The Effect of Traditional and Team Teaching Approaches Upon Student Learning In Earth Science

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CHAPTER I

INTRODUCTION

STATEMENT OF THE PROBLEM

Parents and teachers know that all children are different and that children learn differently. To operate a school on the basis that there is one best curriculum, one best pedagogy, one pace of learning, or one best test and to march the kids through programs based on their chronological ages may be profoundly discriminatory (Sizer,. 1984).

This investigation was done as a micro-replica to the one entitled *A Comparison Of interdisciplinary Teaming and Traditional Departmental Organization At The Seventh Grade* (Gates ,1995). The investigation was carried out within the same school district but did not include the same students or teachers involved in the Gates' investigation. Their investigation concluded that the middle school level team teaching approach had positive effects on parents' attitudes, teachers' satisfaction and professional development. These findings and earlier research showing positive effects demonstrated by team teaching urged us to further investigate the question of whether team teaching is more effective than a traditional approach.

Team teaching is one attempt at trying to break away from the single approach traditional high school teaching structure. In this study, researchers investigated differences in effects of a team class and a traditionally configured class of 9th grade earth science students at the Sidney High School in 1994-95 school year.

HYPOTHESES

The following hypotheses were tested:

1. There is no significant difference between the means of control (traditional) and experimental (teamed) groups on the pretest measure of earth science understanding.

2. There is no significant difference in the mean scores of the control (traditional) and experimental (teamed) groups on a post test of earth science understanding.

3. There is no significant difference between the mean gain scores from pretest and post test results for control (traditional) and experimental (team) groups.

DEFINITIONS

Team teaching groups are composed of colleagues who teach different subjects but share the same students. For example, four teachers may share 150 students. Because they share the same students, teachers on a team may be able to respond more quickly, personally, and consistently to the needs of individual students (MacIver,

1990). This is especially true when the structure permits more reinforced teaching of all subject areas.

Departmental teaching groups consist of formal organized groups without teamed teachers. This arrangement refers to the traditional high school with teachers organized along academic disciplines teaching a rigid subject matter often without regard to intrateacher communication.

Academic achievement refers to accomplishing a goal in an educational setting (Heritage Dictionary, 1982). Academic achievement in this study will be measured by the gain of knowledge from the pre-test to the post-test.

ASSUMPTIONS

The first assumption was that a teacher has the same ability and knowledge teaching in a team as in the traditional classroom. To check this assumption, this researchers observed the class and used a video tape to analyze of techniques employed. The second assumption was that the students in the experimental class and the control class had the same motivational level. Third, it was assumed that the time of day that instruction was provided was not a critical factor relating to student performance. The fourth assumption of the study was that there was no difference between delivery system used in the transmitting of knowledge to both groups.

CHAPTER II

REVIEW OF LITERATURE

INTRODUCTION:

Included in this review is an analysis of the literature on teaming and traditional approaches. Multiple factors in the teaching and learning process are examined during the review.

BACKGROUND:

Science and technology are rapidly transforming the world in ways which will have profound significance for students' well-being. Schools should be a place where close, trusting relationships with adults and peers create a climate for personal growth and intellectual development (Carnegie Corporation of New York, 1989). For many youth, attending school involves drastic changes in their social environment, especially in/during the transition from elementary to secondary school.

The traditional time structured method for delivering academic content to high school students has not been the answer. A better way of teaching the material must be found Sizer (1984) explored different pedagogical views and insists that high schools can do better teaching students by doing less. Team teaching is an avenue designed to challenge students to develop intellectually and solve problems on their own. A thorough review of recent studies on adolescent cognitive development found no persuasive evidence that young adolescents

cannot engage in critical and higher order thinking (Carnegie Corporation of New York, 1989).

Research by A. Ellis indicates that certain improvements occur with the use of team teaching. Among the improvements which occur with the implementation when changing from traditional to team curriculum are: 1) teacher collaboration; 2) greater student involvement; 3) higher level thinking; 4) better content mastery; 5) real-world applications and 6) fewer fragmented learning experiences. Team teaching takes a different approach to teaching and learning than does the traditional approach. Teaming is much more than blending separate subjects because it represents a philosophy of student-centered learning. Teaming attempts to place the learners rather than the subject matter at the center of the learning process. The projects and activities take precedence over academic disciplines.

Teaming:

Departmental organization refers to the traditional arrangement for teachers and students in a high school organized by academic disciplines taught within the rigid frame work of time. Teams are composed of colleagues who teach different subjects but share the same students. Because they share the same students, teachers on a team may be able to respond more quickly, personally, and consistently to the needs of individual students (Mac Iver, 1990).

Despite the problems and concerns revealed by research on teaming, advocates such as R.E. Slavin, 1985a & 1985b have made the following claims: 1) that the team teaching curriculum permits students to be flexible thinkers in situations that address connections and thus improve higher level thinking; 2) students are provided a less fragmented and more coherent set of learning experiences; 3) the teaming curriculum provides real world situations which make it easier to transfer learning than traditional situations; 4) team learning improves mastery of content materials; 5) team learning provides students the opportunity to become more proactive thinkers; and 6) teachers and students involved in teaming are more motivated to learn. A combination of the present team models may lead to greater academic and social gains than models in their pure form (Hauserman, 1992).

Team teaching is the center of this research. It is, however, just one of several types of cooperative learning structures which vary on dimensions such as reward structures, evaluation procedures, teacher role and the nature of students' interactions (Kagan, Zahn, Widaman, Schwarzwald, & Tyrell, 1985). Other types of cooperative learning groups include: 1) expert groups, which require each student to develop expertise in one area and then teach this material to others; 2) collaborative task completion involves students working cooperatively and being rewarded on the basis of a group product, and 3) collaborative problem-solving enables students to solve or investigate either assigned

or self-selected problems and take substantial responsibility for all work (Nastasi, 1994). Each of the methods can and has been used to enhance social-emotional, academic and cognitive competence.

