THE RELATIONSHIP BETWEEN CERTAIN TEACHER-RELATED VARIABLES AND STUDENT ACHIEVEMENT IN THIRD GRADE ARITHMETIC

by

DOYLE HURST

Bachelor of Science
University of Arkansas
Fayetteville, Arkansas
1963

Master of Science
University of Arkansas
Fayetteville, Arkansas
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Thesis Approved:

H S Mendenhall
Thesis Adviser

Vernon Troxel

Milton E Berg

D D Durham
Dean of the Graduate College

PREFACE

Educational administrators must make decisions about employing teachers, certification agencies must decide whom to certify to teach, and colleges must make decisions concerning the curriculum for prospective teachers. Making these decisions would be facilitated by a theory of teacher effectiveness that had been validated by research. Although the investigations of teacher effectiveness have been numerous, the knowledge of the characteristics and preparation of an effective teacher is limited.

Teacher effectiveness was the subject of this study. The relationship between selected variables and teacher effectiveness in third grade arithmetic as measured by average student gain scores on the two arithmetic subtests of the Metropolitan Achievement Test, Elementary Battery, Form A, were studied.

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Permission to conduct the research in the Oklahoma City Public Schools and to gain access to certain of the system's records made the study possible. I thank Mr. William J. Coffia, mathematics consultant for the Oklahoma City Public Schools, for his assistance.

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CHAPTER I

INTRODUCTION

The Problem

Hundreds of research projects have investigated teacher effectiveness. The articles and books that have been written on the topic are legion. Yet, the experimental results have been inconclusive. Ackerman (1) wrote on page 273, "...there is hardly any conclusive evidence as to the nature and means of identifying teacher competence." Valid criteria for hiring and rewarding teachers have not been established. Barr (2) commented on page 169, "No one appears to have developed a satisfactory working plan or system that can be used by personnel officers who must make judgments about teacher effectiveness." Woellner (25) wrote on page 184, "...it seems apparent that teacher-certification requirements need to be validated..." What should be included in the preparation of a teacher? Should teachers be required to participate in in-service teacher education programs, to take additional courses, and to complete graduate degrees? A consideration of the teacher's influence on his students and the money spent on education indicates that these problems deserve attention. It is almost axiomatic that a single study cannot solve any of these problems. This study is no exception. However, it provides additional information about the relationship between certain teacher related variables and teacher effectiveness.

This is a teacher effectiveness study; but teacher effectiveness, which cannot be measured directly at the present time, will be dealt with indirectly. It will be inferred from average student gain scores on a standardized achievement test in mathematics. The philosophical question of whether high student scores on standardized achievement tests is a desirable end of teaching is not dealt with in this study.

It is anticipated that this study will contribute to an understanding of the relationship between and among certain variables and teacher effectiveness. If enough studies produce similar results, they could help provide a sound basis for hiring and rewarding teachers. A knowledge of the relation between teacher effectiveness and graduate education could help justify or discredit the trend toward requiring a masters degree. If the relationship between effectiveness in teaching a subject and college preparation in the subject were known, it would be possible to plan a better college curriculum.

Previous Research

No research applying directly to the present study was found. However, there was research that dealt with some of the same variables and used student achievement as the criterion of effective teaching. This research was included in the review of the literature. In addition, two reports concerning criteria of teacher effectiveness were included.

The Committee on Criteria of Teacher Effectiveness (18) listed changes in pupil behavior as one of the most important components of teacher effectiveness. On page 13 Barr (3) wrote,

> A fourth type of criterion of teacher effectiveness is that of pupil growth and achievement, which is usually expressed as pupil gain scores based upon achievement tests administered prior to instruction and again at some subsequent date when a particular unit of instruction or course

has been completed. To most persons this criterion is considered a primary criterion against which all other criteria should be validated.

As measured by the average achievement of their students, is there a significant difference between teachers? If no such difference exists, no variables could be significantly related to the nonexistant difference and this study would be useless. Webb and Bowers (23) studied flying instructors in the United States Navy. Using student flying proficiency as the criterion of effective teaching, they found a significant difference (0.01) among the instructors.

Moss, Loman, and Hunt (15) studied teacher effectiveness in first year general college chemistry at 28 Land Grant Colleges for a two year period. Scores on a chemistry test were corrected for high school chemistry and <u>American Council on Education Psychological Examination</u> scores. No tests of significance were made, but an examination of the data obtained from these corrected scores suggested there was probably no signifacant difference in the effectiveness of the teachers with a Ph.D. and those with a masters degree. However, teachers with eleven or less years of teaching experience seemed more effective than those with 12 or more years of experience.

Hughes (11) reported a study in which three physics tests were given to physics students in 29 secondary schools of different sizes. Although the results were not checked for level of significance, examining the mean scores on each test indicated that teachers having a major in physics were more effective in teaching physics than those who did not.

In a study involving 28 teachers of seventh and eighth grade social studies in small schools, Rostker (19) used student achievement on several tests as the criteria of teacher effectiveness. Several tests of social studies information were administered to the teachers. On page 45 he wrote, "These teacher measures are primarily tests of information and indicate no significant relationship between knowledge of subject information and teaching ability."

Davis (7) conducted a study involving 190 Class A Minnesota schools and approximately 800 teachers. The criterion for judging the work of teachers was the performance of their students on the Minnesota State Board Tests for 1932. Statistical techniques for determining the significance level of the results were not applied. When the teachers were classified as qualified or unqualified to teach a subject on the basis of their college credits, an examination of the data indicated that as a whole there was no difference between the effectiveness of those classified qualified and those classified unqualified; however, there was a trend for the qualified teachers to be more effective in the more specialized subjects. The evidence suggested that the students of teachers with less than two years of experience and the students of teachers with more than two years of experience did not differ in their achievement on tests of subject matter.

Hall (10) studied two groups of 17 first year third, fourth, and fifth grade teachers. The teachers in one group were fully certified, those in the other group had a college degree but were only provisionally certified because they had not met the professional education requirements. Gain scores on each of the subtests of the Stanford Achievement Tests were the criteria of effective teaching. The results favored the fully certified teachers on each of the six subtests. The number of hours of professional education was significantly (0.01) related to achievement gain on the Paragraph Meaning, Word Meaning, and Spelling subtests.

Barr (4) reported a study of 66 teachers in grades three to seven inclusive. A correlation of 0.30 ± 0.08 was found between the students' raw-score gain on the Arithmetic Subtest of the Stanford Achievement Tests and the teacher's performance on the New Stanford Arithmetic Test, Form V.

In an unpublished doctoral dissertation Watts (22) reported a study in 13 school systems. The sixth grade student's scores on the California Achievement Test, Elementary, Complete Battery, were predicted from a multiple regression equation using his scores on the California Short-Form Test of Mental Maturity, Level Two, and the Index of Status Characteristics, developed by Warner, Meeker, and Eels. The difference between the predicted and the actual achievement test scores for a district as a whole was used as the criterion of teacher effectiveness. The teachers in grades one through six were included in the study because it was believed that all of them had had an influence on the students' achievement. The results indicated that there was no significant relationship between teacher effectiveness and teaching experience, degree held, years of training, recency of training, or overall value of teachers' qualifications.

The literature listed change in student behavior as a criterion of teacher effectiveness. Furthermore, experimental evidence revealed that teachers differed in the amount of change produced in their students.

The studies of the relationship between preparation to teach a subject or information about a subject and effectiveness in teaching the subject were about equally divided between finding a significant relationship and not finding a significant relationship. The evidence seemed to suggest a slight relationship, the magnitude of which depended upon the particular academic discipline.

The study by Hall (10) indicated that professional education courses contributed significantly to teacher effectiveness. However, the writer concluded that the experimental design made it impossible to determine whether the differences were due to education courses or to the experience gained in student teaching.

The only study of recency of training did not find a relationship between it and effective teaching. Only one of the three studies in which teaching experience was an independent variable found a relation between it and teacher effectiveness. Thus, the evidence did not support the claim that recency of training and teaching experience were significantly related to teacher effectiveness. Likewise, no relationship was found between graduate training and effective teaching.

Theoretical Basis

Even a casual glance at the catalogs of teacher education institutions or at the requirements for a teaching certificate will reveal certain theoretical implications. The colleges are attempting to provide effective teachers. The certification requirements attempt to keep ineffective teachers from teaching. Thus, the colleges and certification agencies are prompted by a theory of what makes an effective teacher. The requirements imply that courses in a subject area and courses in the methods of teaching the subject help produce effective teachers.

Although the research was inconclusive, it indicated there was probably a slight positive relationship between formal preparation to teach a subject and effectiveness in teaching the subject. In addition, the research suggested that the relationship varied substantially from academic discipline to academic discipline. Perhaps this was due in part to the great differences in the teachers' opportunities to learn various subjects informally. For example, the occasions for learning social studies informally were probably much more numerous than the occasions for learning physics informally.

Many schools provide in-service training for their teachers. Several colleges and universities have off campus programs to keep teachers abreast of the developments in their field and in professional education. Numerous agencies will pay teachers to attend summer school. Recent education can be used for renewing a teaching certificate. These actions are based on the belief that recency of education is positively related to teacher effectiveness. The study by Watts (22) cast doubt on the validity of this belief. The relationship between recency of training and effective teaching needed further investigation.

Almost without exception, salary schedules for teachers are based on the theory that experience in teaching produces a more effective teacher. Hence, the theory warrants attention. The research surveyed did not support the theory when effectiveness was measured by student achievement.

There is a trend for schools and certification agencies to require graduate work or a masters degree. Most salary schedules reward teachers for graduate hours completed or for obtaining a masters degree. It is needless to say that the institutions awarding the degrees are encouraging the trend. The basic assumption being made is that completing graduate courses and graduate degrees contributes to a teacher's ability to teach. When effectiveness was measured by student achievement, this view was not substantiated by the research in the preceding section.

The writer believes that a teacher will do a better job of teaching a course if he received pleasure from teaching the course or if he is confident of his ability to teach the course or both. This is based on a belief that the teacher will devote more effort to a course he enjoys and that confidence will let him devote more of his attention to teaching the course to the students instead of to the course material. No research was found on these variables with student achievement as the criterion of effectiveness.

