

AN ABSTRACT OF THE THESIS OF

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Title: COMPARISON OF AN INSTRUCTIONAL MANAGEMENT SYSTEM  
WITH A TRADITIONAL TEACHER/LEARNER MODE

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Abstract approved : \_\_\_\_\_

E. Wayne Courtney \_\_\_\_\_

Purpose of the Study

The purpose of the study was to determine whether there were significant differences in students' achievement and attitudes as a result of two different instructional strategies utilized in a vocational graphic arts program. In order to accomplish this, the following procedures were considered.

Procedures

This comparative study utilized an experimental design consisting of one experimental and two control groups. The experimental group consisted of students working within an instructional management system, and the two control groups functioned within a traditional teacher oriented instructional environment. A pre-test/post-test design was utilized with both an achievement

exam and an attitude rating scale. Data were collected for the calculation of variable correlations which included course grade and days absent. The statistical procedures used to assess the measured results were the F statistic, the Least Significant Difference Test and the Pearson Product-Moment correlation coefficient.

### Conclusions

The following basic conclusions were drawn from the study's analysis:

1. Students in the experimental group scored significantly higher on the achievement exam; the higher scores were attributed to the instructional management system treatment.
2. There was no significant difference in attitude ratings between students in experimental or control groups.

### Implications

On the basis of the findings and conclusions drawn in this study, the following implications are provided:

1. The traditional teaching/learning mode should continue to hold its place in the instructional program, but should be modified and balanced with facets of the instructional management system.

2. An instructional management notebook and individualized procedures should be utilized.
3. Provide students with a choice of teaching/ learning methodology where practical, while using traditional lecture-demonstration methods where it enhances the overall program and student goals.
4. Students should be given responsibility for laboratory instruction and management; however, students who cannot function in this environment should be directed toward a more structured program.

Comparison of an Instructional Management  
System with a Traditional  
Teacher/Learner Mode

by

John Edward Anderson

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Typed by Audrey Anderson for John E. Anderson

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# COMPARISON OF AN INSTRUCTIONAL MANAGEMENT SYSTEM WITH A TRADITIONAL TEACHER/LEARNER MODE

## I. INTRODUCTION

### Background

Much has been written about pedagogy, its development, growth, and various paths for change. While some writers decry the present rate of innovation and experimentation within one educational system, many are eager to discover alternative educational strategies.

In this age of rapid technological progress and changing human needs, it has become apparent that alternative or modified methods of teaching/learning must emerge at all educational levels. A recognition of this need to improve the teaching/learning environment has created a growing movement toward new and modified approaches to education.

Most of the new approaches to education have recognized the importance of the instructor, and many recognize a transition in the role he plays. Rose (1961) sees the competent instructor as the builder of bridges between expanding and changing subject matter on one side and a wide range of personalities on the other, personalities of people who must learn new theories, new attitudes, and new skills. According to Kuethe (1968) teaching includes

having people read certain material, see particular demonstrations, and engage in various activities as long as learning is one of the products. His definition includes the popular concept of the teaching/learning mode, with the standard teacher-student interaction in which learning is the main product. Essentially, this long accepted point of view depicts the teacher guiding the activities of a student in order to produce learning.

A variety of approaches to the teaching/learning process are clearly evidenced in all segments of an educational program. The area of vocational education, as part of the broad spectrum of career education in our nation today, has equal need for information on alternatives to the teaching/learning process. It is in recognition of this need for additional information and data about teaching/learning strategies that this study was initiated. A personal and professional challenge toward aiding "change" within a public school district was further encouraged by the content of the book The Courage to Change, edited by Roman Pucinski and Sharlene Pearlman Hirsch (1971).

#### Purpose of the Study

The major purpose of this investigation was to compare the use of traditional teacher/learner instructional methodology with that of an instructional manage-

ment system developed within the study. Student achievement was measured, as well as student attitudes toward various aspects of the teaching/learning strategies. Correlations between several variables (ie. course grade, absences, evaluation scores, etc.) were observed to identify strengths and weaknesses of program components.

The results of the study provide information and direction for modification and revision of teaching/learning methodology of all vocational education program areas in the local school district. Any modification or change brought about by the study should serve as a model for other program areas and school districts.

#### The Major Hypotheses

The major hypotheses under investigation in this research were as follows:

- 1). there is no significant difference in achievement level between students taught within the traditional teacher/learner mode as compared to those within the instructional management system.
- 2). there is no significant difference in the attitudes of students taught within the traditional teacher/learner mode as compared to those within the instructional management

system.

The independent variable was the use of an instructional management system (IMS) with the experimental group.

#### Subordinate Problems

A significant element of the study was the development of an instructional management system (IMS) for use with one segment of instruction. Comparison of the traditional teacher/learner mode with the instructional management system led to the formation of subordinate problems which included the following:

- 1). To determine if one of the two instructional management designs more adequately meets the interests and abilities of the students.
- 2). To determine the instructional management design that provides the greatest degree of learning by students.
- 3). To identify weaknesses and strengths of each instructional management methodology.

As a result of the study the following additional concerns were also addressed:

- 1). Recommendations for an improved instructional management strategy.
- 2). Changes or modifications in the existing instructional program.

### Statistical Method

A one-way analysis of variance, using the F statistic, was used to determine if any significant difference existed between 1) the achievement level scores between the experimental and control groups and 2) the attitude level scores between the experimental and control groups. (Refer to Chapter III for description of evaluation instruments.)

A subsidiary test was established in the event  $F$  was found to be significant. A multiple comparison analysis was conducted to determine where the difference lies (ie., between  $\bar{X}_x = \bar{X}_y$  or  $\bar{X}_x = \bar{X}_z$  or  $\bar{X}_y = \bar{X}_z$ ). The Least Significant Difference (LSD) Test was used for the assessment of differences among population means.

The relationship between several variables within the study were measured by means of the Pearson product-moment correlation coefficient ( $r$ ). These correlations provided additional bases for identification of strengths, weaknesses, and recommendations.

### Need and Significance of the Study

Many programs have been theorized and implemented for the improvement of instruction in content areas and the subsequent enhancement of student achievement. Awareness and concern for students' attitudes are as important as competence in this area of endeavor.

It appears that students' attitudes exert a great deal of influence upon their learning processes. In fact, Witty (1948) was one of the first proponents of this idea when he said, "In every subject area the efficacy of the instruction will be heightened by the development of an instructional program which recognizes the significance of each child's attitude." It follows, therefore, that teaching/learning strategies may be significant in influencing differences in attitudes toward an instructional program.

The changing role of the teacher, as discussed by Rose (1961), depicts a builder of bridges between expanding and changing subject matter on one side and a wide range of personalities on the other, personalities of people who must learn new theories, new attitudes, and new skills. According to Kueth (1968), teaching includes reading certain material, seeing particular demonstrations, and engaging in various activities as long as learning is one of the products. His definition includes the popular concept of the teaching/learning mode; with the standard teacher-student interaction in which learning is the main product. Essentially, this long-accepted point of view depicts the teacher guiding the activities of the student in order to produce learning.



On the other side of the issue we have new and emerging teaching/learning modes that have attempted to build upon the solid base that has developed over the years. Knezevich (1970) suggests that educators must think positively about technology as a new approach to meet the child in his own arena each day. Education, of all man's social institutions, appears to be in the best position to promote better living through technology.

The use of systems design, in this educational realm, is beginning to gain in thrust. In discussing the systems concept writers (Gagne 1965, Banathy 1968, Lehmann 1968, Yee 1970, Tosti and Harmon 1973, Stowe 1973) seem to be in agreement as to the importance and needs of systems design in education. Although the systems concept has gained some attention in recent years due to a thrust toward accountability, little attention has been given toward gaining empirical evidence about instructional management alternatives. Writers and researchers in past years and at the present time express urgency in the need for more systematic and educationally sound instructional management strategies.

There appears to be an urgent need for comparing a traditional instructional delivery approach with that of a strategy which is systematically designed and structured. This comparative study is but one step toward the understanding of attitudes and achievement of students as

affected by the type of teaching/learning strategies employed. This study provides significant input to a number of educational, administrative, and economical concerns within the public school district.

#### Definitions of Terms

In order to avoid ambiguity and inconsistency, the following definitions are included:

Attitude: An attitude is an intangible or a concomitant part of the learning process and is incorporated into a system of ideas with emotional feelings. An attitude utilizes both the negative sentiments, such as prejudice, and the positive one, which include attachments and loyalties to persons, objects or ideals.

Components: Parts which comprise a system and which are selected to accomplish specific functions required for the attainment of the objectives of the system. (In education we have human components, such as the learner, teacher, counselor; media, such as books and audio-visual equipment; facilities, such as classrooms and playgrounds; and other material and financial means.) (Banathy 1968, p.87).

Individualized Instruction: A teaching/learning strategy whereby a student selects from alternative learning paths which he can follow at his/her own rate of speed.

The instructor assumes the role of "coordinator of learning activities". Learning is enhanced through individual, small group and total class instructor contact utilized at appropriate times.

Instructional Management System (IMS): Specially developed and organized components of instruction and management which provide for a student managed, individualized program designed to increase student responsibility and initiative in the teaching/learning process. The instructor's role is that of a manager of the learning process and environment as well as personal tutor and counselor.

System (Man-made): An entity comprised of parts which is designed and built by man into an organized whole for the attainment of a specific purpose (Banathy 1968, p. 90).

Systems Approach: Common sense by design. A self-correcting and logical methodology of decision making to be used for the design and development of man-made entities. Component strategies of the methodology include the formulation of performance objectives, the analysis of functions and components, the distribution of functions among components, the scheduling, the training and testing of the system, installation, and quality control (Banathy 1968,

p. 90).

Traditional Teacher/Learner Mode: Teacher directed instruction through the use of traditional lecture, demonstration, and assignment. Little or no room for self-pacing, individual interests, or self-initiated activities. The teacher is the focal point of classroom management, instruction, and the disseminator of facts and other information.

#### Description of Population and Program

Minnetonka Senior High School is a large secondary school of approximately 2,000 students in grades ten, eleven, and twelve. This suburban school district provides educational opportunities for a wide range of student interest and abilities. All socio-economic levels are represented within the school district. This comprehensive high school provides guidance and support services for all students throughout their academic, vocational or alternative education pursuits.

The experimental and control groups for this study consisted of students enrolled in three vocational Graphic Arts I classes. Students were assigned to the three sections according to a random computerized scheduling procedure. The number of students originally scheduled into each section ranged from twenty-eight to thirty.

Normal schedule modifications and student transfers resulted in twenty-four to twenty-six students participating in each class for the duration of the treatment period. To provide equally distributed populations for the study, one student was not utilized in one control group and an additional score was used to bring control group (z) up to twenty-five.

The Vocational Graphic Arts I instructional program is a comprehensive introduction to most aspects of the graphic arts industry and related occupations. The traditional teacher/learner methods of instruction were utilized for the two control groups (y and z). The experimental group (x) worked within the instructional management system that was developed as part of this study.

The instructor was the same for each of the three groups, thus avoiding much of the bias that might occur (Tuckman, 1972). The instructor possessed a standard teaching certificate and full vocational graphic arts certification.

#### Assumptions of the Study

A number of factors effect the validity of the conclusions which were drawn from this investigation. One of these factors refers to the nature of the study group and deals with interpretations based upon results

from a single program area in one high school. This research study was designed with the assumption that there was external validity and that the students were representative of vocational students throughout the nation.

A second assumption was the provision of balance within the sample with regards to grade level, ability, sex, or prior experiences. Because of the computerized scheduling, a random distribution was assumed.

A third assumption of the study was that the population size of twenty-five, in each of the two control groups and experimental group, was adequate for this type of research.

A fourth assumption of the study was that utilization of a single laboratory for the instruction of both experimental and control groups was feasible.

A fifth assumption was that the length of the treatment period was appropriate. The second nine week period of the first semester of the 1974-75 school year was utilized.

A sixth assumption of the study was that the reduction of school district budget allocations for both instructional supplies and capital expenditures would not appreciably effect the research. A reduced quantity of hardware, software, and supplies necessitated minor

adjustment and modification of both instructional management strategies.

A final assumption was that the attitude-assessing instrument was valid. The results of the study are assumed valid internally to the degree in which the inventory measured what it purported to measure. The results of the study should be interpreted in terms of the identified assumptions.

