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## Team Teaching in Secondary School Science: Techniques in Large and Small Group Instruction and the Use of Para-Professionals

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TEAM TEACHING IN SECONDARY SCHOOL SCIENCE:  
TECHNIQUES IN LARGE AND SMALL GROUP  
INSTRUCTION AND THE USE OF  
PARA-PROFESSIONALS

by

Berlin C. Jensen

A seminar report submitted in partial fulfillment  
of the requirements for the degree

of

MASTER OF EDUCATION

in

Secondary School Teaching

Approved:

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TABLE OF CONTENTS

Chapter	Page
I. INTRODUCTION . . . . .	1
Purpose of Study . . . . .	3
Definition of Terms . . . . .	4
Limitations . . . . .	5
Methods and Procedures . . . . .	5
II. HISTORICAL BEGINNINGS OF TEAM TEACHING . . . . .	6
III. LARGE AND SMALL GROUP INSTRUCTION . . . . .	9
Large Group Instruction . . . . .	9
Scheduling time and size of group . . . . .	9
What should be taught . . . . .	10
Who should teach the large group . . . . .	11
Techniques used in large group instruction . . . . .	12
Guidelines for large group instruction . . . . .	15
Small Group Instruction . . . . .	16
Scheduling time . . . . .	16
What should be taught . . . . .	17
Who should teach the small group . . . . .	18
Techniques used in the small group . . . . .	19
Guidelines for small group instruction . . . . .	21
IV. THE USE OF PARA-PROFESSIONALS . . . . .	23
Need for Para-Professionals . . . . .	23
Source of para-professionals . . . . .	23
Selection of Para-Professionals . . . . .	24
Duties of Para-Professionals . . . . .	25
V. SUMMARY OR CONCLUSION . . . . .	27

TABLE OF CONTENTS CONTINUED

Chapter	Page
VI. DESCRIPTION OF TEAM TEACHING IN WEBER	
COUNTY SCHOOLS . . . . .	29
Analysis of Terms and Objectives	
Used in Team Teaching . . . . .	29
Objectives of the Science Program . . . . .	30
Basic Consideration in Team Teaching . . . . .	31
Introduction . . . . .	31
Demonstration . . . . .	32
Conferences . . . . .	33
Group discussion . . . . .	34
Filmstrips . . . . .	35
Films . . . . .	36
Resource personnel . . . . .	37
Student research and projects . . . . .	38
Testing - quiz - exams - grading . . . . .	39
LITERATURE CITED . . . . .	40



## CHAPTER I

### INTRODUCTION

In team teaching there are considerations that are basic to conducting a successful learning experience. In large and small group instruction certain techniques are used that can reduce the tension and anxiety of the team teacher. Just how these techniques are used will vary for the individual team teacher. How to secure and use para-professionals are also basic considerations in a team teaching program. According to this survey certain techniques can be effectively used in large groups (1). The school plant itself has undergone a remarkable change. Newly constructed schools can now accommodate larger and more effective classes, or the space can be used in smaller group instruction, or for independent study.

While schools have made advancements in the past twenty years, there have been many criticisms. The "watered down curriculum" and the "abandonment of the classical subjects" have been greatly criticised. An educational system that can withstand these criticisms and continue to expand with new ideas, concepts, techniques and philosophies is a credit to education.

One of the newer innovations in programming instruction is team teaching. Team teaching is a pattern for organization of staff and pupil to attempt to improve or better the quality of instruction for all of our children in the public schools.

J. Lloyd Trump (26) said, "Every time we read a book, magazine, or newspaper, watch television, go to a movie or attend a lecture, we participate in large group instruction. We would remain poorly informed without practicing this type of learning. What we hear and see as members of these large groups frequently becomes the subject of discussions with other persons, usually in groups of two or more, and sometimes motivates us to seek more understanding of the subject in libraries, bookstores, museums, or by travel or listening to other persons."

Frequently we clarify ideas and are stimulated toward further inquiry as a result of conversations we have with other persons. We also use such opportunities to persuade others to accept our belief. New acquaintances and friendships develop in such chance or planned meetings. Life would be quite incomplete without the discussions we hold with other persons in small groups (25). Small classes represent essential education for citizenship in a democracy. Students need to learn to discuss controversial matters, to communicate effectively, to respect the opinions of others, and to deal with people whose backgrounds differ from

their own. The discussions they hold reinforce and use the knowledge the students have learned in large groups and in their own independent study. Team teaching is purported to provide greater opportunity for such small group activity.

