

TEAM TEACHING MATHEMATICS
IN JUNIOR HIGH SCHOOL

by 149

ROY H. BUSH

B. A., Colorado State College, 1961

A MASTER'S REPORT

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

College of Education

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1967

Approved by:


Major Professor

LD
2668
R4
1967
B978
C.2

ACKNOWLEDGEMENTS

The author wishes to express appreciation to Edna Johnson and Robert Poole for their contribution and cooperation concerning the writing of this report.

TABLE OF CONTENTS

	PAGE
THE PROBLEM	1
Introduction	1
Statement of the Problem	1
Definition of Terms	2
Team teaching	2
Team teaching rooms	2
Ability grouping	2
Below average student	3
Average student	3
Above average student	3
Heterogeneous grouping	3
Large group instruction	3
Limitations of the Study	3
REVIEW OF THE LITERATURE	5
Antecedents of Team Teaching	5
Types of Team Teaching Organizations	11
Advantages of Team Teaching	13
Disadvantages of Team Teaching	15
Research in Team Teaching	16
Research in Team Teaching of Mathematics	17
METHODS AND PROCEDURES	20
Description of the Population	20

	PAGE
Description of the Sample	20
Methods Used	22
RESULTS	37
Evaluation of the Mathematics Team Teaching Program by the Other Teacher Involved in the Experiment	41
Evaluation of the Mathematics Team Teaching Program by the Principal of the Junior High School	47
SUMMARY AND CONCLUSION	50
Conclusions	50
Implications and Recommendations	52
BIBLIOGRAPHY	54
APPENDIX A	57
APPENDIX B	72

LIST OF TABLES

	PAGE
I. Student Fluctuation at the end of Eighteen Weeks	22
II. Teachers' Class Schedule	27
III. Lesson Presentation Schedule for 18 Weeks For Teachers A and B	29
IV. Mean Daily Average Number of Minutes Devoted to Clerical and Instructional Elements Recorded for One Week	33
V. Student Evaluation of Team Teaching of Mathematics, All Seventh, Eighth and Ninth Grade Students	58
VI. Student Evaluation of Team Teaching of Mathematics, All Students in Team Teaching At the Time the Questionnaire was Administered	60
VII. Student Evaluation of Team Teaching of Mathematics, Seventh Grade Students in Team Teaching at the End of 18 Weeks	62
VIII. Student Evaluation of Team Teaching of Mathematics, Eighth Grade Students in Team Teaching at the End of 18 Weeks	64

IX. Student Evaluation of Team Teaching of
Mathematics, Ninth Grade Students in Team
Teaching at the End of 18 Weeks 66

X. Student Evaluation of Team Teaching of
Mathematics, Seventh Grade Students Moved
to a Higher Ability Group 68

XI. Student Evaluation of Team Teaching of
Mathematics, Seventh Grade Students Moved
To a Lower Ability Group 70

LIST OF FIGURES

	PAGE
1. Seating and Classroom Arrangement	35

THE PROBLEM

Introduction

Watson Junior High School in Colorado Springs, Colorado, has been constructed for the purpose of team teaching in those subjects for which the team teaching approach is suited. The social studies and English departments have conducted a team teaching program for the past three years and seem to have had success with the team approach.

The administration and the mathematics department have considered adopting the team approach in mathematics to improve instruction. However, there was little research available that evaluated the suitability of the team approach in mathematics. As a result, the administration and mathematics department were not content in adopting the program until more evidence of the team approach in mathematics was available.

Statement of the Problem

The purpose of this study was (1) to determine if more teacher preparation time could be allotted so that instruction could be improved, (2) to determine if students in large group instruction could receive more individual attention by team work, (3) to determine if students maintained their interest in mathematics in large group instruction, (4) to determine if ability grouping of students into average

and above average classes was more effective in team teaching mathematics than heterogeneous grouping, (5) to determine if student assistance could be utilized, (6) to better evaluate the individual student, (7) to determine student attitudes towards team teaching of mathematics.

Definition of Terms

Team teaching. Team teaching refers to two teachers who combined their efforts for teaching mathematics to sixty students every day during the same fifty-five minute period of time. This was "a cooperative team program, with all members equal in status and authority."¹

Team teaching rooms. Team teaching rooms consist of two rooms separated by removable partitions. When the partitions are removed, the two small rooms make one large room capable of seating approximately sixty students. The center room contains the overhead projector and podium.

Ability grouping. Ability grouping was the process by which students were placed into three categories or classes according to their abilities and ambitions in mathematics.

¹Dean Carrigan and Robert Hynes, "Team Teaching Proceed with Caution," Clearing House, 39:312, January, 1965.

The three groups were below average, average, and above average learners. The students were placed in one of the three classes according to their past mathematics grade, past teachers' recommendations, and a standardized test score.

Below average student. A below average student was a student who maintained a grade average of "D" or "F" in mathematics.

Average student. An average student was a student who maintained a grade average of "C" in mathematics.

Above average student. An above average student was a student who maintained a grade average of "B" or better in mathematics.

Heterogeneous group. A heterogeneous group was a group of students composed of below average, average, and above average students.

Large group instruction. Large group instruction consisted of one teacher lecturing to approximately sixty students daily during one 55 minute period.

Limitations of the Study

This study was limited in that (1) the experiment was conducted with average ability groups in the seventh grade, high ability groups in the eighth grade, and a heterogeneous

group in the ninth grade, (2) the re-grouping and re-scheduling of the eighth and ninth grade pupils was not possible unless an exchange of students could be made with other mathematics classes, (3) the sampling of the eighth and ninth grade students was hampered by conflicting individual schedules, (4) the study was limited to eighteen weeks, (5) no extra financial aid was received.

REVIEW OF THE LITERATURE

Antecedents of Team Teaching

A review of the literature will reveal that the American education system has been influenced or affected by many different forces in the past. Probably the more influential factors affecting education have been the teacher shortage, the knowledge explosion, increased understanding of child growth, and a re-examination of educational goals. Such factors as these contributed to the formation of the team teaching concept.¹

The teacher shortage has been a persistent problem in American education. This problem developed into a near-crisis following World War II when the increase in birth rate not only demanded more teachers, but also more school buildings to house the increased growth in student population.² The average class size in schools had decreased 1.8 pupils from 1955 to 1961, requiring more classes and teachers. Schools are providing more services for students, such as counselors, social workers, speech therapists, and subject matter specialists.³ Most of these jobs are being filled by teachers leaving

¹Medill Bair and Richard G. Woodward, Team Teaching in Action (Boston: Houghton Mifflin Company, 1964), pp. 3-7.

²Judson T. Shaplin and Henry F. Olds, Jr., Team Teaching (New York: Harper & Row, Publishers, 1964), p. 24.

³Bair and Woodward, op. cit., p. 4.

the educational field entirely for jobs which are more attractive financially.

Teachers' wages hit an all time low during World War II, but have since increased because of the strong public demand for more teachers.¹ Although teachers' salaries have increased since the war, so have the requirements for teacher qualification. The increase in salary has been mainly for the beginning teacher, while the ceiling for the experienced teacher has remained below par. After ten years experience, most teachers have reached their top salary unless they acquire more education or enter administrative positions.² The increasing salaries for teachers is still below most occupations requiring a college degree, which seems to deter quite a number of top students from following a teaching career. There have been several attempts to alleviate the problem of low teachers' salaries; one proposed solution was to gain federal aid, which has been unsuccessful as yet. Another solution has been to give merit pay to those teachers who do an outstanding job, but this approach has not been very successful, due to the lack of measuring tools for good and poor teaching.³

In 1956, the National Association of Secondary-School

¹Shaplin and Olds, op. cit., p. 27.

²Ibid., pp. 27-28.

³Ibid., pp. 30-31.

Principals established a commission to seek solutions to the teacher shortage problem, without lowering the standards for entrance to the profession or lowering the quality of education.

For more than four years the commission sponsored, worked with, and studied the results of experiments in nearly 100 junior and senior high schools across the United States. Financial support came from the Fund for Advancement of Education and the Ford Foundation.¹

From these different programs, termed Staff Utilization Studies, came experimentation with closed-circuit television, use of tape recordings, reorganization of class size and time, programmed learning, team teaching and other projects.² Most of these projects have been carried out in the public schools in conjunction with nearby colleges and universities, consequently bringing the two levels of education closer together.

To help alleviate the teacher shortage without lowering the professional standards, some colleges and universities have offered a Masters of Arts in Teaching. The major purpose of such programs was "to give university training to Bachelor's degree holders with a subject area specialty who had few, if

¹J. Lloyd Trump and Dorsey Baynham, Guide to Better Schools: Focus on Change (Chicago: Rand McNally & Company, 1961), p. 1.

²Lloyd S. Michael, "What Are We Trying to Accomplish in the Staff Utilization Studies?" The Bulletin of the National Association of Secondary-School Principals, 43:5-10, January, 1959.

any, undergraduate education courses."¹ This program attracted some people with above average ability to the teaching profession in the secondary schools, but did little for the shortage in the elementary schools.

