A COMPARATIVE STUDY OF THE EFFECT ON THE ATTITUDES OF STUDENT TEACHERS OF A CONCURRENT AND A SEQUENTIAL DESIGN

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PREFACE

For some time I have been interested in the attitudes of student teachers and have wondered what could be done to improve them. This study gave me the opportunity to investigate one possibility.

I am especially grateful to Dr. Vernon Troxel, my thesis adviser, for his counsel, guidance, encouragement, and patience.

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A special debt of gratitude goes to my 92 year old mother and my son Bob for their understanding and encouragement during this time of neglect.

To all others who assisted directly or indirectly in this investigation, I express sincere appreciation.

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CHAPTER I

INTRODUCTION

The Problem

The traditional pre-service educational program for elementary school teachers has been a sequential one in which courses in the disciplines to be taught were followed by methods courses for teaching those disciplines. The participants were then allowed to put into practice what they had learned in an experience situation commonly known as student teaching.

The problem of this study was to explore the efficacy of a program different from the traditional sequential one, a program under which the students would have a better opportunity to see a close relationship between the content, the methods, and the actual practice. The phase of the problem upon which this investigator concentrated was the effect of such a program on the attitudes of the prospective elementary teachers.

Interest in the attitudes of teachers has been of long standing, as evidenced by the following two quotations:

In 1935, Barr and Reppen (5, 237) wrote:

> First of all the teacher's attitude will limit in a very real way her progress in learning to teach. It will determine the kinds of modifications that she is willing to attempt in her teaching, the energy with which the changes are pursued, and the learning that takes place.

Seegar (42, 46), in 1955, began an article about a twenty-year study of teacher attitudes toward supervision and administration with this paragraph:

> The attitude of teachers toward their work and toward the circumstances surrounding that work has been given a good deal of consideration over the years. Various studies have been made in an attempt to come to some understanding of what those attitudes might be and thereby to form some notions as to how they could be improved.

The importance of attitudes in relation to mathematics and to the teaching of mathematics was emphasized in the statements of Johnson (25, 113):

> In our concern for improving the mathematics curriculum and increasing enrollment in mathematics, have we forgotten a crucial factor, namely attitudes?...It is the attitudes that our students develop which are likely to stimulate or to stop further study of mathematics. It is the attitudes which we build that are highly involved in the learning and retention of our subject. It is the attitudes which we teach that are the most important factors in the activities in which our youth participate--now and later. And it is often the attitudes *you* [author's italics] have built that are the basis for your rank as a successful or unsuccessful teacher.

The above statements emphasize the importance of the attitudes of teachers and students involved in the teaching and learning of mathematics. It is, therefore, important that prospective teachers be provided with programs that will induce desirable attitudes.

Johnson (25, 120) also said: "If the right attitudes aren't growing in our classrooms, we need to do something about it."

Shirley Hill (22, 40) suggested that "The attitude of the teacher toward mathematics is likely to be transmitted to the children."

"The teacher must remember," said Capps and Cox (10, 215), "that attitudes are learned and that a major function of effective teaching is to provide an environment for the growth of positive attitudes."

Johnson, Hill, Capps and Cox called attention to the fact that teachers are responsible for the attitudes of children. If so, then teachers' attitudes should be desirable ones. Dutton (12, 424) reported that "Attitudes toward arithmetic, once developed, are tenaciously held by prospective elementary school teachers." Therefore, it is especially important that programs for preparing elementary mathematics teachers should be so designed that they produce desirable attitudes.

At Oklahoma State University, a new program was initiated in the elementary education area for the 1970-71 academic year, a program in which the methods instruction was correlated with the practical experience of student teaching for the prospective elementary teachers.

At that time the student teaching experience was changed from the sequential block plan to the full sixteen-weeks semester plan under which the students used four days of each week in the classroom and the fifth day in workshops devoted to teaching methods related to the areas of language arts, social studies, science, and mathematics.

It was the purpose of this study to investigate some of the effects on the attitudes of student teachers involved in the new program. To do this the attitudes of those who received instruction under this design in the spring term were compared with those of students who received their methods instruction in the traditional sequential design. This latter group did their student teaching during the fall term. The study of the attitudes of the student teachers took two directions, the students' attitudes toward mathematics and their attitudes toward the teaching of mathematics.

Previous Research

Dutton, with his developing of Thurstone-type attitude scales, seemed to set in motion a trend of studies of attitudes. Quite often one form or another of his twenty-two or fifteen item scales has been used. A study of attitudes toward the discipline coupled with a study of the understanding of mathematics concepts seems to have been the pattern for many of the studies.

The related research presented here has been organized in four sections: first, a review of some of the studies that dealt with the attitudes of student teachers toward mathematics; second, those studies that were concerned with the attitudes of teachers or student teachers toward the teaching of mathematics; third, those studies that pertained to the attitudes of children toward mathematics; and fourth, the studies that sought to determine the effects of teachers' attitudes on children.

Attitudes of Student Teachers Toward Mathematics

The research study that was most nearly like the one being reported in this paper was made by Wickes (50). He endeavored to determine the effects of two different arrangements of courses on the attitudes of prospective elementary teachers and on their understanding of mathematics. In one arrangement the students were required to satisfactorily complete a specially designed mathematics course before enrolling in a course of methods of teaching elementary mathematics. The second arrangement consisted of a consolidated course in which content and methodology were correlated.

The Wickes (50) study was made at Brigham Young University. He used a control group of 65 students who had taken the first curriculum during the two preceding years. His experimental group consisted of 104 students who completed the consolidated course. The subjects in both arrangements made statistically significant gains in both attitudes toward mathematics and in the understanding of the fundamental concepts of mathematics. Wickes found no difference between the two groups in the gains shown on the attitude scale but the control group showed significantly greater gains in the understanding of the mathematics concepts. He concluded that, all things considered, the two-course sequence was the more effective.

Probably the most widely known studies of attitudes of elementary education majors are those made by Dutton, who developed several forms of scales that he and many others have used in studies with teachers, student teachers, and pupils of varying ages as subjects.

In 1962, Dutton (12) made a study at the University of California at Los Angeles in which he found that 38 percent of the 127 elementary education majors had unfavorable attitudes toward mathematics. As a part of that study he asked the students to list their reasons for liking and disliking mathematics. Those who disliked mathematics gave such reasons as these: word problems, boring work, long problems, drill, lack of understanding. Those who liked mathematics listed reasons such as these: useful, practical applications, definite, precision of concepts, logical aspects, fun just working with numbers, challenging.

In 1965, Dutton (14) used a one-group design to study the changes in the students' attitudes toward mathematics and in the understanding of concepts, again at the University of California at Los Angeles. His subjects were 160 students enrolled in an upper division methods course dealing with the teaching of mathematics who were scheduled to begin their supervised teaching after completing the course. His findings in regard to attitudes

> ...reflected a growing appreciation of the subject as they increased their understanding of the subject. The general attitude of about 75 percent of the students toward arithmetic was quite favorable...The lowest 25 percent of the students in this study had unfavorable attitudes toward arithmetic...Many students have ambivalent feelings toward arithmetic. (14, 364)

It should be noted here that, although the majority of the students in Dutton's study improved in respect to their attitudes toward mathematics, there was that group of 25 percent of the prospective teachers who maintained unfavorable attitudes in spite of the intervening course of instruction.

Smith (45, 474-477) in 1964 made a study quite similar to Dutton's 1962 study in which he compared the attitudes of 123 prospective teachers with those reported by Dutton for another group ten years previously. The results were practically the same. His subjects listed reasons for disliking mathematics such as these: lack of understanding, written problems, poor teaching, failure, lack of teacher enthusiasm, too much long work, afraid of it.

Reys and Delon (39, 363-366) in a pretest-posttest study during the 1965-66 academic year administered the Dutton attitude scale to 385 University of Missouri students at Columbia. The subjects were those who took one of the three courses offered in elementary mathematics education. Reys and Delon found a significant decrease in the percentage of students who agreed with such statements as: "I avoid arithmetic because I am not very good with figures," and "I am afraid of doing word problems." They found an increase in the percentage of students who agreed with the statements: "Arithmetic is very interesting," and "I like arithmetic because it is practical." There were more positive statements and fewer negative statements on the posttests than on the pretests.

At Brigham Young University, Gee (20, 6528) gave pretests and posttests on attitudes toward mathematics and understanding of basic mathematics to 186 prospective elementary school teachers in a required mathematics content course in 1964 and reported results that included the following: (1) there was a significant improvement in attitudes toward mathematics while students were enrolled in the course, (2) there was a positive significant correlation between the pretest attitude scores and the final grades; also in the posttest attitude scores and the final grades, (3) there were nonsignificant correlations between the pretest attitude scores and changes in the understanding of mathematics, (4) there was a nonsignificant correlation between changes in attitudes and changes in the understanding of mathematics.

These and other similar studies seem to indicate that the majority of elementary student teachers change their attitudes favorably while pursuing their preparation for teaching, regardless of the particular program they are following, but there are still too many with poor attitudes preparing to go into the elementary classroom to teach mathematics.

Attitudes of Teachers or Student Teachers Toward the Teaching of Mathematics

While the investigator found many studies of attitudes only a very few were slanted toward, or included, the attitudes of teachers toward the teaching of mathematics. The reports seemed to concentrate on the content of the discipline and the attitude toward the discipline, not the teaching of it. The three following however did take the attitude of the teacher toward the teaching of mathematics into consideration.

Kane (26, 169-175) did a study in which he developed a technique of assessing attitudes of prospective elementary teachers toward mathematics and toward the teaching of mathematics by using an instrument that he designed. His instrument was a questionnaire on which the respondent was asked to rank-order the subject areas of English, mathematics, science, and social studies in response to each of six statements:

1. I enjoyed my work in this field the most in high school.
2. This field was the most worthwhile for me to study in high school.
3. I enjoyed courses in this field the most in college.
4. I learned the most in courses in this field in college.
5. I probably will enjoy teaching this subject the most.

6. I probably will be most competent to teach this subject. (26, 170)

Each student was also asked to indicate his preference for grade level, choosing from the alternatives: grades K-3, 4-6, or no preference at that time.

The subjects in Kane's study, 58 elementary education majors at Purdue University, were administered the questionnaire at the close of their student teaching experience. A neutral person administered the instrument in a neutral setting to avoid bias toward any of the subject areas.

The results indicated that the subjects tended to have relatively favorable attitudes toward mathematics, and particularly toward the teaching of mathematics in the elementary school. Relatively positive attitudes toward mathematics and a preference for teaching in the intermediate grades seemed to be paired, also.

Stright (46, 280-286), in her study, was interested in the attitudes of 1023 elementary pupils and their 29 teachers. She found that over 93 percent of the elementary teachers really enjoyed teaching mathematics and tried to make it interesting. According to the data in her study the teacher's age, education, and experience had little effect on the teacher's attitude toward teaching mathematics.

A questionnaire, designed by Hurst (23, 72), included two questions similar to those used in Kane's study.

He listed ten courses that are customarily taught in the elementary school and asked each subject in his study to rank-order them twice: first, according to the pleasure received from teaching them; and second, according to the confidence the subject felt he had in teaching them. The subjects for this part of the study were 55 third grade teachers in the public schools of Oklahoma City, Oklahoma. However, he used these questions as part of a study of teacher effectiveness by testing relations between each of them with achievements of their students. No emphasis was placed on the results of these two questions as such, as he was particularly interested in the teachers' attitudes toward modern mathematics.

Hurst concluded that there was a significant relationship between the recency of preparation to teach a course and effectiveness in teaching it, but the relationship was not positive. He found no evidence to substantiate the postulates that teacher effectiveness was positively related to each of the following: (1) recency of his last education course, (2) teaching experience, (3) amount of graduate work completed.

The postulates relating the teacher's effectiveness in teaching and his pleasure and confidence in teaching mathematics were not substantiated by Hurst's study.

Attitudes of Children Toward Mathematics

Since a number of reports, such as that of Morrisett and Vinsonhaler (32, 132), have indicated that attitudes toward mathematics in adults can be traced to childhood, the study of attitudes of children toward mathematics needs to be considered.

McDermott (30, 71) reported that of 34 college students in his case studies who were afraid of mathematics the majority said they first met with frustration in regard to mathematics in the elementary grades.

Dutton (12), White (49), and Smith (45) found evidence that college students majoring in education developed their attitudes toward mathematics throughout grades two through twelve, but grades four through six were more influential.

Fedon (19) claimed in the report of an interesting study he made using Dutton's 22-item attitude scale with third grade children that very definite attitudes toward mathematics may be formed as early as the third grade.

He used an "intensity scheme" which he developed to increase the accuracy of the reactions to Dutton's attitude scale. This intensity was determined by a color chart. To build the color intensity scheme Fedon placed seven color swatches in a circle. The children were asked to select the colors they most liked, the ones they disliked, and the neutral ones, then their intermediate choices.

The choices were scored on a point basis from 7 (most liked) to 1 (least liked).

Fedon then had to teach the children the significance of the "color intensity scheme" and practice its use with them throughout the year. He stressed the relationship of red to indicate an extreme positive attitude with black an extreme negative attitude and yellow a neutral attitude. The intermediate colors light blue, dark blue, brown and orange conveyed lesser degrees of the two extremes. The children's understanding of this scheme was tested through common experiences in many situations during the year.