John Brownell (4) found that a team demand increased expertness from its teachers since it organizes to exploit individual talent for instruction and curriculum study. The team pushes its teachers into a variety of instruction methods.

The team requires the teacher to acquire many workable techniques for large and small group instruction, for tutorials, for organizing and supervising independent study, and for using teaching machines and other types of specialized equipment. A team provides opportunities for teachers to learn to use the time of the para-professional to provide the teacher with relief from mechanical and clerical duties - the routine of which consumes as high as twenty percent of the instructional time.

#### Purpose of the Study

The purpose of this study was to survey techniques used in large and small group instruction that have been tried in science team teaching programs, to report the source and uses of para-professionals in a team teaching program, and to project ways in which science team teaching

instruction may be improved through the use of the above mentioned techniques and use of para-professionals in the program.

#### Definition of Terms

Team Teacher. A fully certificated teacher who serves as a member of a teaching team

Team Teaching. A design for instructional organization, the common element being some type of planned sharing of responsibility by two or more teachers for the instruction of a group or groups of students

Large Group. Instruction facilities designed to accommodate from 100 to 140 students, including use of sound systems, overhead projectors and filmstrips.

Small Group. Instruction facilities designed to accommodate a group of students that ranges in size from three to thirty and housed in conference rooms located near large group rooms.

Para-professional. A non-certified person from the community who works with the team on a paid, part-time basis, relieving teachers of clerical and other routine work

### Limitations

This paper has been limited to a report of those techniques used in large and small group team teaching instruction in secondary science programs, and a description of the procedures found useful in securing and using para-professionals in the team teaching enterprise.

### Method and Procedure

The methods primarily used in this study was a survey of the literature of the past ten years as it pertained to:

1. Historical beginnings of team teaching
2. Large and small group instruction designed for use in team teaching which formed upon
  - a. patterns for scheduling time
  - b. teaching content
  - c. qualifications for instructors of large and small groups
3. Sources and uses of para-professionals.
  - a. need for para-professionals
  - b. source of availability of para-professionals
  - c. methods of selecting para-professionals
  - d. duties of para-professionals

## CHAPTER II

### HISTORICAL BEGINNINGS OF TEAM TEACHING

According to Philip Lambert (14) the first team teaching project was started in 1960 in Lexington, Massachusetts. It has already become one of the most talked about developments in American Education. Like most new approaches to instruction, it has attracted both sincere supporters and violent critics.

Although relatively little was known about team instruction prior to 1963, arguments pro and con have been heard all over the country. Teachers and administrators in hundreds of schools have been trying to sell their colleagues on team teaching, and asking eagerly, "How do we do it?" Those opposed to its organizational structure have hurriedly reviewed their program in order to defend the existing system or to substantiate some new alternative focus on structure.

Judson T. Shaplin (20) reported many programs in several schools in which the size of the team varied from two to ten or more teachers. A conservative estimate of the number of teachers now involved in team teaching is 1,500; of students, more than 45,000. The communities in which schools have been engaged in team teaching are spread over

twenty-four states with concentrations in Massachusetts, Florida, Illinois, Wisconsin, Michigan, Colorado, Utah and California. In California, the Claremont Graduate School team teaching program embraces eight school districts. In several states, major universities have helped establish team teaching in neighboring communities.

In 1958 team teaching was barely mentioned in the annual collection of reports only one school system appeared to have developed a team teaching project during the 1956-1957 period reported. In contrast, in the 1961 Bulletins of the Secondary School Principal's Association, more than half of the reports specifically mentioned team teaching.

The fund for the advancement of education has supported numerous pamphlets and books which survey the changing atmosphere of public education and suggest methods of experimenting with new concepts or organization. Descriptions of team teaching and its potential advantages figure prominently in each of these publications; Time, talent and teachers; schools for tomorrow and schools for tomorrow-today 7

The term "team teaching" did not appear in the Educational Index until 1957-1959 (Volume II) apart from the few articles in the professional journals and an occasional article in the more popular periodicals. The main source of information about team teaching has been the documents

developed by the projects themselves. These consist of proposals, annual reports, or working papers, and descriptive articles in local publication of teachers organizations in state journals of education, and in newsletters and special pamphlets designed for public relations purposes.