#### Approval for Research

This research study was conducted with full approval and partial financial support from the Minnetonka Public School District. Three special project fundings were approved by the district for the developmental work involved in preparing the Instructional Management System (IMS). Written approval was obtained from the high school principal prior to implementation of the study within the instructional program.

The study was provided with encouragement and support from the Minnesota Industrial Education Association and the Vocational-Technical Division of the Minnesota State Department of Education.

## II. REVIEW OF RELATED LITERATURE

### Introduction

In an age where we are "long on knowledge and short on experience" it has become apparent that alternative or modified methods of teaching/learning must emerge at all educational levels. In recognition of this need to improve the teaching/learning environment, numerous writers and practitioners in the field have sought new approaches to education.

A review of the literature reveals a prolific amount of material which relates to new and existing teaching/learning methodology. There appears, however, to be minimal information which relates directly to instructional management activities and responsibilities.

To provide a broad base for the development of this investigation the following pertinent areas were reviewed:

- a. teaching methods and strategies
- b. individualization of instruction
- c. systems approach to education
- d. comparative studies on teaching method

The information gathered from this review of literature has been analyzed, synthesized and organized in a manner which portrays a pattern of educational progression. This review is not exhaustive survey of all literature; however it provides good coverage of a wide range of



literary sources.

Teaching methods and strategies have changed over the years. New approaches to education have emphasized the importance of the instructor, and many recognize a transition in the role he plays.

### Overview of Teaching Methods and Strategies

The instructor's changing role has progressed through a cycle to where most teaching/learning relationships involve more than one teaching strategy. The traditional methods of lecture, discussion, project, and recitation have served the educational process for a long time. These methods provide proven success at meeting the needs of a great many students. Over the past decade other methods have been developed and utilized in an attempt to provide a broader teaching/learning environment to meet the needs of more students. Such specialized techniques as simulation, programmed instruction, and team teaching are examples of new developments in the realm of teaching and learning methodology (Kuethé, 1968).

Improved methods and techniques for aiding the teaching/learning process have been encouraged by educational leaders for many years. Dewey suggested that good teaching is simply the provision of opportunity

and the creation of need for the learner to engage in the method of learning. The task of the teacher is to see that the conditions essential to learning are present. The teacher's problem is to insure that learning is progressive - that is, cumulative, and that it amounts to something in terms of the possibilities of continued growth (Axtelle, 1964).

Hayes (1968), in his study of the ways to evaluate and to improve classroom teaching effectiveness, has suggested that education has been criticized because it has not developed a satisfactory yardstick to measure teaching effectiveness. A satisfactory measuring instrument is needed so teachers may see more clearly what they should do to improve their teaching.

Barr (1948, 1952) examined many investigations of teaching efficiency of the past several decades and found that they pay insufficient attention to "the particulars of teaching" and the relationship between teacher and student. Gage, Chatterjee and Runkel (1960) have found that sixth grade teachers will modify their teaching in the light of pupil rating. This suggests that feedback to teachers can be as beneficial as it is to students. Remmers (1963) has concluded: "If 25 or more student ratings are averaged, they are as reliable as the better educational and mental test available."

Teachers have not always relied on input from students when modifying instructional methods and strategies. Learning theory has paved the route many educators have followed over the years.

According to Kneller (1967), approved methodology has respectable roots in the history of learning theory, which may be etched somewhat as follows: (1) Learning should proceed from the known to the unknown. (2) All things should be taught in due succession and only one thing at a time. (3) Teaching should be simple and straight-forward, not complicated. (4) Proper order, position, and interconnection of subjects should be preserved. (5) An item of knowledge should not be abandoned before it is thoroughly understood. (6) Instruction should be adapted to the ability of the learner. (7) Children should learn by doing.

Learning theories relating to "how students learn" have perpetuated many educational developments. Many educators over the years have stressed the development of good thought processes; certainly this is still a very real concern of today's educational leaders. John Dewey (1916), years ago, expressed the following concern for the educational process:

"Processes of instruction are unified in the degree in which they center in the production of good habits of thinking. While we may speak, without error, of the method of thought, the important

thing is that thinking is the method of an educative experience. The essentials of method are therefore identical with the essentials of reflection. They are first that the pupil have a genuine situation of experience - that there be a continuous activity in which he is interested for its own sake; secondly, that a genuine problem develop within this situation as a stimulus to thought; third, that he possess the information and make the observations needed to deal with it; fourth, that suggested solutions occur to him which he shall be responsible for developing in an orderly way; fifth, that he have opportunity and occasion to test his ideas by application, to make their meaning clear and to discover for himself their validity."

Whatever philosophical basis teachers are guided by, it would appear that most strategies have evolved over a period of time and experience. One overriding factor which seems to be in common agreement is that a teacher needs to help others to educate themselves.

In their book Managing Minds, Allen and Tiemann (1932) express the belief that if a teacher is going to help people teach themselves, he must not only know how they work, but why they work as they do. If he does this, he becomes in reality the servant, rather than the master, the guide rather than the commander. A good teacher must remember at all times that teaching is the act of making efficient learning possible.

Basic thoughts about education have not drastically changed over the years, but new and emerging teaching/learning modes have attempted to build upon this solid base that has developed. Educational programs are coming

to be better organized around more clearly defined objectives and instructional goals. Students need to have available a learning environment which enables them to reach established objectives.

Teachers must select teaching strategies which will aid students in reaching objectives. Students should be provided with ample opportunities to achieve, as well as develop thinking processes which have been deemed so important over the years. It is therefore important that the teaching strategies as well as the materials, media, and texts be adapted and geared for students to achieve.

Traditionally, teaching strategies have been classified as a series of methods ranging from lecture, discussion and recitation to the multi-method, the project, the self-discovery and the self-selection approach. All of these methods serve a vital role and are an integral part of the educational process.

The ability of each method of instruction to do the job is usually determined by the teacher's ability to organize and work with students. Each teaching method has a pattern that should be followed. The following examples by Gebhard (1971) serve as an illustration of teaching methods:

- (1) A lecture is presented - followed by a series of provocative questions centering on the contents of the lecture.
- (2) An open-ended demonstration is presented - followed by pupil observations, explanations, theorization, and testing of the proposed theories.
- (3) A discussion is initiated eliciting a variety of pupil viewpoints - followed by the requirement to substantiate these viewpoints with relevant data.
- (4) A project is initiated to serve as a vehicle - followed by cooperative planning on the part of pupils and teachers in a systematic search to enlarge certain concepts.
- (5) A problem is posed - followed by the self-discovery method in which relevant data are gathered, analyzed, and synthesized, resulting in testable hypotheses and possible solutions.
- (6) A multi-method approach is employed involving a combination of a variety of methods and multisensory materials - followed by better pupil adaptation of individual learning styles to process data, aquisition of skills, and reinforcement both of the knowledge and skill development.

Whatever method or combination of teaching-learning methods is used, each must be carefully planned and developed. Providing the optimum learning enviroment is a goal that teachers must continue to strive for; however, deciding on the correct design for an educational environment is not always easy.

According to Joyce (1968), once identified, teaching strategies are employed in several ways. First, they are used in curriculums, and at that level consist of the overall design for the curricular means within a subject area,

or a group of areas. Second, they are used to guide the behavior of teachers as they interact with students and serve as models for units or lessons. Third, they are used to shape instructional materials, or instructional systems that use media and personnel to achieve their goals.

As teaching methods and strategies continue to be reviewed and modified, Knezevich (1970) suggests that educators must think positively about technology as a new approach to meet the child in his own arena each day. Education, of all man's many social institutions, appears to be in the best position to promote better living through technology.

In writing about instructional technology, Heinrich (1968) suggests that educators need to experiment with mediated instruction which develops skills in inquiry, problem solving, and the shaping of our complex behavior patterns. The short view of technology is sometimes frightening with its man-made pollutions and its accelerated changes in our ways of behaving. Lange (1968), however, believes the long view of man's development - a theory of human development and learning - must necessarily highlight technology as the humanizing element in man's development.

In further support of educational technology, Wiseman (1968) stresses that the accumulation of infor-

mation has increased so greatly in recent years that it is impossible to make use of it by methods that were adequate less than a century ago. However, Wiseman also cautions that as with most human endeavors, educational technology has its shortcomings. Educational technology is no better than the program on which it operates.

Lessinger (1970) suggests that nothing in schools is more mechanical and dehumanizing than the dreary, endlessly repetitive routine of instructing too many children in the most basic skills. He also stresses that the technology that we develop ought not to compete with teachers; it ought to free them to do other things that now are sadly, but necessarily, neglected.

In summary, it must be noted that teaching methods and strategies cover a wide range of design. All, however, seem rooted in "age old" theory and basic fundamentals. Transitions over the years have brought changing strategies and educational goals. Dittrick (1971) suggests that over the course of the past thirty years, instructional technology has demonstrated value as a means of making conventional classroom instruction a more effective vehicle for learning.

Albert Einstein once remarked that "our age is characterized by a perfection of the means and a confusion of goals" (English and Conte, 1968). More clearly



defined and organized learning strategies will help teachers provide an educational environment that reduces the confusion of goals.

One teaching/learning strategy that has become quite widespread is based upon the individualization of instruction. A review of various aspects of individualized instruction help to put this strategy into perspective.

### Individualization of Instruction

The concept of individualized instruction is having a definite impact on contemporary education. By raising some pertinent questions in both theory and practice, it has stimulated a reexamination of the very foundations of our educational system. The results of this introspection are expressed in the concerns of the educational community for the changing process and goals of education and in the new roles assumed by its professionals (Connolly and Sepe, 1972).

What is this disruptive force in education? In a paper presented at the annual meeting of the American Educational Research Association, Heathers (1971) provided an encompassing and accurate description of what individualized instruction is and what it is not.

Education is individualized. . .as the learning goals an individual pursues, and the means whereby he works toward them, are selected for and by him. Individualization is not limited to independent learning or

learning in a tutor-student dyad. Depending on the learning goal and learner characteristics, individualized education also can occur in group contexts. Individualization is fostered through emphasizing student involvement in choosing and conducting learning activities. Managing individualized instructional programs in schools depends greatly on student self-direction accomplished either through using programmed materials or through students' developing competencies in selecting, planning, and conducting learning tasks.

Definitions such as this elucidate the reasons for the impact of this concept. It becomes quite apparent that the characteristics of individualized instruction cited by Heathers are quite distinct from those of traditional, group oriented instructional methods.

The idea of individualizing instruction is not new to teachers of vocational education. For many years the project method of instruction has served as a focal point for the development and growth of individual abilities and interests. The changing pattern of individualization of instruction has come about in part because of new developments and concepts in instructional media, educational techniques and teaching methodology (Bjorkquist, 1971).

Many people involved in the realm of education have identified the changing role of the teacher as moving from a dispenser of information to that of a manager of teaching/learning activities. It has become possible for teachers to help students learn in different ways which accounts for individual and unique differences. The task of providing

a good teaching/learning environment which meets needs of individuals is by no means simple.

Any form of individualized instruction must meet the student on his own terms. It must take into account his ability to learn, his interests, needs, motivation, educational history and experience. Individualized instruction gives the learner a role in what he studies, as well as in the rate at which he proceeds (Melching, 1969).

In meeting the individual needs of the student, aptitude and ability levels must be considered. Learning performance has been found to be directly and highly related to aptitude level (Taylor and Fox, 1967). Low aptitude students are likely to require considerably more time to achieve the same level of learning as high aptitude students. This provides a good rationale and justification for individualization of instruction. Bjorkquist (1971), however, points out that low aptitude students will not achieve as many learning outcomes in a specified period of time as will higher aptitude learners.

Most writers agree that instructional procedures must be tailored to the needs of each individual student. According to McKeegan (1968), the current concept of individualized instruction has as its objectives the preparation of a variety of instructional sequences and the development of classroom procedures which maximize the

probability that each learner will master previously determined instructional objectives at some level of competency. Experimentation with programmed instruction and computer technology, coupled with the growing humanistic concern for attention to individuality in young people, provides further support for approaches to individualized instruction.

Under individualized instruction the traditional role of the teacher is greatly modified. In describing the changing role of the teacher in Duluth, Minnesota's Chester Park School, Thomas Ogsten (1968) explained that their teachers do not spend as much time in front of the class lecturing to the students, but do spend more time working with students individually or in small groups.

There are a variety of techniques and alternatives to individualizing instruction. For some educators, one key to providing for individualized instruction would be through the preparation of individualized learning packages (Kapfer, 1968). Others would rely heavily on various audio-visual media while others would use a variety of several techniques and strategies.