Each question in Dutton's scale was read to the children to avoid reading difficulties, and words that might not be common to the children's vocabulary were defined. The children reacted to each question indicating the acceptance or rejection of an attitude by their color choice.

Fedon combined the values of the color intensity scale and Dutton's statements to develop a scale value for the color scheme. Dutton's scale values were from 1.0 to 10.5. By using the median of 5.75 as 0 and making scale steps by .5, he evolved a numerical scale that ranged from -9.5 to +9.5 with eleven positive and eleven negative statements on each side. He arbitrarily assigned values from .7 to .1 to the colors from red to black and got an intensity value for each statement. When he multiplied the rating of each statement by the color scale values, a measure of intensity for the entire attitude scale resulted. The total positive and negative scores were subtracted to produce the child's attitude score.

The children's responses indicated that they had a strong respect for arithmetic and considered it as being necessary. The challenge presented by arithmetic was apparently a strong motivating force. The children had strong negative feelings in regard to fear of arithmetic and dislike of arithmetic. At least one-third of the group had already established attitudes opposed to arithmetic. Some fear was indicated.

Fedon concluded that very definite attitudes are being expressed, both for and against arithmetic, as early as the third grade, with at least one-third of them negative.

In Stright's (46) 1960 study, she claimed some evidence of a decline from the third through the sixth grades in the percentage of pupils expressing negative attitudes toward mathematics.

According to Lyda and Morse (29) positive changes in attitudes toward mathematics occurred when a "meaningful method" of teaching was employed. The meaningful method emphasized such things as the aims of mathematics, the concept of number, understanding the numeration system, the use of fundamental operations, and the relationships which make mathematics a system of thinking.

Kaprelian (27) reported that over 75 percent of the 65 fourth-grade pupils he used as subjects said they liked mathematics better after viewing the then new television program, "Patterns in Arithmetic." Also, 75 percent of them claimed that their attitude toward mathematics had changed because the television program had helped them understand their mathematics.

In a more recent report Callahan (8) said that as a middle school teacher he felt a strong need to look for ways to help his pupils succeed in and enjoy mathematics. He was interested in such questions as,

> Why do some adolescents enjoy mathematics? Why do some of them dislike the subject so strongly? When did they develop these feelings? What is it about mathematics they enjoy the most? What do they dislike the most? Is there some way of changing negative attitudes? What can be done to prevent such a buildup of negative attitudes toward a subject as useful and logical as mathematics? (8, 751)

These are the questions most people interested in preparing elementary teachers are asking and trying to answer, especially the last question.

Inspired by Dutton's previous investigations, Callahan replicated one of those studies using 366 eighth graders from a junior high school in New York. His subjects consisted of 186 girls and 180 boys, in seventeen sections of approximately 23 pupils each.

Callahan found that five percent of the total group felt extreme dislike for mathematics and avoided using it, which meant that there were probably a few in each classroom with whom the teacher needed to be prepared to deal. Seventy percent of the pupils enjoyed working problems when they knew how to do them well. This posed a different problem for the teacher.

The reasons given by the pupils in Callahan's study for liking mathematics were its practical aspects and the realization that mathematics is needed in life. Their reasons for dislike were strongly related to their feelings of inadequacy about learning and memorizing and their thinking that mathematics was boring and too repetitious.

Callahan concluded that lasting attitudes toward mathematics are developed at each grade level, but grades six and seven were given by the pupils in his study as the most important. About one-half of the pupils in his study recognized that they had changed their attitudes toward mathematics, one way or the other, during the year.

The results from Callahan's study, like most others of similar nature, do not differ greatly from those of Dutton. They do point to the fact that the problem of the attitudes of pupils had not been solved in the interim between Dutton's first studies and Callahan's.

In summary, it may be possible to measure attitudes toward mathematics as early as the third grade. Also, attitudes toward different aspects of mathematics are different variables, as, for example, something learned by rote like the multiplication facts would not be the same as interpreting and solving a word problem. This, of course, does not alter the fact that adults' attitudes toward mathematics evidently are formed in the elementary grades and much consideration needs to be given to the programs for preparing the elementary teachers that will prevent the formation of such undesirable attitudes.

Effects of Teachers' Attitudes on Children

It seems to be a rather generally accepted proposition that the attitudes and effectiveness of teachers in particular subjects are important determiners of pupil attitude and performance in these subjects. However, as Aiken (1, 23) suggested, it is possible to interpret findings from some of the studies as being due to "sour grapes" on the part of the subjects, so teachers should not be indicted too severely as being responsible for the negative attitudes of children toward mathematics, even though they seem to be in a vulnerable position.

Bassham, Murphy, and Murphy (6, 66) claimed that one of their studies revealed that predicting achievement on the basis of attitude toward mathematics could not be done since often below-average pupils reflected the enthusiasm or lack of enthusiasm of the teacher. Thus, it appears, a major factor influencing pupils' attitudes is the teacher's attitude toward the course. The teacher, then, needs to reflect a positive approach and allow pleasant experiences and memories to be developed since more favorable attitudes are formed under pleasant emotional conditions. It is the responsibility of the teacher to create this type of environment in the classroom, and to do this he must begin with his own attitude and enthusiasm for mathematics.

Banks (4, 19) places major responsibility for developing the attitudes of the children on the teacher. He says,

> An unhealthy attitude toward arithmetic may result from a number of causes...But by far the most significant contributing factor is the attitude of the teacher. The teacher who feels insecure, who dreads and dislikes the subject, for whom arithmetic is largely manipulation, devoid of understanding, cannot avoid transmitting her feelings to the children...
>
> On the other hand, the teacher who has confidence, understanding, interest, and enthusiasm for arithmetic has gone a long way toward insuring success. (4, 19)

In 1964 Peskin (35, 3983-4) made a study of the relation of teacher attitudes and understanding of seventh grade mathematics to the attitudes and understanding of mathematics of the pupils in nine New York City junior high schools. She used scores of the pupils and the teachers on six tests of attitudes toward and the understanding of arithmetic and geometry.

Peskin found no significant relation between the teacher's attitude and the pupils' attitude scores in either arithmetic or geometry. In arithmetic there was a positive correlation between the teacher's understanding scores and the pupil's attitude scores. She found significant negative correlations between the teacher's understanding and the pupils' attitudes at the "very high" level in geometry.

Combinations of varying degrees of attitudes and understanding in the teachers and pupils were studied by Peskin. Teachers with "middle" attitudes and "high" understanding produced pupils with the best scores in geometry. Teachers who had "high" understanding and "low" attitudes produced pupils with the worst results in arithmetic and geometry. The results indicated the interaction of attitude and understanding was very strong.

Aiken and Dreger (3) conducted a study that required the construction of a Likert-type attitude scale. This they administered at a southeastern college to entering freshmen who had elected to take mathematics during the fall semester. One of the results they found that was apropos to this study was that "Experiences with former mathematics teachers are somewhat related to present mathematics attitudes." (3, 24)

The studies cited here tend to reinforce the commonly accepted theory that the attitudes of teachers are important determiners of pupils' attitudes and performance.

Throughout the previous research reported here regarding the attitudes of student teachers toward the teaching of mathematics, attitudes of children toward mathematics and the effects of teachers' attitudes on children there seems to be one common central theme: The attitudes of teachers, and therefore student teachers, especially of the elementary grades, are of paramount importance to the teaching of mathematics. It therefore behooves those involved in preparing student teachers to do all that is possible to promote desirable attitudes toward mathematics and toward the teaching of mathematics.

Theoretical Basis

In the interest of clarity and communication the following definitions of terms will be used throughout this report:

Attitude: "An emotionalized tendency, organized through experience, to react positively or negatively toward a psychological object." (37, 362)

Concurrent Design: The arrangement of methods instruction and student teaching in use in the elementary education area at Oklahoma State University during the 1970-71 academic year.

C-group: The student teachers who were the subjects in the study during the spring term of the 1970-71 academic year. They received instruction under the concurrent design.

GPA: Grade point average based on 4.0 for A grades.

Mathematics: Mathematics and arithmetic will be denoted by "mathematics" except in the case of a direct quotation or in the case where there is a need to distinguish between forms of mathematics.

Methods instruction: Instruction given in related learning theory, materials for teaching, and strategies of teaching.

Pupils: Anyone attending school in grades K-12.

Sequential Design: The arrangement of methods instruction and student teaching in use in the elementary education area at Oklahoma State University prior to the academic year 1970-71.

S-group: The group of student teachers who were the subjects in this study during the fall term of the 1970-71 academic year. They received instruction under the sequential design.

Significant Difference or Statistically Significant: "The observed phenomenon represents a significant departure from what might be expected by chance alone." (36, 50)

Student: Anyone attending school beyond the twelfth grade.

Student teaching: An experience during which time the student is located in an elementary classroom under the direction of a cooperating teacher, for the purpose of observing pupil and teacher behavior, performing routine classroom teaching tasks, and gradually assuming most of the roles of a teacher.

Teacher: The person who is fully certified and regularly employed in a school system to instruct the pupils.

It is commonly believed that attitudes and interests exert a dynamic, directive influence on an individual's responses; therefore, children's attitudes may well be related very closely to their learning. The studies summarized in previous sections seem to indicate that rather definite attitudes toward mathematics have been developed by the time children complete the intermediate grades. The following brief reports of studies are illustrative of this belief.

Bassham, Murphy and Murphy (6, 71) observed an important difference in the level of achievement in mathematics between sixth-grade pupils who had relatively more favorable attitudes toward mathematics and those who had less favorable attitudes.

In Dean's study (11, 92) he found significant differences that indicated that pupils who did well in mathematics usually indicated a preference for it.

Also, Greenblatt (21, 60) reported in his study that there was a significant relationship between relative preference for mathematics and mathematics achievement level on the part of the girls in grades three to five.

However, Suydam and Weaver (47, 1-2) sum up the situation as follows:

> There is no consistent body of research evidence to support the popular belief that there is a significant positive relationship between pupil attitudes toward mathematics and pupil achievement in mathematics. We have little research basis for believing that these two things are causally related. Those studies which have been reported indicate only a trend or a low positive relationship between attitude and achievement.

Again, research has little to contribute as definite answers to questions which pertain to the influence of the teachers' attitudes toward and interests in mathematics upon pupils' attitudes, interests, and achievement, but Wickes (50, 27-28) related that he had

> ...often heard college undergraduate students state that even though college mathematics professors have an excellent understanding of the subject-matter, many are poor teachers because of poor attitudes toward the teaching of subject-matter. It is such statements as this which tend to make one believe that the teacher's attitude toward mathematics and the attitude toward teaching of mathematics is likely equal in importance to the knowledge and understanding of mathematics.

Thus, there seem to be indications, strong ones, but not positive proof, that the attitudes of teachers affect the attitudes of their pupils; certainly these indications are strong enough to point to the need to study the topic of attitudes and its relationships and effects. This, then emphasizes the great importance of the need to study ways to prepare teachers so they can be the most effective possible.

It was upon this belief that assumptions were made and hypotheses were formulated for this study as reported here.

Basic Assumptions

The population to which the writer wished to apply the results of this study was all the elementary student teachers at Oklahoma State University who participate in the new concurrent-design program in mathematics education either at the time of this study or in the future terms, as long as the design and the instructor remain constant.

Any generalizations to other populations or to other courses even in the same program could not be justified statistically.

Several assumptions were made in this study, some of which were concerned with the sampling of the population. The study was conducted as a field study with the subjects being those who were doing their student teaching in the four public school systems of Oklahoma City, Ponca City, Stillwater, and Tulsa, Oklahoma. It was assumed that those participants would be representative of all the elementary education student teachers at Oklahoma State University.

Because of the fact that this was a field study it was not feasible to choose the groups at random. The groups were more-or-less self-selected as to the term and the location of the student teaching experience so the S-group and the C-group were assumed to be samples from the same population, having been drawn at different times.

Due to the different locations in which the subjects were teaching it was necessary to test the students in each of the four locations on different days. It was assumed that this would not cause any difference in the results of the study.

It was also assumed that attitudes were measurable and could be measured by the instruments chosen or designed for that purpose.

Shaw and Wright (43, 7) state that

> ...attitudes are construed as varying in quality and intensity (or strength) on a continuum from positive through neutral to negative...The strength or intensity of the attitude is represented by the extremity of the position occupied on the continuum becoming stronger as one goes outward from a neutral position...Attitudes on one side of such a continuum indicate negative affective reactions...Attitudes on the other side of the continuum indicate positive affective reactions.

It was also assumed that the subjects' responses reflected their true attitudes and not those they felt the "ideal" student teacher would reflect.

Again, Shaw and Wright (43, 13) state:

> The most frequently used methods of measuring attitudes require subjects to indicate their agreement or disagreement with a set of statements about the attitude object. Generally, these statements attribute to the object characteristics that are positively evaluated and rarely neutral...The typical attitude scale measures the acceptance of evaluative statements about the attitude object. The attitude toward the object is inferred from the statements endorsed by the subjects based upon the consensual evaluation of the nature of the characteristics attributed to the object by the acceptance of these statements. Such scales measure only the positivity--negativity of the affective reaction.

Hence, it was also assumed that attitudes are normally distributed and may be treated accordingly.