## CHAPTER III

### LARGE AND SMALL GROUP INSTRUCTION

#### Large Group Instruction

##### Scheduling time and size of group

How long should the period be for large group instruction? Research does not support a specific answer. Children, many with low ability, watch TV hour after hour without losing interest and gain some understanding from the experience! The kind of presentation, the audio-visual aids used, the subject of the presentation, the effectiveness of the teacher, are among the factors related to the length of the period. Most junior and senior high school teachers seem to prefer a period of approximately forty minutes for large group instruction. On the other hand, many schools operate effectively with fifty-five minute large group instruction periods, while some argue in favor of a twenty-five minute presentation. What a given teacher believes is an important consideration in answering the question.

The number of large group presentations per week depends on the analysis of what is to be taught in large groups, small groups, and through independent study. The frequency of large group meetings should be flexible,

subject to change on the basis of personal preference and further independent study.

J. Lloyd Trump (26) suggested that the proportion of time spent in the phases be 40 percent large group instruction, 20 percent small group instruction, and 40 percent individual work. James Spinning (21) reported that large groups meet for two thirty-minute lecture lessons per week and two sixty-minute, small-group sessions and perhaps one hour for individual pupil conference or testing of which all might be reinforced by whatever help can be derived from non teaching and aide service.

Ivan Bodine (2) reported the procedure that has proven most effective in large group instruction has been to divide 350 students into three class groups. The large group would then accommodate 100 to 120 students.

#### What should be taught

J. Lloyd Trump (26) suggested the presentation procedures include the following parts: a survey assessment of students' past achievement and interest in the topic, and a relationship of the new material to that which students already know, and that these two procedures reduce the necessity for pure memorization and enhance interest and conceptualization. Other considerations in preparation include simplicity of explanation, use of clever illustration, development of meaningful relationships, and the use of questions which may be

answered by group response. The presentation should suggest further study of essential information and creative investigations as well as to raise issues for small group discussions. The basic purpose of large groups is to provide the student with background information and to get him so excited about learning that he wants to go into the laboratories and resource centers to learn more for himself.

Harold Howe (11) reported that fundamentals taught in every classroom can be presented in such a way that all students have a certain uniformity of instruction that these fundamental materials be the keypoints in a course, and that by presenting them in large groups it was possible to avoid duplication of instruction and provide all students a minimum exposure to basic ideas, though these should be amplified in small groups.

#### Who should teach the large group

Monte S. Nortan (17) reported the need to utilize teachers better in large group instruction by carefully studying the characteristics of a teacher, his level of proficiency or background in some areas of science, and then to determine if he could do more effective teaching than a teacher with less background in an area of science.

The basic criterion always is the best teacher for a given topic working with as large a group of students

as possible. If, on the other hand, one has available a film that presents better teaching than the staff has to offer, the film or TV program should be used and the best available teacher complements the presentation in person. If there is an individual in the community who is available and could make a better presentation for a given topic than a teacher in the school, the community person should be used and the best available teacher for that subject would then complement that presentation. The basic purpose of large group is to place students in contact with the best possible teaching.

Anne Happcock (8) described team teaching and large group instruction as follows:

The teacher involved in school experiments have found that the large class is appropriate and educationally sound for imparting the basic information that all students must have in the course. No longer, for example, need five biology teachers repeat essentially the same thing about the classification of living things into class order, family, genus and species five times a day for a total of twenty-five presentations. (p. 47)

Instead, the one with the most competence in this segment of subject matter "imparts the basic information" by lecturing to all five sections.

#### Techniques used in large group instruction

Melvin P. Heller and Elizabeth Bedford (10) reported that the crucial factor in the learning situation for the learner is his mental activity. Because of this, the

teacher may use several approaches to keep the learner interested. The use of visual aids with lectures can be effective. Careful thought must be given to what type and quantity of visual aids best suited for the instructional purpose. Humor, gimmicks, change of pace, rhetorical and real questions still have their place in large group instruction. "One cannot over-emphasize the importance of mental activity, the necessity of learning on the ideational level."

The teacher may utilize an outline, a set of study questions, a topical reference to salient points singled out for emphasis or a brief summary of the lecture for discussion purposes.