For some teachers there is a fear of mediated instruction. According to Knirk and Gentry (1971), a problem that has long plagued teachers and instructional technologists alike involves the determination of appro-

priate media for specific teaching purposes. It would appear that what is needed is a broader view of media rather than the traditional, isolated view of a "teaching aid". For those teachers who are able to see the relationship between media technology and individual learning abilities there are many desirable features.

### Desirable Features of Individualized Instruction

A program based upon understandings of how a student learns, individual differences, and other teacher-learner methodology, can provide a solid base for the initiation of individualized instruction. In a report, sponsored by the Office of Education (DHEW), David Bjorkquist (1971) identified the following questions that may be helpful in building desirable features into an individualized instructional program:

1. Does the instruction provide for knowledge of results to the learner? On the basis of this knowledge of results, the learner will make adjustments to perform a given task correctly. In addition, the reinforcement for correct performance becomes an incentive for the learner. Knowledge of results may be provided to the learner in several forms. A simple statement such as "that is correct" or "that is incorrect" is one such form. In other cases, the learner internalizes the feedback process (Gagne and Fleishman, 1959). He can learn to observe whether the results of his behavior produce correct outcomes. This can be facilitated by giving the learner a model for comparison. For example, a correctly made solder joint could serve as comparison for students learning to solder.
2. Does the instructional sequence allow the student to experience success? There is truth in the old

adage, "success breeds success." Since individuals tend to repeat those experiences which they find enjoyable, they are inclined to do again the things at which they succeed. The implication for individualized instruction is that the units should be structured so the student is assured of success in learning. Instructional sequences should begin with small steps. These should be arranged in order, so the learner can proceed from those things that are basic to those which are more complex. As the learner finds success, this in itself will serve as reinforcement by relieving the tension of the learning situation (Sorenson, 1964). This, in turn, should help the student to develop confidence.

3. Are a variety of presentation modes used in instruction? The use of a variety of presentation modes seems to be justified, not because variety in itself is beneficial to learning or because the use of two communication channels will produce more learning than the use of one. However, because of learner differences and content differences the use of a variety of presentation modes is recommended (Briggs, 1968).

Media appropriate to the content to be learned should be used with individualized instruction. If motion, as the flow of electrons, is important to learning the concept, the instruction should probably include motion pictures. Oversized or reduced photographs are often helpful to the learner in developing accurate concepts. Amplified sounds can be used to good advantage in some cases. Most students will probably learn the correct sound of the pulse for measuring blood pressure best by listening to pulse sounds.

4. Does the instruction provide for some form of active response by the learner? This response may be spoken, written, or take some other form of action. The response may take the form of a simple "yes" or "no" answer or it may be considerably more complex. When learning manipulative skills it is especially important that early practice be correct. It may be as easy for the learner to practice and develop an incorrect skill as to develop a correct skill. Therefore, the instructional program should provide for the step-by-step advance of the student, and he should be required to actively participate in those learning steps (Flug, 1967). Without doing this the learner can easily assume that he is capable of performing or

that he understands without trying the task at hand and eventually have difficulty when he does try to perform the correct behavior.

5. Does the instruction provide for different rates of presentation? If they are hurried, slow learners tend to make errors. Conversely, fast learners often need to have the pace set for them so they don't waste time (Gropper and Kress, 1965). An instructional system in which the speed of presentation can be adjusted will be adaptable to the needs of more learners.

6. Does the individualized instructional system provide for branching alternatives? This means that the instructional system would not force the learner to repeat those learnings he has already acquired. Branching alternatives make it possible to adjust for differences in background and capability of the student to learn. It allows the learner to skip those units of instruction which he gives evidence of knowing. Likewise it provides for the repeat of instructional units where mastery has not been achieved with one attempt (Briggs, 1968).

7. Does the instruction provide for periodic and spaced review? The effect of learning can probably be retained longer if such reviews are provided. This will probably be accomplished by an instructional system which provides for the review of learning materials within a single instructional session. Subsequent reviews may be spaced increasingly further apart, forcing the student to recall what he has previously learned.

The questions which Bjorkquist has identified appear to be expressed in various ways throughout the literature. Knowing these, a teacher could better select an educational sequence or plan individualized instructional sequences for effectively accomplishing learner objectives. Some additional insight into the strengths and weaknesses of individualized teaching/learning methodology may be better identified through some uses of individualized instruction.

### Uses of Individualized Instruction

The decision to individualize a total program or course is usually up to the teacher. Oftentimes the partial individualization of instruction can provide good benefits to the teaching/learning process. Instructional systems often include objectives, diagnostic tests, instructional materials, and evaluation instruments. According to Burns (1971), individualizing instruction really is nothing more than applying logic to the learning act, and then, by careful planning and organization, providing an efficient method whereby learners have the opportunity to acquire behaviors in their own way at their own rate. A total systems approach may take a variety of forms.

An illustration of a totally individualized instructional system is a multimedia course which includes units in welding, polystyrene plastic molding, and concepts of electricity (Bakamis, 1969). Each of these units included instruction, required laboratory work, and self-evaluation by the student. The course units were intentionally selected because of the diversity of content and learning activity. Totally individualized instructional systems are not restricted to content which deals with acquisition of knowledge, as illustrated by the units in welding and plastic molding.



Standardized instruction may be used within many programs. Often it is easier to individualize part of a program and then expand as the materials are developed. If funds are available for purchase and/or development of a totally individualized program before it begins, this appears to be the more appropriate path to follow.

There are several ways in which individualized instruction may be used for part of a course (Kenneke, 1970). The teacher can prepare materials for a course orientation that includes course objectives and outlines, safety procedures, and administrative details. Conventional means of individualizing instruction such as instruction sheets can be used to convey these ideas to students and may be supplemented with such media as slide-tape presentations.

Individualized instruction works well as supplementary instruction, for student make up, or to provide remedial help to slow learners and nonreaders. Teachers will identify other unique situations which can find great benefit from the individualized instructional approach.

Individualized instruction for lab experiences can be very beneficial to the learner. Many examples are cited in the literature and serve as good examples to stimulate teachers in the field. One source (Gausman and Vannes, 1969), indicates that teachers at one insti-

tution made single-concept film loops and tape recordings to individualize instruction for their students. In other situations close-up photographs were used (Manning and Turner, 1970) to show the step-by-step process of correctly grinding a tool bit. Tape recorded cassettes have been utilized in providing feedback to the student from the teacher for such things as project notebooks and mechanical drawing. A slide projector and synchronized tape recordings have been used to teach disassembly of automotive electrical components (Hunter, 1970).

Individualized instructional methodology may be put into practice once teachers have the necessary information for planning this type of teaching/learning environment. Tying together all of the essential elements for individualized instruction is important. Knowing the desirable features of an instructional program, based on what is known about the way in which students learn, is critical to the development of a meaningful and accountable program.

In response to an urgent need for more information about individually managed learning, the American Institutes for Research in Palo Alto, California in 1960, began a twenty year study of some 400,000 secondary students (Weisgerber and Rahnlow, 1968). This was Project

TALENT, an in-depth study of the relevancies between individual student abilities, American educational practice, and past high school vocational trends. The continuing findings of this survey have yielded clear evidence of the need for greater tailoring of educational practice to individual abilities as a means of enhancing vocational success and life adjustment. Dr. John C. Flanagan, who conceived Project TALENT, has also conceived and is directing Project PLAN, a national project aimed at one possible solution to the need for individualized learning in the 1970's.

These projects help provide insight and support information for the development of educational programs and methods. Selecting the teaching/learning methodology that serve the needs of students is not a simple matter. Many teachers, however, have attempted to meet these needs by utilizing a variety of instructional approaches. One growing area of interest is based upon a systems approach to education.

#### A Systems Approach to Education

In a publication of the American Association of School Administrators (Knezevich, 1970), the ways of organizing students or plans for presenting instructional materials are considered a rudimentary type of intellectual technology. Many ways of organizing pupils, or sequencing

instructional experiences, and of deploying teachers in the schools have been attempted over the last century. The new technology of systems which focuses on various patterns of organization is concerned primarily with form or structure of operations. The purpose in organizing in the first instance is to design a systematic means of differentiating and coordinating human and material resources to attain objectives.

The objective of any scheme of instructional organization, according to Knezevich, would be to differentiate and coordinate time, personnel, and resources available to schools to maximize learning opportunities for all students. The fundamental value of a given pattern must be judged in terms of its capability to maximize learning opportunities and experiences and to minimize expenditure of resources without reducing learning effectiveness.

One approach that is gaining interest in many educational arenas has attempted to achieve these priorities through the use of systems design. The systems concept initially emerged during and after World War II as a result of research and development in problem solving, efficiency analysis, and the development of complex man-machine systems. In the discussion of systems, writers usually refer to the design of weapon systems such as those on combat aircraft during World War II (Finn, 1956).

What emerged from this concept, was evidence that a new method of planning and development was feasible. Identification of purpose and performance expectations enabled development of all the parts that make up a total system.

Systems methodology concentrates upon the relationship among parts. Research is often restricted to investigations of the parts themselves to maintain experimental control of the sources of variance. In this regard, Banathy (1968, p. 84) observes:

"In doing educational research, many of us have been frustrated by a demand to isolate variables and deal with them as single entities. We have faced this situation knowing that such a demand can seldom, if ever, be satisfied. In the contemporary educational setting, we have to accept the complexity of interacting variables, and it is this phenomenon which the systems approach can best accommodate. The systems approach appears to make it possible to identify functions and components, describe their interaction, and then predict, observe and measure the effect of change or variations in components and functions."

Tosti and Harmon (1973) suggest that when using the systems approach, if certain paths consistently fail to produce results (behavior change as measured by post-test), then each component (both activities and decisions) of that path should be examined. This concept has been disregarded by educational leaders for too long. It is imperative to have integration of the essential components of instruction - the teacher, the learner, and that which is to be learned (Kapfer, 1968).

Banathy (1968, p. 84) discussed a rationale for interaction of systems methodology and research:

"One of the most conspicuous characteristics of the systems approach is the necessity to change in order to improve the system. It is this characteristic and the feedback structure of the systems design that indicates that the systems approach has an inherent potential which, if properly explored, may offer a framework and a set of strategies for educational innovation and research."

Stowe (1973) believes it is reasonable to predict that systems methodology will become a valued ally to educational research. Also stressed, is the need for a great many more studies, in both the development and operations phases of instruction. To further support this concern, Tosti and Harmon (1973) suggest a radical change in the quality of American education will only come from the increased application of the growing body of knowledge about the form, purpose, and processes involved in instructional decision making.

According to Yee (et al., 1970), the application of a systems approach to educational planning requires that instructional management systems be feasibly and logically developed from their most general to most specific aspects. Other writers, such as Gagné (1965) and Lehmann (1968), have suggested the use of a systems approach to help decision-makers and workers develop an orderly program of defining needs, objectives, constraints, alternatives, selections, implementation, evaluation, and modification.

Heinich (1968) agrees that we need to experiment with instructional management arrangements that permit mediated instruction to pay for itself. He believes that inevitably the introduction of technology into any process leads to the concept of systems and the systems approach.

The goal of a system of individualized instruction must be to develop persons who seek opportunities to learn, and who have the capabilities for setting their own goals, planning an instructional program, and evaluating and monitoring their activities as learning progresses (Lindvall and Bolvin, 1970). More recent thinking, according to Hinst (1971), conceives educational technology as a systems approach to the teaching/learning process which centers around the optimal design, implementation and evaluation of teaching and learning as such.

One such method is described as Individually Prescribed Instruction (IPI): an instructional system based on a specific set of educational objectives which has correlated to these objective diagnostic instruments, teaching materials and methods (Scanlon, 1970). Another writer, Frank Gorow (1971), believes that what is needed is a cybernetic, or self-correcting, instructional system which will enable teachers to continually improve their

teaching to the point of optimum results.

It becomes quite evident that the systems approach to education is being looked at quite closely by an increasingly large group of individuals and organizations. According to many people such as Kaufman (1968), knowledge is at an ever-increasing premium, and future citizens must be able to (1) survive, and (2) contribute to the society which supports and nurtures them. It is believed that we can design teaching systems which will improve the probability of students being able to do these things, and do them with success and predictability.