Remmers and Gage (38, 7) said that attitude measurements have limitations in that they are temporary and changeable and subject to rationalization and deception. One assumption that had to be made, then, was that such limitations did not significantly affect the results of this study.

It was assumed that the attitudes of the groups of subjects were equivalent prior to the student teaching experience.

Since the instructor was the same for the mathematics methods instruction for the groups under both designs, it was assumed that his attitude would remain constant.

It was assumed further that a time lapse between the initial study of methods and their application increases the probability that the significance of the methods to the classroom situation would not be appreciated to the degree necessary to produce desirable attitudes toward them. Also, it was assumed that the effect on the attitudes of the student teachers would be directly proportional to the student's ability to immediately relate the methods being taught in the true classroom situation. However, since attitudes develop slowly, there might be a definite time lag in these results.

Hypotheses

This study was conducted as a field study with two groups of subjects, with group membership determined by self-selection. The first group, known as the S-group, received thirty-two class-hours of methods instruction in the teaching of elementary school mathematics prior to sixteen weeks of student teaching; the second group, known as the C-group, received approximately seventeen class-hours of concurrent methods instruction and student teaching, as earlier defined. Behavioral objectives of the two methods courses remained constant. The attitude data were secured from the students at the completion of student teaching. The data were taken as evidence of each student's development of attitudes that were desirable for effective elementary school teachers.

The independent variable in this study was the elementary school mathematics methods course in which the subjects participated. The variable was two-dimensional: it varied in its chronological relationship to the student teaching experience and in the number of hours allocated for its instruction. The dependent variable was the attitude of the student as indicated by his replies on the attitude scales.

The initial hypothesis

H_0: There will be no difference in the attitudes of the student teachers given the concurrent treatment and those given the sequential treatment.

was to be tested against the alternate hypothesis

H_1: The student teachers given the concurrent treatment will have more desirable attitudes than those given the sequential treatment.

The hypothesis H_0 was to be rejected at the 0.05 level of significance using a two-tailed test.

Since the attitude scales consisted of several parts, some sub-hypotheses in null form were tested.

The investigator believes a teacher will do better teaching if he receives pleasure from teaching and has confidence in his ability to teach. He probably will devote more time to the course that he receives pleasure from and because of his confidence he will devote more of his attention to teaching and less to the course material. Hence, SH_1 and SH_2.

SH_1: There will be no difference in the pleasure received from teaching mathematics between the student teachers who are given the concurrent treatment and those who are given the sequential treatment.

SH_2: There will be no difference in their confidence in teaching mathematics between the student teachers who are given the concurrent treatment and those who are given the sequential treatment.

Since this study took two directions, the students' attitudes toward mathematics and their attitudes toward the teaching of mathematics, SH_3 and SH_4 were tested.

SH_3: There will be no difference in the attitudes toward mathematics between the student teachers given the concurrent treatment and those given the sequential treatment.

SH_4: There will be no difference in the attitudes toward the teaching of mathematics between the student teachers given the concurrent treatment and those given the sequential treatment.

These four sub-hypotheses were to be rejected at the 0.05 level of significance using a two-tailed test.

The procedure of conducting the study as a field study made it necessary to consider other variables that might have affected the development of the attitudes desired, or that might have prevented the two groups being equivalent.

Variables that were considered were intelligence, mathematical competency, the number of college mathematics courses taken prior to student teaching, the overall grade point average prior to entry into the teacher education program, and the grade point average on the college mathematics courses taken prior to the student teaching experience. The null forms of the resulting preliminary hypotheses tested for this purpose were as follows:

SH_5: There is no significant difference in the intelligence of the two treatment groups.

SH_6: There is no significant difference in the mathematics competency of the two treatment groups.

SH_7: There is no significant difference between the groups in their overall grade point averages prior to entry into the teacher education program.

SH_8: There is no significant difference between the groups in their grade point average on the mathematics courses taken in college prior to their student teaching experience.

SH_9: There is no significant difference between the groups in the number of courses of mathematics taken in college prior to student teaching.

These five preliminary hypotheses were to be rejected at the 0.05 level of significance using a two-tailed test.

The problem of this study was to explore the efficacy of a pre-service education program for elementary teachers that was different from the traditional sequential one. This was a program in which the student teachers received their methods instructions in the field while doing their student teaching. The attitudes of the student teachers in this concurrent-design program were compared to the attitudes of the student teachers who received their methods instructions prior to their student teaching experience.

The independent variable in this study was the elementary school mathematics methods course in which the subjects participated, and the dependent variable was the attitudes of the subjects.

CHAPTER II

PROCEDURE

Design of Study

As previously stated the purpose of this study was to compare the attitudes of student teachers under two different designs of instruction. One group was given mathematics methods instruction prior to student teaching; the second group received this instruction concurrently with the student teaching experience. Attitude scales were administered to each group during the last week of student teaching. The independent variable in this study was the mathematics methods course and the dependent variables were the attitudes of the student teachers.

Prior to the fall 1970 term the program in elementary education at Oklahoma State University included a block of methods studies followed by a block of student teaching. The two blocks were completed in one semester.

Beginning with the fall of 1970 the new design was initiated. The student teaching experience was extended over a full semester of sixteen weeks. The students were in the classroom as student teachers four days each week and on the fifth day they attended workshops in language arts, science, social science, and mathematics.

The student teachers in the sequential design had taken a course in elementary mathematics methods prior to their student teaching experience so the mathematics workshops were deleted during the fall of 1970 and study time was allowed in their place.

In the spring 1971 term the concurrent design was completely initiated with the student teachers in the classrooms four days each week for sixteen weeks and in workshops the fifth day each week. Since those students had not had a methods of teaching mathematics course previously, it was included in the spring workshops.

This arrangement allowed the investigator to compare the two groups, each of which had sixteen weeks of student teaching. One of the groups had a mathematics methods course preceding the student teaching experience and the other received the mathematics methods course concurrently with student teaching.

The students in the sequential design had received thirty-two class hours of instruction in mathematics methods. Those in the concurrent design received seventeen class hours of methods instruction. The methods being studied concurrently could be immediately applied to the classroom situation. Therefore, it was considered that less time for methods instruction would actually accomplish as much or more.

It was not feasible to randomly select and randomly assign the subjects to the two designs due to the chronological relationships of the methods instruction. The new program was already being implemented when the investigator began the observation of the dependent variables, the attitudes of the subjects toward mathematics and toward the teaching of mathematics. The two designs, sequential and concurrent, provided the independent variables that would affect the dependent variables, the attitudes toward mathematics and the attitudes toward the teaching of mathematics. Such information was needed so the elementary education faculty of Oklahoma State University could make decisions in regard to the future of the program.

The subjects in the study were those students who were enrolled in elementary education at Oklahoma State University who had completed the prerequisites for student teaching by the 1970-71 academic year. The group of students participating in the sequential design was designated as the S-group, while the group in the concurrent design was designated as the C-group. These groups were defined briefly in Chapter I, but a more complete description follows:

> S-group: Those students who participated in student teaching in the fall of 1970 who had previously received their instruction in mathematics methods from the same instructor who would be the instructor of mathematics methods for the C-group. There were 77 subjects included in this group.

C-group: Those students who participated in student teaching in the spring of 1971 who had not previously had instruction in mathematics methods but who would receive it during the workshops from the same instructor who taught the mathematics methods for the S-group. In this group there were 74 subjects.

The total number of subjects in the two groups was 151.

The membership in the groups was determined by self-selection. Since it was not possible to randomly select and randomly assign the participants to the groups, it was assumed that the two groups were samples from the same population which had been drawn at different times and would therefore be equivalent groups. Hence, data were secured to justify this assumption.

The two organizational schemes, based on the chronological relationship of elementary school mathematics methods instruction to student teaching, provided the independent variables studied in this investigation. The dependent variables studied were the attitudes of the student teachers toward mathematics and toward the teaching of elementary school mathematics.

In any research there may be extraneous variables which, if not controlled, may jeopardize the validity of the study. Campbell and Stanley (9, 5-6) list these factors in two categories: threats to internal validity and threats to external validity. They list in the first category the following: history, maturation, testing, instrumentation, statistical regression, selection, experimental mortality, and interactions such as selection-maturation interaction. Those that jeopardize external validity: reactive or interaction effect of testing, interaction of selection and the experimental variable, reactive effects of experimental arrangements, and multiple-treatment interference.

The design of this study was similar to Campbell and Stanley's (9, 47) Design 10, "The Nonequivalent Control Group Design." The groups used in this study were naturally assembled collectives, as similar as possible. However, it could not be assumed that they were so similar that a pretest could be dispensed with entirely. Since the program was already in operation when the investigator began the observation of the dependent variables, it was not feasible to administer a pretest. Instead, the two groups were assumed to be equivalent and data were gathered to justify this assumption. Some of these data were secured from the results of tests which were administered to the S-group during the ninth week and to the C-group during the seventh or eighth week of their student teaching. The rest of the data--the overall grade point averages prior to entering the teacher education program, the grade point averages on mathematics courses taken in college prior to the student teaching experience, and the number of mathematics courses taken in college prior to student teaching--were secured from the records of the subjects.

The attitude tests given the subjects were fixed, printed, objective-type tests which were scored according to a predetermined key with no changes in either the instrument or the key so the instrumentation threat was controlled. Regression, which can be a threat to internal validity, was not a problem in this study since the subjects were not chosen for their extreme scores. Selection bias was minimized since the subjects were self-selected. None of the subjects dropped out of the study; so, mortality did not threaten.

Campbell and Stanley (9, 47-48) claim that the more similar the groups, the more the threats to internal validity are controlled. Thus, this design was regarded as controlling the main effects of history, maturation, testing, and instrumentation. However, intrasession history, the irrelevant unique events that occurred during either term to one group could have affected validity. Such things as seasonal or weather changes, approaching vacations or some other event could have had an effect on one of the groups. As each respondent was student teaching under the supervision of a different teacher it is quite possible that the attitudes of some of the subjects reflected the attitudes of their supervising teachers.

Campbell and Stanley (9, 48) suggest that, in studies of their Design 10 type, interactions with the treatment of extraneous factors such as history, maturation, or testing are unlikely.

Since no pretests were administered and the subjects were self-selected there were no interactions of testing or selection with the treatment to threaten external validity. The subjects were aware of the fact that they were subjects in a study. Some of them, because of that, may have marked the scales as they thought the investigator wanted them to instead of the way they really felt. Hence, the reactive arrangements may have affected external validity.

In summary, then, most of the threats to internal and external validity were controlled. Intrasession history and possibly reactive arrangements seemed to pose the greatest threats.

Instrumentation

In order to establish the equivalence of the two groups, statistical methods were used on several possible intervening variables which could affect criterion performance. The variables used for this purpose were intelligence, mathematical ability, overall grade point average prior to entering the elementary education program, the number of mathematics courses taken in college prior to the student teaching experience, and the grade point average on the mathematics courses taken in college prior to student teaching.

The variable, intelligence, was measured by the Otis Quick-Scoring Mental Abilities Test: Gamma Test: Form Am (34) denoted in the rest of this report as the Otis test.

The mathematical ability of the groups was measured by the test known as the Structure of the Number System: Form A, (16) denoted in the rest of this report as SNS.

The Otis and the SNS were administered during the ninth week of the fall semester and the seventh or eighth week of the spring semester.

The data on the other variables needed to establish the equivalence of the groups--the overall grade point average prior to entering the elementary education program, the number of mathematics courses taken in college prior to student teaching, and the grade point average on mathematics courses taken in college prior to student teaching--were secured from the records of the individual subjects. The grade point averages were based on 4.0 for a grade of A.

The investigator was interested in the attitudes of the subjects from two viewpoints: their attitudes toward mathematics and their attitudes toward the teaching of mathematics, which included their interest and confidence in teaching mathematics in the elementary school.

To measure the attitudes toward mathematics one of Dutton's (15, 361-362) scales, A Study of Attitude Toward Arithmetic, which consisted of fifteen statements, was administered. It was a Thurstone-type instrument with scale values ranging from 1.0 (low) to 10.5 (high). A copy of this scale is included in Appendix A.

Dutton (13, 26) stated that "The reliability of the experimental scale was measured by the test-and-retest procedure. The correlation between the two sets of scores, taking an average scale value for the total test for each student, was 0.94."

To measure their confidence toward teaching mathematics and their pleasure in teaching mathematics, the Hurst (23, 72) scales were used. These were the last two items on the questionnaire he used when gathering data for his dissertation. In these two questions each subject was asked to rank-order the ten courses commonly taught in the elementary schools, according to his confidence in teaching them and again according to his pleasure in teaching them. Copies of these scales are included in Appendix B.

Hurst (23, 24) reported on the reliability of the two questions, on confidence and pleasure, which were used in his study as follows:

> 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.

There was no scale available that would measure the attitudes of the student teachers toward the teaching of mathematics. Therefore it became necessary for the investigator to construct a scale that would serve the purpose.

Various types of scales for the measurement of attitudes have been used but Edwards and Kenney (18, 72) stated that "the two most frequently used methods are probably the 'method of equal appearing intervals' developed by Thurstone and Chave and the 'method of summated ratings' developed by Likert."