One of the best ways to insure the desired intellectual interaction is to provide the pupil with a structural approach to the presentation, setting a framework within which the teacher and the pupil can interact. The large group instruction combines unfamiliar concepts and methods of solving new problems. (9)

Edward Tracy and Carl H. Peterson (25) reported that large group instruction periods can also be utilized for general reviewing and testing purposes. Milton O. Pella (19) reported the world lecture had to be abandoned. The intent was to utilize inductive techniques with a large group. This could not be done with words. When the terms presentation was used rather than the term lecture,

other lesson procedures appeared such as incorporating 2 x 2 photomicrographs overlays. Lesson planning changed from telling-then seeing or seeing-then describing. The addition of visual material and changing of sequence resulted in better attention by students.

A second-year, limiting factor in large group was reported by Pella (19). This was the apparent lack or ability of students to take notes. The solution of this problem was attempted by the biology team and was unsuccessful so that the responsibility for teaching the skill was given to the English department with positive results.

Harold Howell (12) reported that during the school year, 1958-1959, thirteen different teachers at Newton High School prepared and presented 118 different large-group lessons. In all of the lectures, materials of established value were combined with original, prepared visual-aids of various kinds. By far the largest proportion of this visual material was on transparencies designed for an overhead projector. Art instructors assisted in their preparation. Teacher-prepared lectures to large group have been developed during summer workshops. Classes with a wide spectrum of ability and interest had presented some difficulties; consequently, at the Newton High School instead of assembling students in large groups, the staff arranged that students of diverse abilities be sent to small group sessions.

### Guidelines for large group instruction

All of the modern technological aids including audio-instructional methods, audio-instructional devices, clerical assistance, general teacher assistance, and community consultants are necessary for an optimum team teaching program. Grouping students for large group instruction in units of fifty or more students for appropriate instructional purposes appears to conserve the time and energy of teachers, foster more efficient use of money and building space, make feasible more effective use of technical aids, and provide student contacts with the best available teaching.

1. Student activities in large groups include listening and viewing, working on programmed instruction devices, and taking written examinations.
2. The number of students available, the size of the room, and the opinions of teachers govern the maximum size of groups.
3. Groups are homogeneous as feasible, based on records and past achievement in the subject area.
4. Large-group instruction in a given subject area usually occurs twice a week, 30-50 minutes each day.
5. The best possible instruction by the teacher present or on film or on television is used for presentations and demonstrations.



6. Instruction assistants and clerks supplement the work of professional teachers.
7. In order to plan instructional systems accordingly, teachers must constantly seek to differentiate among pupil-learnings in large groups, in small groups, in independent study sessions.

### Small Group Instruction

#### Scheduling time

J. Lloyd Trump (26) stated that experiences in schools organizing small groups, and considerable research in group dynamics indicates the maximum desirable size of the small groups to be approximately fifteen. That is the largest number of students that logistically may have an opportunity to become actively involved in discussion during a reasonable period of time. Most schools believe that from thirty to fifty minutes is a desirable length of time for these group discussions.

Each student participates in one small group each week. Twenty-four students are assigned to a group and then divided into two groups of twelve with student leaders conducting the discussion groups in the small group area (8).

According to Melvin P. Heller and Elizabeth Bedford (10) after large group instruction pupils are divided into classes of fifteen or fewer to go over the subject presentation.



### What should be taught

The small group is concerned with assuring the understanding of principles, explaining new ideas, checking the error in homework, and ascertaining the reason for these errors. The small group size enables each person to question as often as necessary for thorough understanding (9).

Edward Tracy and Carl H. Peterson (25) reported that small groups are designated for research, students in their junior year, who demonstrate above the average ability to work independently meet two periods a week to do independent research in the laboratory and library. Pupils are to conduct independent research on a number of topics and report their findings and interpretations at the class meeting for discussion and exchange of ideas (students take turns leading the discussion).

A list of common readings as they pertain to the topic under investigation shall be required of all students, a basic text may or may not be used.

The teacher meeting with the small group has the responsibility to decide on matters that need to be presented more effectively in large-group and to help appraise the quality of instruction.

Melvin P. Heller and Elizabeth Bedford (10) said that curiosity and desire for further investigation of a topic or a whole field of topics stem from the discussion

and probing which take place in the small group. It is then that the student gains his first knowledge of a subject; it is there he glimpses vast unexplored fields beyond this limited knowledge. It is there that the desire is born to investigate further, to find out for himself about the facts of the subject which are too many and too deep to pursue with the entire group.