Because of the large number of variables contributing to teacher effectiveness, it is likely that the contribution of any one variable is small. However, it is postulated that there is interaction among the variables. Thus, certain combinations of the variables should make rather substantial contributions to teacher effectiveness. A knowledge of interaction would be valuable in planning future studies and, possibly, in explaining the results of this one.

To summarize and make the theoretical background precise the following paragraph is included.

It is postulated that the following statements about teacher effectiveness are true:

1. A teacher's effectiveness in teaching a subject increases as his preparation to teach the subject increases.
2. A teacher's effectiveness in teaching a subject is positively related to the recency of his last course in the subject.

3. A teacher's effectiveness is positively related to the recency of his last education course.
4. A teacher's effectiveness increases during his first few years of teaching and then remains relatively constant.
5. A teacher's effectiveness is positively related to the amount of graduate work completed.
6. A teacher's effectiveness in teaching a course is positively related to his pleasure in teaching the course.
7. A teacher's effectiveness in teaching a course is positively related to his confidence in teaching the course.

Specific Hypotheses to be Tested

This study dealt with the determination of whether there were any significant relationships between the dependent variable and the independent variables. The independent variables were the following:

1. Number of credit hours in mathematics.
2. Number of credit hours in mathematics education.
3. Recency of mathematics course.
4. Recency of mathematics education course.
5. Recency of education course.
6. Years of teaching experience.
7. Amount of graduate work completed.
8. Pleasure in teaching arithmetic.
9. Confidence in teaching arithmetic.

The dependent variable was student achievement gain in third grade arithmetic.

The mathematics courses, mathematics education courses, and education courses that were included as independent variables were courses for which the subjects had obtained college credit. The pleasure and confidence in teaching arithmetic were operationally defined to be the scores on a forced choice rating form constructed for this study. Gain scores from both of the arithmetic subtests of the Metropolitan Achievement Test, Elementary Battery, Form A, (9) were used individually as criteria of student achievement gain in third grade arithmetic.

The null forms of the hypotheses that were tested were as follows:

1. There is no significant difference (0.05) in the third grade arithmetical achievement gain of the students of teachers in groups established by using the independent variables one at a time.

2. There is no significant interaction (0.05) between the variables in each of the following pairs:

   a. Number of credit hours in mathematics.
      Recency of mathematics course.

   b. Recency of mathematics course.
      Recency of mathematics education course.

   c. Recency of mathematics course
      Years of teaching experience.

   d. Recency of mathematics education course.
      Years of teaching experience.

   e. Recency of education course.
      Amount of graduate work completed.

CHAPTER II

PROCEDURE

The Research Committee of the Oklahoma City Public Schools graciously granted permission for the present study to be conducted in their system. Practical considerations almost required the cooperation of a large school system. A quasi-experimental design was selected for the research. The study was designed to take advantage of conditions existing in the Oklahoma City Public Schools. In particular, existing scores on the arithmetic subtests of the *Metropolitan Achievement Test* (MAT) were used as data. MAT was administered to third grade students in the fall of 1965 and to the same students as fourth graders during the fall of 1966. The data from these testings and a questionnaire were collected and analyzed during the spring semester of 1967.

During the 1965-66 school year the third grade classes in the Oklahoma City Public Schools were self contained. Part of the schools used the ungraded primary organization and part used a graded organization. There were also some schools that combined third and fourth grade classes. Five of the schools were for the physically handicapped.

The system had a modern mathematics program in the third grade for the 1965-66 school year. Perhaps the best and most objective way to describe the course would be to state that the arithmetic text was *Moving Ahead in Arithmetic* (6). The system has an in-service program. In particular, an in-service program in the School Mathematics Study

Group materials has been conducted for teachers from the fourth grade on up. The schedule for administering standardized tests made the Oklahoma City Public Schools suitable for this research. The Metropolitan Achievement Test, Elementary Battery, Form A, was given to the third grade in most schools during September and October in 1965 and to the fourth grade in most schools during September and October in 1966. The California Test of Mental Maturity, henceforth called CTMM, was also given in the third grade during the 1965-66 school year. Most schools gave this test during January or February but the range for administering it was from November to April. The test results for each student were supposed to be reported by school and by class to a central testing office. The writer was granted access to the files of test results in the testing office.

Selection of Subjects

The forms for reporting MAT scores to the testing office included information in addition to pupil scores--the teacher's name, the name of the school, the grade equivalent at testing, and the date of testing. This additional information was used in selecting a sample for the study. A list of the teachers satisfying the following conditions was compiled:

1. The teacher taught third grade pupils during the 1965-66 school year in a school other than those for the physically handicapped.
2. The teacher reported scores for between eight and forty five students on MAT given during September or October of 1965.
3. The teacher was listed in the Personnel Directory, 1966-1967 (17) for the Oklahoma City Public Schools.

The resulting list contained 153 names.

One hundred names were randomly selected from this list. A teacher whose name appeared among these 100 was included in the study group if the following conditions were satisfied:

1. The teacher returned the completed questionnaire within 50 days of the first mailing.
2. The teacher was still teaching the class when CTMM was administered.
3. Third and fourth grade MAT scores on both of the arithmetic subtests and third grade CTMM scores were available for at least eight of the teacher's 1965-66 third grade pupils. The fourth grade MAT must have been given during September or October of 1966.

The resulting study group contained 55 teachers.

Practically all of the schools gave MAT during September or October. Thus, very few teachers were excluded by eliminating subjects when this was not the case. The third grade MAT was required to have been given during September or October to make the intervals that the teachers had the students following testing as equal and as long as practical. The decision to use the fourth grade MAT only when it was given during September or October was based on a desire to keep the period of time in the fourth grade before testing as short as possible.

The availability of CTMM scores was required to obtain a check on whether a student was still attending the same class when CTMM was administered. The requirement that the teacher was still teaching the class when CTMM was administered was to elimimate teachers who taught a class for only a short period of time.

Availability of complete data for at least eight of a teacher's students was required to obtain a reasonably accurate estimate of the mean gain scores attained by the teacher's students.

A clerical error could have resulted in the scores for more than one class being reported as the scores for a single class. To help eliminate such errors, a teacher was not included in the study if he reported scores for more than 45 students. The number 45, was selected because it was approximately one and one half times the average class size.

The teachers of the physically handicapped were excluded because this study was an attempt to see what happened in the normal classroom.

Two practical considerations were included to facilitate the research. Because forwarding addresses were not available for all of the teachers who left the system before the 1966-67 school year, they were excluded from the study. A cut off date for the return of questionnaires was established because of the need to proceed with the statistical analysis and the writing of the report.

Collection of the Data

The information contained in the personnel records of the Oklahoma City Public Schools was insufficient for the study. Hence, it was necessary to obtain the data directly from the teachers. To collect the data a questionnaire was prepared and sent to the teachers at their school address. The questionnaire, which is included in the appendix, was multilithed in elite type on one side of one sheet of eight and one half by eleven inch paper. The name of the subject was typed on the top line of the questionnaire. A stamped self-addressed envelope was enclosed with the questionnaire. It was mailed on February 14, 1967.

Those who had not responded to the questionnaire by February 28, 1967, were sent another copy on that date. This mailing was the same as the first except a cover sheet, which is included in the appendix, was enclosed. The cover sheet asked the teacher's cooperation. The cover sheet was also multilithed in elite type on one side of eight and one half by eleven inch paper.

To establish the reliability of questions eight and nine dealing with pleasure in teaching arithmetic and confidence in teaching arithmetic respectively, another questionnaire, which is included in the appendix, was mailed on March 14, 1967, to those who had responded to the original questionnaire by that date. This questionnaire was also multilithed in elite type on one side of eight and one half by eleven inch paper.

Besides preparing questions that would elicit the information needed for the study, the most important consideration in the design of the questionnaire was the magnitude of the response. Thus, an effort was made to produce an attractive questionnaire that looked short and could be answered in a minimum amount of time.

The three questions referring to recency of training were originally intended as measures of the amount of time elapsing between a teacher's taking a course and the teacher teaching the students during the 1965-66 school year. The elapsed time interpretation of the questions about recency of mathematics course and recency of mathematics education course was permissible because no teacher in the study group reported taking a mathematics course or mathematics education course after 1965. However, 11 teachers in the study group reported having an education course after 1965 so recency of education course cannot be interpreted as time elapsing between taking a course and teaching the students. The writer decided to forego the latter interpretation instead of infringing on the teachers by sending them another questionnaire.

When taking the information from the questionnaires to use in this study, certain interpretations and judgments were necessary. If the person completing the questionnaire gave a range of values, the average was used. A masters degree was interpreted as 30 hours of graduate work. When dividing the teachers into groups on the basis of the independent variables, an effort was made to not divide at questionable points such as those above. Thus, it is believed these judgments did not seriously effect the study. Several teachers returned questionnaires that were only partially completed. The writer decided to include these subjects in the study group and use them only when studying variables for which they had answered the related questions.

To provide data for a test of whether the study group and the group of persons in the original sample of 100 but not in the study group differed in the number of years of teaching experience, the number of years of experience prior to the 1966-67 academic year of the teachers in the original sample of 100 who did not respond to the questionnaire was supplied by the Department of Personnel of the Oklahoma City Public Schools. The writer was not permitted to see the personnel records; at his request, the information was supplied as a set of numbers so no teacher could be associated with his years of experience.

The gain scores for both the Arithmetic Computation and the Arithmetic Problem Solving and Concepts subtests of MAT were collected, when possible, for all of the teachers in the sample of 100. This information for the study group was used to test the hypotheses. The information for persons not in the study group was used to compare the study group with the group of persons who did not respond to the questionnaire.

The third and fourth grade MAT Computation score and the third and fourth grade MAT Problem Solving and Concepts Score for a student were recorded under the name of a teacher if the student met the following requirements:

1. A CTMM total score was reported for him in the teacher's report of the 1965-66 school year.
2. Both a MAT Computation score and a MAT Problem Solving and Concepts score were reported for him in the teacher's report of third grade students for the 1965-66 school year.
3. Both a MAT Computation standard score and a MAT Problem Solving and Concepts standard score were reported for him by April 5, 1967, as a fourth grade student during the 1966-67 school year in the school at which the teacher taught during the 1965-66 school year.[1]

If these selection criteria did not result in information being recorded for at least eight of a teacher's students, nothing further was done with the achievement test scores.

