the rewards and punishments of academic life are distributed on very precise calculation of academic averages.[4] Students have learned that admission into colleges, universities, and even advanced standing within their own school is too frequently determined on the basis of average grades calculated to the second decimal point.

Many critics of the current grading system feel that the power to grade is the ultimate weapon in the hands of the teacher to determine the content of the course. They argue that it constitutes an intolerable form of tyranny over the minds of students. Learning takes place, they contend, only in an atmosphere of complete and mutual trust between teacher and student.[5]

Paul Goodman expresses an interesting proposition:

> Why do the teachers grade at all? (It happens that a few schools do not grade and manage well enough, and some teachers in many schools nullify the process by giving all A's or C's. We know that the grading is

---

[4] Ibid.

[5] Ibid.

dispensable.)

> I remember an incident at a big Western university, where I sat at lunch with six senior professors, including chairmen of departments. The subject of grading came up, and all were unanimous in the opinion that grading is injurious to both teaching and learning. It does not work, they said, as competition, but rather alienates the peer group and makes for cheating and sabotage. At the very first lecture, the student will ask, "Are we responsible for that on the final examination?" and the teacher's heart sinks. Grading destroys the use of testing, which is a good method of teaching if one corrects the test but does not grade it. Students like to be tested, to give structure to their studying and to know where they are; if tested but not graded, they are eager to learn the right answers and they ask how to solve the problem. But if graded, they are either puffed up or they are crestfallen and gripe that they have been badly treated. The teacher uses tests as a diagnostic, both of what is blank to the student and of what he himself is failing to get across. Even pass or fail are not necessary grades, for if a student isn't working, he should be fired out of the class. So they talked on.[6]

No further information related to the effects of homework and test scores for determining grades to student achievement was found. A search for the information was made in The Reader's Guide to Periodical Literature since 1965, The Educational Index since 1959, Educational Resources Information Center since 1965, and The Mathematics Teacher Index since 1908.

---

[6]Paul Goodman, The Community of Scholars (New York: Random House, 1962), pp. 91-92.

Chapter 3

PROCEDURES

This study was designed to determine the effects of using homework and/or test scores in determining student grades on student achievement in mathematics. It was conducted during a seven-week period at the end of the school year. The sample consisted of four classes of eighth grade mathematics students. These classes had been taught by the author for the entire year. The classes studied the same two units from their textbook. The first unit lasted four weeks and the second unit three weeks. Each class used the same set of objectives.

Since there was a possibility that the four classes could have some differences in ability, it seemed plausible to use the reading and mathematics scores of the SRA Achievement Test taken during the first part of the school year as controls.[7]

The composition of the two classes (class A and class B) had been the same throughout the entire school year. The composition of the other two classes (class C and class D) was the result of a reorganization at the beginning of the second semester.

---

[7] SRA Achievement Series, Form C, Chicago, Scientific Research Association, 1965.

The author was part of a team-teaching section consisting of English, history, and mathematics. At the beginning of the second semester, the teachers felt that there was a group of twenty-five students needing remedial work in these subjects. The regrouping was made on the basis of their first semester grades for these subjects. The top two classes (class C and class D) of this regrouping were used in the study. Class D was composed of students whose achievements were high during the first semester. Class C was composed of students whose achievements were average during the first semester. This group had some students whose achievements were low compared to their ability, while it also had some students whose achievements were high compared to their ability.

The students involved in the study were informed of the study and their part in it. They were given the set of objectives for the two units that were studied. These objectives may be found in Appendix A. They were also given a pre-test over each unit before they began it. The pre-tests were parallel in form and content to the post-tests. At the end of each unit, the students were given a post-test. See Appendix B for the post-test. The post-tests were used to measure student achievement over the two units.

The teacher presented the new material and led discussions using the same lesson plan for the four classes. Since school functions occupied some of the class periods, each class received presentation of new material first at some time during

the study.

The first class (class A) had both homework and test scores used to determine their grades for a unit. The second class (class B) had only test scores used to determine their unit grades. This class had homework, but it was not used in determining the unit grades. The third class (class C) had only homework used to determine their unit grades, although they took tests. The fourth class (class D) did homework and took tests, but neither were used to determine their unit grades. Their grades were determined by agreement in a teacher-student conference. The teacher wrote the grade he thought the student should have for the unit on a piece of paper. He then asked the student what he felt he should have for a grade. If the teacher and student arrived at the same grade, it was recorded. If they were not in agreement, both parties gave their reason or reasons for the grade they assigned. The student gave his first. After both had expressed their reasons, the teacher and student were able to come to an agreement for the grade.