Benefits of Team Teaching:

Much has been written on teacher delivery during team teaching, however, this literature was more opinion than documentation of what occurs in teaming situations. Team teaching requires first and foremost a predisposition on the part of the teacher toward working together (Arhar, Johnston, & Markle, 1989). The National Middle School Association cites teaming as the single most distinguishing feature of those middle schools considered exemplary. This innovation has caused secondary teachers to become interested in teaming. Lounsburg (1990), reported that teaming has given the teachers involved a needed sense of professionalism. Being involved in new programs requires additional training but draws attention from administration, other colleagues, and the community. Teaming may boost teacher morale and permit participants to continue, even where the natural correlation may be highlighted (Lounsburg, 1990).

Today school practices in team teaching are centered around what teachers have discovered on their own through inservice and continuing education. With the research in this area being relatively new, schools must learn by trial and error. The team organization allows teachers to

allocate time to accommodate both the curriculum and the instructional needs of young adolescents (Spear, 1992).

Students can and do learn regardless of teaching methods utilized. Every student must be able to rely upon a small caring group of adults who work closely with other teachers/students to provide coordinated, meaningful and challenging education experiences (Carnegie Corporation of New York, 1989).

Most middle and secondary schools do not use team teaching structures. The schools that use team teaching may have problems providing a common planning time for the team teachers. Common planning by the team teachers of different subjects enables them to communicate and make their colleagues aware of each others' ideas, teaching styles, techniques and strengths. This process helps students to sense consistent expectations for them and to strive to meet clearly understood standards of achievement (Carnegie Corporation of New York, 1989). Within the restructured school day when students seem to respond positively to team teaching. Students who cooperate with others are more likely to be responsible and self-disciplined learners (Edwards, 1991). Such students also have more positive attitudes toward school and teachers. Often such students take responsibility for examining and improving the teams' interaction and work effectiveness (Holubec, 1992).

Professional staff, students and family must, however, develop a personal interest in the teaming process. They must feel shared

ownership and have a desire to succeed and help others succeed. This in turn enables students to achieve greater gains in learning (George, & Alexander, 1993). Furthermore, team teaching has been found to elevate the achievement of students with different ability levels, providing the greatest gains for low and middle achievers, minority groups, and handicapped students (Johnson, & Johnson, 1992). At the same time, higher ability students have fared equally well if not better in team learning situations in comparison to students instructed through a more traditional individualized method. Research indicates that team groups tend to have better attendance, personalize the work required of them and improve the overall quality of their own learning (Johnson & Johnson, 1992).

Support for Teaming:

The main arguments for a team teaching curriculum, or integrated studies are twofold: First, the knowledge explosion is very real and there is simply too much information to be covered in the traditional curriculum: and second, most school subjects are taught to students in isolation from other potentially related subjects (Ellis & Fouts, 1993). By combining subjects in the team structure a higher level of expectations is achieved and repetitious material eliminated. Combining subject presentations encourages students to see a meaningful relationship between subjects because the subject matter serves as a means rather than an end.

Potential Problems related to teaming:

Teaming curricula often tend to favor social studies, language arts and the arts while slighting mathematics. Findings in *The Eight Year Study*, (Ellis & Fouts, 1993), indicated that students from progressive schools were as well prepared for college as their traditional counterparts. With regard to academics, these researchers found that students taught within a teaching team structure were more involved in social and extracurricular activities. This study had little real effect on school life, however; in effect, the weight of tradition prevailed.

Traditional:

Traditional teaching seems to be subject centered. The focus in teaching and learning is on school subjects, or academic disciplines (Ellis & Fouts, 1993). Each subject in a traditional teaching structure has a sequence, one that becomes more technical and abstract through succeeding years. While all subjects have a scope within a given grade level, the scope and the sequence tend to represent the boundaries of a given subject. The focus is often on the subject of rocketry its knowledge, and skills (Ellis & Fouts, 1993). One way to understand the traditional curriculum is to think of its dominant form, the textbook. The area of focus for this research was science. According to Ellis and Fouts(1993), traditional science instruction serves most students poorly, even though many students succeed in science.

SYNTHESIS:

The idea of approaching the school curriculum from a teaming perspective rather than on a basis of separate subjects is a compelling one. Separating academic disciplines for scholarly purposes probably also makes sense. For children and adolescents who are still in the process of adapting or organizing their schema, however, perhaps another option should be available. Obviously, teacher teaming is a way of perhaps enhancing student performance. Teaming creates an environment wherein constructionists can flourish.

A constructionist theory of learning is one which states that each person must construct his/her own reality. The constructivity principle state that "construction should always precede analysis" (Ellis & Fouts, 1993, p. 153). This means that experience is the key to meaningfulness. Learning is personal.

A second theory, progressive learning, came to be known for what it opposed as much as what it advocated. Progressives were opposed to the factory-like efficiency model on which schools have been and still are dependent. They decried the false learning that came from textbooks and written exams. Furthermore, progressive learning claimed that school learning was so unlike the real world that it had little or no meaning to the average child. These arguments may help to drive the schools of today into tomorrow.

CHAPTER III

METHODOLOGY

INTRODUCTION

This research project was conducted to analyze the effects of interdisciplinary team teaching upon ninth grade earth science students' performance in earth science. The intent of this study was to discover if there were significant differences between students served by an interdisciplinary team and students served in the traditional departmentalized organization. The research is action research and micro evaluation of an earlier study (Gates & Gates, 1995). The major focus of this study was to re-examine the effects of teacher teaming and traditional teacher delivery structures. This study sought to examine these issues using both qualitative and quantitative measures.