Van Dalen (48, 321) recommends the Likert-type scale as being "as reliable as the Thurstone technique and somewhat simpler."

Murphy and Likert (33, 42) state that the method of summated ratings "seems to avoid many of the shortcomings of existing methods of attitude measurement, but at the same time retains most of the advantages present in methods now used."

Edwards and Kenney (18, 76, 78) told of their experiences with scales:

> After our own experience in constructing both [authors' italics] Likert and Thurstone scales, we are inclined to agree with other investigators that scales can be constructed by the method of summated ratings more quickly and with less labor than by the equal appearing interval method. We found, for example, that construction of the Thurstone scales required about twice as much time, exclusive of the time spent by the judging group in sorting the items, as did the Likert scale...

> According to the evidence at hand, there is no longer any reason to doubt that scales constructed by the method of summated ratings and containing fewer items will yield reliability quotients as high as or higher than those obtained with scales constructed by the Thurstone method.

In view of such recommendations the investigator of this study chose to construct a Likert-type scale. Therefore the writer made a list of 153 possible statements to be considered for inclusion in such a scale. Some of the items were adopted, or adapted, from sources such as Rice (40), Capps and Cox (10), Husen (24), and Aiken (2) or were suggestions from acquaintances or were original with the writer. Copies of this list of statements were distributed to several graduate students who had been elementary teachers and were preparing to return to teaching. After reading the statements they indicated some that were not clear, that were ambiguous, that might be misinterpreted, or for some other reason were inappropriate. Accordingly, changes were made in the statements implementing the improvements suggested.

To perfect the instrument further the investigator used the informal criteria for editing statements that Edwards (17, 13-14) summarized.

A field trial using the 140 remaining statements was the next step in developing the scale. The instrument was administered to a graduate class in education in which the members were either elementary teachers or were administrators who dealt with elementary teachers.

As Edwards (17, 13) stated:

> One of the best procedures in the preliminary evaluation of statements is to have several individuals respond to the statements as they would if they had favorable attitudes toward the object under consideration. The same individuals may then be asked to respond to the statements as they would if they had unfavorable attitudes. If it is possible for them to give similar responses of acceptance or rejection when they assume different attitudes, then such statements are not likely to be of value in an attitude scale. Preliminary evaluation of statements in the manner prescribed can thus serve to eliminate many ambiguous as well as factual statements.

Thus, the members of the graduate class during the field trial played the role of the elementary teacher with a desirable attitude toward teaching mathematics and marked the attitude scale accordingly. Later, the same group played the role of the elementary teacher with an undesirable attitude toward teaching mathematics and marked the scale again. The participants were asked not to use their names but were requested to use an identifying number so the answers of each person from the opposing viewpoints could be compared. Some of those participants also marked statements as ambiguous, meaning that they could be interpreted in more than one way, and made suggestions for improving the wording of some of the statements.

The field trial revealed that some of the statements were nondiscriminating. They were eliminated and the wording of other statements was improved, using the suggestions from the field trial participants.

Then three teachers were asked to check the scale, which then had 100 statements. The last step in preparing the scale was to place the individual items in random order through the use of a table of random numbers.

In order to encourage the subjects to express their true feelings in each reply, a cover page for the scale was prepared explaining the purpose of the study and requesting that the subjects not sign their names on the tests, only on the cover page which would be discarded before the scales were checked and scores were tallied. They were assured that the scores were for research only, would be available only to the investigator, and could in no way affect their grade. A copy of this scale which the writer has called the Attitude Toward Teaching Elementary Mathematics scale (ATEM) is included in Appendix C.

Thus, the instruments used to gather data about the attitudes of student teachers toward mathematics and toward the teaching of mathematics consisted of the following: A Dutton (15) scale, A Study of Attitude Toward Arithmetic, the Hurst (23) scales on Confidence and Pleasure, and the Attitude Toward Teaching Elementary Mathematics (ATEM) scale.

In order to establish the equivalence of the two groups the Otis Quick-Scoring Mental Abilities Test: Gamma Test: Form Am (Otis) (34) was used to determine the equivalence of the groups in regard to intelligence. The equivalence in regard to mathematical ability of the groups was determined through the use of the test *Structure of the Number System: Form A* (SNS) (16).

Collection of Data

The data needed to establish the equivalence of the S-group and the C-group consisted of two kinds:

1. Data which could be gathered through tests administered to the subjects: intelligence and mathematical ability tests.
2. Data which had to be gathered from the records of the subjects: grade point averages prior to entering the elementary education program, number of mathematics courses taken in college prior to student teaching, and grade point averages on mathematics courses taken in college prior to student teaching.

All testing was conducted during the workshop periods allotted for the methods instruction. This testing was necessarily performed on different days and in different locations as the workshops were conducted in centers located in Stillwater, Ponca City, Tulsa, and Oklahoma City, Oklahoma. The availability of the subjects for testing and the testing schedule were determined by the faculty members responsible for the methods instruction.

The instruments used for obtaining raw scores on the intelligence and mathematical ability variables were the *Otis Quick-Scoring Mental Abilities Test: Gamma Test:*

Form Am (Otis) (34), and Structure of the Number System: Form A (SNS) (16). Those tests were administered during the ninth week of the fall semester and the seventh or eighth week of the spring semester.

The data gathered from the records of the participants included the overall grade point average prior to the student's entry into the elementary education program. This is usually by the end of the fourth semester, when the student would have approximately 64 hours of work completed. Since some students had attended summer school sessions, and others had transferred in from other schools and their accompanying transcripts did not report work by semesters, it became necessary to take the first 64 hours listed on the records with little regard for semester demarcation.

The other data from the student records was easily secured by merely counting the number of mathematics courses on the transcripts prior to student teaching and computing the grade point averages on those courses.

The data from the two categories described above provided the necessary information for establishing the equivalence of the S-group and the C-group.

The data needed for comparing the attitudes of the groups were secured through the use of certain scales that were administered to the groups. For the Dutton (15, 361-362) scale, A Study of Attitude Toward Arithmetic, each subject was asked to check each of the fifteen items which applied to him. The items were weighted and the weights of the items checked were summed to secure each individual's score.

The Hurst (23, 72) Pleasure and Confidence scales were ordinal scales as the items were to be rank-ordered according to the pleasure and confidence the subject felt he would have in regard to teaching the ten courses that were commonly taught in the elementary school.

As the ATEM scale was a Likert-type summated scale, the subjects were asked to mark one and only one of the five replies possible for each of the statements, the one that most nearly represented the participant's true feelings. Their choices consisted of SA (Strongly Agree), A (Agree), U (Undecided), D (Disagree), or SD (Strongly Disagree). The choices were weighted from +2 for favorable choices to −2 for unfavorable choices. The data then consisted of the summated scores of the weights for the choices.

These scales were administered to the subjects in each of the centers: Ponca City, Oklahoma City, Stillwater, and Tulsa, Oklahoma. The S-group were administered the scales during the last week of the fall 1970 term, and the C-group were given the same scales during the last week of the spring 1971 term.

The data gathered by the above discussed scales provided the needed information to compare the attitudes of the two groups.

Statistical Tests

It was assumed in planning this study that the S-group and the C-group were equivalent and that this equivalence would be shown through the use of intelligence test scores, scores from a test of mathematical ability, overall grade point averages, the number of mathematics courses taken in college prior to student teaching, and the grade point averages for those mathematics courses taken in college prior to student teaching.

The t-test for a difference between two independent means, as presented in Bruning and Kintz (7, 10), was used to test the preliminary hypotheses SH_5 and SH_6.

SH_5: There is no significant difference in the intelligence of the two treatment groups.

SH_6: There is no significant difference in the mathematics competency of the two treatment groups.

Scores on the Otis were used as the measure of intelligence and scores on the SNS were used as the measure of mathematical ability. These preliminary hypotheses were to be rejected at the 0.05 level of significance using a two-tailed test.

To test the preliminary hypotheses SH_7 and SH_8, the equivalence of the overall grade point averages prior to entry into the elementary education program and the grade point averages for mathematics courses taken in college prior to student teaching were tested by the t-test as given in Bruning and Kintz (7, 10).

SH_7: There is no significant difference between the groups in their overall grade point averages prior to entry into the teacher education program.

SH_8: There is no significant difference between the groups in their grade point average on the mathematics courses taken in college prior to their student teaching experience.

These also were to be rejected at the 0.05 level of significance using a two-tailed test.

Preliminary hypothesis SH_9 was tested by the Chi-square (χ^2) test using a three by two contingency table.

SH_9: There is no significant difference between the groups in the number of courses of mathematics taken in college prior to student teaching.

Siegel (44, 104) discusses the Chi-square (χ^2) test as follows:

> The hypothesis under test is usually that the two groups differ with respect to some characteristic and therefore with respect to the relative frequency with which group members fall in several categories. To test this hypothesis, we count the number of cases from each group which fall in the various categories, and compare the proportion of cases from one group in the various categories with the proportion of cases from the other group.

The categories used to test SH_9 were: those who took fewer than two mathematics courses prior to student teaching, those who took two courses, and those who took more than two. Thus, the data used in this test were nominal.

SH_9 was also to be rejected at the 0.05 level of significance using a two-tailed test.

The results of the five tests discussed here were used to establish the equivalence of the S-group and the C-group.

To justify accepting or rejecting the attitude hypotheses SH_1 and SH_2 the Mann-Whitney U test was used on the data gathered by using Hurst's (23, 72) Pleasure and Confidence scales.

SH_1: There will be no difference in the pleasure received from teaching mathematics between the student teachers who are given the concurrent treatment and those who are given the sequential treatment.

SH_2: There will be no difference in their confidence in teaching mathematics between the student teachers who are given the concurrent treatment and those who are given the sequential treatment.

Kerlinger (28, 263n) claims the Mann-Whitney U is one of the most powerful of the nonparametric tests.

As is often the case, there were tied scores. Runyon and Haber (41, 27) state that "Although ties within a group do not constitute a problem (U is unaffected), we do face some difficulty when ties occur between two or more observations which involve both groups." The effect of ties is usually negligible but what little effect it has is to change the variability of the set of ranks, so the correction for ties is applied to the standard deviation of the sampling distribution of U.

Siegel (44, 125-126) states,

> When the correction is employed, it tends to increase [author's italics] the value of z slightly, making it more significant. Therefore when we do not correct for ties our test is 'conservative' in that the value of p will be slightly inflated...The writer's recommendation is that one should correct for ties only if the proportions of ties is quite large, if some of the t's are large, or if the p which is obtained

without the correction is very close to one's previously set value of α.

Since the proportion of ties was quite large in this study, it was deemed advisable to make the correction for ties between groups, using the correction formula from Siegel (44, 125).

The hypotheses SH_1 and SH_2 were to be rejected at the 0.05 level of significance using a two-tailed test.

The t-test was used to test SH_3 using the data secured by using Dutton's (15, 361-362) A Study of Attitude Toward Mathematics.

SH_3: There will be no difference in the attitudes toward mathematics between the student teachers given the concurrent treatment and those given the sequential treatment.

This hypothesis also was to be rejected at the 0.05 level of significance using a two-tailed test.

In order to use the ATEM scale with confidence a reliability coefficient was desirable. This was secured through a test-retest procedure using a randomly selected ten percent of the subjects. The Pearson product-moment correlation, as given in Bruning and Kintz (7, 153), was used with the result, $r = 0.82$. This was considered high enough for the scale to be used in the study.

To test SH_4 the t-test as given in Bruning and Kintz (7, 10) was used.

SH_4: There will be no difference in the attitudes toward the teaching of mathematics between the student teachers given the concurrent treatment and those given the sequential treatment.

This hypothesis was to be rejected at the 0.05 level of significance using a two-tailed test.

Assumptions and Limitations

In this study the writer assumed that intelligence, mathematical ability, grade point average, number of mathematics courses taken prior to student teaching, and the grade point averages on those mathematics courses were major variables that might affect the dependent variables. Any other variables that might be significant were assumed to be randomly distributed or they were highly correlated with those considered.

It was assumed that the methods instructor maintained the same behavioral objectives during the times the subjects were enrolled in the various sections of the course. Thus, the learning opportunities were assumed to be the same for all the subjects in both groups. It was assumed that the tests for equivalence showed the two groups to be equivalent, therefore the attitudes of the groups at the beginning of the respective terms of student teaching were assumed equivalent and any differences at the ends of the terms would be due to the independent variables.

The C-group and the S-group were considered to be samples from the same population having been drawn at different times. The population to which the writer wished to apply the results of this study was all those individuals who will receive elementary school mathematics methods instruction and student teaching under the concurrent design with the same methods instructor, at Oklahoma State University. Generalizations to other populations could not be justified statistically.

The purpose of this study as stated earlier was to determine the effect of the concurrent design of student teaching and methods instruction program, as initiated in the elementary education area at Oklahoma State University during the 1970-1971 academic year, on the attitudes of the participating students toward mathematics and toward the teaching of mathematics. It was anticipated that the results of this study would provide some of the information that would aid the faculty in the elementary education area in making decisions for the future in relation to plans for the student teaching program.