#### Who should teach the small group

Melvin P. Heller and Elizabeth Bedford (10) reported that following the large group, pupils divide into classes of fifteen or fewer to discuss the subject of the presentation. The seminar is concerned with assuring the understanding of principles, checking the errors in homework, and ascertaining the reason for these errors. The small group size enables each person to question as often as necessary for thorough understanding. The seminar can be conducted effectively by pupil chairmen, with the teacher serving as a consultant guide, and resource person under the direction of these chairman pupils check homework, take turns translating, carry on question-and-answer sessions. The teacher is present to correct errors, explain new ideas, but the responsibility for the smooth and efficient conducting of the class belongs chiefly to the pupils.

Being alert to the errors of others and trying to avoid errors of their own, the pupils are more aware and

interested in the progress of the class and when they rely upon the teacher to initiate each exercise and to offer all the necessary correction to their work.

#### Techniques used in the small group

Melvin P. Heller and Elizabeth Bedford (10) said the seminar can be conducted effectively by pupil chairmen with the teacher acting as a resource person. The teacher is present to correct errors, but the responsibility for conducting the class should be up to the pupil chairmen. Heller also said that specialized seminars can be set up whenever pupils need to work at a rate of speed noticeably faster or slower than the majority. Pupils learn from the individual differences of members of their own group, but in the case of accelerated or remedial levels, separation has been found to be sometimes more helpful.

William J. Harrison (9) said each student participated in one seminar each week. Twenty-four students assigned to a group and then divided into two groups of twelve with each student leader conducting the discussion groups. This grouping enabled the teacher to avoid becoming the center of all discussion, and allowed him to follow both groups to enrich the instruction as opportunities arose. Edward Tracy (25) reported, pupils were to conduct independent research on a number of topics and reported their findings and interpretation at the class meeting for discussion and exchanged ideas with students taking turns leading the

discussions. In addition to group evaluation of important topics, each student was to be required to select certain topics in which he was particularly interested and additional reading and research in each of them. He then prepared a paper which he presented to the group at the same time defending the findings and conclusions which he had reached.

While one teacher handled the large group presentation, team members were freed to remove the accelerated or remedial children from the lecture and spend this time more profitable on materials pertinent to their needs.

J. Lloyd Trump (26) said to avoid missing the major purpose of the small groups teachers need to cast themselves in the role of the listener, advisor, and co-participant with the students. Students need to learn a variety of group roles leader, recorder, observer, and the kinds of functions served by a variety of group members. To help stimulate independent study through small group discussion by scheduling occasional brief reports from students engaging in exciting science projects on their own. Working with small groups challenges very high professional competencies on the part of the teacher.

Edward Tracy and Carl H. Peterson said the seminar prepares students for later college work by providing training in independent, critical, unbiased thinking and the ability to arrive at an exact and impartial analysis of fact.

Guidelines for small group instruction.

Grouping 15 or fewer students in separate classes aims to develop better interpersonal relations among students while they learn essential knowledge, effective communication of ideas, problem solving, and divergent thinking.

1. Since today's schools largely fail to provide education for effective oral communication, special arrangements for small classes are needed.
2. Approximately 15 students represents the maximum number that can effectively participate in group discussion activities.
3. Small groups are constituted to provide needed discussion experiences for particular kinds of students.
4. Effective teacher participation in student discussions calls for extremely high levels of professional competence.
5. The time required for small-group activities diminishes as students become more sophisticated discussants.
6. Small-group discussion is related to large-group instruction and independent study in all subject areas.

Frequently we clarify ideas and are stimulated toward further inquiry as a result of conversations we have with

other persons. Also, we use such opportunities to persuade other persons to accept our beliefs. New acquaintances and friendships develop in such chance or planned meetings. Life would be quite incomplete without the discussions we hold with other persons in small groups.