The knowledge explosion has made it unprofitable for students to gain knowledge through rote memorization of facts. "Moreover, many of the facts memorized are inaccurate in the light of new knowledge."² The total amount of knowledge has been expanded not only by the passage of time, but also by scientific investigations and technological advances. All these factors combined show the futility of trying to educate students through rote memory work. National curriculum groups are attempting to re-define the learning process in terms of teaching pupils how to learn rather than trying to teach them only specific facts.³

Another factor which has influenced American education in the past thirty to forty years has been the increase in knowledge about child growth. The first major breakthrough in this respect probably was the confirmation that children did have different intellectual abilities, and that they were measurable to a certain degree. In addition to differences in intellectual ability, there has been increased

¹Bair and Woodward, op. cit., p. 8.

²Ibid., p. 5.

³Ibid., p. 8.

understanding concerning giftedness, emotional make-up and creativity. The schools have responded to these individual differences in several ways. Some schools have advanced a pupil through the grades without regard to his achievement. Other schools have offered a double track system in high school; one track for those who expected to continue their formal education beyond high school and another track for those who did not.¹

Another plan, which is the most direct forerunner of team teaching, is the non-graded elementary school. The non-graded elementary school allows for sequential learning and breaks down the rigid grade placement of traditional plans. The curriculum is geared to students' abilities and needs, and places emphasis on students progressing accordingly.²

A re-examination and revision of our educational curriculum has had an influence on our educational system in the past decade. Most curriculum revisions have been in science, mathematics, and recently in English. These revision groups include teachers from public and private schools and from schools of education. But the major initiative for revision projects has come from ". . . university scholars in the academic disciplines, and the main centers of activity

¹Ibid., p. 9.

²Judson T. Shaplin and Henry F. Olds, Jr., Team Teaching (New York: Harper & Row, Publishers, 1964), p. 48.

have been established in the universities or in affiliated institutions."¹ This has not always been the case in the past. The revision programs have been so broad and extensive that they can be applied to almost any school in the United States. In the past this has not been true of revision projects, because most were developed for a specific school system.² When the revision projects were first initiated, they were aimed toward the more able and talented students, but now they have been developed to include the total school population.

While some schools are in both staff utilization projects and curriculum revision projects, these programs were not developed in association with each other, and the reports from individual schools seldom mention any type of combination of the projects. This may be due to the fact that staff utilization projects have a stronger foothold in the social studies and English, while curriculum revision has been done mainly in the sciences and mathematics.

All of these forces influencing American education, the teacher shortage, the knowledge explosion, the increased understanding about individual differences, and the curriculum revisions, have contributed to the founding of team teaching.

¹Ibid., p. 40.

²Ibid., pp. 40-41.

Types of Team Teaching Organizations

Team teaching started in 1956 and 1957 with a few pilot projects. The Fund for the Advancement of Education was the principal financial backer, while much of the professional interest came from the Committee on Staff Utilization, appointed by the National Association of Secondary-School Principals.

According to Shaplin, there are so many versions of team teaching that:

All over the country teaching teams are going through the same process, facing the same problems, and seeking their own unique solutions; but no models capable of common application have as yet been developed.¹

Because there is no common model for team teaching, it is difficult to define, but there are similarities which exist among the different programs.

The most common characteristic of team teaching projects is that the teachers are required to work in a close relationship with each other. "Team teaching programs emphasize the team, rather than the individual teacher, in the planning, teaching, and evaluating cycle."² They do everything as a group, planning, decision making, and volunteering their services to the others in the group. The

¹Judson T. Shaplin and Henry F. Olds, Jr., Team Teaching (New York: Harper & Row Publishers, 1964), p. 13.

²Medill Bair and Richard G. Woodward, Team Teaching in Action (Boston: Houghton Mifflin Company, 1964), p. 30.

difference between team teaching and mere cooperation between teachers is the formalized organization of the group. There are specific delegated tasks to be performed by each individual. Any member may resign from a team, but a new member replacing him must carry out the responsibilities of the retiring member. In mere cooperation between teachers, the relationship may be dissolved and cease to exist if any member chooses to work alone.¹

Another common characteristic of team teaching is that the teams are composed of two or more teachers. These groups of teachers may or may not have clerical aides or paraprofessional help. Those projects which have only one teacher and an aide are not considered teaching teams.²

A third common characteristic of team teaching is the "variety which may be introduced in the assignment, scheduling, grouping, and location in space of the students."³ Some team teaching projects can alter the class time and size and the grouping of students. They may extend a class period to accomplish the presentation of material which is more difficult; they may meet as a large group for a lecture; they may break into smaller groups for individual instruction. They may even schedule certain individuals for a different class,

¹Shaplin and Olds, op. cit., p. 10.

²Ibid., p. 11.

³Ibid.

depending on his past achievements.¹

Team teaching takes on many forms and versions, but the majority of the programs have the similarities previously mentioned. The best definition of team teaching, without limiting it to any particular program or restriction was expressed by Shaplin.

Team teaching is a type of instructional organization, involving teaching personnel and the students assigned to them, in which two or more teachers are given responsibility, working together, for all or a significant part of the instruction of the same group of students.²

Advantages of Team Teaching

There are many advantages claimed by the advocates of team teaching. These benefits affect almost all aspects of the total school organization.

Team teaching programs emphasize the strengths of the individual team members by allowing them to teach, plan, and advise in the curriculum area of their speciality.

Some teams have different levels of responsibilities for the teachers depending on their ability and experience. Higher status and higher salaries are given to the senior members and team leaders. This hierarchy system encourages the better teachers to stay in the profession because of the opportunities for advancement and professional growth.

In most team teaching situations, the absence of a

¹Ibid., p. 12.

²Ibid., p. 15.

teacher can be compensated for by other members of the team. This system eliminates the loss of a days instruction due to the lack of qualified substitutes.¹

Team teaching programs can provide an internship type of training for new teachers by permitting them to be supervised by the senior teachers and by permitting the less experienced teacher to "observe an outstanding teacher adjusting his program as the teacher-learning situation develops."² Under the close supervision of the senior teacher, the young intern can gain valuable experience, and he can always seek help which is readily available.

By emphasizing different class sizes and class lengths, team teaching lends itself to flexible scheduling.³

Many team teaching programs use clerical aids and paraprofessional personnel. The use of such personnel frees the teacher from routine and clerical chores and gives them more time to devote to planning and executing plans within the classroom.

Most teaching teams can make better use of mechanical and audio-visual aids to teaching. This equipment often saves

¹"A Critical Look at Team Teaching," The Instructor, 71:41, October, 1961.

²Medill Bair and Richard G. Woodward, Team Teaching in Action (Boston: Houghton Mifflin Company, 1964), p. 30.

³Ibid., p. 33.

time and money and can improve instruction. Some schools have been better able to acquire mechanical and electronic equipment because it can be assigned to a team and utilized to the benefit of many students at one time, where before it took a piece of equipment for each class and each teacher.¹

Teaching teams can improve guidance and evaluation of students through the exchange of information about students.

Many times the community resources and talented citizens are easier to discover and utilize through team leaders and team meetings.²

Disadvantages of Team Teaching

The critics of team teaching have found the following disadvantages of team teaching programs.

Some teachers are too independent and work better alone in a single classroom.

Not all subjects are adaptable to the team teaching organization, as some courses require more feed back and attention for the individual than is given by large group instruction.

Not all existing school plants are flexible enough

¹Judson T. Shaplin and Henry F. Olds, Jr., Team Teaching (New York: Harper & Row Publishers, 1964), pp. 19-20.

²Malcolm P. Douglass, "Team Teaching: Fundamental Change or Passing Fancy?" The Education Digest, 28:50-51, May, 1963.

to meet the requirements for a team teaching program. The flexible space needed for small and large group work may not be available. There is also a need for more flexible scheduling for the students and teachers.

Not all administrators or communities are susceptible to new ideas without proof of their worth.

Not all ability groups benefit by such an organization, since lower ability groups have a shorter attention span than is needed for large group instruction.¹

In most pilot studies of team teaching the cost per pupil is higher than in the traditional organization.

Too much time is required for team planning.

Teacher colleges are not preparing graduates for team teaching programs.

The hierarchy of some team teaching programs breeds jealousy among its members.²

Research in Team Teaching

Research in team teaching has been carried out at all levels of education and in many different subject areas or a combination of subject areas. These projects have spread to

¹Jack R. Fraenkel and Richard E. Gross, "Team Teaching: Let's Look Before We Leap!" Social Education, 30:336, May, 1966.

²"A Critical Look at Team Teaching," The Instructor, 71:41, October, 1961.

"twenty-four states with concentrations in Massachusetts, Florida, Illinois, Wisconsin, Michigan, Colorado, Utah, and California."¹ Some of these projects have been conducted in conjunction with the state universities and colleges, using them as consultants and resource centers.²

Since there is no set pattern or organization for team teaching, it is difficult to evaluate team teaching from the results obtained in specific experiments. The majority of the experiments that have been reported are:

descriptions of: (1) how teachers and students who experienced a team teaching venture like it, or (2) descriptions of pitfalls to avoid before embarking on such a venture.³

There have been some studies comparing pupil achievement in a traditional class to that of a team teaching class, and the results of these experiments have indicated that the "performance [in team teaching classes] is about equal to that resulting from good instruction, with the greatest gains occurring at high and low ability levels."⁴

Research in Team Teaching of Mathematics

An experiment in team teaching of mathematics was reported in Sarasota, Florida. This experiment was conducted

¹Shaplin and Olds, op. cit., p. 2. ²Ibid.