STUDY POPULATION

The population for the study came from a total of 397 ninth grade students at Sidney High School in Sidney, Ohio, who were taking earth science for the first time. No students repeating ninth grade were involved in the study. Two groups of ninth grade students enrolled in earth science were selected randomly for the research. The control group (31 students) was selected simply by nature of the fact that it was the only regular traditionally scheduled science class taught by the instructor who taught all classes involved in the study. The experimental group of 66

students was selected by lottery from 100 ninth grade students who were enrolled in the interdisciplinary team.

All first year ninth grade students were given the option of being part of the interdisciplinary team except, those students who were classified as special education or gifted students. A second group of 35 ninth grade students who were not part of the interdisciplinary team acted as the control group. Both groups were taught by the same teacher using the same materials.

HYPOTHESES

The following hypotheses were tested:

1) There is no significant difference between the means of control (traditional) and experimental (teamed) groups on the pretest measure of earth science understanding.

2) There is no significant difference in the mean scores of the control (traditional) and experimental (teamed) groups on a post test of earth science understanding.

3) There is no significant difference between the mean gain scores from pretest and post test results for control (traditional) and experimental (team) groups.

PROCEDURES

This procedures description is organized around in the following sections: 1) pre-testing for knowledge prior to beginning the unit,

2) efforts to assure reliability in teacher performance, 3) the application of control and experimental approaches, 4) culminating activity, 5) experimental design and 6) data collection and analysis.

PRE-TEST FOR KNOWLEDGE

Before the project was initiated, the pre-test (Appendix A) was administered to all participants in the study the instruction was teacher generated and consisted of matching and fill-in the blank questions.

EFFORTS TO ASSURE RELIABILITY IN TEACHER PERFORMANCE

An effort was made to determine if the attitude of the classroom teacher were not substantially different in both classes.

TEACHING TECHNIQUES

A total of eleven different teaching variables were identified and evaluated by video taping teachers performance and gathering artifacts used during lessons.

Lecture time was identified as the time the instructor used in verbally presenting the topic. Much of the lecture time utilized charts, graphs, and the overhead projector.

Classroom discussion, was defined as the time spent in asking and answering questions. The researchers isolated the two activities. Discussion with the teachers centered around the subject matter and around discussions among several students and the teacher.

Questions and answers sessions were directed by the teacher. In these sessions the teacher asks the questions and the students answers.

Instructor **Handouts** were materials used in instruction; the same handouts were used in both classes.

Lab work, was work done mainly during designated lab classes. The lab time was spent primarily by students assembling and launching of the rockets.

Temperament was judged by the volume and the curtness of the teacher's voice. The researches counted these in each class.

Physical gestures such as hands on hips and crossed arms on the chest were observed and tabulated. The researchers studied the words used in each class to determine if the teachers were using a different vocabulary in one of the classes.

Word usage such as rockets, launch, recovery, ignition and parachute were counted, tabulated and compared.

Time on instruction was compared between the two groups. The control group met 15 times for 41 minutes each. The experimental group had flexible time because they were together for a block of 4 periods. The only time the classroom teacher in the control group took advantage of the flexible time was during the lab periods used for launching.

Total instructional time was the amount of time focused on instruction. After interviewing the classroom teacher it was determined by

the researchers that the total instruction time and the total amount of lab time for the control and the experimental classes was the same. However, the team setting did allow for flexible time while the traditional classroom did not .

Lesson Plans were teaching document that outlined the objectives to be covered.

APPLICATION OF CONTROL AND EXPERIMENTAL APPROACHES

The control group consisted of 35 ninth grade earth science students in departmentalized unit. Instruction included textbook assignment, work sheets, lectures, question and answer activities, and laboratory experiments. The experimental group of 35 students received instruction from the same instructor who was a member of the interdisciplinary team. All methods were the same as those stated above. Some other team teachers of the teamed unit also assigned student work that was relative to the unit in earth science.

CULMINATING ACTIVITY

After the unit of instruction was completed, students in both group launched rockets that they had developed in their classes. The variables in this study were control variables related to instructional content and techniques. The dependent variable, is student scores, for the two groups, was compared.

EXPERIMENTAL DESIGN

This study utilized the Quasi-Experimental pre-test-post-test nonequivalent design. This design can be represented graphically by:

G_1	O_1	Cx	O_2
G_2	O_3	C	O_4

The pre-test/post-test, nonequivalent control group design aids in checking the extent of group similarity, and the pre-test scores were used for generating gain scores. The experimental group (G_1) was given the same classroom treatment along with incidental exposure to content as presented in other unit member classes Cx. The pre-test/post-test scores, posted by group and gain scores were all compared (Wiersma, 1995; Carlsen, 1995). All members of the team teaching group shared topics in advance of their classroom presentation. Members of the teamed group were not required to teach a topic which colleagues were teaching in their classes. Traditional teaching team members only shared topics or lesson content by convenience.

Prior to the implementation of the of the study students were given a pre-test over the subject matter in Earth Science. A teacher then delivered the earth science unit . The two different methods were: team teaching and traditional teaching. Team teaching groups' were composed

of teachers who taught different subjects but shared the same students. Traditional teaching groups were assigned by grade to a specific class by chance with no more than one teacher in each class.

DATA COLLECTION AND ANALYSIS

After the earth science unit was taught, the students were given a post-test to measure the effectiveness of the team teaching (See Appendix A). In addition to differences between students grade point averages were used to compare teamed and nonteamed students' academic achievement (See Appendix A). Data for this study were collected during April and May of 1995 at Sidney High School in Sidney, Ohio.

Independent and dependent t-tests were used to compare student performance by group. A level of .05 was used to determine significance. The unit of analysis was the mean for the respective groups. Raw data are presented in Appendix C. When comparing scores from two groups it is possible that every score will vary. This variance could be caused by differences among the students and test error. This tape was analyzed so that any changes that may have modified the student performances could be detected.