## CHAPTER IV

### THE USE OF PARA-PROFESSIONALS

#### Need for Para-Professionals

Harold F. Gray (7) said providing relief from mechanical and clerical functions allows the classroom teachers to be more creative, more effective, and better able to meet the demands of a quality program for each student. John A. Brownell (4) reported by understanding the use of the para-professional for routine tasks, teachers find 20 percent or more new instructional time. J. Lloyd Trump (26) reported five classes a day five days a week make difficult for teachers such professional needs as keeping up to date, conferring with colleagues, meeting students on an individual basis and improving evaluation. The failure of schools to provide clerks and instructional assistants prevent science teachers from achieving the professional status they deserve. That of being a full time teacher and not weighed down with paper work.

#### Source of Para-Professionals

Stanley L. Clement (6) reported we have hardly scratched the surface for para-professionals. Such personnel might include; high school students working part time, high school

graduates unable to attend advanced school immediately, college students working part time in practice teaching or cooperative plans, adults working part time, especially mothers with a college education.

Harold F. Gray (7) said assistants are assigned from college students majoring in their specific science subject field.

J. Lloyd Trump (26) reported three types of persons often available; housewife interested in part time work, advanced college students, and retired teachers. William Jack Stone and William K. Ramstad (22) said para-professionals used most frequently were; student teachers, layreaders, college trained adults in the community and clerical workers.

#### Selection of Para-Professionals

J. Lloyd Trump (26) reported that carefully selected qualified instruction assistants may supervise laboratories and work rooms. These assistants need at least a college minor in the science subjects field represented by the workrooms or laboratories. Harold F. Gray (7) said assistants should have basic qualifications and training in the areas to which they are assigned. Scall D. Thomson (24) said to establish guidelines for appointment of para-professionals training must be complete, and a para-professional must be used consistently and constantly.



### Duties of Para-Professionals

Scall D. Thomson (24) said the para-professional is neither a clerk nor certified teacher, though will do considerable typing and some teaching. The para-professional is supervised but also performs as a supervisor dealing directly with students. The para-professional acts as a communication center-liason between department members and with various administrative and guidance officers in the school. Duties of the para-professional include: (a) taking attendance (b) checks absent and tardy students (c) types stencils and department letters (d) duplicates and stores materials (e) develops files and storage for tests and other materials (f) brief absentees (g) schedules appointments (h) makes charts and visuals (i) supervises make-up tests (j) record grades.

David O. Montague (16) reported that para-professionals assist the teachers by (1) setting up and taking down laboratory equipment (2) assist in grading tests (3) participate in small group discussion under the direction of the teacher (4) help students on individual projects (5) work with students who are falling behind (6) review students notebooks and work and (7) assist in field trips.

Robert Marsh (15) said para-professionals are responsible for (1) taking classroom attendance (2) supervising student hall traffic (3) setting up and operating audio-visual equipment (4) supervising the administration

of tests (5) working with students on make-up work and tests and (6) doing research and background work for the team teachers.

William Jack Stone and Willima K. Ramstad (22) reported activities most commonly assigned to teacher paraprofessionals are (1) working with small remedial groups (2) assisting librarians (3) working in department resource centers.

## CHAPTER V

### SUMMARY OR CONCLUSION

The team program should consist of large group instruction by master teachers, small group instruction meeting the individual needs of students, and individual study. Clerical assistants to type, teacher para-professional, and community consultants are necessary for an optimum team teaching program.

Three types of classes must be set up:

- (1) Classes in which students work by themselves.
- (2) Classes in which a person or persons demonstrate or talks.
- (3) Classes in which interaction among students take place.

These three are then placed into three categories entitled:

- (1) Independent study.
- (2) Large group instruction.
- (3) Small group instruction.

A team demands increased expertness from its teachers since it organizes to exploit individual talent for instruction and curriculum study, this essential ingredient must be present. A team pushes its teachers into an era of

variety in instruction. Each teacher needs workable techniques for large and small group instruction, for tutorials, for organizing and supervising independent study, for using teaching machines and other types of specialized equipment. A team forces teachers to learn how to use the time of the teacher para-professional by understanding the use of the para-professional for routine tasks teachers find twenty percent or more new instructional time.

## CHAPTER VI

### DESCRIPTION OF TEAM TEACHING IN WEBER COUNTY SCHOOLS

#### Analysis of Terms and Objectives Used in Team Teaching

Team teaching advocates the organization of a group of teachers and auxiliary personnel to administer a learning unit to one hundred or more students on either one-grade or multiple-grade levels.