³Fraenkel and Gross, op. cit., p. 337.

⁴"A Critical Look at Team Teaching," The Instructor, 71:42, October, 1961.

with two high ability groups of seventh graders and two teachers alternating group lectures. The two teachers only had half an hour planning period together after school hours. The large groups only met three times a week and covered different material from that which was taught in their regular classes. A questionnaire was used to measure the students' attitudes toward the large group instruction. The results showed that

Eighty percent of the pupils preferred having two teachers instead of just one. Thirty percent of them thought that they received more personal attention using this method of instruction and an additional twenty-seven percent thought that they received the same amount of personal attention as they did in the traditional small class arrangement.¹

The instructors felt that they had achieved as much in the large group as in an individual class, although they had no control group for comparison.²

In Glenbrook, Illinois, an experiment was conducted by two teachers with a class of eighty-one geometry students picked at random. The large group met in a study hall of medium size with a door and blackboard at each end. Acoustics and facilities of the room were poor. Because student response to large group instruction was unfavorable, the class

¹Raymond Sweet and Peter Dunn-Rankin, "An Experiment in Team Teaching Seventh Grade Arithmetic," School Science and Mathematics, 62:342, May, 1962.

²Ibid., pp. 341-44.

was divided into three small groups for the remaining nine weeks of the semester.

The instructors "found that the range of grades followed the range of abilities combined with study habits."¹ They also felt that the large group instruction would have worked much better had improved facilities been available.²

There have been a few other studies conducted comparing team teaching of mathematics to that of a traditional class, but there needs to be "more carefully structured and controlled research on the learning achievement of pupils instructed by teaching teams as compared with more traditional approaches."³

¹Wesley G. Bovinet, "Glenbrook Reports on Four Experiments on Utilization of Staff," The Bulletin of the National Association of Secondary-School Principals, 44:246, January, 1960.

²Ibid., pp. 244-47.

³Fraenkel and Gross, op. cit., p. 337.

METHODS AND PROCEDURES

Description of the Population

Colorado Springs, Colorado, is located on the Eastern edge of the Rocky Mountains. Sixty-three per cent of its income is derived from the military personnel stationed at Fort Carson, which lies on the southern edge of Colorado Springs; Ent Air Force Base, located in the heart of the city; and the United States Air Force Academy, located to the North of Colorado Springs. Twenty-eight per cent of the area income is derived from tourist trade, and the remaining 9 per cent comes from industry and other sources.¹

The Widefield School District includes six elementary schools, two junior high schools and one high school, with a total student enrollment of 6,300. Approximately 60 per cent of the student enrollment are children of military personnel. The money for the school budget is derived from property taxes with an assessed value of \$17,000,000. To supplement the money received through property taxes, the school district receives approximately \$320 federal financial aid for each child of military personnel.

Description of the Sample

The experimental groups used in this study were four

¹Colorado Springs Chamber of Commerce

classes of average ability students in seventh grade mathematics, two classes of high ability students in eighth grade mathematics, and two heterogeneous classes of ninth grade algebra. The students involved in each group fluctuated from time to time because of re-scheduling students according to ability and because of transfer students moving in and out of the district. The greatest fluctuation occurred with the seventh grade groups, both with regard to individual changes in the class and to the number of students in each class. Some of the original students in these groups were changed after an evaluation of their progress and ability was made at the end of the fifth week. The number of students in the eighth and ninth grade did not fluctuate to a great extent, although there were individual students changed within these groups. Table I shows the number of students and the changes for each group. The number of boys and girls in each group were nearly evenly divided and remained fairly constant.

The mean intelligence quotient of those students at the end of the study was as follows: seventh grade 2nd period 99.9; seventh grade 3rd period 100.0; eighth grade 119.4; ninth grade 109.2. The average age of both groups of seventh grade students was 12.53 years old; the average age of the eighth grade students was 13.34 years old; the average age of the ninth grade students was 14.38 years old.

The majority of the parents of the students were military personnel.

TABLE I
STUDENT FLUCTUATION AT THE END OF EIGHTEEN WEEKS

	2nd period 7th grade	3rd period 7th grade	4th period 8th grade	7th period 9th grade
First Week	59	57	57	53
Eighteenth Week	48	53	59	49

Methods Used

The sampling procedures were different for each group of students. The seventh grade students were selected at random from an alphabetized list. At the end of the fifth week, the seventh grade students were moved to different math classes according to their mathematical ability and the interest shown. The eighth grade students were chosen by the principal of the school according to academic grades made in mathematics the previous year. The ninth grade students were assigned by the counselors who tried to group by ability, but the ninth graders individual schedules and the fact that there was one less mathematics teacher teaching during that period hampered any real success with ability grouping.

All seventh grade mathematics classes were scheduled during the second and third periods in the morning, which allowed for a flexible schedule with regard to ability grouping. The eighth grade group met during the fourth period in the morning just before lunch and the ninth grade group met the last period of the day.

The seventh, eighth, and ninth grades used a series of three text books published by Holt, Rinehart and Winston, Inc., New York. The authors of this text are Keedy-Jameson-Johnson. These books have been written integrating arithmetic, algebra, and geometry using the discovery approach. The general objective of the Widefield School District for a three year period is to have the below average student complete Book II which includes solving linear equations, the average student to complete half of Book III which includes up to quadratic equations, and the above average student to complete all of Book III which includes some solid geometry and probability.

These texts require supplementary material, especially for the below average and the average students. This supplementary material is needed to provide the students with additional exercises for learning mechanical manipulations. The regular texts were supplemented by a work book written by Keedy-Jameson-Johnson, a traditional text Algebra in Easy Steps, and supplementary material compiled by the teachers.

In addition to the supplementary material, there was a standardized test published by the company which all mathematics classes used. These tests were given at the completion of each unit of each text, and the scores were put on the normal curve between all mathematics classes. The scores made on the standardized tests were used to help determine ability grouping between the mathematics classes, especially for the seventh grade since it was the most flexible as to ability grouping.

Only one outside speaker was used during the experiment. The speaker was from the International Business Machines Corporation. The objective of having this speaker was to instill interest in the students for mathematics and also to give them some conception of why they were learning different aspects of mathematics, particularly different bases and modular systems.

Ability grouping procedures for the seventh grade was done entirely by the mathematics department at the end of the fifth week and the completion of unit one in Book I. There were approximately 300 students making up ten classes for the five teachers during the first two periods of the day. The students were grouped according to their raw scores made on the authors standardized test of the text and according to the maximum number of pupils a teacher could teach in one room. There were a possible forty-one correct responses

to the test. Those students who scored in the range from fifteen to twenty-two correct were moved to the team teaching room or remained in the team teaching room. There were fifty-seven students in one group and fifty-five students in the other group. At the end of unit three of Book I, the seventh grade students were grouped again by standardized test scores, by teacher recommendation, and by their interest shown in mathematics. In a combination of the second and third period team teaching classes, a total of seventeen students moved to either a higher or lower ability group; sixteen students entered from the other mathematics classes.

The only difficulty encountered later in the study was the movement of students to higher ability groups, since they were usually behind on material covered by these groups. But these students would study on their own to cover the material they had missed.

The eighth grade students were a high ability group with the exception of three students. At the end of the seventeenth week these three students were moved to a lower ability group, because they were having difficulty keeping pace with the majority of the students. At the same time three students from an average ability group, on the recommendation of their mathematics teacher, entered the team teaching experiment. As was stated earlier, the eighth grade group was chosen by the principal using previous mathematics

grades as the requirement for the class. The misplacement of these few students probably occurred because of the difference in evaluation procedures of teachers.

The ninth grade was a heterogeneous group composed of approximately sixty students. Although there were high and low ability students in the group, the majority of the students were of average ability. It was difficult to keep the attention of this group. The students who were having the most difficulty were moved to the center room because the students in the center room were closer to the lecturer, which seemed to increase their attention span. Part of the difficulty of keeping attention may have been because this was the last period of the day. Also, on several occasions the room temperature in the afternoon would reach 80 degrees or more when the thermostats in the rooms were not working properly. This group was the most difficult group to motivate and the most difficult group to instill with a desire to complete homework.

The two teachers involved in the experiment were a man and a woman, who will be referred to as teacher A and teacher B, respectively. Teacher A had five years experience and teacher B had ten years experience.

The teachers had equal responsibility and status in the team and worked cooperatively on most of the decisions concerning the team. As shown on Table II, the teachers had

two preparation periods scheduled together for planning lessons and discussing problems. The first preparation period was devoted to students seeking individual help on homework assignments as well as planning for the daily lesson. The teachers planned and discussed problems during other times that both were free, such as during individual study time for the students and testing situations. Both teachers usually remained after school for one hour, except for the first 8 week period during which teacher A was coaching football. This situation increased the responsibilities for teacher B during the after school hours.