An important part of the implementation of teaching systems is in the area of research and evaluation. The design of effective instructional systems must include some means of evaluating them (Watson, 1968). Research which compares the effectiveness of a redesigned course with the "old" basic course is perhaps the best method, according to Watson. Such comparisons will help us learn which variables in the learning system significantly contribute to the learning process, thus helping us discover how to most effectively use the learning resources.

There have been a large number of comparative studies which looked at teaching methods and strategies. Individualized learning techniques, such as programmed instruction, have been compared to "traditional"



instructional methodology and resulted in a variety of interesting and helpful discoveries.

#### Comparative Studies on Teaching Method

A number of researchers have examined individualized instruction as it relates to "traditional" instruction or some conventional approach such as lecture, demonstration or discussion. Gibbs and others (1968) compared conventional and programmed instruction in bookkeeping. The programmed instruction group scored significantly higher on all three of the post-tests and also experienced a 43 percent reduction in learning time.

Aiguirre (1966) studied the programmed instruction-demonstration and illustrated lecture-demonstration methods of teaching engine lathe principles and operating procedures. The author concluded that the method of instruction did not have a significant effect upon achievement, engine lathe manipulative performance, or retention.

Programmed versus conventional instruction as preparation for laboratory performance was investigated by Campbell (1969). Pupils who studied the program scored significantly higher on the written test than those who studied by the conventional method. However, no significant difference was found between scores on the performance test.

Curl (1961), when he explored the effectiveness

of a self-instructional method for teaching equipment operation, concluded that perceptual motor skills relating to the operation of certain types of photographic equipment can be taught individually by means of a self-instructional, demonstration-practice-test type of program.

Hughs and McNamara (1961) compared the learning achievement of employee classes taught by programmed textbooks with that of classes taught by conventional classroom instruction. Although a difference was found between the control and experimental group achievement means even after adjustment for Programmer Aptitudes Test scores, this could have been caused by a difference in variance of the groups.

Manchak (1965) made an experimental comparison of two methods of teaching perceptual-motor task. The findings indicated that the programmed material produced statistically significant differences in overall achievement between the two lower ability groups. There were no significant differences with upper ability subjects. Also, no significant differences in performance were found between the two groups.

Student achievement in a manipulative skill when taught by lecture-demonstration and modified programmed instruction was examined by Seal (1969). The research involved a comparison between a traditional and an

experimental method to determine student learning of beginning welding. There were no significant differences in student achievement for any of the tensile tested welds. The experimental group, however, was significantly superior on the destructive bend test.

Cochran (1966) reports on the evaluation of an experimental lettering program. Results revealed that all three methods of instruction (conventional, direct-detailed, and programmed) were equal in teaching the technical knowledge of lettering. However, programmed instruction was superior in the development of practical lettering skills.

A comparison of self-instructional methods and demonstrations teaching manipulative operations was conducted by Hofer (1963). Written tests covering the knowledge of terminology and procedure were given immediately after instruction and one week later, and indicated that students learned and retained slightly more information when they received instruction from printed programs. It was also noted that 69 percent more individualized assistance was required when instruction was presented by demonstration than when presented by programmed materials.

One comparative study (Oen and Sweany, 1971) measured the effectiveness of an individualized learning

method of instruction when compared to the lecture-discussion method. The study compared the effectiveness of individualized and lecture-discussion methods with a non-instruction (control) method in developing turfgrass competencies in 11th and 12th grade students as measured by achievement in a battery of tests. Teachers from 19 Michigan schools were randomly placed in three groups and attended workshops where they were provided with manuals, accompanying slides, audio-visual and curriculum materials, and an explanation of the study procedures. Five antecedent variable pre-tests were administered to the 632 students, and at the conclusion of the project, a battery of seven post-tests was completed.

Results revealed that the mean post-test scores were higher for students taught by the two instructional methods than the control group. The mean post-test scores of students receiving individualized instruction were significantly higher than those receiving the lecture-discussion method after removing the variance attributed to each of the antecedent variables. However, when the post-test scores were analyzed as a composite package, there were no significant differences between the two instructional methods. The individualized method was also significantly more successful in developing student ability to locate and interpret information.

The idea of research and experimentation in classroom methodology is by no means new. In the early 1920's writers such as Harl Douglas (1926) indicate there is no doubt that the primary function of the classroom teacher is to teach. This function should not be permitted to suffer the intrusion of other activities; yet progress and improvement in teaching skill and methods can be carried on only so far without definite experimentation. Progress in teaching has been dependent upon experimentation and the consequent development of new methods. According to Douglas, much of the experimentation that needs to be done in teaching must be carried on in elementary or secondary school classrooms, in a natural and normal teaching atmosphere, and by experienced and typical teachers.

There has been criticism of studies which deal with the differential effectiveness of one or more experimental treatments and a conventional or traditional instructional method (Bloom, et al., 1971; Briggs, 1968; Reid, et al., 1967; Sullivan, 1969; and Travers, 1962). This design, however, appears fully appropriate for the needs upon which these studies have been based. Without comparative studies such as these, teachers would have little evidence and direction for guiding improved educational methods.

## Summary

After reviewing a great amount of literature related to teaching methods and strategies it has become evident that no one method provides all the answers towards providing good educational opportunities. Newer teaching/learning methods, such as those associated with the individualization of instruction and instructional technology, seem to be the focal point for much research and experimentation.

As these methods are used it becomes apparent that the role of the teacher takes on a new and changing form. Hudgins (1971) discusses the role of instruction and management activities that occur in the classroom. He suggests that instruction is the broader term, subsuming teaching and management, which are coordinate with each other. The teacher must not confuse management with teaching, but rather recognize the important relationship each has to the other in providing for instruction.

Through the management of instruction a teacher can provide a planned and well organized program. Costa (1968) sums up the feeling of many educators when suggesting that, what is needed is a systematic strategy whereby a teacher assumes less and less of the direction of learning and assumes more of a catalytic instructional

role. The learner's reciprocal role would be that of assuming more and more of his self-direction and decision-making, as dependence on the teacher decreases.

The individualizing of instruction, along with the use of a systems approach, appears to have much value in providing an up-to-date instructional program for today's youth. The literature has provided evidence that the systems approach is nothing new. It is the basis of the decision-making process used by industry and government in areas where the penalty of a wrong approach is too costly to conceive. We cannot afford to use less of an approach in structuring our educational systems (Lehmann, 1968).

### III. DESIGN AND METHODOLOGY OF THE STUDY

#### Introduction

This study was designed to determine whether there were significant differences in students' achievement and attitudes as a result of two different instructional strategies utilized in a vocational graphic arts program. The experimental group consisted of students working within an instructional management system, and the two control groups functioned within an environment with a traditional teacher oriented instructional approach.

The investigation was restricted to vocational graphic arts students at Minnetonka High School in Public School District #276 of the State of Minnesota. Although the assumptions were discussed earlier, it seems appropriate to reiterate that any projections to be derived from this study are limited to analagous student populations operating in similar school situations.

#### Design

✓ This comparative study utilized an experimental design consisting of one experimental and two control groups. This statistical methodology, as discussed by Campbell and Stanley (1963), was selected for its suitability within the framework of the questions and assumptions pertinent to the study. Various types of



experimental designs depicted by Sax (1968) also provided support for the selection of a multi-group pre-test/post-test design with randomization.

The experimental treatment group (x) was administered both pre-test and post-test measures. The two control groups were utilized to identify existence of test contamination. One control group (y) received the pre-test and post-test measures. The second control group (z) received only the post-test measures. Crawford (1970) supports this concept by advising the researcher to provide one or more control groups to discover whether or not rival events exert an influence.

The following design matrix shows the strategy utilized and applies to both the achievement and attitude scales:

Students	Achievement and Attitude Measures			
	No Pre-Test	Pre-Test	Treatments (nine weeks)	Post-Test
Experimental Group (x)		n=25		n=25
Control Group (y)		n=25		n=25
Control Group (z)	n=25			n=25

### Population

The population for this study consisted of three groups of students enrolled in the vocational Graphic Arts I course at Minnetonka Senior High School at Minnetonka, Minnesota. The students were assigned to the three groups according to a random computerized scheduling procedure. Each of the groups was made up of both male and female students. Within each group were students from the tenth, eleventh, and twelfth grades.

The experimental treatment group was selected from a time block which was preceded by an instructional preparation period. This allowed for necessary preparation and modification of the facility and program. The two control groups, receiving the traditional teacher/learner instructional program, were arbitrarily identified as to which would receive pre-test/post-test evaluations and that which would receive only post-test evaluations.

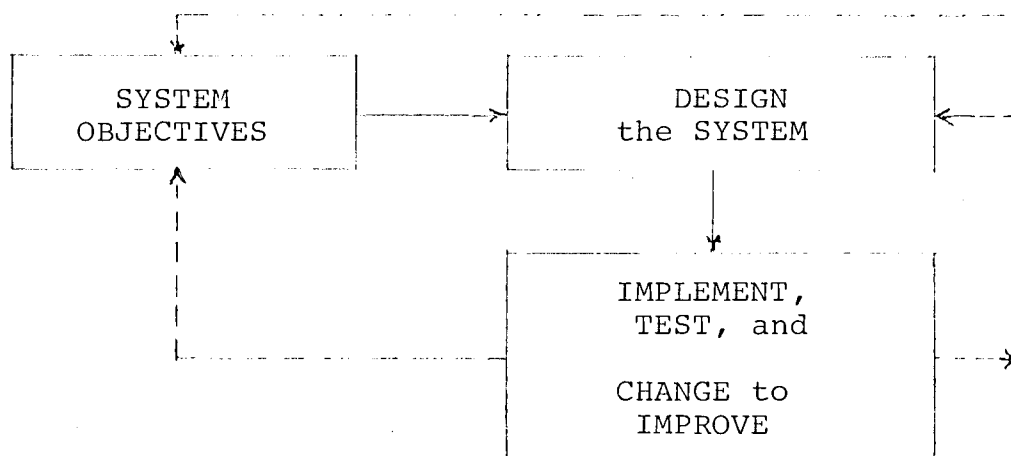
### Treatment

The treatment for this experimental study was an instructional management system (IMS). The instructional management system was developed, as part of the study, to function as a student managed individualized program designed to increase student responsibility and initiative in the teaching/learning process.

The initial impetus for the study came from reviewing

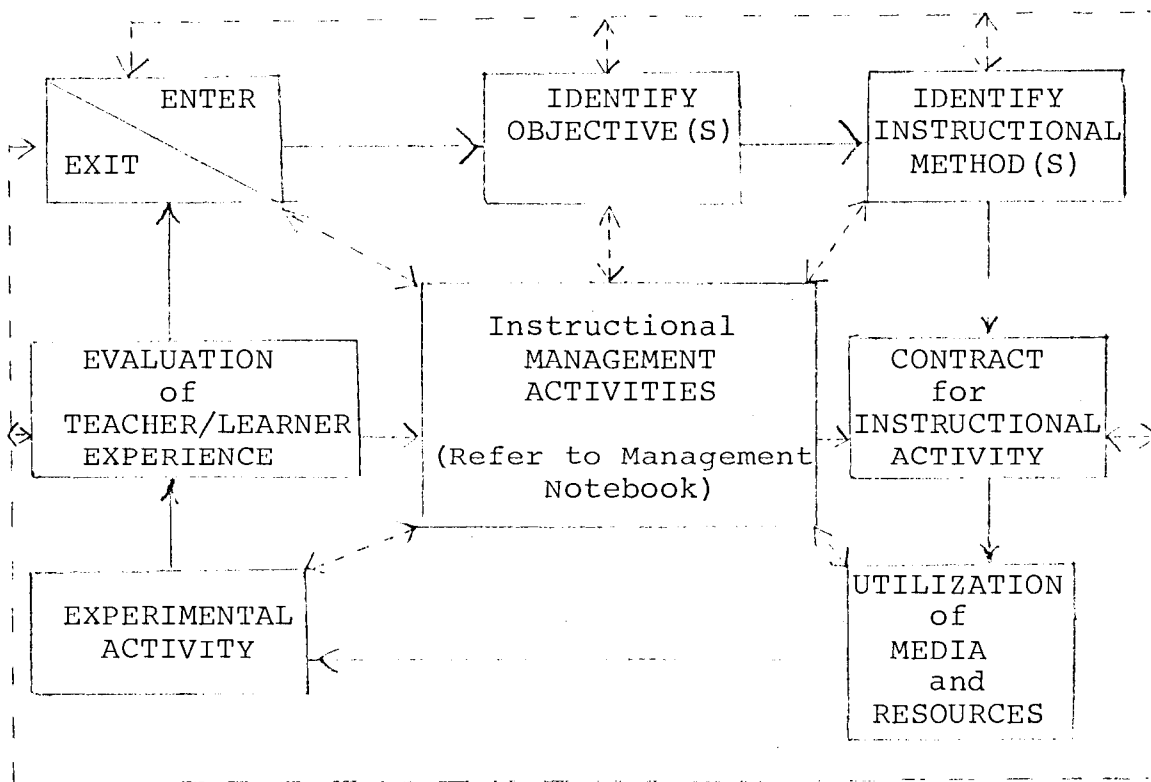
the Title III E.S.E.A. "Project Occupational Versatility" directed by John Lavender in the Highline School District, Seattle, Washington. Additional information and understanding about components of "Occupational Versatility" came from pilot project consultant, Lee Blattner, at Albany, Oregon. Portions of the management system utilized in "Project Occupational Versatility" have been adopted for inclusion in the instructional management system for this study.