Team teaching is designed to increase student learning through more effective use of teacher effort. Teachers on a team work closely together with the facilities they have to more adequately meet individual needs.

Some teams have as few as four members or less; others are as large as ten or twelve. How a team is organized varies with each program, and each team sets up its own daily schedule.

The science team (consisting of four teachers) was planned so that each teacher involved had special interests with a good background in all phases of the science curriculum. Since each teacher in the team had a particular unit of interest, he had the major responsibility of directing the preparation and presentation of the unit with other members of the team assisting.

A teacher aide, or secretary was employed to do the clerical work of typing, duplicating of materials, administering of tests, recording, etc., thus giving the teachers involved additional time for planning and presenting teaching units in a more effective manner.

The entire team take the responsibility for evaluating the students and reporting their achievement.

Study guides, materials used, and methods of presentation in team teaching must have a great deal of flexibility to keep abreast of the constant changes encountered in such an endeavor.

The following material explains the objectives and methods that have been used by the science teachers.

The science program is taught in a team teaching program with the units prepared as rapidly as the student is capable of handling them with continuous guidance being given, leading to breadth as well as depth of subject material being covered.

#### Objective of the Science Program

1. To help each pupil fit himself into his democratic society.
2. To improve each pupil's health and personal adjustment.
3. To encourage each pupil to be independent.

4. To give each pupil a broad range of exploratory experiences.
5. To help pupils explore new fields of interest prior to high school and college training.
6. To build a scientific vocabulary for our present age.
7. To develop a scientific attitude and appreciation.
8. To give each pupil the understandings needed for meeting the problems of everyday living.

#### Basic Considerations in Team Teaching

- A. Introduction.
- B. Demonstration
- C. Conference
- D. Group discussions
- E. Films or film strips
- F. Resource personnel
- G. Student research projects
- H. Testing and grading

#### Introduction

The science curriculum was designed for team teaching using individualized and group instructional methods.

The introduction of a unit can be given in many different ways. The type of introduction varies with what material is given. The introduction is presented to the

large group of students. In our team teaching, this is accomplished by: (1) having all the students in our large room at one time and using the overhead projector as an aid; (2) a film or film strip can be used successfully as a type of introduction; (3) using a group or teacher demonstration as an introduction; can also be used to introduce a unit. Whatever the method used, it must tie in with the unit subject material you have planned and, secondly, it must be stimulating enough to cause the students to want to study the following unit.

#### Demonstration

The demonstration is a valuable teaching aid, if used right, for it should motivate students to consider evidence that may be observed and recorded. This may be simple example of comparing two objects, yet it is needed to help build onto a concept. A demonstration is used to reach a conclusion or to emphasize a particular point which is desired. The demonstration method may illustrate a special technique in which something is accomplished, such as injecting a thermometer through a rubber stopper without breaking it.

The preparation and presentation of demonstrations has the usual desirability of involving students to participate if possible. This is usually arranged by encouraging and helping students to set up the equipment, explain what is taking place, and otherwise having students actively involved.



The demonstrator should keep a record of each demonstration so that they may refer to the results when discussions are in progress.

The number is usually desired of 20-30 to a group for most efficient work. However, the situation may necessitate a larger number.

### Conferences

A conference in a science program is for clarification and application of the principles that have been covered on the unit material thus far presented. This enables the directive thinking of the students with a teacher's guidance.

The preferred size of these groups may be single students or from eight to twelve students, where comments and suggestions are readily and freely discussed toward a common goal. Students should be put at ease and helped, not hindered, in these groups.

The conference benefits all students, the accelerated as well as the directed learner, also giving each individual help if and when needed.

Larger group conferences, twenty or more students, utilize a question-answer method, supplementing the material covered previously through lecture or other large group presentation.

The time element is important in the program, therefore, if the students feel they have a clear knowledge of the material, additional work is given, and they proceed without undue repetition. However, as much time will be taken as needed in this conference group for the full coverage of any or all materials not fully understood.

These conferences are two fold - some are given to clarify students concepts prior to taking their progressive tests. They are also given after a student takes the test and fails to satisfactorily pass according to his ability.

#### Group discussion

This method is used when individuals having a similiar problem are directed into a research problem such as a special work assignment.

These are carried on with a student chairman taking charge and a teacher being consulted or checking periodically as they may need additional materials to proceed. Library and supplemental science facilities are of a great essence for this activity.