TABLE II
TEACHERS' CLASS SCHEDULE

	1st period	2nd period	3rd period	4th period	lunch	5th period	6th period	7th period
Time	7:40 8:35	8:45 9:35	9:39 10:29	10:33 11:29	11:29 12:10	12:11 12:54	12:58 1:53	1:57 2:50
T. A	prep. period	7th grade	7th grade	8th grade	lunch duty	lunch prep. period	9th grade	9th grade
T. B	prep. period	group	group	group	lunch	prep. period	9th grade	group

The teachers usually prepared their lesson presentation separately, after discussing what materials should be covered

or omitted and what supplementary material must be used. There was also discussion of other problems such as grouping, seating arrangement, and distribution of materials.

As shown by Table II, teacher A had lunch duty while teacher B was eating; therefore, teacher A had to eat during the preparation period, which consumed about twenty minutes of the forty-three minutes allotted for preparation and planning. Occasionally teacher B had outside duty for ten minutes during the first planning period.

During the experiment the teachers each instructed two classes, alternating classes every week up to the sixteenth week. Table III shows the lesson presentation schedule for each teacher. At the beginning of the sixteenth week it was decided that it may be better to assign teacher instruction according to units of the text books used. Every week but the fifth week one teacher instructed both seventh grade classes; during the fifth week each teacher instructed one seventh grade class. However, it was decided that since both seventh grade groups were given the same short quizzes and unit tests that it might be better to have the same teacher instruct both groups to obtain more consistency in the materials presented, even though the teachers did not feel that there was much difference in their presentations.

Whenever a teacher was absent a substitute was called in to help with the clerical duties and distribution of

TABLE III
 LESSON PRESENTATION SCHEDULE FOR
 18 WEEKS FOR TEACHERS A AND B

Week	2nd period 7th grade	3rd period 7th grade	4th period 8th grade	7th period 9th grade
1st	B	B	A	A
2nd	B	B	A	A
3rd	A	A	B	B
4th	B	B	A	A
5th	B	A	A	B
6th	A	A	B	B
7th	B	B	A	A
8th	A	A	B	B
9th	B	B	A	A
10th	A	A	B	B
11th	B	B	A	A
12th	A	A	B	B
13th	A	A	B	B
14th	B	B	A	A
15th	A	A	B	B
16th	B	B	A	A
17th	B	B	A	A
18th	B	B	A	A

papers. Although this put the full teaching responsibilities on the remaining team teacher, the students never missed a days instruction because a substitute was not qualified to teach mathematics. Once or twice the substitute was moved to replace another teacher in the building who had become sick during the day, leaving the one team member alone. This did not upset the teaching routine; however, it put the team behind on clerical duties.

Since the clerical duties of teaching consumes much of a teacher's time, the team set up a system that utilized student help. Some clerical duties of the classroom were conducted by the students during the first three to four minutes of the class. One student was responsible for roll call each day. Two other students were responsible for handing back homework papers from the preceding day, which were in order for each row so that it was only necessary to give the first person in each row their set of papers to pass back. Test booklets, quizzes, work sheets, and supplementary books were handed out and collected in the same manner. The test booklets for the standardized tests were numbered and handed out in order so that they would be received in the same order.

After all papers were returned, the homework assignments were corrected by the students themselves as the teacher gave the correct responses or asked the students for their

answers. The students were encouraged to ask questions on any problem they had missed or did not understand. Following the correction and discussion of homework, which took approximately thirty minutes, the students were asked to pass their papers forward. All homework was recorded on bookkeeping paper which was taped on the collapsable walls in the center of the two rooms. It was recorded by three volunteer seventh grade students after school. The homework was not given a grade, but was recorded as complete, incomplete, or no attempt made to do the work. The incompletes did not affect the grades unless there was an excess of them. For every three assignments that were not attempted by the students, their grade was lowered one per cent of their total grade average. The placement of the recorded assignments saved time in another way. Whenever a student had been absent, instead of going to the teacher and consuming his time, he would go directly to the assignment records which had all previous assignments listed by page.

After the homework had been corrected, the new material was presented by the teacher and an assignment was usually made each day. Average study time given in class was eleven minutes for each period in all four groups. During this time both teachers would walk around the room helping those who needed help. The students would usually have time in class to complete the majority of the homework if they applied them-

selves. Table IV shows the average time spend on each classroom activity.

Most quizzes and tests were either corrected by the free teacher or during class time by the students. Occasionally reliable students were used to help after school, but this did not occur too frequently. One ninth grade student, who was above average and who had studied most of the algebra that the junior high offered, volunteered to help with the clerical duties during the period she was scheduled for algebra. There were some chapters in the algebra text she had not covered, so she studied them on her own time and scored above 90 per cent on all of the tests. This student was so efficient and well versed in mathematics that she not only recorded grades for all groups, but made up and corrected extra credit papers for all groups. She also helped many times in copying quizzes made up by the teacher on to duplicating paper and running it off. Before she began helping the team the majority of the free teacher's time was spent in doing clerical work.

Another time consuming process which was finally solved was the cleaning of the overhead projector, which was in use constantly throughout the day. At first one teacher was delegated to the job in the morning preceding the second period seventh grade class, but later the job was delegated to two seventh grade students who came to the

TABLE IV

MEAN DAILY AVERAGE NUMBER OF MINUTES DEVOTED
TO CLERICAL AND INSTRUCTIONAL ELEMENTS
RECORDED FOR ONE WEEK*

	Roll call, distribute papers	Review of homework	Lecture on new assignment	Individual study period
Monday	3	25	12	15
Tuesday	4	32	8	11
Wednesday	4	33	10	8
Thursday	4	38	6	7
Friday	3	22	16	14
Total time	18	150	52	55
Average time	3.6	30.0	10.4	11.0

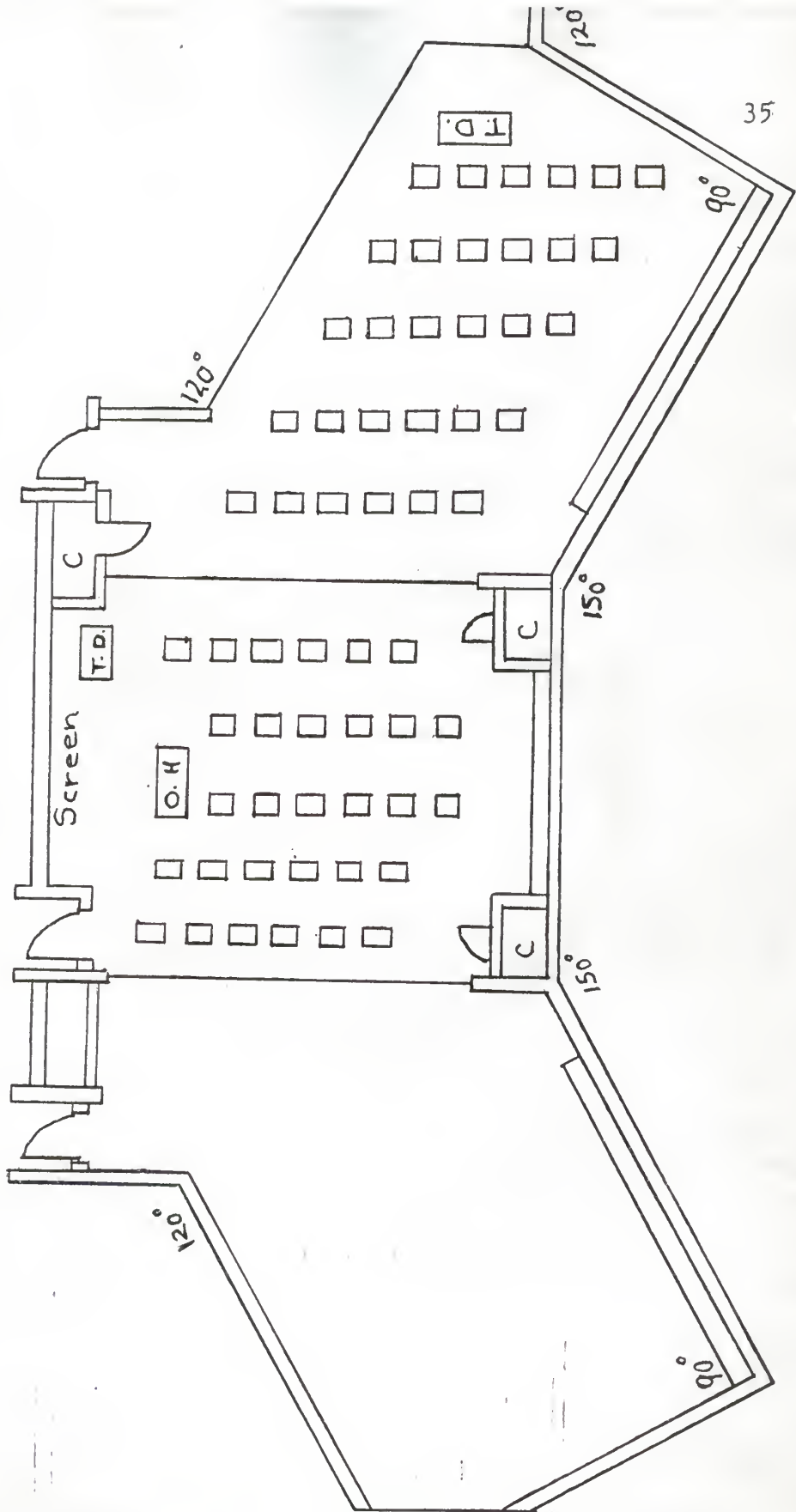
*55 minute period

second period mathematics class. The amount of time between the first bell and the beginning of class in the morning corresponded with the amount of time it took to clean the overhead projector. It was also reasonable to believe that at least one of the students would most always be present.