CHAPTER III

ANALYSIS OF DATA

Introduction

The analysis of data is in two main sections. The first section contains the analysis of data related to the equivalence of the two groups included in this study. Equivalence was established by comparing the scores of each of the groups on selected criteria: *Otis Quick-Scoring Mental Abilities Test: Gamma Test: Form Am* (34), denoted as Otis, *Structure of the Number System: Form A* (16) denoted as SNS, overall grade point averages of the subjects prior to their entry into the elementary education program, the grade point averages on the mathematics courses taken in college prior to student teaching, and the number of mathematics courses taken in college prior to the student teaching experience. The second section contains the analysis of data related to the attitudes of the student teachers. This analysis includes a comparison of the scores of the groups on the following instruments: A Dutton scale (15, 361-362) *A Study of Attitude Toward Arithmetic*, Hurst's (23, 72) *Confidence* and *Pleasure* scales and the Attitude Toward Teaching Elementary Mathematics scale (ATEM) which was constructed for use in this study.

The total number of subjects in the study was 151. In the S-group of 77 subjects were those student teachers who had received their mathematics methods instruction prior to their student teaching experience. The C-group included 74 subjects who were receiving their mathematics methods instruction concurrently with their student teaching. In the S-group complete sets of scores were secured for 77 subjects. One of those in the C-group was not included because she had had student teaching during a previous term.

The use of both parametric [Student's t-test and Pearson Product-Moment Correlation] and non-parametric [Mann-Whitney U and Chi-Square tests] statistics necessitated the use of both raw scores and ranks in various computations. Therefore, in addition to tabulating raw scores for all subjects, the scores were also arranged in rank order. The scores used in the various comparisons may be found in Appendix D.

Comparability of Groups

The design used in this study called for scores between groups to be statistically equivalent. To meet this requirement preliminary hypotheses SH_5, SH_6, SH_7, SH_8, and SH_9, as listed on page 29, were formulated and tested. The variables in those preliminary hypotheses were intelligence, mathematical ability, overall grade point average prior to entering the elementary education program, the grade point average on the mathematics courses taken in college prior to student teaching, and the number of mathematics courses taken in college prior to student teaching, respectively. Those preliminary hypotheses were related to the comparability of the two groups being studied.

The t-test for differences between two independent mean scores was used to test SH_5, SH_6, SH_7, and SH_8. Bruning and Kintz (7, 9) claim the most common use of this test is to determine "whether the performance difference between two groups of subjects is significant."

In order to use the t-test with confidence certain conditions must be met. Siegel (44, 19) lists these as

> 1. The observations must be independent...
> 2. The observations must be drawn from normally distributed populations.
> 3. These populations must have the same variance (or, in special cases, they must have a known ratio of variances).
> 4. The variables involved must have been measured in at least [author's italics] an interval scale...

In regard to these conditions Siegel (44, 19) states that

> With the possible exception of the assumption of homoscedasticity (equal variances), these conditions are ordinarily not tested in the course of the performance of a statistical analysis.

However, a brief discussion would be appropriate here. In this study the basic design was that of two independent samples. The independence arose from the fact that a person's being in one group, did not preclude another from being in the same group. The second condition was that the observations must be drawn from normally distributed populations. Since the subjects in each group were self-selected, it could hardly be a biased representation.

Popham (36, 139) notes that,

> In practice it usually is considered satisfactory if the sample data do not depart drastically from normality...As one often has difficulty in drawing purely random samples in educational situations, a more reasonable guide would be to make sure that the sample has not been drawn in such a fashion that it is a biased representation of the population under study...In general the assumptions noted above are quite lenient. One can depart quite markedly from them and still obtain a t value which can be correctly interpreted.

The fourth condition was met for the Otis, SNS, overall GPA, and mathematics GPA as all of these were measured with interval scales.

The use of the t-test also requires the third condition that the variances of scores for the two variables are equal. This assumption can be tested by a statistical technique known as the F ratio in which the larger variance is divided by the smaller variance. The quantity that results is known as F and is interpreted for statistical significance from a table similar to the t-table. The smaller the F the more tenable the assumption that the variances of scores for the two variables are equal. The F-test was used in this study each time a t-test was needed. The form of the t-test used depended on the F ratio. The results of the statistical tests for SH_5, SH_6,

SH_7, and SH_8 are contained in Tables I, II, III, and IV respectively.

TABLE I

DIFFERENCE BETWEEN MEAN SCORES ON THE <u>OTIS</u> <u>GAMMA</u>

	N	Mean	Variance	t	df	Level of Significance
S-group	77	56.13	62.21	.82	149	$p > .20$
C-group	74	57.24	77.30			

Significant beyond the 0.20 level
F = 1.24

The ratio of the variances yielded an F = 1.24 for scores on the Otis and an F = 1.18 on the SNS. These F's were small enough to support the assumption of homogeneity of variance for using the t-test. Therefore the t-test that was suitable when $n_1 \neq n_2$ and $s_1^2 = s_2^2$ was selected. Popham (36, 148) recommends the pooled variance formula with degrees of freedom equal to $n_1 + n_2 - 2$. This is the most powerful test.

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\left(\frac{\sum x_1^2 + \sum x_2^2}{n_1 + n_2 - 2}\right)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

TABLE II

DIFFERENCE BETWEEN MEAN SCORES
ON THE SNS

	N	Mean	Variance	t	df	Level of Significance
S-group	77	24.64	29.21	.896	149	$p > .20$
C-group	74	25.46	34.53			

Significant beyond the 0.20 level
$F = 1.18$

On the overall grade point averages the $F = 1.75$ while on the mathematics grade point averages the $F = 1.61$, both of which were larger than the table values. This could possibly be due to the marked deviation from normality of the grade point averages. For instance, there were 21 subjects in the study who had mathematics GPA's of 4.0. In addition there were 56 others who had mathematics GPA's of 3.0 or greater but less than 4.0. This was more than one-half of the subjects with scores above the average C grade. This could be due to the Oklahoma State University requirement: to enter the elementary teacher education program a student must have a minimum GPA of 2.3.

Thus, in SH_7 and SH_8 the F-ratio larger than the table values indicated a significant difference in the variances.

Since the F-ratio was larger than the table value for both the overall grade point averages and the mathematics grade point averages the hypothesis of variance homogeneity in each case was untenable. Therefore a form of the t-test that is appropriate when $n_1 \neq n_2$ and $s_1^2 \neq s_2^2$ was used to test SH_7 and SH_8. Popham (36, 148) calls the form needed the "separate variance formula":

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

To use this t-test the tabled t value for a given level of significance is determined by averaging the t values for degrees of freedom equal to $n_1 - 1$ and degrees of freedom equal to $n_2 - 1$. In both cases, in this study, since n_1 and n_2 were each large, the table t values were the same for $n_1 - 1$ and $n_2 - 1$.

TABLE III

DIFFERENCE BETWEEN OVERALL GPA

	N	Mean	Variance	t	df	Level of Significance
S-group	77	2.71	.164	1.130	149	$p > .20$
C-group	74	2.79	.287			

Significant beyond the 0.20 level
F = 1.75

TABLE IV

DIFFERENCE BETWEEN MATHEMATICS GPA

	N	Mean	Variance	t	df	Level of Significance
S-group	77	2.71	.57	.759	149	$p > .20$
C-group	74	2.82	.91			

Significant beyond the 0.20 level
F = 1.61

The level of significance of the values of t were computed using a two-tailed test since the hypotheses were nondirectional. The difference in the S-group and the C-group mean scores was not statistically significant for any of the four tests analyzed. Therefore preliminary hypotheses SH_5, SH_6, SH_7, and SH_8 are tenable. It should be noted that the hypotheses could not be rejected even at the 0.20 level of statistical significance. This is a strong indication that the existing differences in the mean scores were little more than chance differences and the two groups may be assumed to be samples from the same population with respect to intelligence, mathematical ability, overall grade point averages, and mathematics grade point averages. However, in each case the difference in the means favored the C-group over the S-group. It is worth noting here that there is only one chance in sixteen that all four of the differences would vary in the same direction. There is evidence here, then, that the C-group was superior to the S-group in regard to intelligence, mathematics competency, overall grade point averages, and mathematics grade point averages. The difference is not great enough to be statistically significant.

The other variable used for testing the equivalence of the groups was the number of mathematics courses taken in college prior to student teaching. This was tested by using the Chi-square (χ^2) test. This statistical test is a test of the hypothesis that the numbers of mathematics courses taken by the two groups prior to student teaching are equivalent. The statistic is a non-parametric statistic with the function to determine the significance of differences between two independent groups when the data consist of frequencies in discrete categories. To use it the measurement may be as weak as nominal scaling which is the scaling used here.

The Chi-square (χ^2) test as used in this report took the form of a three by two contingency table with the rows indicating the classification of subjects as those who took less than, exactly, or more than two mathematics courses in college prior to their student teaching. The columns indicated the groups, the S-group and the C-group. This gave six cells that indicated the number of subjects in each group who took less than, exactly, or more than two courses.

A fundamental assumption in the use of χ^2 is that each observation of frequency is independent of all other observations. The fact that one subject took a certain number of courses did not preclude another subject from taking the same number of courses. Hence, this assumption was met. Another requirement is that when the number of degrees of freedom is greater than one the expected frequency in 80 percent of the cells should equal or exceed five, and no cell should have an expected frequency of less than one. The expected frequencies in the cells in this report vary from 9.8 to 51.5. None of the cells has an expected frequency of five or less. Therefore this requirement was met.

The data for the Chi-square (χ^2) test are shown in Table V. The computed value of χ^2 was 0.76. The value of χ^2 would have to be greater than 5.99 in order to reject SH_9 at the 0.05 level of significance. Therefore, the two groups were equivalent in regard to the number of mathematics courses taken prior to student teaching.

TABLE V

DIFFERENCES IN THE NUMBER OF MATHEMATICS COURSES TAKEN

	S-group	C-group	
0 - 1	11 (10.199)	9 (9.801)	20
2	49 (51.503)	52 (49.497)	101
3 - 7	17 (15.298)	13 (14.702)	30
	77	74	151

Considering the results of the t-tests on SH_5, SH_6, SH_7, and SH_8 and the Chi-square (χ^2) test on SH_9 one conclusion can be drawn: the two groups were equivalent on the variables specified in these preliminary hypotheses. However the t-tests showed that the results of four of the five tests favored the C-group. Thus the C-group was superior to the S-group in regard to intelligence, mathematics competency, overall grade point average, and mathematics grade point average, but this superiority was not statistically significant. Therefore, the two groups should be assumed to be samples from the same population.

Criteria Performance

The independent variables in this study were the attitudes of student teachers in the elementary education area. The study of the attitudes included two phases, the student teachers' attitudes toward mathematics and their attitudes toward the teaching of mathematics. Four subhypotheses SH_1, SH_2, SH_3, and SH_4, as listed on page 28, were formulated and tested. These subhypotheses were concerned with the pleasure a subject had in teaching mathematics, the confidence he had in teaching mathematics, his attitude toward mathematics, and his attitude toward the teaching of mathematics, respectively.

The Mann-Whitney U test was used to test SH_1 and SH_2, the pleasure and the confidence the subject had in teaching mathematics. The Mann-Whitney U is a statistical test of the hypothesis that the distributions of two sets of scores are equivalent. The statistic is a non-parametric statistic and requires only the assumption that the ordinal level of measure has been obtained; that is, the ranks of the scores provide an ordering of the scores through which one score can be said to be better than another.

To calculate the statistic U, all scores are placed in rank-order without regard to the group to which the subjects belong. The rank of 1 is assigned to the score which is algebraically lowest. Ranks range from 1 for the algebraically lowest score to $N = n_1 + n_2$ for the algebraically highest score. Tied observations are assigned the average of the tied ranks. The ranks are then summed for one of the groups. The selection of the group has no bearing on the outcome of the test. Calculation of U is then based on the sum and the number of subjects in each group. As sample sizes become large, greater than twenty, the distribution of U approaches the normal distribution. In this case, a value called z can be calculated from U, and the level of significance of the test can be obtained from a table for the normal distribution with zero mean and unit variance. When the normal approximation to the sampling distribution is used in a test of a null hypothesis, it does not matter which of the following formulas is used in the computation of U.

$$U = n_1 n_2 + \frac{n_1(n_1 + 1)}{2} - R_1$$

or

$$U = n_2 n_2 + \frac{n_2(n_2 + 1)}{2} - R_2$$

where R_1 = sum of the ranks assigned to the group whose sample size is n_1

R_2 = sum of the ranks assigned to the group whose sample size is n_2 (44, 120)

The absolute value of z yielded by the formula

$$z = \frac{U - \frac{n_1 n_2}{2}}{\sqrt{\frac{(n_1)(n_2)(n_1 + n_2 + 1)}{12}}} \qquad (44, 121)$$

will be the same if either formula for finding U is used. The sign of the z depends on which U formula is used but the value does not.

If ties occur between two or more observations in the same group the value of U is not affected, but if this occurs between two or more observations involving both groups, the value of U is affected. Although the effect is usually negligible, the effect of tied ranks is to change the variability of the set of ranks so the correction for ties must be applied to the standard deviation of the sampling distribution of U. Corrected for ties the standard deviation formula becomes

$$\sqrt{\left(\frac{(n_1)(n_2)}{N(N-1)}\right)\left(\frac{N^3 - N}{12} - \sum T\right)}$$

where $N = n_1 + n_2$

$T = t^3 - t$ (t is the number of observations tied for a given rank)

$\sum T$ is the sum of the T's over all groups of tied observations. (44, 124)

When correction is employed, it tends to increase the value of z slightly, making it more significant. When correction is not made for ties, the test is conservative in that the value of p will be slightly inflated. Siegel (44, 126) recommends

> ...that one should correct for ties only if the proportion of ties is quite large, if some of the t's are large, or if the p which is obtained without the correction is very close to one's previously set value of α.