Otherwise, the scores that were recorded in grade equivalents were changed to standard scores by using the conversion table in the <u>Directions for Administering Metropolitan Achievement Tests, Elementary</u>

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[1]If the requirement of standard scores in condition three kept the number of students for a particular teacher less than eight, the requirement was relaxed to include grade equivalents as well as standard scores.

Battery (8). When more than one standard score was associated with a particular grade equivalent, the average of the possible standard scores was used. To facilitate the description of computations using the achievement test scores, certain symbols were introduced. Let C_i be a standard score on the Computation subtest of MAT given at the ith grade level. Let P_i be a standard score on the Problem Solving and Concepts subtest of MAT given at the ith grade level. Let $N \geqq 8$ be the number of scores. $(\Sigma C_3)/N$ and $(\Sigma P_3)/N$ were computed to three decimal places for each teacher to determine the achievement level at the beginning of the study period. $(\Sigma C_4 - \Sigma C_3)/N$ and $(\Sigma P_4 - \Sigma P_3)/N$ were computed to six decimal places for each teacher as the two measures of average student achievement gain.

To facilitate processing the data a three-by-five inch card was prepared for each teacher in the experimental group. The front of each card contained the information from the questionnaire, $(\Sigma C_3)/N$, and $(\Sigma P_3)/N$. The back of the card contained $(\Sigma C_4 - \Sigma C_3)/N$, $(\Sigma P_4 - \Sigma P_3)/N$, and information for identifying the card.

Either standard scores or grade equivalents were reported on every one of the forms. Thus, no teacher was eliminated because of the method of reporting scores.

Not all of the schools had reported MAT scores by April 5, 1967. However, since this allowed a period of five months for the reporting and since some schools never did report the 1965 MAT scores, the statistical analysis was begun.

The scores reported by the teachers were used. Therefore, this study depended in part upon the accuracy of scoring and reporting by the teachers.

The decision to look for a student's name on fourth grade MAT reports only in the school in which he attended the third grade is based largely on the practical impossibility of searching the records of all elementary schools to find the name of one student. Students do tend to attend both grades in the same school. Looking at the records of other schools would have made the problem discussed in the next paragraph even more acute.

The writer was forced to judge whether names appearing on the three testing reports were names of the same people or not. He decided the error of omitting scores because of differences in reporting a student's name would be less severe than the error of having the scores of two students mixed together. With this in mind the only claim for validity of the results he can make is that he tried.

Statistical Tests

The Pearson product-moment coefficient of correlation using ungrouped data was used to compute the test-retest reliability of the questions dealing with pleasure and confidence in teaching arithmetic.

Most studies depending upon a questionnaire present problems of determining the population to which the results apply since the return is usually nowhere near 100 per cent. Only 55 of the original sample of 100 were included in the study group. In an effort to obtain some experimental evidence of whom the population should contain, two tests were used.

The median test as described by Smith (21) on pages 558-560 was used to test whether there was any significant difference (0.05) between the median number of years of teaching experience of the study group and the median number of years of teaching experience of those in the original sample but not in the study group.

The t-test was used to test whether there was any significant difference (0.05) between the means of the average gain scores on each of the arithmetical subtests of MAT of the study group and the non-respondents for whom these gain scores were available.

A treatments by levels design was used to check the first hypothesis: There is no significant difference (0.05) in the third grade arithmetical achievement gain of the students of teachers in groups that are established by using the independent variables one at a time. This method was chosen because on page 121 Lindquist (12) said it increases the precision of the experiment.

Lindquist (12) said on page 133 that the variable used to determine the levels should be chosen so its correlation with the criterion variable is as high as practical. Therefore, the initial achievement on the particular subtest of MAT, which was providing the gain score, was selected as the variable to use in determining levels. The division points for levels based on average initial MAT Computation standard scores were 32.00 and 34.65 where the scores ranged from 22.11 to 40.44. The division points for levels based on average initial MAT Problem Solving and Concepts standard scores were 34.80 and 38.70 where the scores ranged from 20.75 to 47.25. For each of the subtests there were 18 subjects in the low group, 19 subjects in the middle group, and 18 subjects in the high group.

The grouping of subjects into three categories by the independent variables was done on a separate basis for each of the 18 tests made. These divisions are noted in the third chapter.

The treatments by levels design was analyzed by analysis of variance. Since disproportionality existed in all of the 18 tables, it was necessary to select a technique that permitted disproportionality. The statistical technique selected was reported by Patterson (16). Wert, Neidt, and Ahmann (24) gave a clear explanation of how to apply the method. Their instructions and example were used to determine the number of decimal places to carry in the various stages of computation. This method gave more information than was necessary to test the hypotheses. The additional information was reported.

Analysis of variance for double classification was also used to check for significant interaction between selected variables. The technique reported by Patterson was used to adjust for disproportionality. Only the F for interaction was reported.

The number of subjects included in the study was too small to justify a three way classification, so the use of levels had to be abandoned at this stage.

When checking for significant interaction between recency of mathematics course and recency of mathematics education course, and between recency of mathematics education course and years of teaching experience, it was impossible to arrange a nine cell table with a minimum of two entries per cell so a four cell table was used. The other tests for significant interaction were made with nine cell tables.

Assumptions and Limitations

The population to which the writer wished to apply the results of this study was all teachers of third grade students in all of the elementary schools of the Oklahoma City Public Schools except the schools for the physically handicapped. Any generalizations to other populations, to other courses, to other grade levels, to other independent variables, or to other criteria of teacher effectiveness must be based on logic because they cannot be justified statistically.

Several assumptions were made in this study. Some were concerned with sampling the population. Teachers who left the system, teachers who did not respond to the questionnaire, and teachers for whom there was not complete information available for at least eight of their students were excluded from the study group. From the section on statistics it can be seen that an effort was made to determine whether the last two of the reasons for excluding subjects invalidated the results. However, it was still necessary to assume the validity of the sample. An alternative would be to place these restrictions on the population.

As reported earlier it was necessary for the writer to make certain judgments in the process of data collection. It was assumed these judgments were sufficiently accurate as to not invalidate the results.

Although the reliability of the last two questions on the questionnaire were reported in the third chapter, it was still necessary to assume that the reliability and validity of the questionnaire were sufficiently large as to not invalidate the results.

It was assumed that average student achievement gain on each of the arithmetic subtests of MAT was a measure of one facet of teacher effectiveness.

The assumption was made that the arithmetic subtests of MAT were properly administered, scored, and reported.

The teaching and testing intervals did not coincide perfectly. The author had no control over the amount of time the subjects spent on arithmetic. It was assumed that these factors did not invalidate the results.

CHAPTER III

RESULTS

Reliability of Response to Questionnaire Items

The reliability of questions eight and nine of the questionnaire, pleasure and confidence in teaching arithmetic, was determined by using the test-retest results of 45 teachers' responses to these questions. Pearson product-moment coefficients of correlation, using ungrouped data, were computed for this purpose. The coefficients were $r = 0.76$ for question eight and $r = 0.81$ for question nine. These coefficients were as high as could be expected for single questions of their type. The reliability appeared to be sufficiently high to use the questions for groups and this was the use made of them in this study.

Comparability of Respondents and Non-Respondents

As there was not a total response to the questionnaire, an effort was made to establish whether the respondents were comparable to the non-respondents. Information for making two such comparisons was available.

The median test of years of teaching experience for 94 teachers yielded $\chi^2 = 0.00$. This was not significant at the 0.05 level. Thus, the hypothesis--there is no significant difference between the median number of years of teaching experience of the study group and the median number of years of teaching experience of teachers in the original sample but not in the study group--was not rejected.

A t-test of the hypothesis--as measured by each of the arithmetical subtests of of MAT, there is no significant difference between the mean of the average student achievement gain for teachers in the study group and the mean for the 28 teachers who did not respond to the questionnaire but for whom average student achievement gain scores were available--yielded $t_{81} = 0.65$ for Arithmetic Computation and $t_{81} = 1.93$ for Arithmetic Problem Solving and Concepts. Neither was significant at the 0.05 level, so the hypothesis was not rejected.

Since it was impossible to say that the study group was different from the original sample in either experience or student achievement gain, it is reasonable to assume that the study group is a representative sample of the population.

Significance of Independent Variables

The results of the statistical tests of the hypotheses relating to the independent variables taken one at a time (page 9) are presented below. Each of the independent variables was used twice in making comparisons with the achievement test data--once with the Computation data, again with the Problem Solving and Concepts data. Four tables will be related to each of these independent variables. The first two will report the number of teachers in subgroups established on that variable and the adjusted means of the scores of the pupils of those teachers in each subgroup. The next two tables will report the analyses of variance using the Computation scores and the Problem Solving and Concepts scores. Then the pattern of tables is repeated for the remaining variables.

The first set of hypotheses was concerned with the influence of the teachers' credit in mathematics on the achievement of their pupils. The ranges of the mean scores among the three subgroups were quite small--1.11 for Computation and 0.73 for Problem Solving and Concepts. An interesting phenomenon exhibited itself in Tables I and II.