Each class was given about ten minutes at the beginning of the period to ask questions about the previous day's material. The two classes having homework were then asked to hand their papers in to the teacher. Next, approximately twenty minutes were used to present new material to each class. The remainder of the period was devoted to study. During this study period, the teacher handed back the homework assignment which had been corrected from the previous day, and moved about

the room to observe their work and answer questions.

Table 1, illustrates which classes had homework or test scores used to determine the students' grade.

Table 1

Factors Used to Determine Students' Grade

	Homework	No Homework
Test Scores	Class A	Class B
No Test Scores	Class C	Class D

Chapter 4

RESULTS

At the beginning of the study, the pre-test was administered to the students. After scoring the tests, it was found that the mean score was very low for each class, approximately two out of one hundred-five for unit 1 and one out of twenty-five for unit 2. This indicated the students knew virtually nothing about the units. This was expected as the units consisted of new material. The pre-test scores were not used because the students lacked knowledge of the material.

The homework scores, test scores, and the mathematics and reading scores from the SRA Achievement Test were recorded for each student.[8] Using this information, Dr. Jackson Byars programmed the computer to give the mean score, standard deviation, and the intercorrelations among the variables by class. Also, a second program was written by Dr. Byars, following the procedures from Statistical Principles in Experimental Design, for an analysis of covariance for factorial design with an unequal N and an unweighted means analysis.[9]

Table 2 shows the means, standard deviation, and intercorrelations among the variables for class A. It was

---

[8] Ibid.

[9] B. J. Winer, Statistical Principles in Experimental Design (New York: McGraw-Hill Book Company, 1962), pp. 228-240, 595-605.

found that high positive correlations existed among the variables for class A.

Table 2

Means, Standard Deviation, and Intercorrelations Among the Variables for Class A

Class A, 17 Students, Homework and Test Scores Used to Determine Grade

	Mean	S.D.	Correlation				
			SRA Math.	SRA Read.	Unit 1 Post-test	Unit 2 Post-test	Home-work
SRA Math.	8.38	1.90	1.000	0.911	0.764	0.679	0.457
SRA Read.	9.43	2.23		1.000	0.642	0.548	0.413
Unit 1 Post-test	40.65	28.73			1.000	0.786	0.771
Unit 2 Post-test	12.35	7.87				1.000	0.869
Homework	344.47	140.45					1.000

Table 3 shows the means, standard deviation, and intercorrelations among the variables for class B. It was found that high positive correlations existed among the variables for class B.

Table 3

Means, Standard Deviation, and Intercorrelations Among the Variables for Class B

Class B, 23 Students, Only Test Scores Used to Determine Grade						
			Correlation			
	Mean	S.D.	SRA Math.	SRA Read.	Unit 1 Post-test	Unit 2 Post-test
SRA Math.	8.72	1.14	1.000	0.832	0.441	0.303
SRA Read.	10.12	1.65		1.000	0.452	0.392
Unit 1 Post-test	44.83	15.52			1.000	0.685
Unit 2 Post-test	9.96	7.34				1.000

Table 4 shows the means, standard deviation, and intercorrelations among the variables for class C. It was found that a negative correlation existed with the unit 1 post-test and homework to the SRA mathematics and reading. As the individual scores of students in class C were noted, six students had scores above the mean for mathematics and reading in the SRA Achievement Test, while their unit 1 test scores and homework scores were far below the mean score.[10] Two students were below the mean on the SRA mathematics and reading, while they were far above the mean on the unit 1 test. Three students were below the mean on the SRA mathematics and

[10] Op. cit.