Group size varies from two to ten. Limited numbers here assure each individual within the group to be a participant not just an observer.

### Filmstrips

Filmstrips may be used for the same purpose as the films but in addition to these, they have the advantage of being relatively cheap. Many filmstrips are used by individual students through the use of small hand viewers so they do not disturb students that are involved in other activities.

When the facilities are available, small groups of students may view a filmstrip while a teacher is in an adjoining room giving help to other students. This is made possible by recording a narration for the filmstrip on tape and storing them with the filmstrips. The tape recorder can then be started and one of the students can run the filmstrip projector.

### Films

Films are used in several ways in the science program. The most vital and valuable use of film is that of visualization. This does not mean that they take the place of the demonstration or experiment, but are used to supplement them. Oftentimes, a film can show many features that cannot be seen in any other way, by the use of time-lapse photography and by taking pictures of expensive working models that are impossible on the classroom or school level.

A second purpose of films is to help motivate and stimulate interest in a subject area.

Films are an excellent way of introducing a unit of material or of summarizing a unit. However, the idea of the single concept is probably the best method of using a film. When only a single concept is presented in a short film (5-15 minutes in length) the teacher can aim for a specific idea and hit it. Film loops are very useful for illustrating definite concepts.

In using films, the students need to be oriented prior to showing the film and then after showing the material, should be reviewed and further clarifications made when necessary.

#### Resource personnel

In most communities, there are many people who can contribute to classroom experiences. A teacher should make it his business to know something about industrial establishments in his locality, as well as the occupations of student's parents, so that he can incorporate them into his program. Personnel in industry or in the professions are usually willing to help in any way they can, but the initiative for promoting such a relationship is the responsibility of the school, or more specifically the teacher.

We take advantage of many different types of resource personnel available through visiting scientist programs and other community resources.

#### Student research and projects

Ideas for student research projects begin early in the team's planning of the unit. It cannot be assumed that pupils will begin their work spontaneously. They need help and guidance if the project method is to be effective.

Most of the suggestions for research and project work originates in the teacher-student conferences. During regular classroom activities, we point out possible ways to follow up certain topics. We often note a special area of interest and encourage a student to develop this interest. We also provide lists of suggested projects and activities for the accelerated as well as regular and the directed learner, slower student to do when they have completed their unit. This, we feel adds individual stimulation and motivation as they receive extra credit for this work. However, the teacher must not dictate what a pupil is to do or how he is to do it. Should the teacher do so, he is merely making another assignment. Part of the value in project work comes from the opportunities of individuals or small groups to make choices and plan methods of attack.

Research work is carried out in both the school and community libraries, in the classroom, and at home. Most project work begins with research in the classroom and library and then moves to the project rooms where tools and facilities are available.

Possible outcomes of student research and project work

1. Stimulate an interest in science.
2. Develop critical thinking.
3. Encourage independent thinking.
4. Develop problem-solving techniques.
5. Increase self-confidence.
6. Give experience with tools and techniques of science.
7. Worthy use of leisure time.

Testing - quizzes - exams - grading

It is always a question as to the criteria used in an evaluation process of pupil achievement. What does a grade show? Growth, understanding of concepts, material comprehension, or motivation? Using grades as a guide, we try to program our units in such a way as to provide the above points, to fit the needs of all of the students.

We feel that the best way to provide guide lines for our program is through comprehensive small group conferences and pencil and paper tests. These are usually the objective,

completion, true-false and matching type test. Lack of personnel and time limits the essay type test. After a predetermined amount of student experiences, we give a quiz to cover the area studied. If a student shows he hasn't grasped the material according to his abilities, he then returns to the study area and conference groups to reorganize his thoughts and understanding. After the student understands his problem, he then returns to the test room for a second quiz containing similiar material, presented in different questions. The highest grade on either test prevails. However, it is recorded if a student has to return for the second quiz.

Final tests are given at the end of each unit. Students take the final test at the same time in their assigned rooms. The final tests are designed to cover all of the concepts and methods presented by the unit.

### Grades

Even though grades sometimes do present a problem, our department feels that "what is put into a subject is gotten out of it." The grades are objective with due consideration to pupil growth. Total points are added together and grades are assigned according to percent-age graph. Our aim is to motivate and inspire students to work to their fullest capabilities.

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