Figure I shows the seating and classroom arrangement. At first the students were arranged in alphabetical order from the list of students assigned to each teacher. This not only facilitated the collection and recording of homework papers, but also helped the teachers in learning the names of students. A seating chart was made for each group and taped to the desk of the overhead projector to help learn the names. The most difficult group to learn was the seventh grade students because they were all new to both teachers, and because of their fluctuation due to ability grouping.

An overhead projector was used in the center room with no microphone for the teacher. The center room lights were turned off so that the students in the other room could see. The students who complained most about seeing were the students in the third and fourth seats of each row immediately to both sides of the projector. The top of the overhead and the head of the teacher blocked out the line of sight for these students. These students were usually moved to a

FIGURE I
SEATING AND CLASSROOM ARRANGEMENT



different seat if available, or shifted their desks to a different position. Any other students with eye problems, of which the teacher was made aware, were moved to a seat from which they could see.

Hearing was the most difficult problem encountered as far as the seating arrangement was concerned. The majority of the students could hear the teachers, but had a difficult time hearing other students ask or respond to questions, especially from one room to the next. To alleviate this problem the questions or answers of students were normally repeated by the teacher so all could hear.

A parents' orientation night was held the third week of school to acquaint parents with the school and the teachers. At this time the mathematics team explained what was expected of the students in mathematics and also the procedures of team teaching. The parents asked more questions about modern mathematics than team teaching. This might have been because the parents were already familiar with team teaching in the social studies and English departments.

RESULTS

A questionnaire of twenty questions evaluating team teaching in relation to individual groups was administered to all students who had been involved in the team teaching program. The students were asked to give their honest opinions to the questions. No student was required to put his name on the answer sheet. Any students who were absent the day of the administration of the questionnaire answered it when they returned. Percentages were computed for each grade level; percentages were computed for the total number of students in the seventh, eighth, and ninth grades; and percentages were computed for those seventh grade students moved to lower and higher ability groups.

Some students may have been influenced by the fact that they were in several subjects which were team taught and may have answered the questions in reference to team teaching in general instead of pertaining only to mathematics.

The discussion of the responses to the questionnaire, unless otherwise indicated, are based on the percentages shown on Table V, page 58, computed for all students in the seventh, eighth, and ninth grades who were involved in the team teaching project. An example of the questionnaire is on page 73 in the appendix, and the responses for each group to each question can be found in the appendix on pages 58 to 71.

In the team teaching situation it was found that more teacher preparation time was available and could be better utilized. In addition to the team planning conducted during the two preparation periods allotted to all teachers, the team members could do individual preparation during the class period while the other team member was lecturing. Sixty-seven per cent of the students felt that the team teachers were just as well prepared as teachers in their regular classes, and 24 per cent felt the team teachers were better prepared. Forty-five per cent of the students felt they learned as much in the team teaching class as they would have in a self-contained class; 34 per cent felt they learned more.

Thirty-six per cent of the students did not feel they received as much individual attention as they would have in a regular class and 64 per cent felt they received the same or more. Seventeen per cent of the 36 per cent who did not feel they received as much individual attention were students who were moved to a low ability group and who needed more individual attention.

Thirty-two per cent of the students felt their interest in mathematics had increased because of team teaching. An interesting point was that 51 per cent of the seventh grade students (Table XI, page 70) moved to a lower ability group felt their interest in mathematics had decreased; 33 per cent

of the seventh grade students (Table X, page 68) moved to a higher ability group felt their interest had increased; and 44 per cent of the eighth grade students, (Table VIII, page 64) who were a high ability group, felt their interest had increased.

Forty-five per cent of the students preferred being taught by two alternating teachers rather than one teacher. When students were questioned about this response, they commented that they liked the variety of having two teachers instead of facing the same teacher daily.

When the students were questioned on whether they enjoyed the large group instruction more than regular class instruction, 67 per cent responded that they liked it better or just as well.

The team members felt that homogeneous grouping according to mathematical ability was much more successful in team teaching than heterogeneous grouping. In the heterogeneous group some students were ready to move along to new material while others were still trying to learn what had already been covered. This made it quite difficult to teach to the large group without boring some students and covering material too fast for others.

Evaluation of students seemed better in the team teaching situation than in a traditional class. By discussing the students, the team members felt that the grades given

to the students were better indications of their progress in mathematics than when only one teacher evaluated the student. The majority of the students (82 per cent) felt that they had received the grade they deserved as compared to other students in their class.

The majority of all students favored team teaching to a self-contained classroom; 59 per cent were in favor of team teaching and 41 per cent were in favor of a self-contained class. This percentages was negatively affected by those students who were moved down to lower ability groups. Of those students who were being team taught at the time of the questionnaire, which would exclude those seventh grade students moved to lower ability groups, 75 per cent of the eighth grade (Table VIII, page 64), 67 per cent of the ninth grade (Table IX, page 66), and 66 per cent of the seventh grade (Table VII, page 62) were in favor of team teaching as compared to a self-contained class. Of the total per cent of students who were being team taught at the time of the questionnaire (Table VI, page 60), 68 per cent were in favor of team teaching.

EVALUATION OF THE MATHEMATICS TEAM TEACHING PROGRAM
BY THE OTHER TEACHER INVOLVED IN THE EXPERIMENT¹

Can two teachers operate together effectively?

Yes, provided each is willing to learn from the other, accept criticism or suggestions to improve. The team must be able to compromise, willing to experiment, accept failures as well as success. Each member should be truthful, tactful, helpful in this relation with the other members. No one member should be given full responsibility of the large group. If one is instructing, the other part of the team should be willing to eliminate fast and effectively any potential discipline problem, help with the distribution of materials pertaining to the lesson, be available to work with a student individually or a group of students with a common problem and be always on hand during study periods as a resource person.

Can student assistance be utilized in team teaching?

Yes. The student selected must be mature enough to be able to take responsibilities and carry them out without much teacher's assistance. They can do various jobs such as taking attendance, record grades, keep a posted record of assignments for those students who are absent, fill out the excused absentee

¹Interview: Mrs. Dale H. Johnson, B. A. Colorado State College, Greeley, Colorado. Team Teacher in Mathematics at Watson Junior High, Colorado Springs, Colorado.

slips in relation to the posted record of assignments kept, pass back graded papers, proctor make-up tests when more than one student is involved, keep a record of any extra credit students choose to do, help the teacher check homework assignments for common mistakes, for completeness, and keep a record of homework assignments. Of course one student would not do all of this, but these are various jobs where students could assist.. Depending on the student's mathematics background, some can even give individual instruction. For example, an algebra student could be able to help a seventh grader with decimals, fractions, and per cents.

Can teacher's preparation time be better utilized so that instruction can be improved?

To a certain extent. If the members of the team have their preparation time together - definitely yes. A "pool" of ideas can always improve a lesson. Ideally we would want the preparation time of the team of teachers to be the same. Better tests can be made if done together. If the members must be preparing their instruction on their own, the instruction no doubt will be the same as if they were teaching their own individual classes.

The pre-planning for a unit of study must be done together as to what should be emphasized, what can be left out, what supplementary materials could be used, what enrichment can be given. Then, the individual who is to be the instructor

for the specific unit should plan on his own, getting ideas from the team, and can outline two or three days in advance what he is actually going to need so that his team members can assist him in producing materials or ideas.

Can students receive more individual help from two teachers in a larger class than from one teacher in a smaller class?

Yes. Even during the instructional part of the class period, the other teacher can be working with individuals who need help. Also, during study periods, both teachers can be working with individual students and not have to worry about discipline problems. With two teachers in the room, more students are willing to ask for help because they feel they have a better chance of getting it when each teacher can see their hand. Often it is possible to group a small amount of students with the same problem in a corner of the room, and then they and one of the teachers can re-hash the problem together.

What are students' attitudes toward team teaching mathematics?

Varied, few complaints. If the student was mis-grouped, his attitude is generally poor because he was not successful or was bored. If he is successful, he generally likes team teaching. The slower student does not care for the variety of

approaches that a team of teachers can give. It confuses them. The faster student enjoys the variety and can easily determine which one makes more sense to him and chooses that method. The average student enjoys the different ideas too, but generally, uses the one in the book because he can have a pattern to follow. For all students the discovery approach is best and should be used as often as possible. In this way, the team teaching approach can work well, as individually we can accept or reject the discovery of each student and point out the reasons.

Which groups work most effectively in a team teaching situation, heterogeneous or homogeneous?

Homogeneous, definitely! No matter which group is being taught, the spread becomes wider as the year progresses. Therefore, it is very important to group them homogeneously at first. Then, when the spread becomes apparent, re-group. The average achiever group is where the re-grouping most often takes place. Depending on the interest and the locale, the bulk of the math students are either high average or low average. Team teaching, being for a larger group of students, would normally take the bulk. So the single classroom teacher would have low, average, or high. Again this depends on the entire group as a whole. Because of this way of grouping, a fairer grading system can develop according to their ability.