The instructional management system is a student managed and individualized instructional management strategy which places emphasis on the individual. A student systematically progresses through the curriculum area utilizing a variety of instructional activities. The overall developmental design structure for the instructional management system is expressed in the following diagram (Banathy, 1968, p. 27):



----- feedback line

Each student is responsible for instructional and management activities within the program. The student maintains individual records which include orientation sheet, attendance and time utilization, student performance record, contracts, equipment and operation check list, materials cost record, and evaluation forms. The student maintains a "management notebook" in which management forms, instructional information and individual learning expedients are organized. The following diagram shows the overall system design relationship:



----- Feedback Line

Within the group, individuals assume major responsibilities for such positions as: lab manager (office attendance record, equipment and materials supervision, etc.), safety supervisor, area supervisors and supportive team. Additional responsibilities are placed upon students for such things as working with staff and other students, working on time-lines, and meeting scheduled production deadlines.

Instructional experiences are suggested, and guidelines provided, for students to achieve individual and identified course goals and objectives. Much flexibility, with opportunity for creative and self-initiated experiences, is provided for students who are able to function in this environment. For students who require greater direction, there are a number of alternative teaching/learning experiences.

A significant portion of the instructional information and materials needed for students to function within the instructional management system are available in individualized format. While the system does not incorporate a great deal of large or small group methodology, these procedures are encouraged to help achieve a cooperative and supportive attitude between individuals.

Individualized instructional materials all have been developed for students to experience a variety of

hardware and software technology. A student's selection of teaching/learning methodology may include the use of a sound-on-slide system, sound-page system, audio-tutorial instruction, print materials, and a variety of other instructional alternatives. A listing of instructional media utilized within the instructional management system may be found in Appendix A. Specific details and examples of materials and forms students use within the system may be found in Appendix B.

The treatment period for the instructional management system was during a nine week block of time. This time period coincided with the school district's second quarter of the academic year. At the conclusion of the semester students had the opportunity to elect additional instructional opportunities in this or other areas.

The instructor's primary responsibility was to function as a resource person. As the manager of a learning environment the instructor had greater opportunity to work individually with students and guide learning activities and decision making. A comparison of the instructor's time commitments within the instructional management system and the traditional teaching/learning mode are outlined in Appendix C.

### Instruments Utilized

The instruments utilized in this study were designed to assess a student's cognitive growth in the technical area, as well as a student's attitude towards the teaching/learning method, role of the teacher, and personal achievement.

An objective achievement exam was designed around a block of technical content and experiences with which the majority of students would be working within during the nine week period. The instrument consisted of thirty multiple choice items, each having four possible responses. Responses were placed on special answer forms for electronic processing (Refer to Appendix D).

The second instrument consisted of thirty statements relating to attitudes and attitudinal changes. A Likert scale using five responses, from strongly disagree (SD) to strongly agree (SA), provided for a wide choice of individual responses by students (Refer to Appendix E).

Since each of the instruments was developed as part of the study it was imperative that each be validated. The first stage of validating the instruments was the selection of a jury of experts in the field. Personnel selected for the jury included public school teachers, administrators, college and university staff, as well as the State Department of Education (Refer to Appendix F).

Each of the experts in the field was asked to review the instrument and identify any changes and modifications that seemed appropriate. All respondents provided input for modifications that were made in the instruments.

The second phase of validation for the revised instruments was a pilot evaluation with a group of fifteen students in an advanced graphic arts program. As a result of this, additional modification and clarification of the instruments were made. Upon completion of the two phases of validation the instruments were prepared in final format for subsequent data collection.

#### Collection of Data

Prior to treatment, the objective achievement exam and attitude rating scale instruments were administered to the experimental group (x) and to the control group (y). These pre-test instruments were administered on two consecutive days, with the objective achievement exam being administered first.

Throughout the nine week treatment period careful observations were made of students in both the treatment and control groups. These observations provided additional information for answering the subordinate problems identified in Chapter I.

The nine week treatment period coincided with the second quarter of the school year, thereby enabling a



pre and post evaluation which appeared to be part of the "normal" program. This timing virtually eliminated that uncontrolled variable which is usually associated with group experimental design. Respondents provided information as part of an ongoing instructional program rather than as part of an experimental study.

Additional insight into the effect of experimental variables was provided by the fact that the control group (z) received only post-test evaluations. The experimental design enabled identification of the existence of test contamination which often results between pre and post evaluations.

The post-test evaluations were administered to the experimental group (x) and control groups (y) and (z). The data collected on the objective achievement exams were tabulated on the basis of equated items, with electronic computation providing raw score results. The responses on the attitude scale were converted to numerical results, with five (5) points for the most positive response and one (1) point for the opposite extreme. Electronic computation for totals and percentages provided data necessary for the study.

Data were gathered routinely for calculation of variable correlations with such items as course grade, days absent, and evaluation scores. Resultant data were

tabulated for each individual in the three populations.

#### IV. PRESENTATION AND ANALYSIS OF DATA

This chapter presents the results of the statistical analysis for the testing of hypotheses. The results of this study have been analyzed and assembled in accordance with stated null hypotheses and subordinate questions as identified in Chapter I.

The operational hypotheses stated in the null form were as follows:

1. There is no significant difference in achievement level mean scores between students taught within the traditional teacher/learner mode as compared to those within the instructional management system.

2. There is no significant difference in the attitude mean scores of students taught within the traditional teacher/learner mode as compared to those within the instructional management system.

The null hypotheses asserted that no differences exist between the population parameters of the groups being compared. Even though sample differences may be observed, these differences can reasonably be explained as a result of random variation. The results of the analysis of the data must indicate that a population difference exists at the stated level of significance in order to reject the null hypothesis. If the results do not indicate that a population mean difference exists (except for

random variation), the null hypothesis cannot be rejected.

The 0.05 level of probability was used in this study as the level for rejection of the null hypotheses (the difference can result only 5 times in 100 when the treatment is actually having no effect). A one-way analysis of variance, using the F statistic, was used to determine whether significant differences existed among means. It was ascertained that for two degrees of freedom in the numerator and 72 degrees of freedom in the denominator, an F-ratio of 3.13 is significant at the 0.05 level.

The hypotheses were tested with a sample size of 75 vocational graphic arts students, in three equal groups, during a nine week period of the 1974-75 school year. The alternative or research hypotheses were as follows:

1. There is a significant difference in achievement level mean scores between students taught within the traditional teacher/learner mode as compared to those within the instructional management system.
2. There is a significant difference in the attitude mean scores of students within the traditional teacher/learner mode as compared to those within the instructional management system.

A subsidiary test was established in the event  $F$  was significant when testing the hypotheses. The Least Significant Difference (LSD) Test was used for the assessment of difference among population means:

$$\text{L.S.D.} = t .05 \sqrt{2 s^2/n}$$

This multiple comparison analysis enabled identification of significant mean differences.

The relationship between several variables within the study were measured by means of the Pearson product-moment correlation ( $r$ ). Those variables are identified as 1) course grade, 2) days absent, 3) pre-achievement score, 4) post-achievement score, 5) pre-rating scale score and 6) post-rating scale score. Computations were completed within the experimental group ( $x$ ) and control group ( $y$ ), with comparisons being made between group coefficients.

#### Findings Related to Major Hypotheses

The pre-test/post-test experimental research design utilized in this study identified by the assessment of the control group in comparison to the treatment group, that : 1) the groups were not significantly different, and 2) any differences which occurred in the experimental treatment group, taking into consideration the study's assumptions, could be attributed to the instructional management system.

Two major hypotheses were developed and tested in relation to the questions asked. The use of two control groups allowed measurement of pre-test influence on post-test results. An illustration of mean ( $\bar{x}$ ) scores and standard deviations (s) for each group are shown in Table 1. A comparison of post-achievement test means ( $\bar{x}$ ), between control group (y) (21.48) and control group (z) (19.60) indicated that a small degree of pre-test influence did exist. The post-rating scale mean ( $\bar{x}$ ) for control group (y) (107.60) showed minor pre-test influence when compared to the control group (z) mean ( $\bar{x}$ ) (105.72).

Table 1. Comparison of Mean ( $\bar{x}$ ) Scores and Standard Deviation (s) on Pre/Post Evaluation.

		Pre-Ach.	Post-Ach.	Pre-Rat.	Post-Rat.
Experimental Group (x)	$\bar{x}$	10.24	21.84	111.64	113.72
	s	5.44	2.99	8.55	9.59
Control Group (y)	$\bar{x}$	7.16	21.48	105.44	107.60
	s	2.54	2.90	6.16	7.58
Control Group (z)	$\bar{x}$		19.60		105.72
	s		3.43		9.23

Statistical analysis of the post-evaluation results were accomplished through the following F-test:

$$F = \frac{\text{mean square for "between" groups}}{\text{mean square for "within" groups}}$$

In the development of the analysis of variance for the three groups, the usual procedure was followed in determining sum of squares and mean squares. The results of the analysis between post-achievement scores for the experimental group (x), control group (y), and control group (z) are shown in Table 2. The statistical data indicated there are significant differences between the means tested. Null hypothesis 1, therefore, was rejected because the computed F value (1531.08) is greater than the tabular F value (3.13).

Table 2. One-Way Analysis of Variance for Post-Achievement Test Scores.

Source of Variation	df	Sum of Squares	Mean Square	F
"Between" Groups	2	29764.2	14882.1	1531.08 <sub>s</sub>
"Within" Groups	72	699.7	9.72	
Total	74	30463.9		

s = significant ( $p < .05$ )

A one-way analysis of variance between post-rating scale scores for the experimental group (x), control group (y), and control group (z) is shown in Table 3. The results of this analysis indicate a significant difference between the means at the 0.05 probability level. Null hypothesis 2, therefore, was rejected because the computed F value (3.59) is greater than the tabular F value (3.13). The computed F value (3.59) was not significant, however, at the 0.01 level of probability. (A complete outline of data used for the F-tests is found in Appendix G.)

Table 3. One-Way Analysis of Variance for Post-Rating Scale Scores.

Source of Variation	df	Sum of Squares	Mean Square	F
"Between" Groups	2	80303.6	40151.8	3.59 <sub>s</sub> *
"Within" Groups	72	804579.4	11174.73	
Total	74	884883.0		

s = significant ( $p < .05$ )

\* not significant ( $p < .01$ )

The statistical analysis, thus far, has identified that a significant difference exists between the means of the three groups on each of the evaluation instruments. A subsidiary test, established in the event F was significant, provides a multiple comparison analysis to determine



whether the difference lies between  $\bar{X}_X = \bar{X}_Y$  or  $\bar{X}_X = \bar{X}_Z$  or  $\bar{X}_Y = \bar{X}_Z$ . The Least Significant Difference (LSD) Test is used to assess for differences between population means.

Statistical results of the Least Significant Difference Test, comparing means on the post-achievement tests, are shown in Table 4. The computed L.S.D. value is 1.76. When the computed L.S.D. value of 1.76 is compared with the subtracted differences, differences are exceeded for means X and Z and between Y and Z. The means for groups X and Y, while not differing from each other, are inferior to the mean of group Z.

Table 4. Least Significant Difference Test Analysis for Post-Achievement Scores.