Table 4

Means, Standard Deviation, and Intercorrelations Among the Variables for Class C

Class C, 27 Students, Only Homework Used to Determine Grade							
			Correlation				
	Mean	S.D.	SRA Math.	SRA Read.	Unit 1 Post-test	Unit 2 Post-test	Homework
SRA Math.	8.42	0.86	1.000	0.543	-0.153	0.107	-0.285
SRA Read.	8.96	1.53		1.000	-0.011	0.058	-0.031
Unit 1 Post-test	39.22	22.91			1.000	0.066	0.593
Unit 2 Post-test	7.44	5.49				1.000	0.160
Homework	458.89	147.64					1.000

reading, but were far above the mean on the homework. With this number of extremes out of twenty-seven cases, it would be possible to get a negative correlation for unit 1 test and homework to the SRA mathematics and reading scores. This class was composed of students whose achievements were average during the first semester. This group had some students whose achievements were low compared to their ability, while it also had some students whose achievements were high compared to their ability. Since this was at the end of the year and the students would be needing some homework to determine grades, they may have decided to get to work on the second unit, thus having low positive correlations for unit 2. As the

individual scores were checked, there was no evidence of any extremes between unit 2 test and the students' ability as measured by the SRA Achievement Test.[11]

Table 5 shows the means, standard deviation, and intercorrelations among the variables for class D. It was found that high positive correlations existed among the variables for class D.

Table 5

Means, Standard Deviation, and Intercorrelations Among the Variables for Class D

Class D, 32 Students, Neither Homework nor Test Scores Used to Determine Grade

	Mean	S.D.	Correlation			
			SRA Math.	SRA Read.	Unit 1 Post-test	Unit 2 Post-test
SRA Math.	9.91	1.20	1.000	0.624	0.657	0.503
SRA Read.	11.12	1.21		1.000	0.312	0.190
Unit 1 Post-test	44.56	19.38			1.000	0.526
Unit 2 Post-test	15.78	6.53				1.000

In Table 6, the analysis of variance is shown for unit 1 test. There were no significant main effects and no significant interaction effects. Also, shown in Table 6, is the analysis of covariance for unit 1 test with reading

[11] Ibid.

Table 6

Treatment Means, Analysis of Variance, and Analysis of Covariance for Unit 1 Test

Treatment Means Unit 1 Test		
	Homework	No Homework
Test Scores	40.65	44.83
No Test Scores	39.22	44.56

Analysis of Variance				
Source	Sum of Sq	D.F.	Mean Sq	F
Test Effect	16.71	1	16.71	0.035
Homework Effect	531.20	1	531.20	1.103
Interaction Effect	7.90	1	7.90	0.016
Error	45763.73	95	481.72	
Total	46319.54	98		

Analysis of Covariance, Reading Controlled				
Beta = 4.629				
Source	Sum of Sq	D.F.	Mean Sq	F
Test Effect	101.69	1	101.69	0.237
Homework Effect	66.20	1	66.20	0.155
Interaction Effect	178.15	1	178.15	0.416
Error	40252.68	94	428.22	
Total	40598.73	97		

Analysis of Covariance, Mathematics Controlled				
Beta = 8.242				
Source	Sum of Sq	D.F.	Mean Sq	F
Test Effect	777.27	1	777.27	2.082
Homework Effect	160.80	1	160.80	0.431
Interaction Effect	392.98	1	392.98	1.053
Error	35090.73	94	373.31	
Total	36421.78	97		

controlled, and an analysis of covariance for unit 1 test with mathematics controlled. In all parts of the table, there were no significant main effects and no significant interaction effects.

The interpretation of the results of the analysis of variance and analysis of covariance on unit 1 test indicated that neither of the variables studied had any significant influence on student achievement for unit 1 test. Furthermore, the lack of significance in the interaction effect showed that no combination of variables was significantly better than others.

In Table 7, the analysis of variance is shown for unit 2 test. There was a significant main effect for the homework variable ($P < .05$). The difference favored the no homework treatment. There was no significant main effect for the test variable. There was a significant interaction effect ($P < .01$) which indicated that some combinations of treatments produced results which could not have been predicted from the treatment effects alone. Classes A and D had scores which were higher than might have been expected and class C had a score less than might have been expected. Class A was working in a classroom setting which was comfortable for them. They had both homework and test scores used to determine their grade. Class C may have felt that they did not need to be concerned about the test since their grade was based only on homework. The students in class D may have

Table 7

Treatment Means, Analysis of Variance, and Analysis of Covariance for Unit 2 Test