SUMMARY OF METHODOLOGY

Two groups of 35 ninth grade earth science students at Sidney High School were sampled. The groups were initially equivalent and given the same in class instruction. One group was organized into an

interdisciplinary team for four periods while the other (control group) was organized in the traditional departmentalized method for four periods. Grade point averages from the team (experimental) and the traditional (control) group were also used in comparing the team group with the traditional group.

CHAPTER IV

RESULTS

In this study the researchers were interested in student outcomes. The main dependent variable was students achievement. Data used in the research came from a pre-test and a post-test administered to a group of ninth grade Earth Science students at Sidney High School.

Prior to application of control and experimental treated, an assessment was completed to assure that the teacher who instructed both groups was consistent in performance. Data obtained from the assessments are included in Appendix F. The conclusion drawn from this analysis are presented in Table 1.

Table 1

COMPARISON MATRIX OF TEACHER INSTRUCTION

	CONTROL	EXPERIMENTAL
Content:		
Lesson Plans	Same	Same
Teaching Techniques:		
Lecture	Same	Same
Classroom Discussion	Same	Same
Questions and Answers	Same	Same
Handouts	Same	Same
Lab Work	Same	Same
Teacher Attitude:		
Temperament	Same	Same
Physical Gestures	Same	Same
Word Usage	Same	Same
Time:		
Instruction Time	41 min. Per.	Varied
Total Instruction Time	Same	Same

Additional information was gathered from other team members using the questionnaire (See Appendix D). The purpose of this research was to determine if team teaching significantly increased the knowledge of students as compared to students who were taught in the traditional departmentalized classroom. The researchers chose a unit on rockets for the research project.

The researchers chose an effects matrix as one means for depicting information about the study (See Table 2). An effects matrix displays data on one or more outcomes in as differentiated form as the study requires. The label *direct* is used to remind the reader that outcomes are always the outcomes of something: a global program, an independent variable, an intervening variable. In effect, the basic principle is one of focus on dependent variables (Miles & Huberman, 1984).

Analysis of the effects' matrix table on learning outcomes requires explanations of the categories. "Program Objectives" refers to those who the research is to effect. In this study the effects refer to a control group, that is taught in a traditional classroom and an experimental group that is receiving the treatment of team teaching. The two groups were determined to be equivalent as measured by the pre-test. The groups means varied by less than one point. This difference of .88 per cent was not statistically significant ($t=-.361$, $df=63$, $p=.72$).

Table 2

EFFECTS MATRIX: LEARNING OUTCOMES AFTER IMPLEMENTATION OF TEAM TEACHING

Program Objectives:	Direct Effects:	Outcomes:
Effects on Control Group	a. Content was the same as experimental group b. Teaching techniques of lecture, classroom discussion, questions and answers, handouts, and lab work were used c. Instruction and lab work time were held in daily blocks of 41 minutes d. Total time was the same as experimental group e. Earth science teacher the same as the earth science teacher for the experimental group	The knowledge gained as measured by the mean of the post-test (67.29) increased by 44.58 points
Effects on Experimental Group	a. Content was the same as control group b. Teaching techniques of lecture, classroom discussion, questions and answers, handouts, and lab work were used c. Classroom and lab work time periods were able to be adjusted in length because of flexible time d. Total time was the same as control group e. Cooperating teachers planned classroom activities that corresponded to the unit in earth science f. Earth science teacher the same as the earth science teacher for the control group	The knowledge gained as measured by the mean of the post-test (74.76) increased by 52.92 points

Direct Effects refers to the activities that were planned for the control and experimental groups. The direct effects of content, teaching techniques, total instructional and lab time, and the earth science teacher were the same. However, the direct effects of block time and cooperating teachers were different. The experimental group had the benefit of flexible time for instruction and lab work. Also, the experimental group's cooperating teachers had planned activities to coincide with the earth science unit (See Appendix D).

Outcomes are the results of the direct effects changing the behavior of the program objectives. The outcome column was based on quantitative information generated by pre-test and post-test results. The results of the outcomes of the means show that a significant level of learning took place in both groups. The experimental group out performed the control group by 7.47 points using mean scores. This is not statistically significant.

A t-test was performed on the means of the pre-test and the post-test of the control and experimental raw scores. When comparing the pre-test scores of the control and experimental groups there was no significant difference ($t=-.361$, $df=63$, $p=.72$). Post-test comparisons showed no significant statistical differences though approached significance ($t=1.729$, $df=60.9$ $p=.089$). When comparing the post-test score of the experimental and control groups there was no significant differences. However, when one compared the gain for experimental and

control groups a significant difference was detected which favored the experimental group (t=2.224, df=66.6, p=.03).

HYPOTHESES

Hypothesis I

There is no significant difference between the means of the experimental and control groups' pre-test scores on a test of earth science understanding.

Data: The differences were subjected to an independent t-test, the result of which was 0.73 (.05) level.

Finding: Null Hypothesis was supported

Hypothesis II

There is no significant difference between the means of the experimental and control groups' post-test scores on a test of earth science understanding.

Data: The differences were subjected to an independent t-test, the result of which was a 0.09 (.05) level

Finding: Null hypothesis supported

Hypothesis III

There is no significant difference between the mean gain scores from pre-test to post-test for both groups.

Data: The differences were subjected to an independent t-test, the result of which was a 0.04 (.05) level.

Finding: Null hypothesis rejected.

SUMMARY

The researchers investigated the differences of learning levels associated with team teaching and traditional classroom teaching. This was a tightly controlled micro study, and a replication of a similar study (Gates and Gates, 1994), conducted on first year ninth grade earth science students at Sidney High School. Both qualitative and quantitative research methods were used. The experimental group's mean gain score was 8.54 points or 19% higher than the control group's mean gain score. The results of the study indicate that significant gain occurred among the experimental group.