Is it possible to effectively group students for team teaching of mathematics?

Yes, if the administration, counselors and mathematics teachers work together. At first the grouping must be done on previous grade and performance as well as teacher recommendation. Then with a flexible schedule where all math teachers would be teaching the same grade level at one time, further re-grouping can be accomplished without changing the student's entire daily schedule. Of course this idea of re-grouping can only be done effectively if there are other teachers involved in teaching besides those on the team. More teachers involved at one time the better the program of team teaching because of the possibilities of the placement of the student where he can do his best work.

How would you suggest an effective way of organizing an initial team teaching program in mathematics?

First, the physical plant must be practical for team teaching. It should be an area that can be used by at least two teachers, each with the average load of students for a particular school.

Second, look for teachers that can work well together. Not necessarily friends, not necessarily people who are alike in their teaching personalities and habits, but individuals who are willing to change, give and take, experiment, accept

criticism, able to handle a little bit of failure as well as success, and can share in the responsibilities of the classroom.

Third, see if the administration is willing to go along with the scheduling of the students of the same grade level at the same time for mathematics - all hours a day.

Fourth, plan ahead! Make sure each teacher is aware of when he has an instructional assignment and that he has materials ready for each class two or three days in advance. Organization is much more important in team teaching, and it is the key to success of an individual classroom teacher. So organize and plan ahead with the team so every one knows what is happening. This can be done without a team leader, but possibly, it would be better to have one who is in charge of the planning.

Fifth, as a team, look forward to a pleasant, enjoyable year. Be willing to accept last minute changes. Enjoy them. Be flexible. Do not be so "planned-out" that any change causes a hardship.

EVALUATION OF THE MATHEMATICS TEAM TEACHING PROGRAM
BY THE PRINCIPAL OF THE JUNIOR HIGH SCHOOL¹

The basic objective for team teaching in mathematics at Watson Junior High is (1) to allow more preparation time for teachers, (2) to provide a greater variety in methods and materials, (3) to better evaluate the individual student and eliminate impartial grades, (4) to improve discipline, and (5) to provide for more professional use of the teacher's time.

To allow more preparation time for teachers. In a study of Self-Analysis of Secondary Teachers by this writer, the average work week was forty-six hours. Teachers averaged twenty-seven hours and forty-eight minutes per week or 60.5 per cent of their time was devoted to non-instructional elements of their job.

Included in these non-instructional elements, which could be accomplished by one member of the team rather than duplication by both, were (1) 41.4 minutes during the school day on supervision of halls and classrooms during class changes, (2) 4.3 minutes during the school day on assigned administrative duties, (3) 6.2 minutes during the school day on interruptions, (4) 7.8 minutes during the school day on house

¹Robert Poole, Principal, Watson Junior High, Colorado Springs, Colorado.

keeping, (5) 4.9 minutes during the school day for the distribution and collection of materials in the classroom, and (6) 7.3 minutes during the school day on duplication of materials.

The instructional elements eliminated by team teaching included (1) 27.9 minutes during the school day on lectures and demonstrations, (2) 3.7 minutes during the school day on audio and/or visual aids, (3) 15.6 minutes during the school day on classroom tests, and (4) 6.6 minutes during the school day on assignments.

To provide a greater variety in methods and materials. There are at least two factors responsible for inefficient teaching. The first is lack of knowledge on the part of the teacher to gain a learning attitude from his pupils; the second is that some teachers fail to use their full knowledge and creative ability. Team teaching can improve both of these weaknesses by mutual recognition and joint effort to correct them.

To better evaluate the individual student and eliminate impartial grades. Students must be guaranteed, as far as possible, fair treatment in the administration of tests and the assignment of marks. In team teaching, there is more urgency to define consistent standards. There is a constant check and an awareness to prevent problems. Thus evaluation under team teaching seems to be more accurate and realistic

than that under conventional teaching.

To improve discipline. Poor discipline is particularly dangerous because it starts a chain reaction which can make the teaching job all but impossible. Team teaching can only be successful with vigorous, well-organized teachers. This helps create the atmosphere that makes for good discipline. Teachers, working together, establish better routines and are alert to follow procedures that insure a continuous process of good discipline.

To provide for more professional use of the teacher's time. Teachers need more time to be available to work with individual students who may be falling behind in a subject or pushing ahead on their own. Team teaching teachers say that they are working harder but on a higher professional plane and with more satisfaction. But more important is their strong personal commitment to "their program" and, consequently, a higher motivational drive toward the teaching task.

SUMMARY AND CONCLUSION

This experiment was conducted to evaluate the effectiveness of team teaching junior high mathematics. An average ability seventh grade group, above average eighth grade group and an heterogeneous group of ninth grade students were involved in the program.

A questionnaire of twenty questions was administered at the completion of the study to determine the attitudes of the students towards team teaching.

Conclusions

The following conclusions were made on the basis of the results:

1. As was found in similar studies,¹ students could be utilized and could contribute to the organization and clerical duties of the team.
2. Assuming the students answered the questionnaire honestly, the interest of the majority was either maintained or increased.
3. More preparation time was made available because

¹H. L. Slichenmyer, "Arlington Heights, Illinois, Studies Curriculum and Testing, Instruction Assistants, Team Teaching, and Modern Technology in Fourteen Projects," The Bulletin of the National Association of Secondary-School Principals, 45:41-49, January, 1961.

of team teaching since one teacher was free to prepare for lectures or to perform clerical duties while the other teacher was lecturing. This would not have been possible in a self-contained classroom where they both would have been lecturing.

4. The majority of the students felt they received more or the same amount of individual attention in the team teaching class as compared to a self-contained classroom. The writer felt the individual attention given to students was comparable to that given in a self-contained classroom.

5. The majority of the students preferred the team teaching class to a self-contained class.

6. The teachers of the experiment felt they had much better success teaching the homogeneous groups as compared to the heterogeneous group.

7. The majority of the students felt they received the grade they deserved as compared to other students in the team teaching class and other mathematics classes. The teachers believed that a better evaluation of student performance was given when discussed between the two teachers.

Implications and Recommendations

The writer recommends that any school planning to conduct such an experiment in mathematics homogeneously group their students as close as possible to academic ability and interest, unless the program is especially designed to allow for a wide range of individual differences in mathematical ability and interest.

Similar experiments should be conducted comparing achievement gains in team teaching of mathematics to those of a traditional approach.¹

¹Jack R. Fraenkel and Richard E. Gross, "Team Teaching: Let's Look Before We Leap!" Social Education, 30:337, May, 1966.

BIBLIOGRAPHY

BIBLIOGRAPHY

BOOKS

- Bair, Medill, and Richard G. Woodward. Team Teaching in Action. Boston: Houghton Mifflin Company, 1964.
- Beggs, David W., III. Team Teaching: Bold New Venture. Bloomington: Indiana University Press, 1966.
- Shaplin, Judson T. and Henry F. Olds, Jr. Team Teaching. New York: Harper & Row, Publishers, 1964.
- Trump, J. Lloyd and Dorsey Baynham, Guide to Better Schools: Focus on Change. Chicago: Rand McNally & Company, 1961.

PERIODICALS

- Anderson, Robert H. "Organizational Character of Education: Staff Utilization and Deployment; Cooperative Teaching," Review of Educational Research, 34:456-58, October, 1964.
- _____. "Team Teaching," Education Digest, 26:5-7, May, 1961.
- _____. "Team Teaching in Elementary School," Education Digest, 25:26-28, November, 1959.
- Arnold, William E. "Is Team Teaching the Answer?" School and Society, 91:407-409, December 14, 1963.
- Bloomenshine, L. L. "San Diego Uses the Teaching Team Approach in Staff Utilization," The Bulletin of the National Association of Secondary-School Principals, 43:217-19, January, 1959.
- Bovinet, W. G. "Glenbrook Reports on Four Experiments on Utilization of Staff," The Bulletin of the National Association of Secondary-School Principals, 44:244-53, January, 1960.
- Brown, Frank. "A New Design for Individual Learning," Journal of Secondary Education, 37:368-75, October, 1962.
- Carlin, Phillip M. "A Current Appraisal of Team Teaching," Education, 85:348-52, February, 1965.

- Carrigan, Dean and Robert Hynes, "Team Teaching Proceed With Caution," Clearing House, 39:312, January, 1965.
- Dean, Stuart E. "Team Teaching: A Review," School Life, 44:5-8, September, 1961.
- Douglass, Malcolm P. "Team Teaching: Fundamental Change or Passing Fancy?" CTA Journal, 59:26-29, 55-56, March, 1963.
- Drummond, Harold D. "Team Teaching: An Assessment." Educational Leadership, 19:160-65, December, 1961.
- Fraenkel, Jack R. and Richard E. Gross, "Team Teaching: Let's Look Before We Leap!" Social Education, 30:335-37, May, 1966.
- Gross, Calvin E. "Team Teaching in Pittsburgh," Education Digest, 28:12-15, November, 1962.
- Hoppock, Anne. "Team Teaching Form Without Substance?" NEA Journal, 50:47-48, April, 1961.
- Instructor. "A Critical Look at Team Teaching," Instructor, 71:39-42, October, 1961.
- Johnson, R. H., M. D. Lobb, and Gordon Patterson, "Continued Study of Class Size, Team Teaching, and Scheduling in Eight High Schools in Jefferson County, Colorado," The Bulletin of the National Association of Secondary-School Principals, 43:99-103, January, 1959.
- King, Arthur R. "Planning for Team Teaching: The Human Considerations," Education Digest, 28:16-19, December, 1962.
- Klausmeier, Herbert J. and William Wiersma, "Team Teaching and Achievement," Education, 86:238-42, December, 1965.
- Lambert, Philip, and others. "Comparison of Pupil Achievement in Team and Self-Contained Organizations," Journal of Experimental Education, 33:217-24, Spring, 1965.
- Lowrie, Jean E. "Team Teaching and the Creative Elementary School Library," Wilson Library Bulletin, 36:129-32.
- Michael, Lloyd S. "What Are We Trying to Accomplish in the Staff Utilization Studies?" The Bulletin of the National Association of Secondary-School Principals, 43:5-10, January, 1959.