TABLE I

MEAN ARITHMETIC COMPUTATION FOR NUMBER
OF CREDIT HOURS OF MATHEMATICS

Hours of mathematics	0 - 5	6 - 8	9 up
Number of teachers	19	18	16
Adjusted mean	15.59	14.52	14.48

TABLE II

MEAN ARITHMETIC PROBLEM SOLVING AND CONCEPTS FOR NUMBER
OF CREDIT HOURS OF MATHEMATICS

Hours of mathematics	0 - 5	6 - 8	9 up
Number of teachers	19	18	16
Adjusted mean	11.19	11.39	11.92

Note that when the credit in mathematics was increasing, the means of the test scores for Computation were decreasing, while the opposite effect was found for the Problem Solving and Concepts scores. However, Tables III and IV present evidence that the differences were not

TABLE III

ANALYSIS OF VARIANCE WITH DISPROPORTIONALITY FOR NUMBER OF CREDIT HOURS OF MATHEMATICS USING COMPUTATION AS CRITERION VARIABLE

Sources of Variation	df	Sum of Squares Unadjusted	Sum of Squares Adjusted	Mean Square
Hours of mathematics	2	24.3039	14.5963	7.2982
Levels	2	104.5299	94.8223	47.4112
Interaction	4	73.6230	83.3306	20.8326
Within	44	633.3591		14.3845
Total	52	835.8159		

$F_{2,44}$ Hours of Mathematics = 0.51

$F_{2,44}$ Levels = 3.29*[1]

$F_{4,44}$ Interaction = 1.45

statistically significant when using either set of scores. For this reason, the hypotheses of no significant differences among groups were not rejected since the 0.05 level was arbitrarily selected as the value for accepting or rejecting each hypothesis. An F-ratio of approximately 3.21 would be necessary for the null hypotheses to be rejected at the 0.05 level. As neither of these ratios approached that magnitude, these conclusions gave support to the practical consideration of the limited significance of the differences among the mean scores.

[1]An asterisk will be used to indicate significance at the 0.05 level.

TABLE IV

ANALYSIS OF VARIANCE WITH DISPROPORTIONALITY FOR NUMBER OF CREDIT HOURS OF MATHEMATICS USING PROBLEM SOLVING AND CONCEPTS AS CRITERION VARIABLE

Sources of Variation	df	Sum of Squares		Mean Square
		Unadjusted	Adjusted	
Hours of mathematics	2	0.2614	4.5355	2.2678
Levels	2	64.3695	68.6436	34.3218
Interaction	4	73.3093	69.0352	17.2588
Within	44	372.9512		8.4762
Total	52	510.8914		

$F_{2,44}$ Hours of Mathematics = 0.27

$F_{2,44}$ Levels = 4.05*

$F_{4,44}$ Interaction = 2.04

The next set of hypotheses dealt with the relationship between a teacher's credit in mathematics education and the arithmetical achievement of his students. The ranges of the mean scores, reported in Tables V and VI and the F-ratios, reported in Tables VII and VIII,

TABLE V

MEAN ARITHMETIC COMPUTATION FOR NUMBER OF CREDIT HOURS OF MATHEMATICS EDUCATION

Hours of mathematics education	0 - 2	3 - 4	5 up
Number of teachers	14	22	17
Adjusted mean	15.23	14.86	14.96

TABLE VI

MEAN ARITHMETIC PROBLEM SOLVING AND CONCEPTS FOR NUMBER OF CREDIT HOURS OF MATHEMATICS EDUCATION

Hours of mathematics education	0 - 2	3 - 4	5 up
Number of teachers	14	22	17
Adjusted mean	11.43	11.48	11.33

TABLE VII

ANALYSIS OF VARIANCE WITH DISPROPORTIONALITY FOR NUMBER OF CREDIT HOURS OF MATHEMATICS EDUCATION USING COMPUTATION AS CRITERION VARIABLE

Sources of Variation	df	Sum of Squares Unadjusted	Sum of Squares Adjusted	Mean Square
Hours of mathematics education	2	4.6530	1.1030	0.5515
Levels	2	114.7477	111.1977	55.5988
Interaction	4	7.0757	10.6257	2.6564
Within	44	724.2587		16.4604
Total	52	850.7351		

$F_{2,44}$Hours of Mathematics Education = 0.03

$F_{2,44}$Levels = 3.38*

$F_{4,44}$Interaction = 0.16

were the smallest ones found during the study. The maximum range was only 0.37; the F-ratios were not significant. The mean scores for the subgroups were so close to each other and the F-ratios so small that there appeared to be no real differences among the subgroups.

TABLE VIII

ANALYSIS OF VARIANCE WITH DISPROPORTIONALITY FOR NUMBER OF CREDIT HOURS OF MATHEMATICS EDUCATION USING PROBLEM SOLVING AND CONCEPTS AS CRITERION VARIABLE

Sources of Variation	df	Sum of Squares Unadjusted	Sum of Squares Adjusted	Mean Square
Hours of mathematics education	2	2.6696	0.2199	0.1100
Levels	2	59.8456	57.3959	28.6980
Interaction	4	14.9836	17.4333	4.3583
Within	44	436.5749		9.9222
Total	52	514.0737		

$F_{2,44}$ Hours of Mathematics Education = 0.01

$F_{2,44}$ Levels = 2.89

$F_{4,44}$ Interaction = 0.44

Recency of mathematics course was one of the independent variables. An attempt was made to determine whether this variable was significantly related to student achievement. The ranges of the mean scores among the three subgroups were large--2.60 for Computation and 3.09 for Problem Solving and Concepts. Tables IX and X show similar relations

TABLE IX

MEAN ARITHMETIC COMPUTATION FOR RECENCY OF MATHEMATICS COURSE

Recency of mathematics course	Through 1945	1946 - 1959	1962 on
Number of teachers	18	15	20
Adjusted mean	14.65	16.50	13.90

TABLE X

MEAN ARITHMETIC PROBLEM SOLVING AND CONCEPTS FOR RECENCY OF MATHEMATICS COURSE

Recency of mathematics course	Through 1945	1946 - 1961	1962 on
Number of teachers	18	20	15
Adjusted mean	11.31	12.89	9.80

among the mean scores. In each case the middle group had the highest score, the group with the oldest mathematics course scored second, and the group having the most recent mathematics course had the lowest mean score. Tables XI and XII indicate that the differences were statistically significant for Problem Solving and Concepts but were not

TABLE XI

ANALYSIS OF VARIANCE WITH DISPROPORTIONALITY FOR RECENCY OF MATHEMATICS COURSE USING COMPUTATION AS CRITERION VARIABLE

Sources of Variation	df	Sum of Squares Unadjusted	Sum of Squares Adjusted	Mean Square
Recency of mathematics course	2	29.0153	56.3182	28.1591
Levels	2	104.5299	131.8328	65.9164
Interaction	4	176.8798	149.5769	37.3942
Within	44	525.3910		11.9407
Total	52	835.8159		

$F_{2,44}$ Recency of Mathematics Course = 2.36

$F_{2,44}$ Levels = 5.52*

$F_{4,44}$ Interaction = 3.13*

TABLE XII

ANALYSIS OF VARIANCE WITH DISPROPORTIONALITY FOR RECENCY OF MATHEMATICS COURSE USING PROBLEM SOLVING AND CONCEPTS AS CRITERION VARIABLE

Sources of Variation	df	Sum of Squares Unadjusted	Sum of Squares Adjusted	Mean Square
Recency of mathematics course	2	81.4973	82.3130	41.1565
Levels	2	64.3695	65.1852	32.5926
Interaction	4	46.9563	46.1406	11.5352
Within	44	318.0683		7.2288
Total	52	510.8914		

$F_{2,44}$Recency of Mathematics Course = 5.69*

$F_{2,44}$Levels = 4.51*

$F_{4,44}$Interaction = 1.60

significant for Computation. Therefore, for Problem Solving and Concepts the probability of by chance obtaining among the three groups established on recency of mathematics course differences as large as the differences obtained is less than 0.05. None of the F-ratios for Computation was significant, but this is the one that came closest. The hypotheses of no significant difference among groups established by recency of mathematics course was rejected for Problem Solving and Concepts and was not rejected for Computation. Therefore, there is probably a significant relationship between recency of mathematics course and teacher effectiveness as measured by student achievement gain on the Arithmetic Problem Solving and Concepts subtest of MAT.

Another set of hypotheses was concerned with the relationship of the recency of a teacher's last mathematics education course to the achievement of his students in arithmetic. The ranges of the means were 1.61 for Computation and 2.29 for Problem Solving and Concepts. A surprising phenomenon exhibited itself in Tables XIII and XIV. The more

TABLE XIII

MEAN ARITHMETIC COMPUTATION FOR RECENCY OF MATHEMATICS EDUCATION COURSE

Recency of mathematics education course	Through 1953	1954 - 1962	1963 on
Number of teachers	16	20	17
Adjusted mean	15.56	15.41	13.95

TABLE XIV

MEAN ARITHMETIC PROBLEM SOLVING AND CONCEPTS FOR RECENCY OF MATHEMATICS EDUCATION COURSE

Recency of mathematics education course	Through 1954	1955 - 1962	1963 on
Number of teachers	18	18	17
Adjusted mean	12.26	11.94	9.97

recent a group's last mathematics education course, the lower their mean score was. However Tables XV and XVI present evidence that these results were significant only in the case of Problem Solving and Concepts. The F-ratio was significant for Problem Solving and Concepts so the hypothesis of no significant differences among the groups was rejected for this criterion, but a nonsignificant F-ratio for Computation resulted in the hypothesis not being rejected for Computation. These findings give substance to the reaction that there is a significant relationship between recency of mathematics education course and average student achievement gain on Problem Solving and Concepts.

TABLE XV

ANALYSIS OF VARIANCE WITH DISPROPORTIONALITY FOR RECENCY OF MATHEMATICS EDUCATION COURSE USING COMPUTATION AS CRITERION VARIABLE

Sources of Variation	df	Sum of Squares Unadjusted	Sum of Squares Adjusted	Mean Square
Recency of mathematics education course	2	22.9277	26.8892	13.4446
Levels	2	114.7477	118.7092	59.3546
Interaction	4	137.2852	133.3237	33.3309
Within	44	575.7746		13.0858
Total	52	850.7351		

$F_{2,44}$Recency of Mathematics Education Course = 1.03

$F_{2,44}$Levels = 4.54*

$F_{4,44}$Interaction = 2.55

The relationship between teacher effectiveness and recency of education course was also investigated. The ranges of the mean scores among the three subgroups differed substantially--1.27 for Computation and 2.23 for Problem Solving and Concepts. The relation between the mean scores in Tables XVII and XVIII is the same as the relation found for recency of mathematics education course. The group with the oldest education course had the highest mean score and the group with the most recent education course had the lowest mean score. The evidence in Tables XIX and XX indicate that these differences were not statistically significant. The hypotheses of no significant differences among the groups was not rejected because neither F-ratio was greater than 3.21 as would be necessary for the null hypotheses to be rejected at the 0.05 level. The findings supported the conclusion of no significant relationship between recency of education course and teacher effectiveness.