CHAPTER V

SUMMARY, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

This chapter is presented in four sections: summary, conclusions, implications, and recommendations for further research.

SUMMARY OF THE STUDY

This study investigated the influence of team teaching on a group of ninth grade earth science students by comparing them with a group of ninth grade earth science students being taught in a traditional classroom. The study also compared the earth science teacher's classroom presentations in both the team classroom and the traditional classroom. Three hypotheses were studied during this project and each will be discussed in turn.

The cooperating team (experimental) was composed of four teachers and 66 first year ninth grade students. A teacher of the learning disabled was added to the team to work with the learning disabled students. The subject areas taught in the team were English, Math, Earth Science, and Social Studies. The four teachers shared a common block of time consisting of 4 periods of 41 minutes each. Within this block of time, the team teachers were free to schedule classes as they saw fit. The 1994-95 school year was the first year in which teaming was utilized. A grant was received by the school to initiate the project.

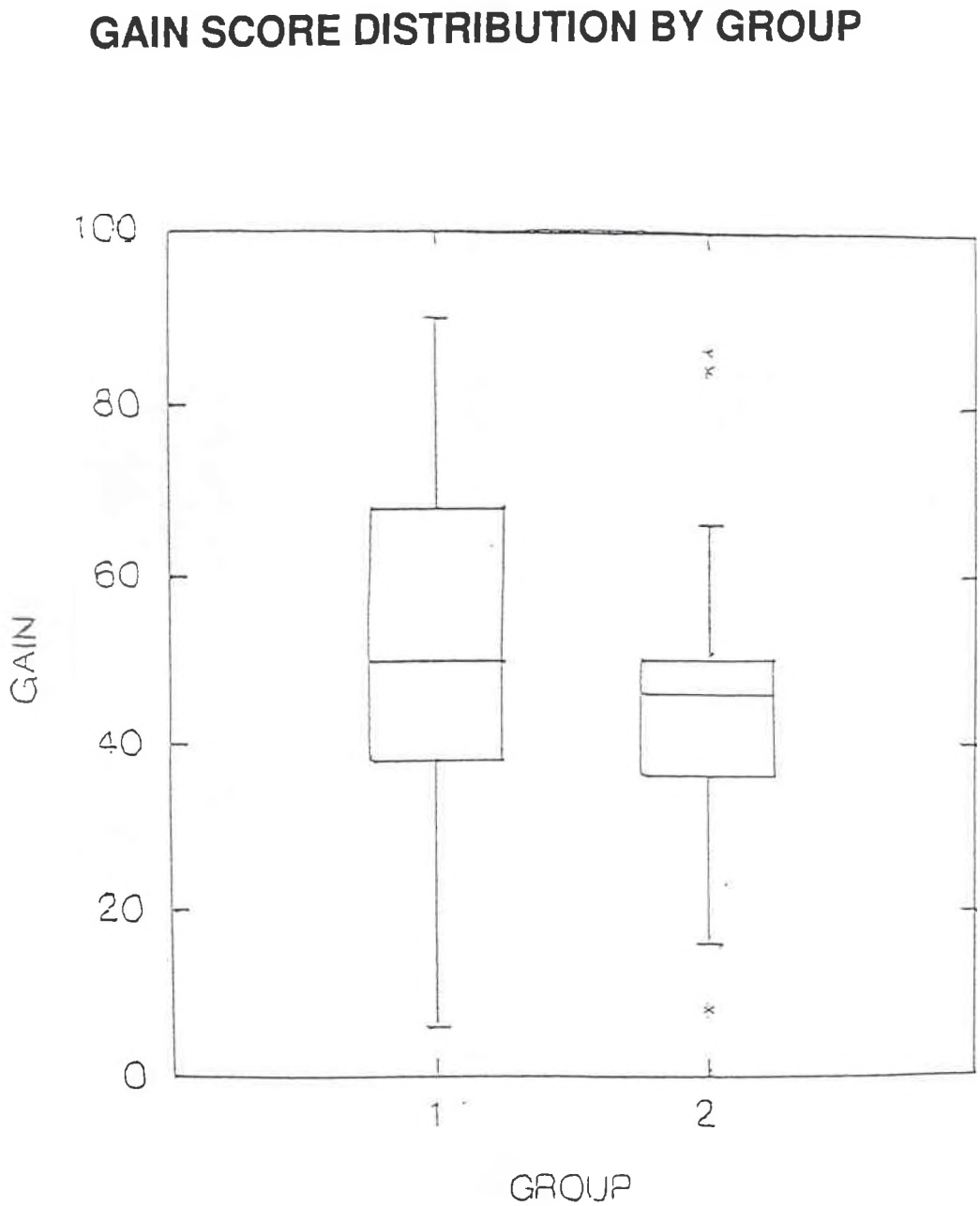
The catalyst for this investigation was a study conducted in the Sidney City School system in 1993-94. This study concluded that team teaching made a significant difference on 7th grade students taking the Ohio Proficiency Test (Gates & Gates, 1995). Because of the success of the 7th grade experience with team teaching, a similar team was initiated at Sidney High School for 9th grade students.

CONCLUSIONS

Ninety seven first year 9th grade students participated in the study. A pre-test and post-test were administered to the students and the means were compared as a measurement of academic achievement. Both groups of students, experimental and control, gained significantly. The mean on the pre-test for the experimental (team) was 22.71 and the mean for the control group (traditional) was 21.84. Statistical analysis using a t-test indicated to the researchers that initially the groups were academically similar. The experimental group received the team teaching treatment while the control group received the traditional teaching method. The unit on rockets lasted for 3 weeks and the students were given a post-test for comparison of their mean scores. The study confirmed that a significant gain in learning took place for both groups. When the experimental group was compared with the control group, the experimental group student's overall gain score significantly out performed the control groups' gain score. When gain scores in the

groups are compared graphically, (See Figure 1), one can clearly see that 50% of the experimental students out performed 75% of the control group.