Treatment Means Unit 2 Test		
	Homework	No Homework
Test Scores	12.35	9.96
No Test Scores	7.44	15.78

Analysis of Variance				
Source	Sum of Sq	D.F.	Mean Sq	F
Test Effect	4.92	1	4.92	0.105
Homework Effect	206.86	1	206.86	4.395*
Interaction Effect	675.32	1	675.32	14.349**
Error	4470.97	95	47.06	
Total	5358.07	98		

Analysis of Covariance, Reading Controlled				
Beta = 1.297				
Source	Sum of Sq	D.F.	Mean Sq	F
Test Effect	0.28	1	0.28	0.006
Homework Effect	24.98	1	24.98	0.582
Interaction Effect	435.08	1	435.08	10.128**
Error	4038.00	94	42.96	
Total	4498.34	97		

Analysis of Covariance, Mathematics Controlled				
Beta = 2.358				
Source	Sum of Sq	D.F.	Mean Sq	F
Test Effect	21.92	1	21.92	0.573
Homework Effect	13.79	1	13.79	0.360
Interaction Effect	357.26	1	357.26	9.336**
Error	3596.97	94	38.27	
Total	3989.94	97		

*Significant at the .05 level, $F_{.05}(1,90)=3.96$.[12]

**Significant at the .01 level, $F_{.01}(1,90)=6.99$.

[12]Winer, op. cit., pp. 642-647.

felt insecure about their achievement and studied for the test. A high score on the test, they may have determined, would help justify their grade in the teacher-student conference.

The analysis of covariance on unit 2 test showed parallel results when mathematics and reading were controlled. In both cases, the homework effect became non-significant. This indicated the observed differences between treatments were due to differences in initial ability rather than to the treatment. In both cases the interaction effect remained significant at the .01 level.

The results of the study with the analysis of variance, showed that there were no significant main effects and no significant interaction effects for unit 1 test. Unit 2 test showed that there was a significant main effect for the homework variable ($P < .05$) favoring the no homework treatment. There was a significant interaction effect ($P < .01$) which indicated that some combinations of treatments produced results which could not have been predicted from the treatment effects alone.

The results of the analysis of covariance with reading and mathematics controlled, showed that there were no significant main effects or significant interaction effects with unit 1 test. Unit 2 test showed parallel results for reading and mathematics controls. In both cases, the homework effect became non-significant while the interaction effect remained significant at the .01 level.

The results of this study indicated that neither of the variables studied had any significant influence on student achievement for unit 1 test. Unit 2 test indicated that classes A and D had scores which were higher than might have been expected and class C had a score less than might have been expected.

Chapter 5

SUMMARY

Teachers today are often subjected to new procedures in education. Many teachers accept this change very well, while others will fight it. With this thought in mind, a person might repeat the question that Robert S. Fouch asked, "are tests really necessary in the educational process?".[13]

This study was designed to determine the effects of using homework and/or test scores in determining student grades on student achievement in mathematics. Each class used the same set of objectives.

Class A had both homework and test scores used to determine their grades for a unit. Class B had only test scores used to determine their unit grades. This class had homework, but it was not used in determining their unit grades. Class C had only homework used to determine their unit grades, although they took tests. Class D did homework and took tests, but neither were used to determine their unit grades. Their grades were determined by agreement in a teacher-student conference.

Each class was given a pre-test over the unit just

---

[13]Robert S. Fouch, Evaluations in Mathematics (Washington, D.C.: The National Council of Teachers of Mathematics, 1961), p. 172.

prior to beginning the unit. After studying the unit, they were given a post-test. The post-test was used to measure student achievement.

The results of this study indicated that neither of the variables, homework and test scores, had any significant influence on student achievement for unit 1 test. Unit 2 test showed that the class having both homework and test scores used to determine their unit grades, scored higher than might have been expected. Also, the class having neither homework or test scores used to determine their unit grades scored higher than might have been expected. The class having only homework used to determine their unit grades scored less than might have been expected.

Although the class which had neither homework or test scores used to determine their unit grades scored higher than might have been expected on unit 2 test, they seemed insecure during the duration of the study. They were constantly wanting to know what their grades were going to be for the unit. The author believes that students should not have an insecure feeling about their achievement. Therefore, the teacher must use some method of grading that leaves the student with a feeling of security regardless of the educational structure.