- Noall, M. F. and Lawrell Jensen, "Team Teaching at Roosevelt Junior High School, Duchesne County, Utah," The Bulletin of the National Association of Secondary-School Principals, 44:156-63, January, 1960.
- Noall, M. F. and Gale Rose, "Team Teaching at the Wahlquist Junior High School, Weber County, Utah," The Bulletin of the National Association of Secondary-School Principals, 44:164-71, January, 1960.
- Rinker, Floyd, "Subject Matter, Students, Teachers, Methods of Teaching, and Space are Redeployed in the Newton, Massachusetts, High School," The Bulletin of the National Association of Secondary-School Principals, 42:69-80, January, 1958.
- Sanford, C. W. "Why the Commission on the Experimental Study of the Utilization of the Staff in the Secondary School was created," The Bulletin of the National Association of Secondary-School Principals, 42:16-18, January, 1958.
- Science Teacher. "Team Teaching," Science Teacher, 31:30-37, October, 1964.
- Slichenmyer, H. L. "Arlington Heights, Illinois, Studies Curriculum and Testing, Instruction Assistants, Team Teaching, and Modern Technology in Fourteen Projects," The Bulletin of the National Association of Secondary-School Principals, 45:41-49, January, 1961.
- Sweet, Raymond and Peter Dunn-Rankin. "Experiment in Team Teaching Seventh Grade Arithmetic," School Science and Mathematics, 62:341-44, May, 1962.
- Watson, Robert L. "Team Teaching of Chemistry at the High School Level," School Science and Mathematics, 65:556-62, June, 1965.

APPENDIX A

TABLE V

STUDENT EVALUATION OF TEAM TEACHING OF MATHEMATICS
ALL SEVENTH, EIGHTH AND NINTH GRADE STUDENTS*

	Poor	Fair	Ave.	Good	Exel.
1. Visibility of overhead and teacher.	6%	14%	14%	35%	30%
2. Seating arrangement.	5%	25%	23%	35%	12%
3. Individual study time.	20%	23%	28%	25%	4%

	Seldom	Usually	Always
4. Ability to hear lectures.	3%	18%	79%
5. Ability to hear other students.	29%	47%	24%

	Less	Same	More
6. Interest in mathematics.	17%	51%	32%
7. Opportunity to know more students.	7%	34%	59%
8. Opportunity to make more friends.	5%	48%	47%
9. Amount of classroom participation.	44%	38%	18%
10. Enjoyment of large group instruction.	33%	30%	37%
11. Amount of attention paid to teacher.	20%	45%	35%
12. Amount of individual attention.	36%	51%	13%
13. Amount learned in group work.	21%	45%	34%
14. Amount of discipline needed.	20%	52%	28%
15. Lecture preparation.	9%	67%	24%

*Total: 292 students.

TABLE V (continued)

	No	No pref.	Yes
16. Preference of alternating teachers.	28%	27%	45%
17. Preference of overhead projector in self-contained classroom to a blackboard.	27%	22%	51%

	Too slow	Right speed	Too fast
18. Speed with which material is covered.	14%	64%	21%

	Yes	No
19. Fair grading.	82%	18%
20. Prefer a team teaching class in mathematics rather than a self-contained class.	59%	41%

TABLE VI

STUDENT EVALUATION OF TEAM TEACHING OF MATHEMATICS
 ALL STUDENTS IN TEAM TEACHING AT THE TIME
 THE QUESTIONNAIRE WAS ADMINISTERED*

	Poor	Fair	Ave.	Good	Exel.
1. Visibility of overhead and teachers.	4%	14%	10%	36%	36%
2. Seating arrangement.	4%	22%	22%	36%	16%
3. Individual study time.	14%	23%	32%	28%	3%

	Seldom	Usually	Always
4. Ability to hear lectures.	1%	19%	80%
5. Ability to hear other students.	17%	48%	25%

	Less	Same	More
6. Interest in mathematics.	13%	53%	34%
7. Opportunity to know more students.	2%	29%	65%
8. Opportunity to make more friends.	2%	49%	49%
9. Amount of classroom participation.	42%	39%	19%
10. Enjoyment of large group instruction.	26%	32%	42%
11. Amount of attention paid to teacher.	15%	44%	41%
12. Amount of individual attention.	32%	53%	15%
13. Amount learned in group work.	14%	49%	37%
14. Amount of discipline needed.	18%	54%	28%
15. Lecture preparation.	7%	65%	28%

*Total: 209 students.

TABLE VI (continued)

	No	No pref.	Yes
16. Preference of alternating teachers.	21%	25%	54%
17. Preference of overhead projector in self-contained classroom to a blackboard.	16%	21%	63%

	Too slow	Right speed	Too fast
18. Speed with which material is covered.	7%	75%	18%

	Yes	No
19. Fair grading.	84%	16%
20. Prefer a team teaching class in mathematics rather than a self-contained class.	68%	32%

TABLE VII
STUDENT EVALUATION OF TEAM TEACHING OF MATHEMATICS
SEVENTH GRADE STUDENTS IN TEAM TEACHING
AT THE END OF 18 WEEKS*

	Poor	Fair	Ave.	Good	Exel.
1. Visibility of overhead and teacher.	2%	16%	8%	38%	36%
2. Seating arrangement.	5%	23%	16%	37%	19%
3. Individual study time.	16%	19%	38%	25%	2%

	Seldom	Usually	Always
4. Ability to hear lectures.	1%	15%	84%
5. Ability to hear other students.	20%	49%	31%

	Less	Same	More
6. Interest in mathematics.	13%	59%	28%
7. Opportunity to know more students.	8%	26%	66%
8. Opportunity to make more friends.	6%	40%	54%
9. Amount of classroom participation.	36%	38%	26%
10. Enjoyment of large group instruction.	27%	33%	40%
11. Amount of attention paid to teacher.	18%	40%	42%
12. Amount of individual attention.	30%	47%	23%
13. Amount learned in group work.	13%	50%	37%
14. Amount of discipline needed.	18%	56%	26%
15. Lecture preparation.	10%	61%	29%

*Total: 101 students.

TABLE VII (continued)

	No	No pref.	Yes
16. Preference of alternating teachers.	26%	24%	50%
17. Preference of overhead projector in self-contained classroom to a blackboard.	16%	16%	68%

	Too slow	Right speed	Too fast
18. Speed with which material is covered.	13%	75%	12%

	Yes	No
19. Fair grading.	84%	16%
20. Prefer a team teaching class in mathematics rather than a self- contained class.	66%	34%

TABLE VIII

STUDENT EVALUATION OF TEAM TEACHING OF MATHEMATICS
EIGHTH GRADE STUDENTS IN TEAM TEACHING
AT THE END OF 18 WEEKS*

	Poor	Fair	Ave.	Good	Exel.
1. Visibility of overhead and teacher.	7%	12%	17%	27%	37%
2. Seating arrangement.	3%	15%	29%	39%	14%
3. Individual study time.	17%	31%	19%	30%	3%

	Seldom	Usually	Always
4. Ability to hear lectures.	0%	27%	73%
5. Ability to hear other students.	40%	46%	16%

	Less	Same	More
6. Interest in mathematics.	16%	40%	44%
7. Opportunity to know more students.	1%	31%	68%
8. Opportunity to make more friends.	0%	56%	44%
9. Amount of classroom participation.	47%	41%	12%
10. Enjoyment of large group instruction.	20%	31%	49%
11. Amount of attention paid to teacher.	17%	42%	41%
12. Amount of individual attention.	34%	61%	5%
13. Amount learned in group work.	17%	46%	37%
14. Amount of discipline needed.	17%	59%	24%
15. Lecture preparation.	3%	70%	27%

*Total: 59 students.