TABLE XVI

ANALYSIS OF VARIANCE WITH DISPROPORTIONALITY FOR RECENCY OF MATHEMATICS EDUCATION COURSE USING PROBLEM SOLVING AND CONCEPTS AS CRITERION VARIABLE

Sources of Variation	df	Sum of Squares Unadjusted	Sum of Squares Adjusted	Mean Square
Recency of mathematics education course	2	43.1142	52.5111	26.2556
Levels	2	59.8456	69.2425	34.6212
Interaction	4	90.3692	80.9723	20.2431
Within	44	320.7447		7.2897
Total	52	514.0737		

$F_{2,44}$ Recency of Mathematics Education Course = 3.60*

$F_{2,44}$ Levels = 4.75*

$F_{4,44}$ Interaction = 2.78*

TABLE XVII

MEAN ARITHMETIC COMPUTATION FOR RECENCY OF EDUCATION COURSE

Recency of education course	Through 1956	1957 - 1963	1964 on
Number of teachers	14	17	22
Adjusted mean	15.93	14.80	14.66

TABLE XVIII

MEAN ARITHMETIC PROBLEM SOLVING AND CONCEPTS
FOR RECENCY OF EDUCATION COURSE

Recency of education course	Through 1959	1960 - 1963	1964 on
Number of teachers	16	15	22
Adjusted mean	12.67	11.55	10.44

TABLE XIX

ANALYSIS OF VARIANCE WITH DISPROPORTIONALITY FOR RECENCY OF EDUCATION COURSE USING COMPUTATION AS CRITERION VARIABLE

Sources of Variation	df	Sum of Squares Unadjusted	Sum of Squares Adjusted	Mean Square
Recency of education course	2	6.7716	14.9669	7.4834
Levels	2	122.7741	130.9694	65.4847
Interaction	4	117.9343	109.7390	27.4348
Within	44	629.8090		14.3138
Total	52	877.2890		

$F_{2,44}$Recency of Education Course = 0.52

$F_{2,44}$Levels = 4.57^{*}

$F_{4,44}$Interaction = 1.92

TABLE XX

ANALYSIS OF VARIANCE WITH DISPROPORTIONALITY FOR RECENCY OF EDUCATION COURSE USING PROBLEM SOLVING AND CONCEPTS AS CRITERION VARIABLE

Sources of Variation	df	Sum of Squares Unadjusted	Sum of Squares Adjusted	Mean Square
Recency of education course	2	38.4740	45.1635	22.5818
Levels	2	63.3776	70.0671	35.0336
Interaction	4	96.4913	89.8018	22.4504
Within	44	311.1265		7.0711
Total	52	509.4694		

$F_{2,44}$ Recency of Education Course = 3.19

$F_{2,44}$ Levels = 4.95*

$F_{4,44}$ Interaction = 3.17*

Another set of hypotheses dealt with the influence of the number of years of teaching experience of a teacher on the achievement of his students. At 2.70 for Computation and 1.62 for Problem Solving and Concepts, the ranges of the mean scores among the three subgroups were mediocre in size. From Table XXI it is observed that for Computation the mean scores increased as the number of years of teaching experience increased. However, neither F-ratio was even half as large as would have been necessary for significance at the 0.05 level. Therefore, the hypothesis of no significant differences among the means was not rejected. This lends substance to the conclusion that the number of years of teaching experience of a teacher does not significantly influence his student's achievement.

TABLE XXI

MEAN ARITHMETIC COMPUTATION FOR NUMBER OF YEARS OF TEACHING EXPERIENCE

Years of teaching experience	1 - 6	7 - 19	20 up
Number of teachers	20	18	13
Adjusted mean	14.06	14.74	16.76

TABLE XXII

MEAN ARITHMETIC PROBLEM SOLVING AND CONCEPTS FOR NUMBER OF YEARS OF TEACHING EXPERIENCE

Years of teaching experience	1 - 4	5 - 15	16 up
Number of teachers	18	14	19
Adjusted mean	11.56	10.35	11.97

TABLE XXIII

ANALYSIS OF VARIANCE WITH DISPROPORTIONALITY FOR YEARS OF TEACHING EXPERIENCE USING COMPUTATION AS CRITERION VARIABLE

Sources of Variation	df	Sum of Squares Unadjusted	Sum of Squares Adjusted	Mean Square
Years of teaching experience	2	11.8193	52.4514	26.2257
Levels	2	133.6420	174.2741	87.1370
Interaction	4	114.4897	73.8576	18.4644
Within	42	613.6388		14.6104
Total	50	873.5898		

$F_{2,42}$ Years of Teaching Experience = 1.80

$F_{2,42}$ Levels = 5.96*

$F_{4,42}$ Interaction = 1.26

TABLE XXIV

ANALYSIS OF VARIANCE WITH DISPROPORTIONALITY FOR YEARS OF TEACHING EXPERIENCE USING PROBLEM SOLVING AND CONCEPTS AS CRITERION VARIABLE

Sources of Variation	df	Sum of Squares Unadjusted	Sum of Squares Adjusted	Mean Square
Years of teaching experience	2	25.2499	22.7846	11.3923
Levels	2	69.6218	67.1565	33.5782
Interaction	4	67.8367	70.3020	17.5755
Within	42	346.4862		8.2497
Total	50	509.1947		

$F_{2,42}$ Years of Teaching Experience = 1.38

$F_{2,42}$ Levels = 4.07*

$F_{4,42}$ Interaction = 2.13

One set of hypotheses stated that there is no significant difference (0.05) in the third grade achievement gain of students of teachers in the three groups established by using the amount of graduate credit. The ranges of the mean scores among the three groups were small--0.77 for Computation and 1.15 for Problem Solving and Concepts. This indicated that the differences were probably not significant. Tables XXVII and XXVIII confirm that indeed the differences were not significant. Thus, the hypotheses were not rejected. The evidence supported the conclusion that number of hours of graduate credit was not significantly related to teacher effectiveness. However, Tables XXV and XXVI reveal that for the particular group of teachers studied the teachers with some graduate credit but not a masters degree were the most effective.

TABLE XXV

MEAN ARITHMETIC COMPUTATION FOR NUMBER OF HOURS OF GRADUATE CREDIT

Hours of graduate credit	0	1 - 29	30 up
Number of teachers	13	17	24
Adjusted mean	14.67	15.44	15.06

TABLE XXVI

MEAN ARITHMETIC PROBLEM SOLVING AND CONCEPTS FOR NUMBER OF HOURS OF GRADUATE CREDIT

Hours of graduate credit	0 - 5	6 - 29	30 up
Number of teachers	19	11	24
Adjusted mean	11.10	12.25	11.27

TABLE XXVII

ANALYSIS OF VARIANCE WITH DISPROPORTIONALITY FOR HOURS OF GRADUATE CREDIT USING COMPUTATION AS CRITERION VARIABLE

Sources of Variation	df	Sum of Squares Unadjusted	Sum of Squares Adjusted	Mean Square
Hours of graduate credit	2	17.4255	4.3694	2.1847
Levels	2	124.3047	111.2486	55.6243
Interaction	4	128.3143	141.3704	35.3426
Within	45	607.8634		13.5081
Total	53	877.9078		

$F_{2,45}$Hours of Graduate Credit = 0.16

$F_{2,45}$Levels = 4.12*

$F_{4,45}$Interaction = 2.62*

TABLE XXVIII

ANALYSIS OF VARIANCE WITH DISPROPORTIONALITY FOR HOURS OF GRADUATE CREDIT USING PROBLEM SOLVING AND CONCEPTS AS CRITERION VARIABLE

Sources of Variation	df	Sum of Squares Unadjusted	Sum of Squares Adjusted	Mean Square
Hours of graduate credit	2	6.8781	9.7064	4.8532
Levels	2	59.1628	61.9911	30.9956
Interaction	4	56.3923	53.5640	13.3910
Within	45	391.7628		8.7058
Total	53	514.1960		

$F_{4,45}$Hours of Graduate Credit = 0.56

$F_{4,45}$Levels = 3.56 *

$F_{4,45}$Interaction = 1.54

The eighth set of hypotheses was concerned with the influence of the teachers' pleasure in teaching arithmeitc on the achievement of their pupils in arithmetic. Neither range of the mean scores among the three subgroups was large--1.79 for Computation and 1.59 for Problem Solving and Concepts. Tables XXIX and XXX show that the group rating

TABLE XXIX

MEAN ARITHMETIC COMPUTATION FOR PLEASURE IN TEACHING ARITHMETIC

Pleasure in teaching arithmetic	1	2	3 - 10
Number of teachers	11	27	17
Adjusted mean	14.60	15.87	14.08

arithmetic as the course they received the most pleasure from teaching made the lowest mean score in one case and made the middle mean score in the other case. However, Tables XXXI and XXXII present evidence that the differences were not statistically significant for either Computation or Problem Solving and Concepts. The hypotheses of no significant differences among groups were not rejected since neither F-ratio was large enough for significance at the 0.05 level. The results suggested that the pleasure a teacher receives from teaching a course had no practical influence on his effectiveness in teaching that course.