BIBLIOGRAPHY

BIBLIOGRAPHY

A. BOOKS

Aichele, Douglas B. and Robert E. Reys (eds.). Readings in Secondary School Mathematics. Boston: Prindle, Weber and Schmidt, Inc., 1971.

Brown, B. Frank. The Nongraded High School. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1963.

Butler, Charles H., F. Lynwood Wren and J. Houston Banks. The Teaching of Secondary Mathematics. New York: McGraw-Hill Book Company, 1970.

Goodman, Paul. The Community of Scholars. New York: Random House, 1962.

Keedy, Marvin L., Richard E. Jameson and Patricia L. Johnson. Exploring Modern Mathematics, Book 2. New York: Holt, Rinehart and Winston, Inc., 1963.

National Council of Teachers of Mathematics. "Evaluation in Mathematics," Twenty-Sixth Yearbook. Washington, D. C.: The National Council of Teachers of Mathematics, 1961.

Winer, B. J. Statistical Principles in Experimental Design. New York: McGraw-Hill Book Company, 1962.

B. PERIODICALS

Dairi, N. G. "New Techniques for Checking Knowledge," Soviet Education, (January, 1964), 42-53.

Ebel, Robert L. "Using Test for Evaluation," The Education Digest, (March, 1956), 26-28.

Mannello, G. "College Teaching Without Grades," The Journal of Higher Education, (June, 1964), 328-334.

Trump, J. Lloyd. "Secondary Education Tomorrow," The Education Digest, (September, 1966), 22-25.

OTHER SOURCES

Dale, Wesley J. "Concerning Grading and Other Forms of Student Evaluation" (A talk presented during a panel on Grading and Other Evaluations of Student Achievement during the Ninth Annual Meeting of the Council of Graduate Schools in the United States, December 4-6, 1969, Washington, D. C.)

Sparks, David S. "Grading and Student Evaluation" (A talk presented during a panel on Grading and Other Evaluations of Student Achievement during the Ninth Annual Meeting of the Council of Graduate Schools in the United States, December 4-6, 1969, Washington, D. C.).

SRA Achievement Series, Form C. Chicago: Scientific Research Association, 1965.

APPENDIXES

APPENDIX A

OBJECTIVES

APPENDIX A

Objectives
Unit 1

The students will be able to solve equations, justifying each step of their work by using the commutative, associative, distributive, inverse, and identity properties of multiplication and addition. The addition, subtraction, multiplication, and division properties of equality will be used also.

Objectives
Unit 2

The student will be able to add, subtract and multiply polynomials.

APPENDIX B

POST-TESTS

APPENDIX B

Post-Test

Unit 1

Instructions: Name the Property of Numbers or Equations which Justifies Each of the following.

EXAMPLE:

$7 \times (4 \times 1/7) = 7 \times (1/7 \times 4)$	Commutative property of multiplication.
$= (7 \times 1/7) \times 4$	Associative property of multiplication.
$= 1 \times 4$	Multiplicative Inverse.
$= 4$	Multiplication property of 1.

---

1. $(3/4 - 1/6)48 = 48(3/4 - 1/6)$
   $= 48(3/4 - 48(1/6)$
   $= 36 - 8$
   $= 36 + -8$
   $= 28$

---

2. $973(101) = 973(100 + 1)$
   $= 973(100) + 973(1)$
   $= 97{,}300 + 973$
   $= 98{,}273$

Instructions: Solve the Following Problems Justifying Each Step.

3. $B + 4B - 8 = 6 + 2B + 1$
   $B + 4B + -8 = 6 + 2B + 1$
   $5B + -8 = 6 + 1 + 2B$
   $5B + -8 = 7 + 2B$

Appendix B (continued)

$5B + -8 + -2B = 7 + 2B + -2B$	
$5B + -2B + -8 = 7 + 2B + -2B$	
$5B + -2B + -8 = 7$	
$3B + -8 = 7$	
$3B + -8 + 8 = 7 + 8$	
$3B = 15$	
$3B/3 = 15/3$	
$B = 5$ therefore, the solution set is 5.	

Instructions: Solve the Following Problems Justifying Each Step.