<u>Group</u>	<u><math>\bar{X}</math>'s</u>	<u>Differences</u> <u>(Subtracted)</u>	<u>Decision</u>
X	21.84	.36	No Significant Difference
Y	21.48		
Z	19.6	1.88	Significant Difference

---

L.S.D. = 1.76 (t.05 = 2.000 at 60 df).

As a result of this subsidiary test, the real differences between the sets of means have been identified. The mean post-achievement score for the experimental group (x) has been shown to be significantly higher than either of the two control groups. This difference may

be attributed to the instructional management system treatment.

Statistical results of the Least Significant Difference Test, comparing means on the post-rating scale, are shown in Table 5. The computed L.S.D. value is 59.78. When the computed L.S.D. value of 59.78 is compared with the subtracted differences, no differences are exceeded for any of the means.

Table 5. Least Significant Difference Test Analysis for Post-Rating Scale.

<u>Group</u>	<u>X's</u>	<u>Differences</u> <u>(Subtracted)</u>	<u>Decision</u>
X	113.72	6.12	No Significant Difference
Y	107.60		
Z	105.72	1.88	No Significant Difference

L.S.D. = 59.78 (t.05 = 2.00 at 60 df)

#### Correlations of Several Variables Resulting from the Study

The relationship between several variables resulting from the study were measured by means of the Pearson product-moment correlation coefficient (r). Correlations were computed between the following variables:

1. course grade - days absent
2. course grade - post-achievement
3. course grade - post-rating scale

4. days absent - post-achievement
5. days absent - post-rating scale
6. pre-achievement - pre-rating scale
7. pre-achievement - post-achievement
8. pre-achievement - post-rating scale
9. pre-rating scale - post-achievement
10. pre-rating - post-rating
11. post-achievement - post-rating scale

This comparison of variables resulting from the study was aimed toward identification of relationships which might have had an effect upon the teaching/learning method. Statistical calculations using the Pearson product-moment correlation coefficient ( $r$ ), for each of the variables, are shown in Table 6.

A causal relationship between variables has been established or rejected by a logical analysis. The process of computing the coefficient of correlation quantifies the relationship that was previously established. Any analysis drawn from these computations may be somewhat misleading. The significance of the coefficient of correlation for each factor is affected and limited by the nature of factors, the number of cases, and the range of score data.

Table 6. Pearson Product-Moment Correlation Coefficients for Variables in the Experimental Group (x) and Control Group (y).

Variables	Experimental Group (x)	Control Group (y)
1. GRADE/ABSENT	0.7026	0.3407
2. GRADE/POSTACT	-0.0731	0.0683
3. GRADE/POSTRAT	-0.1861	0.2654
4. ABSENT/POSTACT	-0.1476	-0.1057
5. ABSENT/POSTRAT	-0.3263	-0.0754
6. PRACT/PRERAT	0.1811	0.3380
7. PRACT/POSTACT	0.1846	0.5533
8. PRE/POSTRAT	0.1766	0.1180
9. PRERAT/POSTACT	0.5668	0.0831
10. PRERAT/POSTRAT	0.6454	0.7718
11. POSTACT/POSTRAT	0.5916	-0.0060

A closer look at the correlation coefficients ( $r$ ) of several variables is helpful in identifying varying relationships between the experimental group (x) and control group (y). The scattergram shown in Table 7 illustrates the coefficient of correlation between course grade and days absent for the experimental group (x). This coefficient of 0.7026 may be compared to a coefficient of 0.3407 for control group (y) as shown in Table 8. The coefficient of correlation (0.7026) shows a substantial relationship, indicating that days absent

Table 7. Scattergram Illustrating the Correlation Between Course Grade and Days Absent for Experimental Group (x).

X	Y
8	A
0	B
2	B
20	Inc.
7	B
6	B
11	C
2	A
13	B
0	A
3	A
6	B
8	A
11	A
3	A
7	B
2	A
7	A
3	B
16	D
12	C
0	A
8	D
4	B
2	B

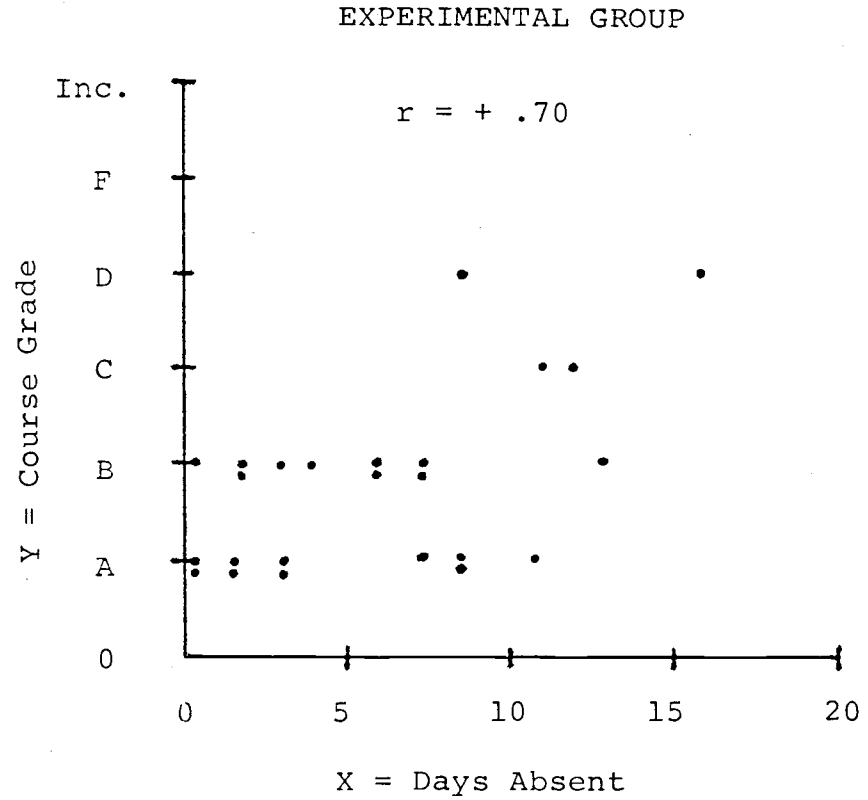
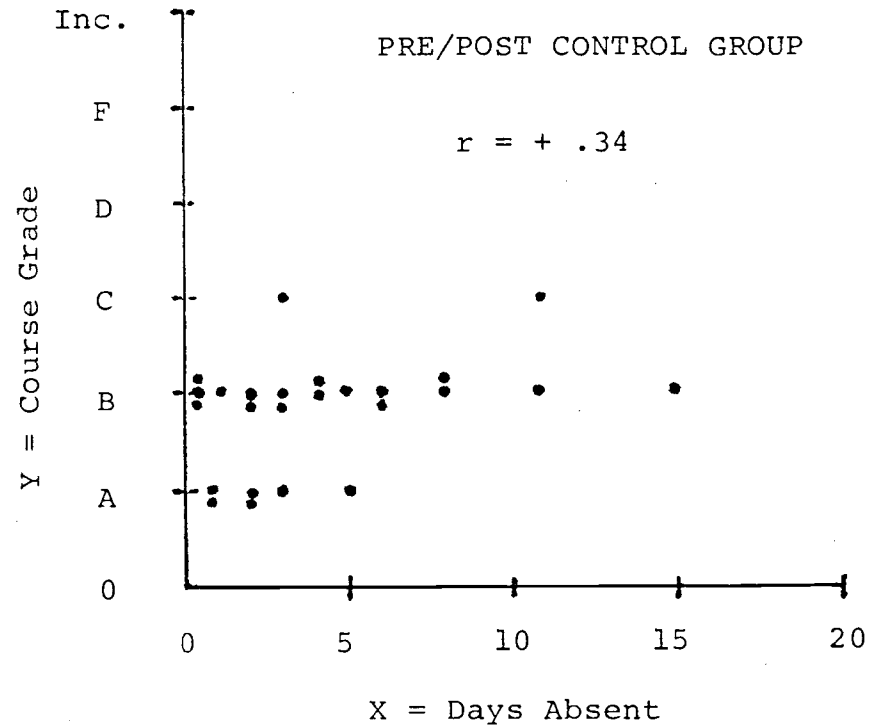


Table 8. Scattergram Illustrating the Correlation Between Course Grade and Days Absent for Control Group (y).

X	Y
2	A
0	B
6	B
3	C
11	B
4	B
4	B
2	B
5	B
8	B
0	B
15	B
1	A
0	B
3	B
4	B
5	A
1	A
8	B
2	A
3	A
3	B
6	B
11	C
1	B



in the experimental group did not hinder the attainment of higher course grade. In the control group (y), however, the coefficient of correlation (0.3407) indicates that fewer students received high course grades if they had a high absence rate.

The relationship between pre-achievement test scores and pre-rating scale scores for the experimental group (x) is shown in Table 9. There is a coefficient of 0.1811 in the experimental group (x) as compared to a coefficient of 0.3380 in control group (y), as illustrated in Table 10.

In comparing pre-achievement test scores and pre-rating scale scores there is a negligible relationship in the experimental group (x) as expressed by a low coefficient (0.1811). A slight relationship is expressed by the coefficient (0.3380) in the control group (y). There is no significant relationship between students scores on the pre-achievement test as compared to the pre-rating scale scores.

A comparison between pre-achievement test scores and post-achievement test scores for the experimental group (x) is illustrated in Table 11. The coefficient of 0.1846 is smaller than the coefficient of 0.5533 for the control group (y) as illustrated in Table 12. This analysis indicates a negligible relationship between

Table 9. Scattergram Illustrating the Correlation Between Pre-Achievement and Pre-Rating Scale Scores for Experimental Group (x).

X	Y
7	117
3	90
5	99
6	108
7	117
5	122
10	110
9	111
8	119
2	113
9	111
11	101
5	115
7	117
6	110
9	93
11	113
12	110
6	109
4	108
2	124
7	116
9	122
13	119
8	117

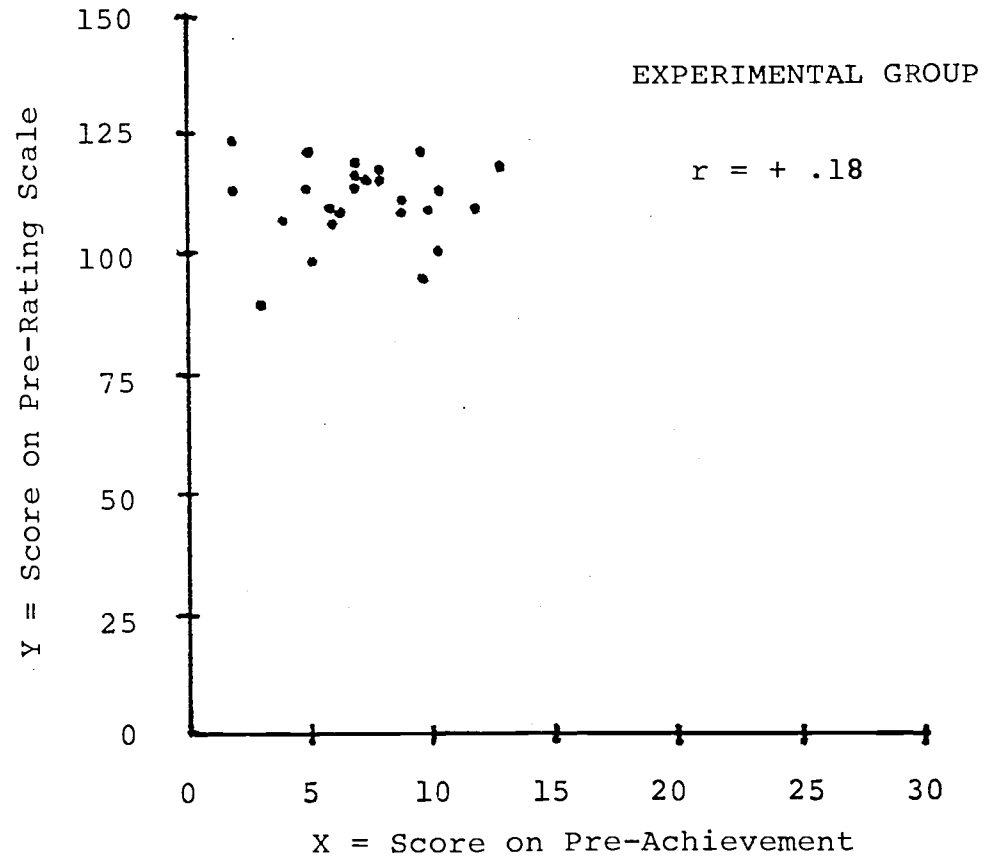




Table 10. Scattergram Illustrating the Correlation Between Pre-Achievement and Pre-Rating Scale Scores for Control Group (y).