Figure 1.



This significant gain score (t=2.118, df=95, p= 0.037) along with the preceding graphic dramatically demonstrate the superiority of cooperative team teaching.

The earth science teacher did not alter the methods of teaching between the experimental group and the control group. The difference appears to be with the cooperating teachers associated with the experimental group.

IMPLICATIONS

The implications of the study confirmed the results of an earlier study on team teaching in the Sidney City Schools (Gates & Gates, 1995). It appears that the scores of those students involved in cooperative teaching improved 19 per cent over the control group. It would appear that the school should investigate and consider the expansion of the team approach.

RECOMMENDATIONS

The researchers believe the study has answered some questions but opened the door to even more questions that need to be studied. The following are additional areas that need to be studied. Team teaching should be studied to determine whether all teachers can effectively team. Must all teachers team to be effective? What are the long term effects on staff performance and morale? Do initially high performing students profit as much as initially low performing students? Will students retain the information longer? Must there be a team of teachers or could unified

units, or topics of instruction posted in the teachers' lounge have the same effect? These and more areas need to be explored by future research. But, for now at least, teaming teachers at the high school level seems to exhibit promise for 9th grade earth science students' achievement.

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APPENDICES

APPENDIX A

NAME_____

PRE-TEST

SOLID FUEL ROCKETS

1. You have just successfully launched your rocket. The parachute has opened and the rocket floats gently to earth. You wish to launch your rocket again right away because you are too excited to wait until tomorrow. Number the steps below in the correct order so that you are able to launch again!!!!

_____ PACK THE PARACHUTE INTO THE BODY

_____ CHECK THE ROCKET FOR DAMAGE

_____ MAKE SURE THE SAFETY KEY IS NOT IN THE LAUNCHER

_____ COUNT DOWN 3 - 2 - 1 ! ! ! BOOOOOOMMMMMM ! ! !

_____ PACK RECOVERY WADDING (CLEAN TOILET PAPER) INTO ROCKET

_____ PLACE A NEW ENGINE INTO THE ROCKET

_____ CLEAR LAUNCH PAD AREA

_____ PLACE AN IGNITER INTO THE ENGINE

_____ REMOVE USED ENGINE FROM ROCKET

_____ HOOK LEAD WIRES TO IGNITER WIRES

_____ PLACE ROCKET ONTO LAUCH PAD

_____ PLACE SAFETY KEY IN THE LAUNCHER

2. Label the following drawing of the inside of the rocket engine. Also state the function of each engine part

A. _____

B. _____

C. _____

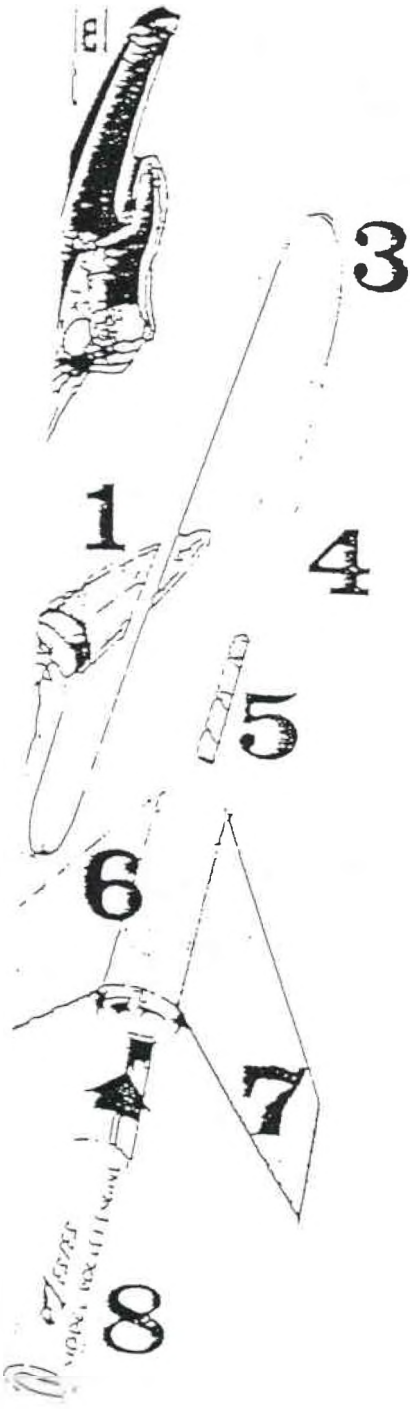
D. _____

E. _____

3. Match the following recovery systems with the correct description of each.

_____ PARACHUTE RECOVERY	A. FALLS TO EARTH THE WAY THE SPACE SHUTTLE & A PAPER AIRPLANE DOES.
_____ STREAMER RECOVERY	B. FALLS TO EARTH IN A SPINNING MOTTION.
_____ TUMBLE RECOVERY	C. FLAPS AGAINST THE WIND, SLOWING THE ROCKET DOWN.
_____ ROTOR RECOVERY	D. POPS OUT, FILLS WITH AIR, AND SLOWS THE ROCKET DOWN.
_____ GLIDER RECOVERY	E. RECOVERY SYSTEM USED WITH VERY LIGHTWEIGHT ROCKETS.

4. Label the following drawing of a rocket. Also, include the functions of each rocket part.



ROCKET PART & FUNCTION

1 _____

2A. _____

2B. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

APPENDIX B

NAME_____

POST-TEST

SOLID FUEL ROCKETS

1. You have just successfully launched your rocket. The parachute has opened and the rocket floats gently to earth. You wish to launch your rocket again right away because you are too excited to wait until tomorrow. Number the steps below in the correct order so that you are able to launch again!!!!