4. $1 + 3(2B + 4) = 15 + 6B$	
$1 + 3(2B + 3(4) = 15 + 6B$	
$1 + 6B + 12 = 15 + 6B$	
$6B + 1 + 12 = 15 + 6B$	
$6B + 13 = 15 + 6B$	
$6B + 13 + -6B = 15 + 6B + -6B$	
$13 + 6B + -6B = 15 + 6B + -6B$	
$13 = 15$ therefore, solution set is 0.	

Instructions: Solve the Following Problems Justifying Each Step.

5. $9B - 24 = 3B$	
$9B + -24 = 3B$	
$9B + -24 + 24 = 3B + 24$	
$9B = 3B + 24$	
$9B = 24 + 3B$	
$9B + -3B = 24 + 3B + -3B$	

Appendix B (continued)

6B = 24	
6B/6 = 24/6	
B = 4. Therefore, solution set is 4.	

Instructions: Solve the Following Problems, Justifying Each Step.

EXAMPLE:

3B = 2B + 16	
3B = 2B + 16	Copy down problem.
3B = 16 + 2B	Commutative property of addition.
3B + -2B = 16 + 2B + -2B	Addition property of equality.
3B + -2B = 16	Addition of similar terms.
B = 16	Additive inverse.

6. 4B + 18 = 10B

7. 18B = 203 - 11B

8. 7 = B/2 - 1

9. B + 36 = 1 - 4(B - 5)

10. 15B = 144 + 9B

Appendix B (continued)

Post-Test
Unit 2

Instructions: Add Each of the Following Polynomials.

1. $(5Y^2 + 4Y + -4) + (-4Y^2 + 7Y + 7)$
2. $(33Y^4 + 2Y^2 + 4Y + -3) + (-9Y^4 + 7Y^3 + -4Y + 4)$
3. $(7Y^2 + -Y + 3) + (-7Y + Y + -3)$
4. $(4Y^2 - 7Y + 3) + (-2Y^2 + 4Y - 4)$
5. $(-7Y^3 + 7Y^2 - Y + 1) + (10Y^3 - 5Y^2 + 3Y - 3)$
6. $(4Y^2 + -4Y + 3) + (-Y^2 + 3Y + -5)$

Instructions: Subtract Each of the Following Polynomials.

7. $(7Y^2 + 4) - (4Y^2 + 1)$
8. $(Y^2 + 9Y + 3) - (-2Y^2 + 7Y + 2)$
9. $(-6Y^4 + 5Y^2 + 6) - (2Y^4 + 7Y^3 + 5Y^2 + 7)$
10. $(8Y^3 + 3Y + 4) - (6Y^3 + 4)$

Instructions: Multiply Each of the Following Polynomials.

11. $(3Y)(-7)$
12. $(-2Y)(2Y)$
13. $(-Y)(-Y)$
14. $(-Y^4)(-Y^6)$
15. $(15Y^6)(0)$
16. $(4Y)(4Y^2 + 3Y + -7)$
17. $(-Y^5 + 3Y + -4)(-3Y)$
18. $(4Y)(Y^2 + 3Y + 2)$
19. $(Y + 5)(Y + 4)$
20. $(Y + 3)(Y - 4)$
21. $(4Y^2 - 2)(Y - 4)$
22. $(Y + 7)(3Y + 1)$
23. $(Y + 7)(Y - 5)$
24. $(5Y + 2)(3Y - 3)$
25. $4Y^2(6Y^2 + 12Y + 3)$

THE EFFECTS ON STUDENT ACHIEVEMENT OF USING HOMEWORK AND TEST SCORES FOR DETERMINING GRADES

by

ARTHUR ERNEST SCHWIETHALE, JR.

B.S., Kansas State Teachers College, Emporia, 1962

AN ABSTRACT OF A MASTER'S REPORT

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

College of Education

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1971

This study was designed to determine the effects of using homework and/or test scores in determining student grades on student achievement in mathematics.

Four classes of mathematics students were used, with all of the combinations of the variables. A post-test was given at the end of each unit to measure student achievement. An analysis of variance and analysis of covariance with reading and mathematics controlled were used to determine if there were any significant effects between the variables on student achievement.

The first unit studied showed no significant effects between the variables on student achievement. The second unit showed significant interaction effects for some combinations of the variables on student achievement.