X	Y
6	97
6	100
5	112
9	102
4	100
7	111
4	98
8	110
5	109
7	113
7	100
9	114
12	102
5	92
7	112
9	110
12	115
5	100
12	103
11	106
6	107
8	111
4	106
6	106
5	100

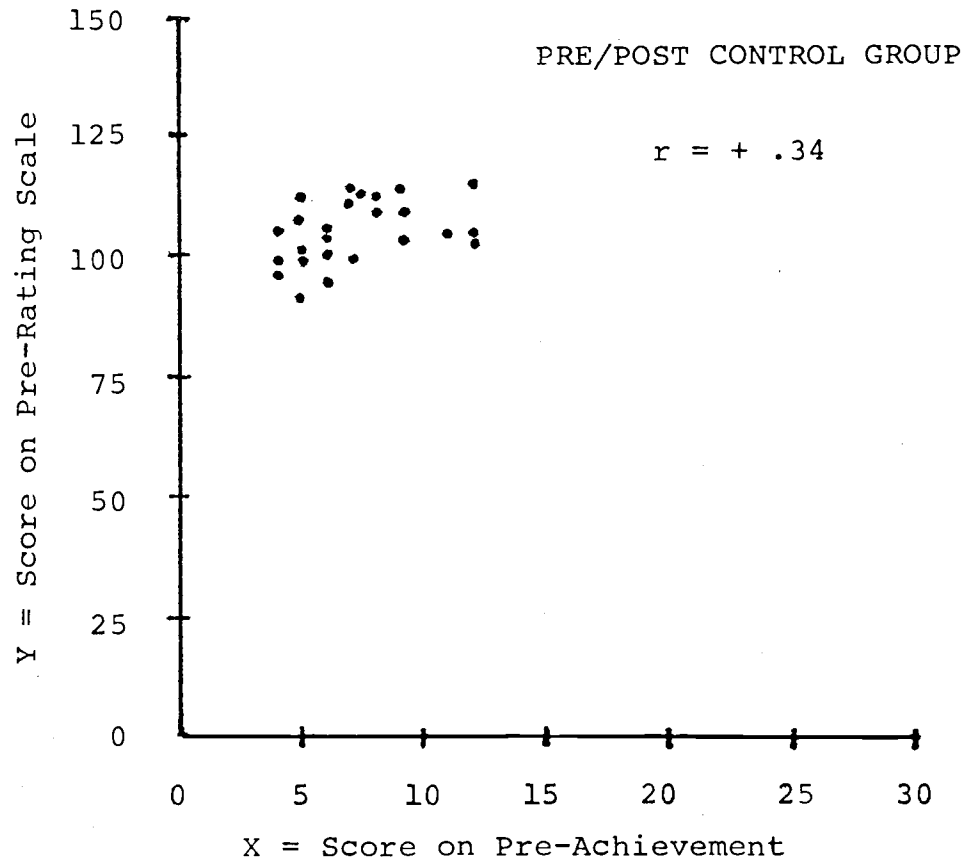


Table 11. Scattergram Illustrating the Correlation Between Pre-Achievement and Post-Achievement Scores for Experimental Group (x).

X	Y
23	7
15	3
14	5
21	6
21	7
23	5
24	10
23	9
23	8
21	2
25	9
23	11
21	5
19	7
23	6
22	9
23	11
23	12
21	6
16	4
23	2
25	7
25	9
25	13
24	8

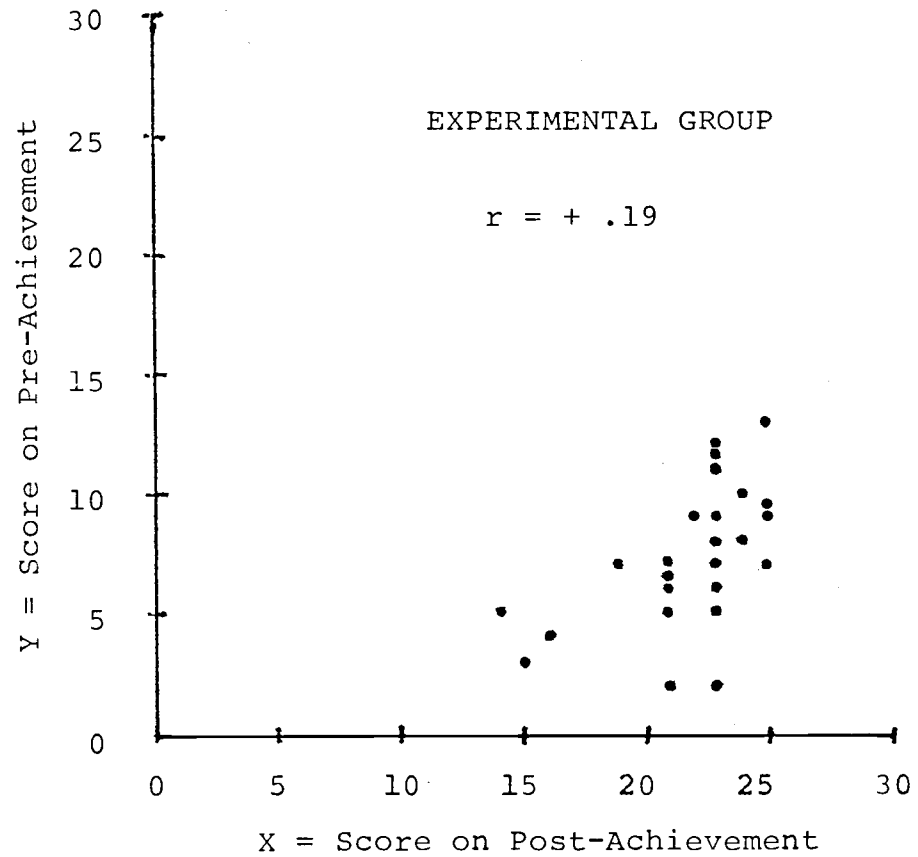
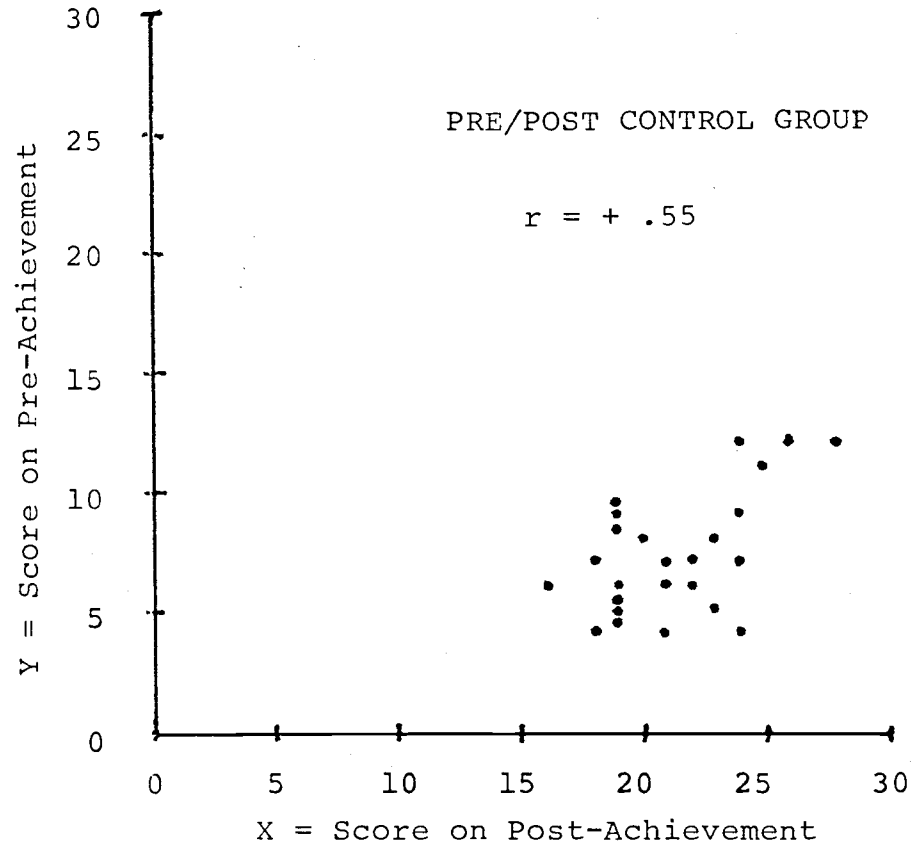


Table 12. Scattergram Illustrating the Correlation Between Pre-Achievement and Post-Achievement Scores for Control Group (y).

X	Y
19	6
22	6
19	5
24	9
24	4
18	7
21	4
20	8
23	5
24	7
21	7
19	9
24	12
19	5
22	7
19	9
28	12
23	5
26	12
25	11
16	6
23	8
18	4
21	6
19	5



pre/post-achievement scores for the experimental group (x). The control group shows a moderate relationship because of a higher coefficient (0.5533), indicating some students who scored high on the pre-achievement test also scored higher on the post-achievement test.

There is a substantial relationship between scores on the pre-rating scale and post-rating scale for each group, as illustrated in Table 13 for experimental group (x) and in Table 14 for control group (y). Each group shows a substantial relationship between pre and post-rating scale scores. This would indicate no extreme shift in attitudes; however, the greatest change in ratings between pre and post evaluation is within the experimental group (x).

A comparison between post-achievement test scores and post-rating scale scores for the experimental group (x) is illustrated in Table 15. A moderate relationship, as indicated by a coefficient of 0.5916, is contrasted to a very negligible and negative relationship in control group (y), as indicated by a coefficient of -0.0060 and illustrated in Table 16. A greater number of students scored high on both post-achievement and post-rating scale evaluations in the experimental group (x). A low negative correlation (-0.0060) within the control group (y) indicates that some students who scored high on the post-achievement test scored low on the post-rating scale.

Table 13. Scattergram Illustrating the Correlation Between Pre-Rating Scale and Post-Rating Scale Scores for Experimental Group (x).

X	Y
132	117
96	90
103	99
112	108
113	117
122	122
107	110
118	111
121	119
116	113
112	111
102	101
123	115
109	117
119	110
106	93
125	113
107	110
113	109
94	108
113	124
117	116
115	122
116	119
132	117

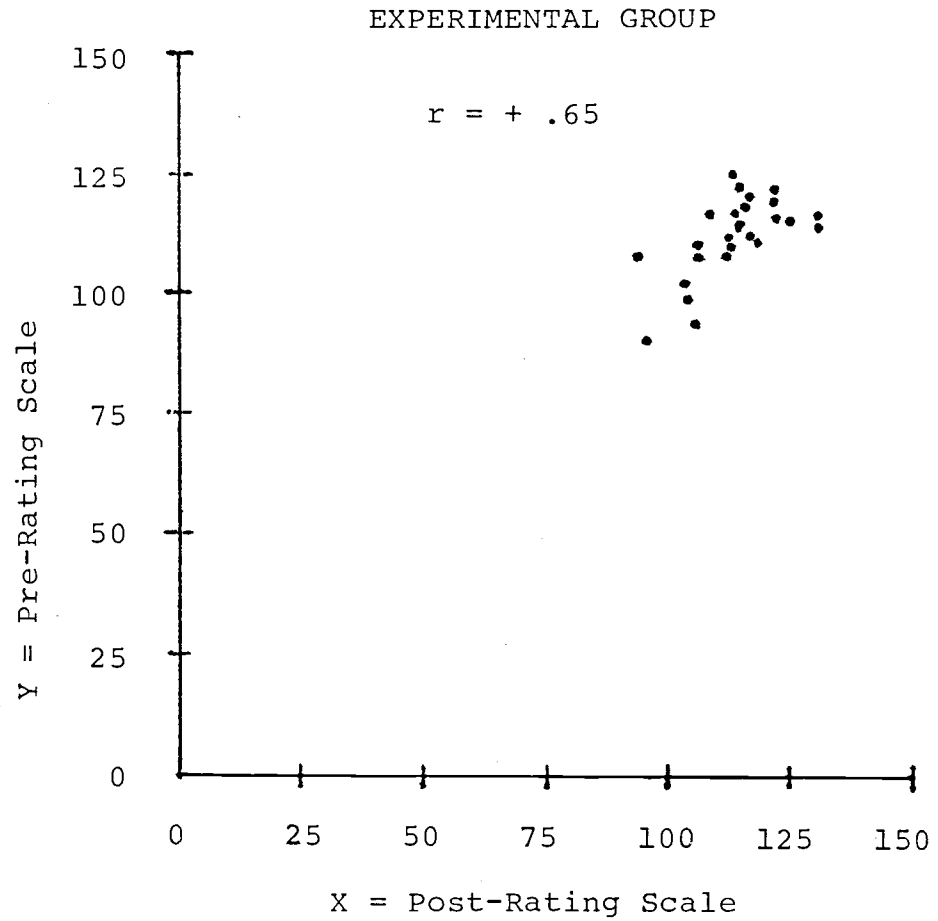


Table 14. Scattergram Illustrating the Correlation Between Pre-Rating Scale and Post-Rating Scale Scores for Control Group (y).