TABLE VIII (continued)

	No	No pref.	Yes
16. Preference of alternating teachers.	12%	36%	52%
17. Preference of overhead projector in self-contained classroom to a blackboard.	17%	30%	53%

	Too slow	Right speed	Too fast
18. Speed with which material is covered.	3%	73%	24%

	Yes	No
19. Fair grading.	86%	14%
20. Prefer a team teaching class in mathematics rather than a self-contained class.	75%	25%

TABLE IX
STUDENT EVALUATION OF TEAM TEACHING OF MATHEMATICS
NINTH GRADE STUDENTS IN TEAM TEACHING
AT THE END OF 18 WEEKS*

	Poor	Fair	Ave.	Good	Exel.
1. Visibility of overhead and teacher.	4%	11%	9%	42%	34%
2. Seating arrangement.	4%	31%	25%	30%	10%
3. Individual study time.	8%	23%	33%	32%	4%

	Seldom	Usually	Always
4. Ability to hear lectures.	0%	15%	85%
5. Ability to hear other students.	26%	51%	23%

	Less	Same	More
6. Interest in mathematics.	10%	57%	33%
7. Opportunity to know more students.	6%	33%	61%
8. Opportunity to make more friends.	2%	59%	39%
9. Amount of classroom participation.	46%	39%	15%
10. Enjoyment of large group instruction.	28%	33%	39%
11. Amount of attention paid to teacher.	8%	53%	39%
12. Amount of individual attention.	30%	59%	11%
13. Amount learned in group work.	14%	49%	37%
14. Amount of discipline needed.	18%	45%	37%
15. Lecture preparation.	4%	69%	27%

*Total: 49 students.

TABLE IX (continued)

	No	No pref.	Yes
16. Preference of alternating teachers.	22%	13%	65%
17. Preference of overhead projector in self-contained classroom to a blackboard.	16%	21%	63%

	Too slow	Right speed	Too fast
18. Speed with which material is covered.	0%	77%	23%

	Yes	No
19. Fair grading.	80%	20%
20. Prefer a team teaching class in mathematics rather than a self-contained class.	67%	33%

TABLE X

STUDENT EVALUATION OF TEAM TEACHING OF MATHEMATICS
SEVENTH GRADE STUDENTS MOVED TO
A HIGH ABILITY GROUP*

	Poor	Fair	Ave.	Good	Exel.
1. Visibility of overhead and teacher.	6%	15%	28%	35%	16%
2. Seating arrangement.	9%	30%	26%	33%	2%
3. Individual study time.	31%	28%	19%	19%	3%

	Seldom	Usually	Always
4. Ability to hear lectures.	8%	16%	76%
5. Ability to hear other students.	40%	44%	16%

	Less	Same	More
6. Interest in mathematics.	15%	52%	33%
7. Opportunity to know more students.	8%	44%	48%
8. Opportunity to make more friends.	2%	50%	48%
9. Amount of classroom participation.	30%	44%	26%
10. Enjoyment of large group instruction.	57%	30%	13%
11. Amount of attention paid to teacher.	26%	54%	20%
12. Amount of individual attention.	37%	52%	11%
13. Amount learned in group work.	20%	43%	37%
14. Amount of discipline needed.	13%	56%	31%
15. Lecture preparation.	3%	77%	20%

*Total: 54 students.

TABLE X (continued)

	No	No pref.	Yes
16. Preference of alternating teachers.	35%	35%	30%
17. Preference of overhead projector in self-contained classroom to a blackboard.	52%	20%	28%

	Too slow	Right speed	Too fast
18. Speed with which material is covered.	43%	51%	6%

	Yes	No
19. Fair grading.	79%	21%
20. Prefer a team teaching class in mathematics rather than a self-contained class.	49%	51%

TABLE XI
STUDENT EVALUATION OF TEAM TEACHING OF MATHEMATICS
SEVENTH GRADE STUDENTS MOVED
TO A LOWER ABILITY GROUP*

	Poor	Fair	Ave.	Good	Exel.
1. Visibility of overhead and teacher.	24%	21%	17%	27%	11%
2. Seating arrangement.	7%	34%	24%	24%	11%
3. Individual study time.	34%	14%	24%	17%	11%

	Seldom	Usually	Always
4. Ability to hear lectures.	17%	14%	69%
5. Ability to hear other students.	31%	34%	34%

	Less	Same	More
6. Interest in mathematics.	51%	38%	11%
7. Opportunity to know more students.	14%	48%	38%
8. Opportunity to make more friends.	24%	42%	34%
9. Amount of classroom participation.	79%	21%	0%
10. Enjoyment of large group instruction.	72%	11%	17%
11. Amount of attention paid to teacher.	42%	44%	14%
12. Amount of individual attention.	62%	31%	7%
13. Amount learned in group work.	69%	24%	7%
14. Amount of discipline needed.	48%	31%	21%
15. Lecture preparation.	34%	63%	3%

*Total: 29 students.

TABLE XI (continued)

	No	No pref.	Yes
16. Preference of alternating teachers.	65%	24%	11%
17. Preference of overhead projector in self-contained classroom to a blackboard.	55%	31%	14%

	Too slow	Right speed	Too fast
18. Speed with which material is covered.	11%	14%	75%

	Yes	No
19. Fair grading.	79%	21%
20. Prefer a team teaching class in mathematics rather than a self-contained class.	11%	89%

APPENDIX B

QUESTIONNAIRE USED FOR STUDENT EVALUATION
OF TEAM TEACHING OF MATHEMATICS

Please write the letter of your choice in the blank provided before each question. Choose only one answer for each question.

1. _____ My visibility of the overhead screen and teacher is (A. poor B. fair C. average D. good E. excellent).
2. _____ The seating arrangement is (A. poor B. fair C. average D. good E. excellent).
3. _____ Individual study time allowed is (A. poor B. fair C. average D. good E. excellent).
4. _____ I can hear the teacher lecture (A. seldom B. usually C. always).
5. _____ I can hear other students answer or ask questions (A. seldom B. usually C. always).
6. _____ Since I have been in the team teaching class my interest in math has (A. decreased B. remained the same C. increased).
7. _____ I know (A. fewer B. the same number of C. more) students as a result of being in the team teaching class.
8. _____ I have (A. fewer B. the same number of C. more) friends as a result of being in the team teaching class.
9. _____ I participate (A. less B. the same C. more) in the large group instruction as compared to small group instruction.
10. _____ I enjoy large group instruction (A. less than B. the same as C. more than) instruction in a regular class.
11. _____ I give (A. less B. the same amount of C. more) attention to the teacher in the team teaching class as compared to a regular class.
12. _____ The individual attention I receive in a team teaching class is (A. less than B. the same as C. more than) I receive in a regular class.

QUESTIONNAIRE (continued)

13. _____ The amount I learn in a team teaching class is (A. less than B. the same as C. more than) I learn in a regular class.
14. _____ The amount of discipline needed in my team teaching class is (A. less than B. the same as C. more than) the discipline needed in my regular classes.
15. _____ My team teaching class mathematics lectures are (A. not as well prepared as B. prepared just as well as C. better prepared than) lectures in my regular classes.
16. _____ I would prefer being taught by two alternating teachers rather than by one teacher. (A. no B. does not matter C. yes).
17. _____ In a regular class I would prefer being taught by an overhead projector rather than the blackboard. (A. no B. no preference C. yes).
18. The team teaching class covers material (A. too slow B. at the right speed C. too fast) for me.
19. _____ I feel I am getting the grade I deserve compared to students in my class and in other math classes. (A. yes B. no).
20. _____ I prefer team teaching of math as compared to a regular class in math. (A. yes B. no).

TEAM TEACHING MATHEMATICS
IN JUNIOR HIGH SCHOOL

by

ROY H. BUSH

B. A., Colorado State College, 1961

AN ABSTRACT OF A MASTER'S REPORT

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

College of Education

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1967

This experiment was conducted to evaluate the effectiveness of team teaching junior high mathematics. More specifically the purposes of this study were (1) to determine if more preparation time could be allotted so that instruction could be improved, (2) to determine if students in large group instruction could receive more individual attention by team work, (3) to determine if students maintained their interest in mathematics in large group instruction, (4) to determine if ability grouping of students into average and above average classes was more effective in team teaching mathematics than heterogeneous grouping, (5) to determine if student assistance could be utilized, (6) to better evaluate the individual students, (7) to determine student attitudes towards team teaching of mathematics.

An average ability seventh grade group, above average eighth grade group and an heterogeneous group of ninth grade students were involved in the program. At the end of the experiment, which lasted eighteen weeks, a questionnaire of twenty questions evaluating team teaching was administered to all students who had been involved in the team teaching program. Percentages were computed for each grade level; percentages were computed for the total number of students in the seventh, eighth and ninth grades; and percentages were also computed for those seventh grade students moved to lower and higher ability groups.

In the team teaching situation it was found that more

teacher preparation time was available and could be better utilized. In addition to the team planning conducted during the two preparation periods allotted to all teachers, the team members could do individual preparation during the class period while the other team member was lecturing.

The majority of the students felt they received more or the same amount of individual attention in the team teaching class as compared to a self-contained classroom.

Student interest in mathematics was maintained or increased in the team teaching class. A majority of the students also preferred the team teaching class and large group instruction as compared to a self-contained class.

The team members felt that homogeneous grouping according to mathematical ability was much more successful in team teaching than heterogeneous grouping.

Student assistance was utilized and contributed to the organization and clerical duties of the team.

Evaluation of students seemed better in the team teaching situation than in a traditional class. By discussing the students, the team members felt that the grades given to the students were better indications of their progress in mathematics than when only one teacher evaluated the student.

The writer recommends that any school planning to conduct such an experiment in mathematics homogeneously group their students as close as possible to academic ability and interest.