_____ PACK THE PARACHUTE INTO THE BODY

_____ CHECK THE ROCKET FOR DAMAGE

_____ MAKE SURE THE SAFETY KEY IS NOT IN THE LAUNCHER

_____ COUNT DOWN 3 - 2 - 1 ! ! ! BOOOOOOMMMMMM ! ! !

_____ PACK RECOVERY WADDING (CLEAN TOILET PAPER) INTO ROCKET

_____ PLACE A NEW ENGINE INTO THE ROCKET

_____ CLEAR LAUNCH PAD AREA

_____ PLACE AN IGNITER INTO THE ENGINE

_____ REMOVE USED ENGINE FROM ROCKET

_____ HOOK LEAD WIRES TO IGNITER WIRES

_____ PLACE ROCKET ONTO LAUCH PAD

_____ PLACE SAFETY KEY IN THE LAUNCHER

2. Label the following drawing of the inside of the rocket engine. Also state the function of each engine part

A. _____

B. _____

C. _____

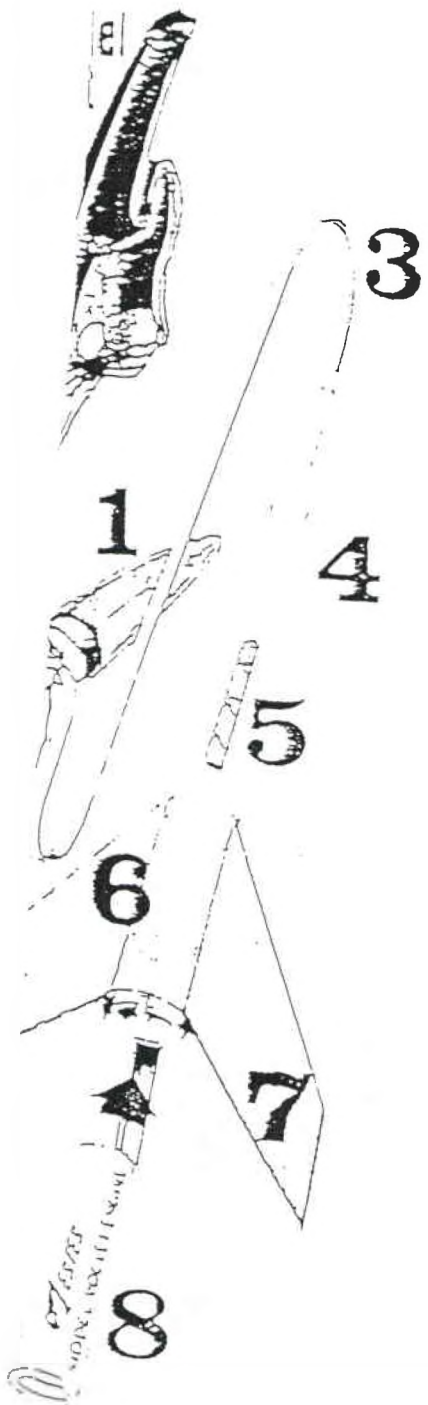
D. _____

E. _____

3. Match the following recovery systems with the correct description of each.

_____ PARACHUTE RECOVERY	A. FALLS TO EARTH THE WAY THE SPACE SHUTTLE & A PAPER AIR-PLANE DOES.
_____ STREAMER RECOVERY	B. FALLS TO EARTH IN A SPINNING MOTTION.
_____ TUMBLE RECOVERY	C. FLAPS AGAINST THE WIND, SLOW-ING THE ROCKET DOWN.
_____ ROTOR RECOVERY	D. POPS OUT, FILLS WITH AIR, AND SLOWS THE ROCKET DOWN.
_____ GLIDER RECOVERY	E. RECOVERY SYSTEM USED WITH VERY LIGHTWEIGHT ROCKETS.

4. Label the following drawing of a rocket. Also, include the functions of each rocket part.



ROCKET PART & FUNCTION

1 _____

2A. _____

2B. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

APPENDIX C

Research Worksheet

Exp. Group		Control Group	
Pre-Test	After Test	Pre-Test	After Test
38	76	24	68
26	52	14	98
18	78	46	84
44	80	6	22
52	100	12	40
52	100	26	72
46	96	44	86
28	66	40	90
40	68	34	80
46	96	28	78
24	54	14	64
32	78	52	100
36	100	26	72
22	84	44	84
32	92	32	78
10	100	12	62
14	62	0	40
52	96	12	98
40	94	12	70
50	90	34	58
56	94	12	70
42	70	22	60
20	82	24	82
16	88	22	50
10	46	2	68
14	86	20	28
6	56	16	50
8	96	14	58
20	76	14	72
8	80	32	56
22	62	14	48
10	48		
4	56		
4	50		
6	96		
2	38		
0	36		
4	28		

	24	58				
	10	52				
	14	62				
	18	52				
	20	62				
	8	94				
	24	38				
	26	66				
	16	84				
	16	22				
	10	70				
	16	92				
	6	64				
	24	64				
	12	78				
	24	92				
	12	98				
	34	86				
	6	94				
	16	98				
	12	66				
	18	100				
	12	62				
	22	76				
	26	100				
	22	96				
	6	68				
	20	90				
Sum	1,428	4,934		704	2,086	
Average	21.64	74.76		22.71	67.29	
	Pre & Post	2.72E-32		Pre & Post	2.75E-15	