TABLE XXX

MEAN ARITHMETIC PROBLEM SOLVING AND CONCEPTS
FOR PLEASURE IN TEACHING ARITHMETIC

Pleasure in teaching arithmetic	1	2	3 - 10
Number of teachers	11	27	17
Adjusted mean	10.59	11.31	12.18

TABLE XXXI

ANALYSIS OF VARIANCE WITH DISPROPORTIONALITY FOR PLEASURE IN TEACHING ARITHMETIC USING COMPUTATION AS CRITERION VARIABLE

Sources of Variation	df	Sum of Squares Unadjusted	Sum of Squares Adjusted	Mean Square
Pleasure in teaching arithmetic	2	43.2228	36.2307	18.1154
Levels	2	120.8027	113.8106	56.9053
Interaction	4	16.8977	23.8898	5.9724
Within	46	698.4935		15.1846
Total	54	879.4166		

$F_{2,46}$ Pleasure in Teaching Arithmetic = 1.19

$F_{2,46}$ Levels = 3.75*

$F_{4,46}$ Interaction = 0.39

TABLE XXXII

ANALYSIS OF VARIANCE WITH DISPROPORTIONALITY FOR PLEASURE IN TEACHING ARITHMETIC USING PROBLEM SOLVING AND CONCEPTS AS CRITERION VARIABLE

Sources of Variation	df	Sum of Squares Unadjusted	Sum of Squares Adjusted	Mean Square
Pleasure in teaching arithmetic	2	7.6650	17.1218	8.5609
Levels	2	60.6653	70.1221	35.0610
Interaction	4	27.3711	17.9143	4.4786
Within	46	420.1116		9.1329
Total	54	515.8129		

$F_{2,46}$Pleasure in teaching arithmetic = 0.94

$F_{2,46}$Levels = 3.84 *

$F_{4,46}$Interaction = 0.49

TABLE XXXIII

MEAN ARITHMETIC COMPUTATION FOR CONFIDENCE IN TEACHING ARITHMETIC

Confidence in teaching arithmetic	1	2	3 - 10
Number of teachers	17	21	17
Adjusted mean	14.67	15.68	14.69

The last set of hypotheses dealt with the effect of the teachers' confidence in teaching arithmetic on their students' achievement. The size of the ranges of the mean scores in Tables XXXIII and IIIIV--1.01

TABLE XXXIV

MEAN ARITHMETIC PROBLEM SOLVING AND CONCEPTS
FOR CONFIDENCE IN TEACHING ARITHMETIC

Confidence in teaching arithmetic	1	2	3 - 10
Number of teachers	17	21	17
Adjusted mean	11.09	10.94	12.38

for Computation and 1.44 for Problem Solving and Concepts--suggested that the differences were not significant. However, it is interesting to note that the teachers who rated arithmetic as the course they had the most confidence in teaching did not have the highest mean score for either set of scores. The F-ratios in Tables XXXV and XXXVI were not large enough to reject the hypotheses of no significant differences among the three subgroups. A conclusion of no significant relationship between confidence in teaching arithmetic and effectiveness in teaching arithmetic was justified.

TABLE XXXV

ANALYSIS OF VARIANCE WITH DISPROPORTIONALITY FOR CONFIDENCE IN TEACHING ARITHMETIC USING COMPUTATION AS CRITERION VARIABLE

Sources of Variation	df	Sum of Squares Unadjusted	Sum of Squares Adjusted	Mean Square
Confidence in teaching arithmetic	2	2.8452	12.1487	6.0744
Levels	2	120.8027	130.1062	65.0531
Interaction	4	43.0762	33.7727	8.4432
Within	46	712.6925		15.4933
Total	54	879.4166		

$F_{2,46}$Confidence in Teaching Arithmetic = 0.39

$F_{2,46}$Levels = 4.20*

$F_{4,46}$Interaction = 0.54

TABLE XXXVI

ANALYSIS OF VARIANCE WITH DISPROPORTIONALITY FOR CONFIDENCE IN TEACHING ARITHMETIC USING PROBLEM SOLVING AND CONCEPTS AS CRITERION VARIABLE

Sources of Variation	df	Sum of Squares Unadjusted	Sum of Squares Adjusted	Mean Square
Confidence in teaching arithmetic	2	21.9970	22.4164	11.2080
Levels	2	60.6653	61.0844	30.5422
Interaction	4	16.1517	15.7326	3.9332
Within	46	416.9989		9.0652
Total	54	515.8129		

$F_{2,46}$ Confidence in Teaching Arithmetic = 1.24

$F_{2,46}$ Levels = 3.37 *

$F_{4,46}$ Interaction = 0.44

Significance of Interaction Between Selected Independent Variables

The statistical analysis of the significance of the interaction between selected independent variables (page 10) is presented below. For each pair of variables the first table shows how the subjects were divided into groups. Except for the first pair of variables, the second table reports the analysis of variance based on Computation to check for significant interaction between the variables. There is no such table for the first pair of variables. For each pair of variables the last table reports the analysis of variance based on Problem Solving and Concepts to check for significant interaction between the variables.

If an interpretive paragraph were presented with each pair of variables, it would of necessity be almost identical to the following paragraph. The repetition would be boring. Therefore, the following paragraph is the interpretive paragraph for the tables of all selected pairs of independent variables.

Not a single significant interaction was found among the selected ones tested. In fact, none of the F-ratios for interaction was even close to the number needed for significance at the 0.05 level, which was the level of significance arbitrarily selected before the analysis of the data. Thus, for each of the five pairs of independent variables the hypotheses of no significant interaction between variables were not rejected. These findings gave substance to the reaction that for each of the selected pairs of variables, each variable is additive with respect to the other variable with which it was paired.

TABLE XXXVII

DIVISION OF SUBJECTS BY RECENCY OF MATHEMATICS COURSE AND RECENCY OF MATHEMATICS EDUCATION COURSE

Recency of mathematics course	Through 1950	1951 on
Number of teachers	22	30
Recency of mathematics education course	Through 1957	1958 on
Number of teachers	22	30

TABLE XXXVIII

ANALYSIS OF VARIANCE WITH DISPROPORTIONALITY FOR INTERACTION OF RECENCY OF MATHEMATICS COURSE AND RECENCY OF MATHEMATICS EDUCATION COURSE USING PROBLEM SOLVING AND CONCEPTS AS CRITERION VARIABLE

Sources of Variation	df	Sum of Squares Unadjusted	Sum of Squares Adjusted	Mean Square
Recency of mathematics course	1	0.3505	1.8638	1.8638
Recency of mathematics education course	1	6.0267	7.5400	7.5400
Interaction	1	24.9975	23.4842	23.4842
Within	48	478.0190		9.9587
Total	51	509.3937		

$F_{1,48}$Interaction = 2.36

TABLE XXXIX

DIVISION OF SUBJECTS BY RECENCY OF MATHEMATICS COURSE AND NUMBER OF CREDIT HOURS OF MATHEMATICS

Recency of mathematics course	Through 1944	1945 - 1959	1960 on
Number of teachers	17	18	18
Hours of mathematics	0 - 3	4 - 6	7 up
Number of teachers	12	16	25

TABLE XL

ANALYSIS OF VARIANCE WITH DISPROPORTIONALITY FOR INTERACTION OF RECENCY OF MATHEMATICS COURSE AND HOURS OF MATHEMATICS USING COMPUTATION AS CRITERION VARIABLE

Sources of Variation	df	Sum of Squares Unadjusted	Sum of Squares Adjusted	Mean Square
Recency of mathematics course	2	39.2196	37.0069	18.5034
Hours of mathematics	2	59.6390	57.4263	28.7132
Interaction	4	11.7138	13.9265	3.4816
Within	44	725.2434		16.4828
Total	52	835.8159		

$F_{4,44}$ Interaction = 0.21

TABLE XLI

ANALYSIS OF VARIANCE WITH DISPROPORTIONALITY FOR INTERACTION OF RECENCY OF MATHEMATICS COURSE AND HOURS OF MATHEMATICS USING PROBLEM SOLVING AND CONCEPTS AS CRITERION VARIABLE

Sources of Variation	df	Sum of Squares Unadjusted	Sum of Squares Adjusted	Mean Square
Recency of mathematics course	2	32.6045	29.1726	14.5863
Hours of mathematics	2	21.1863	17.7544	8.8772
Interaction	4	- 0.7651	2.6668	0.6667
Within	44	457.8659		10.4060
Total	52	510.8914		

$F_{4,44}$ Interaction = 0.06

TABLE XLII

DIVISION OF SUBJECTS BY RECENCY OF MATHEMATICS COURSE AND YEARS OF TEACHING EXPERIENCE

Recency of mathematics course	Through 1944	1945 - 1960	1961 on
Number of teachers	17	16	16
Years of teaching experience	1 - 5	6 - 20	21 up
Number of teachers	18	20	11

TABLE XLIII

ANALYSIS OF VARIANCE WITH DISPROPORTIONALITY FOR INTERACTION OF RECENCY OF MATHEMATICS COURSE AND YEARS OF TEACHING EXPERIENCE USING COMPUTATION AS CRITERION VARIABLE

Sources of Variation	df	Sum of Squares Unadjusted	Sum of Squares Adjusted	Mean Square
Recency of mathematics course	2	46.6855	60.6007	30.3004
Years of teaching experience	2	3.4694	17.3846	8.6923
Interaction	4	52.7976	38.8824	9.7206
Within	40	725.5205		18.1380
Total	48	828.4729		

$F_{4,40}$Interaction = 0.54

TABLE XLIV

ANALYSIS OF VARIANCE WITH DISPROPORTIONALITY FOR INTERACTION OF RECENCY OF MATHEMATICS COURSE AND YEARS OF TEACHING EXPERIENCE USING PROBLEM SOLVING AND CONCEPTS AS CRITERION VARIABLE

Sources of Variation	df	Sum of Squares Unadjusted	Sum of Squares Adjusted	Mean Square
Recency of mathematics course	2	34.1490	77.2107	38.6054
Years of teaching experience	2	16.3201	59.3818	29.6909
Interaction	4	52.0917	9.0300	2.2575
Within	40	401.5567		10.0389
Total	48	504.1175		

$F_{4,40}$Interaction = 0.22

TABLE XLV

DIVISION OF SUBJECTS BY RECENCY OF MATHEMATICS EDUCATION COURSE AND YEARS OF TEACHING EXPERIENCE

Recency of mathematics education course	Through 1959	1960 on
Number of teachers	22	27
Years of teaching experience	1 - 10	11 up
Number of teachers	29	20

TABLE XLVI

ANALYSIS OF VARIANCE WITH DISPROPORTIONALITY FOR INTERACTION OF RECENCY OF MATHEMATICS EDUCATION COURSE AND YEARS OF TEACHING EXPERIENCE USING COMPUTATION AS CRITERION VARIABLE

Sources of Variation	df	Sum of Squares Unadjusted	Sum of Squares Adjusted	Mean Square
Recency of mathematics education course	1	12.3568	31.6604	31.6604
Years of teaching experience	1	7.2402	26.5438	26.5438
Interaction	1	58.0578	38.7542	38.7542
Within	45	766.6155		17.0359
Total	48	844.2703		