Since the proportions of ties on the Pleasure and Confidence scales were large the z scores for both were corrected for ties but the differences found were negligible. The corrected values are listed in Tables VI and VII and the uncorrected values are reported below each of those tables. As SH_1 and SH_2 were non-directional hypotheses two-tailed tests were used.

TABLE VI

DIFFERENCE BETWEEN PLEASURE FROM TEACHING OF ELEMENTARY MATHEMATICS

	N	Sum of Ranks	Median Scores	U	Corrected z	Level of Significance
S-group	75	5039	3			
C-group	74	6136	4	2264	-1.96	p = .05

Significant at 0.05
Before correction z = -1.94

TABLE VII

DIFFERENCE BETWEEN CONFIDENCE IN TEACHING OF ELEMENTARY MATHEMATICS

	N	Sum of Ranks	Median Scores	U	Corrected z	Level of Significance
S-group	74	6123.5	3	2127.5	-2.36	$p < .02$
C-group	74	4902.5	5			

Significant at 0.02
Before correction z = -2.34

The distributions of the S-group and the C-group rankings on the Pleasure and Confidence scales were both statistically significant; the Pleasure scale at the 0.05 level and the Confidence scale at the 0.02 level. Therefore, both subhypotheses SH_1 and SH_2 were rejected.

Since the sum of ranks of the C-group was greater than the sum of ranks of the S-group for the Pleasure scale, the conclusion was drawn that those student teachers given the concurrent treatment received more pleasure from teaching mathematics than those given the sequential treatment.

Also, the sum of ranks of the S-group was greater than the sum of ranks of the C-group for the Confidence scale, and the median score of the S-group was higher than the median score of the C-group. Therefore, it was concluded that those student teachers given the sequential treatment had more confidence toward teaching mathematics than those given the concurrent treatment.

The remaining subhypotheses, SH_3 and SH_4, were tested with the t-test. These subhypotheses were concerned with the subjects' attitudes toward mathematics as shown on the Dutton (15, 361-362) scale and the subjects' attitudes toward teaching mathematics as shown on the ATEM scale. The F ratio was calculated for each and the values found are recorded beneath the corresponding tables of data for SH_3 and SH_4. These data are presented in Tables VIII and IX.

TABLE VIII

DIFFERENCES BETWEEN GROUPS IN ATTITUDE TOWARD MATHEMATICS

	N	Mean	Variance	t	df	Level of Significance
S-group	77	49.04	238.53	-1.204	149	$p > .20$
C-group	74	45.88	284.96			

Significant beyond the .20 level
F = 1.19

The F ratio for the Dutton scale indicated that the variance was homogeneous. Therefore the pooled variance t-test was used. The t-test result was -1.20. This was not significant at the 0.05 level, therefore SH_3 could not be rejected. The negative t indicated that the mean for the S-group was greater than the mean for the C-group. (41, 162)

TABLE IX

DIFFERENCES BETWEEN GROUPS ON THE ATEM

	N	Mean	Variance	t	df	Level of Significance
S-group	77	89.92	696.36	-.495	149	p > .20
C-group	74	87.35	1324.48			

Significant beyond the .20 level
F = 1.90

The ratio for the ATEM scale indicated that the null hypothesis of homogeneous variance was untenable so the separate variance t-test was used. The value of t was -0.495 which was not significant at the 0.05 level. Therefore SH_4 could not be rejected. The negative t indicated that the mean for the S-group was greater than the mean for the C-group. However, the means secured on the data from the ATEM scale were different, but the difference was small. Likewise in the case of the means secured on the data from the Dutton scale, the mean for the S-group was greater than that of the C-group but not much greater.

The results of the t-test on the scores from the Dutton (15, 361-362) scale and the ATEM scale indicate that SH_3 and SH_4 cannot be rejected. Therefore there is no significant difference between the student teachers who were given the concurrent treatment and those who were given the sequential treatment in their attitudes toward mathematics and toward the teaching of mathematics.

The results then of SH_1, SH_2, SH_3, and SH_4 are as follows: Whereas the subjects given the concurrent treatment receive greater pleasure from teaching mathematics, those given the sequential treatment have more confidence in teaching mathematics; and there is no significant difference between the groups in the attitudes toward mathematics and toward the teaching of mathematics.

Summary

The analysis of the data can be summarized as follows:

1. The two groups who were given the sequential or concurrent treatments were equivalent as shown by the fact that the preliminary hypotheses SH_5, SH_6, SH_7, SH_8, and SH_9 were tenable. The two groups, then, were equivalent in intelligence, in mathematics competency, in overall GPA, in mathematics GPA, and in the number of college mathematics courses taken. However, the difference in the means of four of these favored the C-group.

2. Subhypotheses SH_1 and SH_2 were rejected at the 0.05 level of significance while SH_3 and SH_4 could not be rejected at the same level. The two groups, then, had no significant difference in attitudes toward mathematics and toward the teaching of mathematics. The C-group received more pleasure from teaching mathematics than the S-group. The S-group was more confident of teaching mathematics than the C-group.

CHAPTER IV

SUMMARY AND CONCLUSIONS

Summary

During the 1970-71 academic year Oklahoma State University initiated a program in the elementary education area. A concurrent design of methods instruction and student teaching replaced the traditional sequential design of methods instruction prior to student teaching.

The students in the new program were in the classroom as student teachers four days each week in the sixteen weeks semester and in workshops the fifth day each week. During the workshops instruction in methods of teaching language arts, science, social sciences, and mathematics was provided.

The purpose of this study was to assess the effects of the concurrent program on the attitudes of the student teachers toward mathematics and toward the teaching of elementary mathematics. This was done by comparing the attitudes of the two groups of student teachers, denoted as the S-group and the C-group depending on the treatment received, sequential or concurrent, respectively.

The independent variables in this study were the sequential and concurrent treatments while the dependent variables were the attitudes of the subjects toward mathematics and toward the teaching of mathematics.

The subjects for the study were among those who were doing their student teaching in the elementary education area at Oklahoma State University during the 1970-71 academic year. It was not possible to randomly select subjects or to randomly assign them to treatments. So, the students were two self-selected groups, known as the S-group and the C-group. The 77 subjects in the S-group had received 32 hours of mathematics methods instruction prior to student teaching, which they did during the fall term of 1970. The C-group of 74 subjects were given 17 hours of methods instruction concurrently with their student teaching during the spring term of 1971. In each case the student teaching experience extended over a term of sixteen weeks with four days each week in the classroom and the fifth day in workshops. The S-group were allowed study time during the mathematics workshops as they had previously had a course in mathematics methods. The methods instructor was the same for both groups and the behavioral objectives were the same for both groups.

The theory underlying this study was based on the following statements, which are almost truisms:

1. A teacher's attitude affects his effectiveness in the classroom.

2. A teacher's attitude affects the performance and the attitudes of his pupils.

3. Attitudes toward mathematics are usually formed in the elementary grades and, once formed, are tenaciously held.

Hence, if children are to develop the desirable attitudes toward mathematics and are to perform well in mathematics, then they must have teachers whose preparation fosters those desirable attitudes to the greatest possible degree.

On the basis of the above briefly stated theory, it was hypothesized that student teachers who received their methods instruction concurrently with their student teaching so they could see the immediate application of the methods being studied would have more desirable attitudes toward mathematics and the teaching of mathematics than those in a sequential program.

Hence, the null hypothesis that there would be no difference in the attitudes of the subjects given the concurrent treatment and those given the sequential treatment was tested against the alternate hypothesis that the subjects receiving the concurrent treatment would have attitudes more desirable than those receiving the sequential treatment.

Four related subhypotheses in null form were tested. The essence of the subhypotheses was that there would be no difference between the student teachers under the concurrent treatment and those under the sequential treatment in regard to the pleasure received from teaching mathematics, their confidence in teaching mathematics, their attitudes toward mathematics, and their attitudes toward the teaching of mathematics.

The data for this study were secured from a Dutton (15, 361-362) scale, A Study of Attitude Toward Arithmetic, Hurst's (23, 72) Pleasure and Confidence scales, and the Attitude Toward Teaching Elementary Mathematics (ATEM) scale constructed by the investigator for use in this study.

Since the two groups were not randomly selected nor randomly assigned several preliminary hypotheses were tested to show that the groups were equivalent. These preliminary hypotheses stated in null form were that there would be no significant differences between the two groups in intelligence, mathematical ability, overall grade point average prior to entry into the teacher education program, number of mathematics courses taken in college prior to student teaching, and grade point averages on those mathematics courses.

Data needed for establishing the equivalence of the treatment groups in terms of intelligence were secured from scores on the Otis Quick-Scoring Mental Abilities Test: Gamma Test: Form Am (34) and in terms of mathematical ability from scores on the Structure of the Number System: Form A. (16)

The other variables tested were overall grade point averages before entering the elementary education program, the number of mathematics courses taken in college prior to student teaching, and the grade point averages over those mathematics courses. The data for those comparisons were secured from the student records.

Differences between each of the sets of data were tested for statistical significance. The Mann-Whitney U was used to test the scores from Hurst's (23, 72) Pleasure and Confidence scales since they were rank-order scales. The Chi-square (χ^2) test was used to test the "number of mathematics courses taken in college prior to student teaching" variable as this variable involved ordinal data. A three by two contingency table was used in which the numbers of subjects in each group taking less than, exactly, or more than two mathematics courses were compared. Since the rest of the test scores were summated scores, a t-test was used on each.

The ATEM was tested for reliability by the Pearson Product-Moment Correlation based upon a test-retest process using ten percent of the subjects.

Conclusions

The analysis of data was presented in two sections, the first of which was in relation to the equivalence of the two groups in the study, the second of which was in regard to the attitudes of the two groups.

The t-test was used on data for four of the possible intervening variables: intelligence, mathematical ability, overall grade point averages, and mathematics grade point averages. The levels of significance of the values of t were computed using a two-tailed test. In each case the value of t for 149 degrees of freedom was less than the 1.960 for the 0.05 level of significance. Hence, the conclusion was drawn that no significant difference existed between the C-group and the S-group in regard to those four variables. In fact, there was no significant difference in those variables at the 0.20 level. The Chi-square (χ^2) test used to test the fifth variable, the number of mathematics courses taken in college prior to student teaching, confirmed the findings of the t-tests on the above four variables. Therefore, any differences between the groups would be little more than chance differences and the two groups were samples drawn at different times from the same population.

The Mann-Whitney U test was used to compare the results from the scales used to measure the pleasure and confidence in teaching mathematics since those scales gave rank-order data. As the sample sizes were greater than twenty, the distribution of U approached the normal distribution. A z was calculated from U and the level of significance was obtained from a table for the normal distribution. Also, since there were many ties between the groups, a corrected z was computed. However, the differences between the z values found and the corresponding corrected z values were negligible. The differences in the rankings on the Pleasure and Confidence scales were both statistically significant. Hence, the conclusion was drawn that the subjects under the concurrent treatment received more pleasure from teaching mathematics than those under the sequential treatment. Also, the subjects under the concurrent treatment were less confident of teaching mathematics than those under the sequential treatment.

The data concerned with attitudes toward mathematics and attitudes toward teaching mathematics, when tested with the t-test, showed no significant differences so the subhypotheses could not be rejected. Therefore, there was no significant difference between the group which received the concurrent treatment and the group that received the sequential treatment in their attitudes toward mathematics and toward the teaching of mathematics.

Thus, the results of the tests on the scores of the Dutton scale and the ATEM scale showed no significant difference in the student teachers' attitudes toward mathematics and toward the teaching of mathematics. The results on the Hurst Pleasure scale indicated that the subjects under the concurrent treatment received more pleasure from teaching mathematics than the subjects under the sequential treatment. Likewise, those under the sequential treatment had more confidence in teaching mathematics than those under the concurrent treatment.

One of the purposes of making this study was to provide the faculty in the elementary education area at Oklahoma State University with information that would help them in their evaluation of the new program which they had initiated during the 1970-71 academic year and to give them more data upon which to make future decisions in regard to the departmental programs for elementary student teachers.

Implications for Future Research

This study is statistically significant only for the population from which the subjects were drawn, the student teachers in the elementary education area at Oklahoma State University who have the same methods instructor as did the groups in this study. Therefore the study should be replicated on other campuses.

It would be desirable to conduct a similar study under true experimental conditions with the subjects randomly chosen and randomly assigned to groups. This was impossible for the study being reported here.

The writer would suggest a replication of the study reported here with one change made: the number of hours of methods instruction held the same for both groups.

Numerous studies have been made of attitudes toward mathematics of pupils, student teachers, and teachers, but there seems to be a paucity of studies in regard to the attitudes toward the teaching of mathematics, and there has not been a surplus of studies on the effects of teachers' attitudes on children. Studies that would be concentrated on the attitudes of teachers toward the teaching of mathematics might bring to light some useful data. Studies of the effects of the teachers' attitudes on children could point to desirable changes in the preparation of elementary teachers.