DATA WORK SHEET
7/10/95

TOTAL OBSERVATIONS: 66 EXPERIMENTAL GROUP RESULTS

	PRE-TEST	POST-TEST	GAIN
No. of Cases	66.000	66.000	66.000
Minimum	0.000	22.000	6.000
Maximum	56.000	100.000	90.000
Range	56.000	78.000	84.000
Mean	21.636	74.758	53.121
Variance	207.620	413.879	370.600
Standard Div.	14.409	20.344	19.251
Std. Error	1.774	2.504	2.370
Skewness (G1)	0.755	-0.562	0.126
Kurtosis (G2)	-0.350	-0.561	-0.467
Sum	1428.000	4934.000	3506.000
C.V.	0.666	0.272	0.362
Median	19.000	78.000	50.000

DATA WORK SHEET
7/10/95

TOTAL OBSERVATIONS: 97 EXPERIMENTAL and CONTROL GROUPS

	PRE-TEST	POST-TEST	GAIN
No. of Cases	97.000	97.000	97.000
Minimum	0.000	22.000	6.000
Maximum	56.000	100.000	90.000
Range	56.000	78.000	84.000
Mean	21.979	72.371	50.392
Variance	196.208	412.444	355.470
Standard Div.	14.007	20.309	18.854
Std. Error	1.422	2.062	1.914
Skewness (G1)	0.668	-0.472	0.239
Kurtosis (G2)	-0.420	-0.528	-0.229
Sum	2131.000	7620.000	4888.000
C.V.	0.637	0.281	0.374
Median	20.000	72.000	48.000

APPENDIX D

Teacher Interview Form

Qualitative Research

Cooperative Teacher

Name _____ Date _____

1. What do you teach? _____
2. What classroom activities did you plan in cooperation with the earth science unit on rockets?

3. How were these activities correlated with the unit on rockets?

4. May I examine your lesson plans for this activity?

5. Did the students receive a grade for the activity? _____

APPENDIX E

WORKSHEET OF TEACHER TIME ON TASK

Experimental Group Date: 5/2/18

Teaching Techniques	Time on Task
Lecture	20 minutes
Classroom Discussion	8 minutes
Questions and Answers	8 minutes
Handouts	
Labwork	
Total Time	36 minutes

WORKSHEET OF TEACHER TIME ON TASK

Control Group Date: 5/2/18

Teaching Techniques	Time on Task
Lecture	22 minutes
Classroom Discussion	10 minutes
Questions and Answers	7 minutes
Handouts	
Labwork	
Total Time	39 minutes

WORKSHEET OF TEACHER TIME ON TASK

Experimental Group Date: 5/9/18

Teaching Techniques	Time on Task
Lecture	10 minutes
Classroom Discussion	15 minutes
Questions and Answers	15 minutes
Handouts	
Labwork	
Total Time	40 minutes

WORKSHEET OF TEACHER TIME ON TASK

Control Group Date: 5/9/18

Teaching Techniques	Time on Task
Lecture	10 minutes
Classroom Discussion	15 minutes
Questions and Answers	15 minutes
Handouts	
Labwork	
Total Time	40 minutes

WORKSHEET OF TEACHER TIME ON TASK

Experimental Group Date: 5/16/18

Teaching Techniques	Time on Task
Lecture	5 minutes
Classroom Discussion	10 minutes
Questions and Answers	22 minutes
Handouts	
Labwork	
Total Time	37 minutes

WORKSHEET OF TEACHER TIME ON TASK

Control Group Date: 5/16/18

Teaching Techniques	Time on Task
Lecture	8 minutes
Classroom Discussion	9 minutes
Questions and Answers	22 minutes
Handouts	
Labwork	
Total Time	39 minutes

WORKSHEET OF TEACHER ATTITUDE

Experimental Group Date: 5/2/95:

Teacher Attitude	Num. of Times
Temperament	
Raising Voice	7 Times
Slamming Something	
Physical Gestures	
Clenched Fist	
Hands on Hips	2 Times
Arms Crossed	3 Times
Word Usage	
Negative Words	4 Times
Positive Words	14 Times

WORKSHEET OF TEACHER ATTITUDE

Control Group Date: 5/2/95:

Teacher Attitude	Num. of Times
Temperament	
Raising Voice	8 Times
Slamming Something	
Physical Gestures	
Clenched Fist	
Hands on Hips	4 Times
Arms Crossed	2 Times
Word Usage	
Negative Words	5 Times
Positive Words	12 Times

WORKSHEET OF TEACHER ATTITUDE

Experimental Group Date: 5/9/95:

Teacher Attitude	Num. of Times
Temperament	
Raising Voice	8 Times
Slamming Something	
Physical Gestures	
Clenched Fist	
Hands on Hips	6 Times
Arms Crossed	4 Times
Word Usage	
Negative Words	4 Times
Positive Words	13 Times

WORKSHEET OF TEACHER ATTITUDE

Control Group Date: 5/9/95:

Teacher Attitude	Num. of Times
Temperament	
Raising Voice	6 Times
Slamming Something	
Physical Gestures	
Clenched Fist	
Hands on Hips	3 Times
Arms Crossed	7 Times
Word Usage	
Negative Words	5 Times
Positive Words	16 Times

WORKSHEET OF TEACHER ATTITUDE

Experimental Group Date: 5/16/95:

Teacher Attitude	Num. of Times
Temperament	
Raising Voice	6 Times
Slamming Something	
Physical Gestures	
Clenched Fist	
Hands on Hips	5 Times
Arms Crossed	3 Times
Word Usage	
Negative Words	2 Times
Positive Words	14 Times

WORKSHEET OF TEACHER ATTITUDE

Control Group Date: 5/16/95:

Teacher Attitude	Num. of Times
Temperament	
Raising Voice	8 Times
Slamming Something	
Physical Gestures	
Clenched Fist	
Hands on Hips	6 Times
Arms Crossed	3 Times
Word Usage	
Negative Words	5 Times
Positive Words	17 Times