$F_{1,45}$ Interaction = 2.27

TABLE XLVII

ANALYSIS OF VARIANCE WITH DISPROPORTIONALITY FOR INTERACTION OF RECENCY OF MATHEMATICS EDUCATION COURSE AND YEARS OF TEACHING EXPERIENCE USING PROBLEM SOLVING AND CONCEPTS AS CRITERION VARIABLE

Sources of Variation	df	Sum of Squares Unadjusted	Sum of Squares Adjusted	Mean Square
Recency of mathematics education course	1	9.8967	7.1580	7.1580
Years of teaching experience	1	2.7462	0.0075	0.0075
Interaction	1	22.5371	25.2758	25.2758
Within	45	472.3235		10.4961
Total	48	507.5034		

$F_{1,45}$ Interaction = 2.41

TABLE XLVIII

DIVISION OF SUBJECTS BY RECENCY OF EDUCATION COURSE AND HOURS OF GRADUATE CREDIT

Recency of education course	Through 1960	1961 - 1964	1965 on
Number of teachers	18	18	16
Hours of graduate credit	0 - 5	6 - 29	30 up
Number of teachers	17	11	24

TABLE XLIX

ANALYSIS OF VARIANCE WITH DISPROPORTIONALITY FOR INTERACTION OF RECENCY OF EDUCATION COURSE AND HOURS OF GRADUATE CREDIT USING COMPUTATION AS CRITERION VARIABLE

Sources of Variation	df	Sum of Squares Unadjusted	Sum of Squares Adjusted	Mean Square
Recency of education course	2	44.8669	59.9955	29.9978
Hours of graduate credit	2	6.5292	21.6578	10.8289
Interaction	4	32.5454	17.4168	4.3542
Within	43	791.9031		18.4164
Total	51	875.8447		

$F_{4,43}$ Interaction = 0.24

TABLE L

ANALYSIS OF VARIANCE WITH DISPROPORTIONALITY FOR INTERACTION OF RECENCY OF EDUCATION COURSE AND HOURS OF GRADUATE CREDIT USING PROBLEM SOLVING AND CONCEPTS AS CRITERION VARIABLE

Sources of Variation	df	Sum of Squares Unadjusted	Sum of Squares Adjusted	Mean Square
Recency of education course	2	48.8467	52.8778	26.4389
Hours of graduate credit	2	6.9635	10.9946	5.4973
Interaction	4	28.5874	24.5563	6.1391
Within	43	423.4399		9.8474
Total	51	507.8375		

$F_{4,43}$ Interaction = 0.62

Summary

The results of checking the nine variables for significant effects on teacher effectiveness in third grade arithmetic were disappointing. Using average student achievement gain on MAT Arithmetic Computation as the criteria of teacher effectiveness, no significant differences (0.05) were found among the three groups established by use of each variable individually. When average student achievement gain on MAT Arithmetic Problem Solving and Concepts was the criteria of effective teaching, there were significant differences for recency of mathematics course and recency of mathematics education course but none for the other seven variables.

In the majority of the tests no significant difference was found. There are two explanations other than chance for this. There may be no relationship or the relationship may be too small to be detected by this study. The number of things contributing to successful teaching may be so large that the effect of a single variable is minute. In any case, the results indicate that a composite of several variables should be tested in another study.

In the two cases where significant differences were found, the adjusted means were not as expected. For both recency of mathematics course and recency of mathematics education course, the group with the lowest average Problem Solving and Concepts score was the group with the most recent training. For recency of mathematics education course the ordering of scores was such that the more recent the course for a group the lower the groups average Problem Solving and Concepts score. At first it was thought that these odd results might be explained by interaction with teaching experience, but when computed these interactions did not prove to be significant. An unjustified guess is that the results may be caused by the fact that the arithmetic subtests of MAT test the mathematics of 15 years ago. Therefore, the teachers with the most recent training may not emphasize the capabilities tested by MAT.

Interaction between variables could suggest composites which would be interesting to study because of the possibility that several variables together might make an appreciable contribution to teacher effectiveness. No significant interactions were found among those studied, so no suggestions for further study were obtained. It should be noted that the precision of these analyses of variance was not as great as for those involving levels.

The F ratios for levels were reported although they were not used for hypothesis testing. It is interesting to note that of these 18 F ratios for levels only one was not significant at the 0.05 level. Since the variable used to determine levels should correlate with the criterion as highly as practical, this provides some justification for the choice of pre-test scores to determine levels. At least, it shows that in all but one case a significant relation exist.

A significant F was obtained for interaction between levels and the independent variables in only four of the 18 cases. Unless different subjects are taught by different teachers and students are grouped on the basis of their ability in that particular subject, significant interaction could not be used in a practical situation. Therefore, it is of theoretical interest only with the present organization of elementary schools.

CHAPTER IV

IMPLICATIONS

Summary

The present study dealt with the relation between teacher effectiveness in third grade arithmetic as measured by average student achievement gain on the two arithmetic subtests of MAT and the following independent variables:

1. Number of credit hours in mathematics.
2. Number of credit hours in mathematics education.
3. Recency of mathematics course.
4. Recency of mathematics education course.
5. Recency of education course.
6. Years of teaching experience.
7. Number of hours of graduate credit.
8. Pleasure in teaching arithmetic.
9. Confidence in teaching arithmetic.

A random sample of 100 third grade teachers for the 1965-66 school year in the Oklahoma City Public Schools was sent a questionnaire to obtain measures of the independent variables. For these teachers' third grade students the Arithmetic Computation scores and the Problem Solving and Concepts scores from the September and October 1965, administration of MAT and the same scores from the September and October, 1966, administration for the same students as fourth graders were collected from the files of the testing office of the Oklahoma City Public Schools. The third grade tests were used to divide the teachers into three groups on the basis of the average initial achievement of their students. Both the third and fourth grade tests were used to determine average student achievement gain for each teacher.

At this stage only 55 teachers were left in the study group because some teachers did not respond to the questionnaire and insufficient test data excluded others. A median test of teaching experience and a t-test of average student achievement gain failed to find a significant difference between the study group and the teachers in the original sample of 100 but not in the study group. Thus, the assumption that the study group was a representative sample of the teachers of third grade students in the Oklahoma City Public Schools was given some support.

The test-retest reliability of questions eight and nine from the questionnaire gave a Pearson r of 0.76 for pleasure in teaching arithmetic and a Pearson r of 0.81 for confidence in teaching arithmetic. The reliability was judged high enough to use for dividing the teachers into three groups by these questions.

To assess the significance of the relationship between each independent variable and teacher effectiveness, initial achievement was used to determine the levels for a treatments by levels design. This gave a double classification which was analyzed by Patterson's method for conducting analysis of variance when disproportionality is present in a table. For each independent variable this analysis was conducted once for each of the two arithmetic subtests of MAT.

Patterson's method was used again to check for a significant interaction between the following pairs of variables:

1. Recency of mathematics course.

   Recency of mathematics education course.

2. Number of credit hours in mathematics.

   Recency of mathematics course.

3. Recency of mathematics course.

   Number of years of teaching experience.

4. Recency of mathematics education course.

   Number of years of teaching experience.

5. Recency of education course.

   Number of hours of graduate credit.

A significant relationship was found between teacher effectiveness as measured by average student gain scores on the Arithmetic Problem Solving and Concepts subtest of MAT and the following independent variables:

1. Recency of mathematics course.
2. Recency of mathematics education course.

Surprisingly, the teachers having the most recent courses were the least effective according to this measure. For these same two variables no significant relationship was found when the criterion of teacher effectiveness was average student achievement gain on the Arithmetic Computation subtest of MAT.

No significant relationship was found between teacher effectiveness as measured by average student gain scores on either Arithmetic Computation or Arithmetic Problem Solving and Concepts and the following independent variables:

1. Number of credit hours in mathematics.
2. Number of credit hours in mathematics education.

3. Recency of education course.

4. Years of teaching experience.

5. Number of hours of graduate credit.

6. Pleasure in teaching arithmetic.

7. Confidence in teaching arithmitic.

No significant interaction was found between the following pairs of variables:

1. Recency of mathematics course.

   Recency of mathematics education course.

2. Number of credit hours in mathematics.

   Recency of mathematics course.

3. Recency of mathematics course.

   Number of years of teaching experience.

4. Recency of mathematics education course.

   Number of years of teaching experience.

5. Recency of education course.

   Number of hours of graduate credit.

Theoretical Implications

One of the postulates stated: a teacher's effectiveness in teaching a subject increases as his preparation to teach the subject increases. The two independent variables applying to this postulate were number of credit hours in mathematics and number of credit hours in mathematics education. Since no statistically significant differences were found for these two independent variables, no evidence was found to support the postulate.

A related postulate stated: A teacher's effectiveness in teaching a subject is positively related to the recency of his last course in the subject. The independent variables associated with this postulate were recency of mathematics course and recency of mathematics education course. Significant differences for these two independent variables were found when the criterion was Problem Solving and Concepts but were not found when Computation was the criterion. The differences were not in the direction postulated. Thus, the conclusion is that a significant relationship exists between recency of preparation to teach a subject and effectiveness in teaching the subject. However, the relationship is not positive. Perhaps confusion from changing to the modern mathematics and the fact that MAT does not test the newer ideas in mathematics accounted for the group with the most recent courses having the smallest average student achievement gain on Problem Solving and Concepts.

Since no significant difference was found for the independent variable, recency of education course, no evidence was found to substantiate the postulate: a teacher's effectiveness in positively related to the recency of his last education course.

Years of teaching experience was the independent variable that was associated with the postulate: a teacher's effectiveness increases during his first few years of teaching and then remains relatively constant. No significant differences were found for years of teaching experience so the postulate was not verified. Thus, this study produced no evidence of a significant relationship between teaching experience and teacher effectiveness.

Another postulate was that a teacher's effectiveness is positively related to the amount of graduate work completed. Since no significant differences were found for the independent variable, hours of graduate credit, the postulate was not supported.

Two of the postulates stated that a teacher's effectiveness in teaching a course is positively related to his pleasure in teaching the course and to his confidence in teaching the course. These postulates were not substantiated by the study because no significant differences were found for the corresponding independent variables, pleasure in teaching arithmetic and confidence in teaching arithmetic.