The ATEM scale was designed specifically for this study and has been used in its present form only this one time. The writer suggests that it should be refined and used for replications of this study or perhaps for other studies. Other instruments, such as a semantic differential type instrument, could be constructed and used to measure the attitudes of teachers or student teachers toward the teaching of mathematics. This could offset somewhat the scarcity of such instruments. As Dutton (12, 418) said, "The search for more adequate questionnaire and sampling techniques and factors underlying attitudes toward these subjects continues to be an important area for research."

Since the scores on the tests of the attitudes toward mathematics and the attitudes toward the teaching of mathematics indicated the same type of conclusions for both, a study of the relationship between attitudes toward mathematics and attitudes toward the teaching of mathematics might be made.

A study of the relationship of the Mahaffy (31) data and the data in this study would be appropriate since most of the subjects in the two studies were the same ones and the general designs of the two studies were much the same.

Dutton (12, 424) reported that 25 percent of the student teachers maintain their negative attitudes toward mathematics in spite of any intervening instruction. Studies concentrated on that 25 percent could bring to light information that would be most helpful in identifying such persons before they enter teacher education.

There seems to be a time lag in the development of attitudes; therefore longitudinal studies of attitudes toward mathematics and toward the teaching of mathematics need to be made.

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APPENDIX A

A STUDY OF ATTITUDE TOWARD ARITHMETIC

A STUDY OF ATTITUDE TOWARD ARITHMETIC

Directions: Check only the statements which express your feeling toward arithmetic.

______1. I feel arithmetic is an important part of the school curriculum.

______2. Arithmetic is something you have to do even though it is not enjoyable.

______3. Working with numbers is fun.

______4. I have never liked arithmetic.

______5. Arithmetic thrills me and I like it better than any other subject.

______6. I get no satisfaction from studying arithmetic.

______7. I like arithmetic because the procedures are logical.

______8. I am afraid of doing word problems.

______9. I like working all types of arithmetic problems.

_____10. I detest arithmetic and avoid using it at all times.

_____11. I have a growing appreciation of arithmetic through understanding its values, applications, and processes.

_____12. I am completely indifferent to arithmetic.

_____13. I have always liked arithmetic because it has presented me with a challenge.

_____14. I like arithmetic but I like other subjects just as well.

_____15. The completion and proof of accuracy in arithmetic gave me satisfaction and feelings of accomplishment.

SCORING

Scale Value	Test Item
7.2	1
3.3	2
8.7	3
1.5	4
10.5	5
2.6	6
7.9	7
2.0	8
9.6	9
1.0	10
8.2	11
5.2	12
9.5	13
5.6	14
9.0	15

APPENDIX B

HURST SCALES

HURST SCALES

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

_____Art	_____Physical Education
_____Composition	_____Reading
_____Mathematics	_____Science
_____Music	_____Social Studies
_____Penmanship	_____Spelling

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

_____Art	_____Physical Education
_____Composition	_____Reading
_____Mathematics	_____Science
_____Music	_____Social Studies
_____Penmanship	_____Spelling

APPENDIX C

ATTITUDE TOWARD TEACHING ELEMENTARY MATHEMATICS

COVER PAGE

Dear Student Teachers:

The following questionnaires are part of a project which is needed for my graduate work. The results of this study will be used by the Elementary Education Staff to help them make decisions in regard to the sixteen weeks of student teaching.

Please mark the statements as you actually feel--there are no right or wrong answers. The right answers for you are the ones that express as nearly as possible your true feelings.

Please do not write your name on any page except this one. This page will be removed before your papers are read; even I will not know whose answers belong to which person. They will in no way have any affect upon your grades. I need your name on this page for only one purpose: to check the reliability of my questionnaire.

Thank you very much for your cooperation.

Sincerely,

(Mrs.) Velma S. Birkhead

Your name______________________________

ATTITUDE TOWARD TEACHING ELEMENTARY

MATHEMATICS (ATEM)

DIRECTIONS:

Each of the statements on this questionnaire is preceded by a set of abbreviations. Please circle the abbreviation which most nearly represents your true feelings, according to the following categories:

SA Strongly Agree
A Agree
U Undecided
D Disagree
SD Strongly Disagree

The term "mathematics" as used here indicates elementary mathematics.

1.	SA	A	U	D	SD	1.	Elementary teachers should have formal training in the use of mathematics materials.
2.	SA	A	U	D	SD	2.	Children enjoy the challenges of mathematics.
3.	SA	A	U	D	SD	3.	I would like to take another course in mathematics so I can be better prepared to teach it.
4.	SA	A	U	D	SD	4.	I wish that I did not have to teach mathematics.
5.	SA	A	U	D	SD	5.	I dislike teaching mathematics so much that I will quit teaching it as soon as I can get a job where they have a departmentalized system and I don't have to teach mathematics.

6.	SA	A	U	D	SD	6. Mathematics classes are fun for both the pupils and the teacher.
7.	SA	A	U	D	SD	7. Mathematics is a very practical subject to teach.
8.	SA	A	U	D	SD	8. I am eager to get to school each day so I can teach a mathematics class.
9.	SA	A	U	D	SD	9. Those schools which do <u>not</u> put enough emphasis on mathematics are <u>not</u> being fair to their pupils.
10.	SA	A	U	D	SD	10. Mathematics should be taught early in the morning to get it over.
11.	SA	A	U	D	SD	11. Mathematics is as important as any other subject.
12.	SA	A	U	D	SD	12. I think set theory helps to clarify and unify mathematics.
13.	SA	A	U	D	SD	13. Teaching mathematics makes me feel as though I'm lost in a jungle of numbers and can't find my way out.
14.	SA	A	U	D	SD	14. The feeling that I have toward teaching mathematics is a good feeling.
15.	SA	A	U	D	SD	15. I find that the teaching of mathematics is interesting.
16.	SA	A	U	D	SD	16. I like to teach mathematics.
17.	SA	A	U	D	SD	17. Any pupil who is willing to study can learn mathematics.
18.	SA	A	U	D	SD	18. To learn mathematics children must do a great deal of homework.
19.	SA	A	U	D	SD	19. Many concepts presented in mathematics programs are too abstract for the level where they are taught.

20.	SA	A	U	D	SD	20. Changes being made in mathematics for elementary schools are exciting.
21.	SA	A	U	D	SD	21. I really enjoy teaching mathematics.
22.	SA	A	U	D	SD	22. It makes me nervous to even think about having to teach a mathematics class.
23.	SA	A	U	D	SD	23. I detest mathematics, and avoid teaching it as much as possible.
24.	SA	A	U	D	SD	24. Mathematics teaching is intriguing.
25.	SA	A	U	D	SD	25. My mind frequently goes blank and I am unable to think clearly when teaching mathematics.
26.	SA	A	U	D	SD	26. I do <u>not</u> like to teach mathematics; it scares me.
27.	SA	A	U	D	SD	27. Students should be expected to learn mathematics from the textbook without explanation from the teacher.
28.	SA	A	U	D	SD	28. Since mathematics is so precise, it is difficult to teach.
29.	SA	A	U	D	SD	29. I am in a terrible strain when teaching mathematics.
30.	SA	A	U	D	SD	30. Only people with a very special talent can learn mathematics.
31.	SA	A	U	D	SD	31. Mathematics teaching is <u>not</u> very enjoyable but I can see value in mathematics.
32.	SA	A	U	D	SD	32. Mathematics is easy to teach.
33.	SA	A	U	D	SD	33. Although <u>teaching</u> mathematics is difficult, I enjoy it.
34.	SA	A	U	D	SD	34. Mathematics is disliked by most pupils.

35.	SA	A	U	D	SD	35. A mathematics teacher should encourage pupils to participate in the discussion of the mathematics lesson in class.
36.	SA	A	U	D	SD	36. I feel that I make mathematics interesting to most of my pupils.
37.	SA	A	U	D	SD	37. I am enthusiastic about teaching mathematics.
38.	SA	A	U	D	SD	38. It doesn't matter what I do as a teacher, my pupils won't like mathematics.
39.	SA	A	U	D	SD	39. I get butterflies in my stomach just thinking about teaching mathematics.
40.	SA	A	U	D	SD	40. I feel a sense of insecurity when attempting to teach mathematics.
41.	SA	A	U	D	SD	41. It is hard to make mathematics classes interesting.
42.	SA	A	U	D	SD	42. I find that it is fun to teach mathematics.
43.	SA	A	U	D	SD	43. I think children should have time to "play around" with mathematical ideas.
44.	SA	A	U	D	SD	44. The most enjoyable part of my day is in my mathematics classes.
45.	SA	A	U	D	SD	45. Mathematics is a subject in school which I always enjoy teaching.
46.	SA	A	U	D	SD	46. Mathematics is just a skill with little practical application.
47.	SA	A	U	D	SD	47. Emphasis in teaching mathematics should be on "getting the right answer."

48.	SA	A	U	D	SD	48. Teaching mathematics represents a challenge to me to do the best I can to help my pupils understand and appreciate mathematics.
49.	SA	A	U	D	SD	49. Teaching mathematics is a difficult job.
50.	SA	A	U	D	SD	50. Children should work at the blackboard on mathematics problems.
51.	SA	A	U	D	SD	51. I believe most children can learn mathematics if I teach it properly.
52.	SA	A	U	D	SD	52. The new programs in mathematics are interesting and challenging to me as a teacher.
53.	SA	A	U	D	SD	53. Mathematical competence is an essential ingredient in the education of children.
54.	SA	A	U	D	SD	54. I approach a mathematics class with a feeling of hesitation, resulting from a fear of <u>not</u> being able to teach it.
55.	SA	A	U	D	SD	55. The most important reason for studying mathematics is in order to be able to take care of one's own financial affairs.
56.	SA	A	U	D	SD	56. Few people can learn mathematics.
57.	SA	A	U	D	SD	57. Mathematics is a waste of time.
58.	SA	A	U	D	SD	58. Mathematics is very interesting to me and I enjoy teaching mathematics classes.
59.	SA	A	U	D	SD	59. I did <u>not</u> like mathematics in school and I <u>don't</u> like to teach it.
60.	SA	A	U	D	SD	60. Mathematics is one of the most useful subjects I know.

61.	SA	A	U	D	SD	61. In the study of mathematics, if a pupil misses a few lessons it is difficult to catch up.
62.	SA	A	U	D	SD	62. Mathematics classes are the same old thing day after day.
63.	SA	A	U	D	SD	63. I am bored most of the time when I am teaching mathematics.
64.	SA	A	U	D	SD	64. Mathematics should be made meaningful for my pupils.
65.	SA	A	U	D	SD	65. I'm disappointed if my pupils do <u>not</u> like mathematics.
66.	SA	A	U	D	SD	66. Any person of average intelligence can learn to understand a good deal of mathematics.
67.	SA	A	U	D	SD	67. I get frustrated when I teach mathematics.
68.	SA	A	U	D	SD	68. I think children should enjoy studying mathematics.
69.	SA	A	U	D	SD	69. A child will learn better if he is provided with a learning situation in which he somewhat discovers the meanings and concepts of mathematics.
70.	SA	A	U	D	SD	70. Anyone can learn mathematics.
71.	SA	A	U	D	SD	71. Mathematics thrills me and I like to teach it better than any other subject.
72.	SA	A	U	D	SD	72. I hope that I <u>never</u> have to teach mathematics.
73.	SA	A	U	D	SD	73. A mathematics teacher must expect to continue his own education in mathematics indefinitely.
74.	SA	A	U	D	SD	74. As I feel at ease teaching mathematics, I like it very much.

75.	SA	A	U	D	SD	75. I like to teach mathematics better than any other subject.
76.	SA	A	U	D	SD	76. I feel a definite positive reaction to teaching mathematics: it is enjoyable.
77.	SA	A	U	D	SD	77. I should help my pupils think logically and mathematically.
78.	SA	A	U	D	SD	78. There is little place for originality in mathematics.
79.	SA	A	U	D	SD	79. Mathematics is a formal, fixed system, which is learned by mastering rigid, unchanging rules.
80.	SA	A	U	D	SD	80. I can teach mathematics well without reading mathematics magazines and methods books.
81.	SA	A	U	D	SD	81. Mathematics is a very good field for creative people to enter.
82.	SA	A	U	D	SD	82. Teaching mathematics makes me feel secure, and at the same time it is stimulating.
83.	SA	A	U	D	SD	83. Concepts and materials stressed in mathematics programs are difficult for pupils.
84.	SA	A	U	D	SD	84. Teaching mathematics makes me feel uncomfortable, restless, irritable, and impatient.
85.	SA	A	U	D	SD	85. I can't see any reason why we teach about fractions.
86.	SA	A	U	D	SD	86. I'm always glad when mathematics class is over.
87.	SA	A	U	D	SD	87. Mathematics is changing rapidly and I, as a teacher, will have to change with it.
88.	SA	A	U	D	SD	88. There are many interesting ways of presenting mathematical concepts to pupils.

89.	SA	A	U	D	SD	89. I prefer to teach other subjects rather than mathematics.
90.	SA	A	U	D	SD	90. Mathematics is no longer practical since everything can be done with computers.
91.	SA	A	U	D	SD	91. The teacher's manual will give me all the help I need to teach mathematics.
92.	SA	A	U	D	SD	92. If my school changes to a departmental or a team teaching approach I will volunteer to teach the mathematics.
93.	SA	A	U	D	SD	93. Since I <u>don't</u> like to teach mathematics, I can't expect my pupils to like it.
94.	SA	A	U	D	SD	94. Mathematics is the subject I like to teach <u>least</u> of all.
95.	SA	A	U	D	SD	95. I plan to give better marks to pupils who have original ideas about mathematics than to pupils who are most careful and neat in their work.
96.	SA	A	U	D	SD	96. I believe that pupils at the elementary level are capable of learning more mathematics than they are presently being taught.
97.	SA	A	U	D	SD	97. I like to help my pupils appreciate mathematics by showing them how useful it is outside of school.
98.	SA	A	U	D	SD	98. Mathematics is a most useful subject.
99.	SA	A	U	D	SD	99. I am confident that I can teach mathematics so that my pupils can understand it.
100.	SA	A	U	D	SD	100. I have nightmares about teaching mathematics.

APPENDIX D

INDIVIDUAL SCORES OF SUBJECTS
PARTICIPATING IN THE STUDY

S-Group

Subject	SNS[1]	OTIS	Dutton	ATEM	OGPA[2]	MGPA[3]	M[4]	Pl.[5]	Cf.[6]
1	30	67	48.2	72	3.202	3.5	2	1	1
2	23	61	48.2	96	3.089	3.0	2	3	3
3	34	60	62.7	158	2.746	2.95	6	1	1
4	24	64	33.1	100	2.484	2.667	3	2	4
5	23	44	65.7	120	3.4	3.0	2	2	2
6	18	40	38.7	123	2.661	2.0	2	2	4
7	13	36	40.1	76	2.338	1.44	3	7	6
8	28	53	31.1	67	3.079	3.0	2	2	2
9	25	64	56.1	94	3.156	3.0	1	3	2
10	32	61	47.2	101	2.652	2.50	2	4	2
11	28	63	69.0	106	2.4	3.0	1	4	3
12	27	66	68.3	116	2.553	3.25	4	2	2
13	20	55	38.7	101	2.637	2.142	2	4	7
14	31	71	57.5	122	3.065	3.0	2	3	2
15	31	60	65.7	107	3.181	3.0	1	1	1
16	19	54	41.2	102	2.153	2.625	2	4	4
17	37	56	65.7	107	3.267	3.545	3	2	1
18	28	46	58.1	76	3.5	3.0	2	9	8
19	30	63	48.3	71	2.656	3.0	2		
20	24	47	42.0	81	2.873	3.5	2	1	2
21	28	67	65.7	104	2.645	2.61	3	1	1
22	23	56	57.8	101	3.197	2.0	1	6	6
23	20	50	38.7	77	2.2	1.5	2	4	4
24	28	66	52.2	92	2.434	2.5	2	2	3
25	23	48	48.6	86	2.433	2.0	2	5	
26	21	65	42.7	94	2.393	1.5	2	3	4
27	28	66	57.8	87	2.531	3.0	2	3	2

[1]Score on Structure of the Number System test

[2]Score on overall grade point average

[3]Score on mathematics grade point average

[4]Number of mathematics courses taken

[5]Score on Pleasure scale

[6]Score on Confidence scale

Subject	SNS	OTIS	Dutton	ATEM	OGPA	MGPA	M	Pl.	Cf.
28	17	52	15.9	104	2.693	2.5	2	2	1
29	28	68	48.6	59	3.138	3.5	2	4	7
30	23	49	51.5	78	2.733	2.0	1	3	3
31	24	52	65.7	87	1.852	2.5	4	2	2
32	34	71	76.2	128	3.223	4.0	3	4	1
33	25	52	56.7	150	3.125	3.667	3	2	2
34	24	52	68.3	111	2.836	4.0	1	1	1
35	22	51	30.0	51	2.596	2.0	2	5	5
36	25	55	73.9	127	2.542	2.56	7	1	1
37	22	57	40.0	68	2.651	2.5	2	1	5
38	23	54	10.7	37	2.878	3.0	1	9	9
39	24	61	48.3	86	2.97	3.5	2	1	1
40	28	50	29.4	76	2.838	3.5	2	4	5
41	32	68	65.7	81	2.048	2.5	2	3	4
42	23	66	46.6	96	2.4	2.5	2	5	5
43	25	59	38.7	57	2.706	2.5	2	6	5
44	31	61	76.2	130	2.603	3.5	2	2	1
45	25	45	22.8	48	2.54	2.0	3	10	10
46	21	36	58.1	83	2.573	2.5	2	3	6
47	22	59	56.7	49	3.47	4.0	1	6	5
48	15	48	29.7	130	2.784	2.0	2	4	2
49	27	61	56.1	75	3.0	1.913	7	1	1
50	24	60	57.8	103	2.738	3.0	2	2	2
51	24	59	60.1	139	2.562	3.0	2	1	1
52	12	58	48.3	92	1.796	1.0	1	5	5
53	29	51	23.8	65	3.111	4.0	2	3	7
54	23	39	41.0	93	3.397	3.0	1	6	6
55	25	51	48.8	79	3.032	3.0	2	4	5
56	36	68	70.6	88	2.954	2.75	2	1	1
57	24	54	65.7	91	2.101	2.25	4	5	8
58	20	47	46.6	82	2.2	2.0	2	3	3
59	25	67	56.7	102	2.716	4.0	2	2	2
60	16	48	5.6	100	2.031	2.0	2	2	1
61	17	68	27.6	7	2.693	3.5	2	10	9
62	32	60	57.8	130	2.854	2.5	2	5	4
63	27	46	39.5	70	2.434	2.0	2	4	3
64	21	58	35.0	56	2.196	2.5	2	6	4
65	23	68	57.8	87	2.767	3.0	2	2	2
66	21	62	57.8	109	2.563	2.333	3	3	3
67	36	72	50.2	83	3.761	4.0	2	3	5
68	21	58	48.8	86	3.087	2.5	2	7	7
69	19	37	65.7	91	2.236	2.299	3	7	6
70	29	57	21.5	50	2.525	2.333	3		
71	25	53	48.2	89	2.081	2.5	2	3	3
72	32	50	58.1	106	2.857	3.5	2	5	4
73	14	54	65.7	73	2.461	2.0	2	3	3
74	22	52	28.9	64	1.926	1.75	4	5	7
75	15	41	35.1	60	2.774	3.5	2	4	4
76	22	56	57.8	121	2.601	3.5	2	6	6
77	27	52	41.0	60	2.812	0.0	0	8	9

C-Group

Subject	SNS	OTIS	Dutton	ATEM	OGPA	MGPA	M	Pl.	Cf.
78	22	51	16.9	69	2.016	2.0	2	3	4
79	33	63	62.7	161	3.26	4.0	3	1	1
80	18	51	47.2	89	2.127	2.0	2	6	3
81	28	63	57.5	108	3.193	3.0	2	4	4
82	23	55	38.7	108	1.95	1.0	4	2	3
83	30	54	56.7	77	3.033	4.0	3	5	4
84	30	65	69.0	108	3.265	3.5	2	4	3
85	24	53	29.8	51	2.573	2.0	2	5	5
86	37	74	76.2	119	3.156	4.0	1	1	1
87	27	52	52.2	96	2.936	3.5	2	2	2
88	24	55	32.0	55	2.311	3.0	2	8	7
89	18	62	12.0	10	2.0	1.667	3	8	6
90	25	72	46.6	63	3.38	2.5	2	4	5
91	22	57	33.3	80	2.5	2.5	2	7	7
92	26	49	39.5	88	2.767	3.636	3	3	5
93	27	58	49.9	93	2.909	2.5	2	5	5
94	21	44	46.6	72	2.757	3.0	2	4	6
95	17	50	56.2	144	3.746	4.0	2	3	5
96	23	71	13.1	30	3.68	4.0	2	9	9
97	29	62	24.8	33	3.468	3.0	3	10	10
98	25	54	57.8	156	2.606	2.545	3	3	3
99	23	54	69.0	64	3.485	4.0	1	7	7
100	27	61	54.5	93	3.164	3.0	2	2	2
101	27	55	65.7	91	3.047	3.0	2	5	5
102	16	63	33.2	20	2.783	1.5	2	10	10
103	24	47	39.2	82	2.687	2.875	4	4	6
104	34	62	57.5	105	2.984	3.333	3	4	3
105	30	58	25.9	62	2.6	1.5	2	9	5
106	22	56	51.3	94	3.01	4.0	2	3	3
107	25	54	33.0	53	2.983	4.0	2	6	9
108	26	56	57.8	116	4.0	4.0	2	4	5
109	30	63	48.3	129	3.5	3.0	1	2	2
110	20	50	46.6	102	2.715	4.0	2	4	8
111	20	51	21.5	66	2.116	1.272	3	4	4
112	19	50	65.7	82	2.646	2.5	2	5	6
113	29	67	30.6	71	2.796	3.0	2	6	6
114	22	50	56.1	144	2.93	3.0	2	7	7
115	10	48	26.3	-65	2.86	2.5	2	10	10
116	19	40	24.3	66	2.46	2.5	2	7	5
117	32	56	65.7	83	2.532	2.667	3	2	3

Subject	SNS	OTIS	Dutton	ATEM	OGPA	MGPA	M	Pl.	Cf.
118	25	60	9.5	122	2.9	3.0	2	2	2
119	22	50	29.7	56	2.889	2.5	2	8	8
120	30	72	65.7	107	2.778	3.75	3	4	3
121	20	47	48.6	126	2.281	2.0	2	1	3
122	13	49	37.9	58	2.52	1.5	2	4	6
123	29	57	65.7	122	2.58	2.5	2	3	2
124	16	57	57.5	76	3.5	2.0	1	8	9
125	30	56	29.7	102	2.4	3.2	2	6	7
126	32	74	47.2	85	3.746	4.0	2	3	3
127	33	61	65.7	93	2.63	3.0	2	2	5
128	27	65	40.6	91	1.38	4.0	2	3	3
129	31	62	40.0	87	2.258	2.0	2	3	5
130	39	71	61.0	85	2.924	3.5	2	1	1
131	17	50	65.7	123	2.758	2.0	1	4	4
132	24	54	46.6	105	2.3	1.0	2	3	8
133	27	48	39.3	78	0.866	2.5	2	3	3
134	34	49	56.1	105	2.77	2.5	2	3	3
135	21	61	34.4	65	3.4	3.0	2	7	7
136	24	59	62.7	72	3.3	3.5	2	1	1
137	29	68	5.6	77	3.06	4.0	1	4	5
138	35	62	57.5	95	3.68	4.0	2	2	1
139	17	51	57.8	115	2.841	3.5	2	2	2
140	20	43	57.8	145	2.8	3.0	2	2	2
141	33	58	59.4	38	2.815	2.5	2	6	6
142	28	63	59.1	106	2.841	4.0	2	3	3
143	37	69	65.7	157	2.968	3.0	1	2	1
144	30	58	40.4	99	2.645	3.0	2	2	3
145	31	67	65.7	85	3.1	3.0	2	5	6
146	22	52	29.7	105	2.072	3.0	1	6	5
147	25	71	70.6	100	3.04	0.0	0	2	1
148	27	56	48.3	141	2.95	3.375	2	5	4
149	20	46	30.5	62	2.469	2.0	2	4	6
150	29	63	31.2	64	2.08	1.5	2	9	9
151	23	51	21.0	49	2.274	2.0	3	5	5

VITA

Velma Vivian Sisson Birkhead

Candidate for the Degree of

Doctor of Education

Thesis: A COMPARATIVE STUDY OF THE EFFECT ON THE ATTITUDES OF STUDENT TEACHERS OF A CONCURRENT AND A SEQUENTIAL DESIGN

Major Field: Higher Education

Biographical:

Personal Data: Born in Windsor, Missouri, November 27, 1910, the daughter of John Deskin and Erna Vivian Sisson.

Education: Graduated from high school, Bowling Green, Missouri, in May, 1928; received the Bachelor of Science in Education degree from Kansas State College, Pittsburg, with a major in mathematics, in 1939; received a Master of Science degree from Kansas State College, Pittsburg, with a major in mathematics, in 1943; awarded National Science Foundation Summer Institute, Oklahoma State University, Stillwater, in 1965; awarded Educational Professions Development Act Summer Institute, University of Arkansas, Fayetteville, in 1969; completed requirements for the Doctor of Education degree in May, 1973.

Professional Experience: Rural school teacher, Pike County, Missouri, 1928-34; elementary teacher, Center and Curryville, Missouri, 1934-39; mathematics, English, music teacher, Wayside, Kansas, 1939-40; mathematics teacher, Commerce, Oklahoma, 1940-42; mathematics teacher, Junior College, Parsons, Kansas, 1942-47; ground school instructor for Civilian Pilot Training (CPT) and War Training Service (WTS), Junior College, Parsons, Kansas, 1942-43; mathematics teacher, Bowling Green RI High School, Bowling Green, Missouri, 1954-66; extension instructor, Northeast Missouri State University, 1965-66; Assistant Professor of Mathematics, Central Missouri State University, Warrensburg, Missouri, 1966--

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