The above statements that no evidence was found to verify a postulate do not mean that the postulate is not true. Instead, they mean that this study did not produce any evidence that they were true. However, such a statement casts doubt on the validity of the postulate for thrid grade arithmetic.

The results of this study were more in line with the results of the other studies that found no relationship or only a slight relationship between variables such as those studied here and teacher effectiveness than with the theoretical positions implied by the actions of administrators, colleges, and certification agencies.

Since no significant interaction was found between the selected pairs of variables, the postulate of significant interaction for the selected pairs was not supported. Thus, the results did not show that certain combinations of variables reinforce each other to make larger contribution to effective teaching than either alone.

Implications for Future Research

A continuation of efforts to determine what makes an effective teacher appears to be required by the need for the information. The discouraging results of the present study are not justification for cessation of the effort to determine what makes a teacher effective.

The portion of the study that revealed a significant relationship between teacher effectiveness and recency of mathematics course and between teacher effectiveness and recency of mathematics education course yielded a surprising result. The groups having the most recent courses had the lowest average student achievement gain. This portion of the study should be replicated.

Because of the poor showing by single variables used alone, a composite of several variables should be tried. This study did not suggest any combinations. Regression analysis could be used to determine a composite of several variables. The relationship of the composite variable to teacher effectiveness could then be determined.

A SELECTED BIBLIOGRAPHY

(1) Ackerman, Walter J. "Teacher Competence and Pupil Change." The Harvard Educational Review, XXIV (Fall, 1954), 273-89.

(2) Barr, Arvil S. "The Measurement of Teacher Characteristics and Prediction of Teaching Efficiency." Review of Educational Research, XXII (June, 1952), 169-72.

(3) Barr, Arvil S. et al. "Wisconsin Studies of the Measurement and Prediction of Teacher Effectiveness--A Summary of Investigations." The Journal of Experimental Education, XXX (September, 1961), 5-156.

(4) Barr, Arvil S. et al. "The Validity of Certain Instruments Employed in the Measurement of Teaching Ability." The Measurement of Teaching Efficiency. Ed. Helen M. Walker. New York: The Macmillan Company, 1935, pp. 73-141.

(5) Barr, Arvil S. et al. "The Measurement and Prediction of Teaching Efficiency: A summary of Investigations." The Journal of Experimental Education, XVI (June, 1948), 203-83.

(6) Brueckner, Leo J., Elda L. Morton, and Foster E. Grossnickle. Moving Ahead in Arithmetic, Book 3. New York: Holt, Rinehart, Winston, Inc., 1963.

(7) Davis, H. McVey. The Use of State High School Examinations as an Instrument for Judging the Work of Teachers, (Contributions to Education, No. 611). New York: Columbia University, 1934.

(8) Durost, Walter N,. ed. Directions for Administering Metropolitan Achievement Tests, Elementary Battery. New York: Harcourt, Brace, and World, Inc., 1963.

(9) Durost, Walter N., ed. Metropolitan Achievement Tests, Elementary Battery, Form A. New York: Harcourt, Brace and World, Inc., 1959.

(10) Hall, Harry O. "Professional Preparation and Teacher Effectiveness." The Journal of Teacher Education, XV (March, 1964), 72-6.

(11) Hughes, J. M. "A Study of Intelligence and of the Training of Teachers as Factors Conditioning the Achievement of Pupils." The School Review, XXXIII (March, 1925), 191.

(12) Lindquist, E. F. Design and Analysis of Experiments in Psychology and Education. Boston: Houghton Miffin Company, 1953.

(13) Mitzel, Harold E. "Teacher Effectiveness." Encyclopedia of Educational Research, 3rd ed. Ed. Chester W. Harris. New York: The Macmillan Company, 1960, pp. 1481-1486.

(14) Morsh, Joseph E., George C. Burgess, and Paul N. Smith. "Student Achievement as a Measure of Instructor Effectiveness." Journal of Educational Psychology, XLVII (February, 1956), 79-88.

(15) Moss, F. A., William Loman, and Thelma Hunt. "Impersonal Measurement of Teaching." The Educational Record, X (January, 1929), 40-50.

(16) Patterson, R. E. "The Use of Adjusting Factors in the Analysis of Data with Disproportionate Subclass Numbers." Journal of the American Statistical Association, XLI (September, 1946) 334-46.

(17) Personnel Directory, 1966-1967. Oklahoma City: Oklahoma City Public Schools, 1966.

(18) Remmers, H. H. "Second Report of the Committee on Criteria of Teacher Effectiveness." Journal of Educational Research, XLVI (May, 1953), 641-58.

(19) Rostker, L. E. "The Measurement of Teaching Ability, Study Number One." The Journal of Experimental Education, XIV (September, 1945), 6-51.

(20) Ryans, David G. "Prediction of Teacher Effectiveness." Encyclopedia of Educational Research, 3rd ed. Ed. Chester W. Harris. New York: The Macmillan Company, 1960, pp. 1486-1491.

(21) Smith, Keith. "Distribution-free Statistical Methods and the Concept of Power Efficiency." Research Methods in the Behavioral Sciences. Ed. Leon Restinger and Daniel Katz. New York: The Dryden Press, 1953, pp. 536-77.

(22) Watts, Gary Dee. "A Correlation Analysis Between 'Level of Achievement' and Certain Teacher Characteristics in Selected School Systems." (unpub. Ph.D. dissertation, Ohio University, 1964).

(23) Webb, Wilse B. and Norman D. Bowers. "The Utilization of Student Learning as a Criterion of Instructor Effectiveness." Journal of Educational Research, LI (September, 1957), 17-23.

(24) Wert, James E., Charles O. Neidt, and Stanley J. Ahmann. Statistical Methods in Educational and Psychological Research. New York: Appleton-Century-Crofts, Inc., 1954.

(25) Woeller, Robert C. "Certification of Public School Teachers." Review of Educational Research, XXII (June, 1955), 182-5.

APPENDIX

QUESTIONNAIRE

Dear

The Research Committee of the Oklahoma City Public Schools is cooperating with me in the collection of data for a study of the teaching of elementary school mathematics. It is hoped that the results of this study, and others that are similar, will contribute to our efforts to improve the teaching of mathematics in the primary grades.

As a part of this study, I respectfully request that you complete the following questionnaire.

Your cooperation will be greatly appreciated.

Please answer all of the questions to the best of your ability since none of the answers can be used unless all are completed.

1. I have a total of ________(the number) credit hours in mathematics from a college and/or university.

2. I have a total of ________(the number) credit hours in the teaching of mathematics from a college and/or university.

3. My last course for college or university credit in mathematics was taken in ________(the year).

4. My last course for college or university credit in the teaching of mathematics was taken in ________(the year).

5. My last course for college or university credit in education was taken in ________(the year).

6. I had ________(the number) years of teaching experience prior to this academic year.

7. I have completed ________(the number) credit hours of graduate work.

8. Number the following courses from 1 to 10 in the order of the pleasure you receive from teaching them. A "1" should appear by the course you receive the most pleasure from teaching and a "10" by the course you receive the least pleasure from teaching. Do not repeat a number or leave a blank empty.

		___Reading
___Arithmetic	___Music	___Science
___Art	___Penmanship	___Social Studies
___Composition	___Physical Education	___Spelling

9. Number the following courses from 1 to 10 in the order of your confidence in teaching them. A "1" should appear by the course you are most confident when teaching and a "10" by the course you are least confident when teaching. Do not repeat a number or leave a blank empty.

		___Reading
___Arithmetic	___Music	___Science
___Art	___Penmanship	___Social Studies
___Composition	___Physical Education	___Spelling

10. Please check to see that you have answered all questions, then return the questionnaire in the attached envelope. Thank you.

COVER SHEET

Everyone is aware that teachers are busy and that many demands are made upon their time. There is little time to complete questionnaires. However, the value of research on teaching is well known. The number of responses will largely determine the usefulness of the study I am conducting. Thus, I ask you to take five minutes of your valuable time to complete the enclosed questionnaire.

RELIABILITY QUESTIONNAIRE

Dear

I am grateful to you for responding to my questionnaire. It is people like you who make educational research possible.

You are aware that all educational instruments need to possess a high degree of reliability. I need to determine the reliability of the last two questions on the questionnaire. Thus, I request that you answer the following questions and return this form in the enclosed envelope.

8. Number the following courses from 1 to 10 in the order of the pleasure you receive from teaching them. A "1" should appear by the course you receive the most pleasure from teaching and a "10" by the course you receive the least pleasure from teaching. Do not repeat a number or leave a blank empty.

______Arithmetic	______Music	______Reading
______Art	______Penmanship	______Science
______Composition	______Physical Education	______Social Science
		______Spelling

9. Number the following courses from 1 to 10 in the order of your confidence in teaching them. A "1" should appear by the course you are most confident when teaching and a "10" by the course you are least confident when teaching. Do not repeat a number or leave a blank empty.

______Arithmetic	______Music	______Reading
______Art	______Penmanship	______Science
______Composition	______Physical Education	______Social Science
		______Spelling

VITA

Doyle Hurst

Candidate for the Degree of

Doctor of Education

Thesis: THE RELATIONSHIP BETWEEN CERTAIN TEACHER-RELATED VARIABLES AND STUDENT ACHIEVEMENT IN THIRD GRADE ARITHMETIC

Major Field: Higher Education

Biographical:

Personal Data: Born at Gassville, Arkansas, May 19, 1941, the son of Thurman W. and Lois Hurst.

Education: Graduated from Flippin High School, Flippin, Arkansas, in 1959; received the Bachelor of Science in Education degree from the University of Arkansas, Fayetteville, Arkansas, with a major in mathematics, in January, 1963; received the Master of Science degree from the University of Arkansas, Fayetteville, Arkansas, with a major in mathematics, June, 1964; completed requirements for the Doctor of Education degree in July, 1967.

Professional Experience: Graduate assistant in the Department of Mathematics, University of Arkansas, Spring, 1963, through Spring, 1964; Graduate assistant in the Department of Mathematics, Oklahoma State University, 1964-1967.