X	Y
110	97
97	100
118	112
100	102
100	100
110	111
100	98
114	110
113	109
116	113
109	100
116	114
101	102
93	92
113	112
106	110
113	115
108	100
104	103
103	106
109	107
126	111
105	106
106	106
100	100

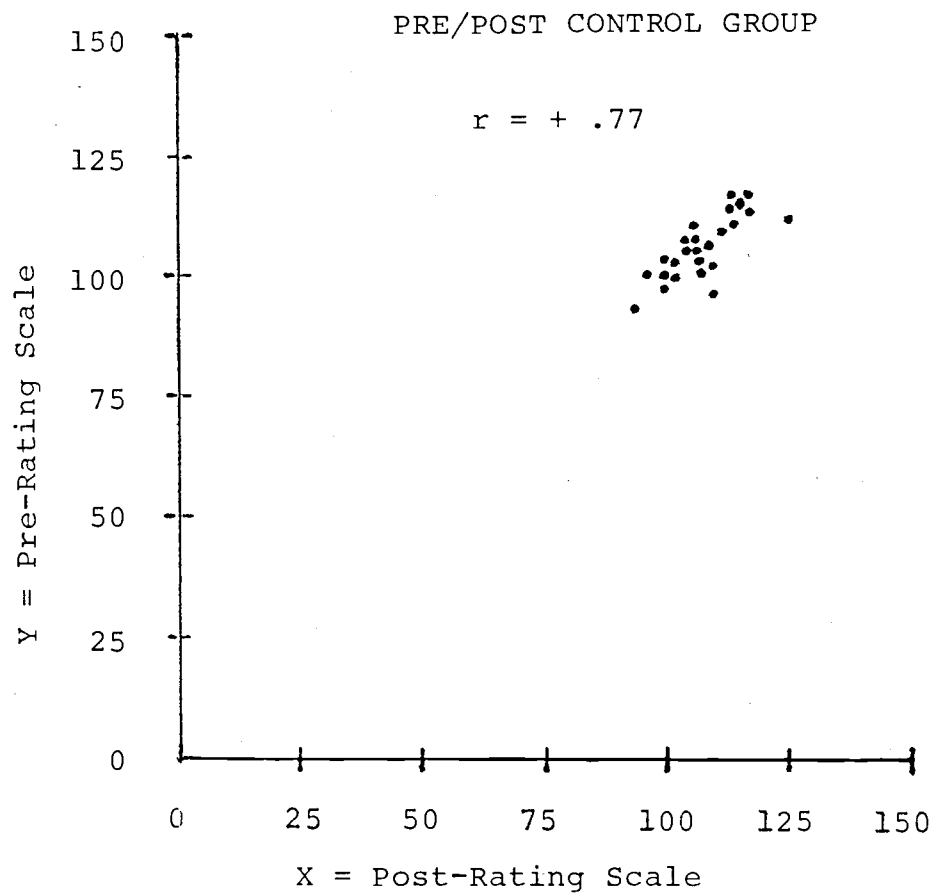


Table 15. Scattergram Illustrating the Correlation Between Post-Achievement and Post-Rating Scale Scores for Experimental Group (x).

X	Y
23	132
15	96
14	103
21	112
21	113
23	122
24	107
23	118
23	121
21	116
25	112
23	102
21	123
19	109
23	119
22	106
23	125
23	107
21	113
16	94
23	113
25	117
25	115
25	116
24	132

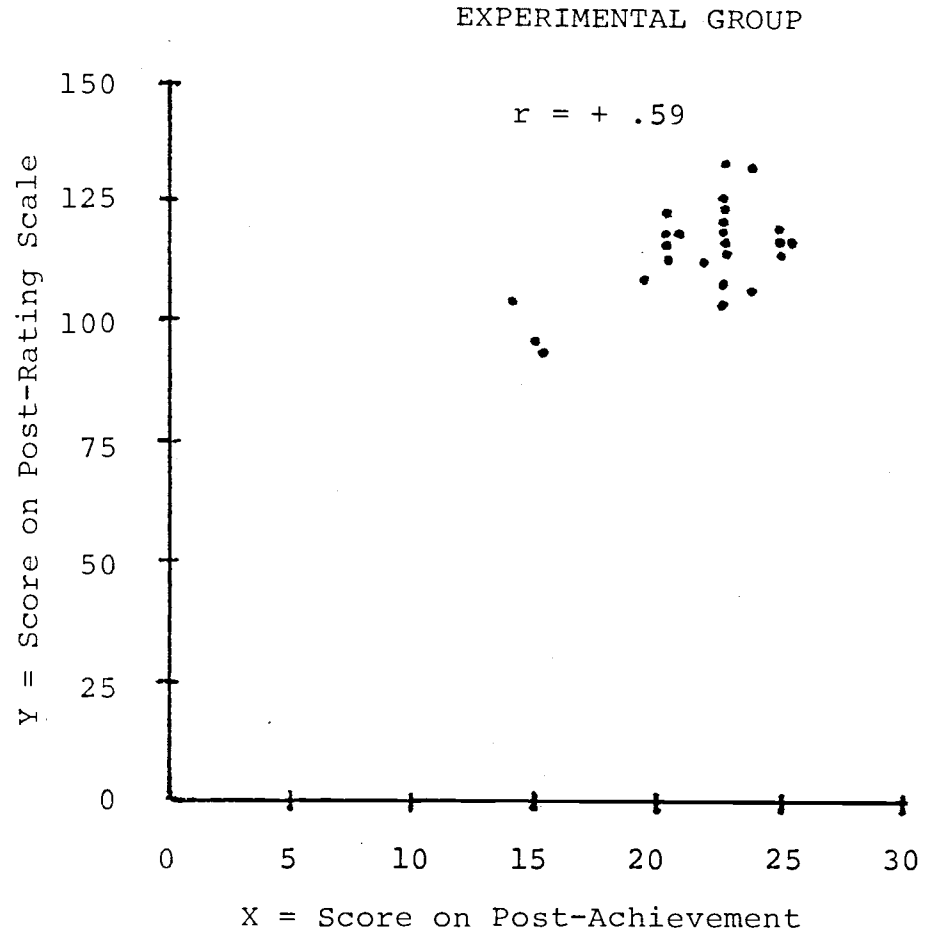
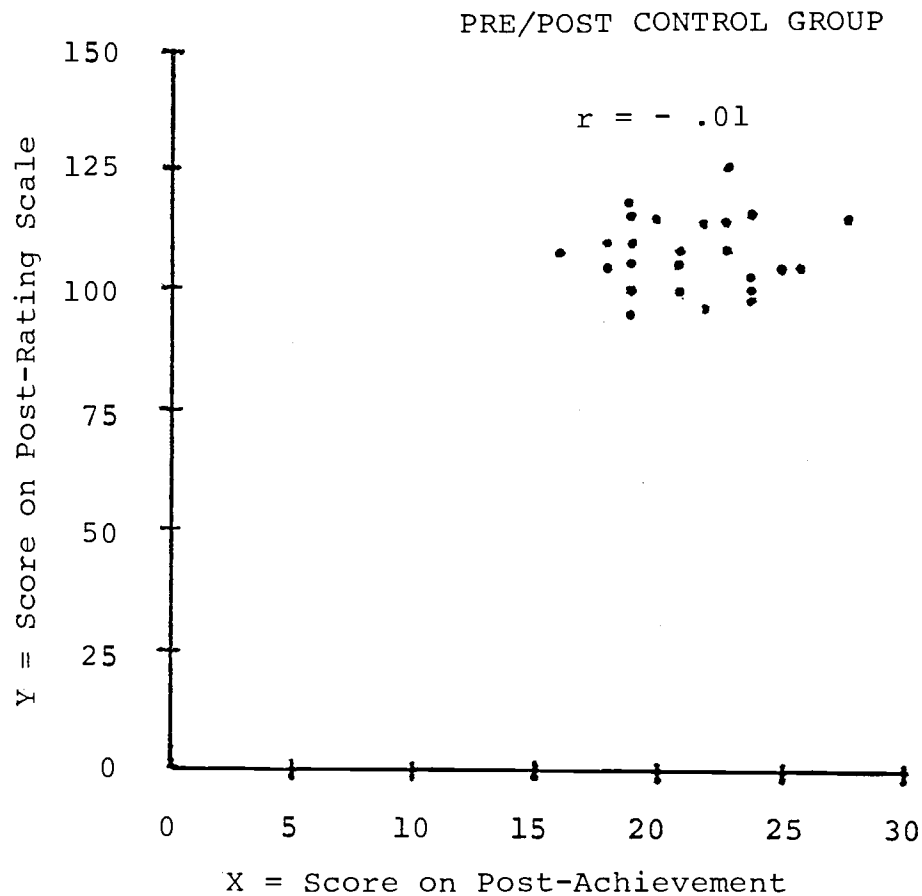


Table 16. Scattergram Illustrating the Correlation Between Post-Achievement and Post-Rating Scale Scores for Control Group (y).

X	Y
19	110
22	97
19	118
24	100
24	100
18	110
21	100
20	114
23	113
24	116
21	109
19	116
24	101
19	93
22	113
19	106
28	113
23	108
26	104
25	103
16	109
23	126
18	105
21	106
19	100





### Summary of Data

The statistical data, as assessed with a one-way analysis of variance using the F-test, indicated that the following null hypotheses were rejected:

#### Hypothesis 1-

There is no significant difference in achievement level between students taught within the traditional teacher/learner mode as compared to those within the instructional management system.

This null hypothesis is rejected at the 0.05 level of probability.

A Least Significant Difference (LSD) Test identified a significant mean difference in the experimental group (x). The difference in student achievement is attributed to the instructional management system treatment.

The statistical results of the F-test, for the rating scale evaluation, indicated rejection of the null hypothesis 2 at the 0.05 level of probability. The hypothesis was retained, however, at the 0.01 level of probability. The subsidiary (LSD) test, as previously established (in case of rejection at 0.05), indicated there was no significant difference between the means tested. The following null hypothesis is therefore retained:

## Hypothesis 2-

There is no significant difference in the attitudes of students taught within the traditional teacher/learner mode as compared to those within the instructional management system.

Correlations of several variables were computed to identify if any causal relationship existed. The Pearson product-moment correlation coefficient ( $r$ ) was used to establish the relationship. The following conclusions were drawn from the statistics calculated for the experimental group (x) and control group (y):

1. Students who were absent quite often, received a higher course grade in the experimental group (x) than did students who were frequently absent in the control group (y).
2. There was a very low relationship between pre-achievement test scores and pre-rating scale scores in both groups.
3. A comparison between pre and post-achievement test scores indicated that a negligible relationship exists in the experimental group (x) and a moderate relationship in the control group (y).
4. There was a substantial relationship between scores on the pre-rating scale and post-rating scale in both groups.

5. A comparison of post-achievement test scores and post-rating scores showed a moderate relationship in the experimental group (x) and a very negligible relationship in control group (y).

Further comparisons, as well as conclusions and implications drawn from the study, are presented in Chapter V.

## V. SUMMARY, CONCLUSIONS, and IMPLICATIONS

### Summary

The primary purpose of this study was to determine whether significant differences occurred in students' achievement and attitudes toward an instructional program as a result of two approaches in a vocational graphic arts course. One approach was labeled the experimental group and consisted of students working with an instructional management system, which was developed as part of the study. Two other groups of students were designated as control groups and included individuals working within a traditional teacher/learner mode. One of the control groups was pre and post tested, while the other control group utilized only post evaluations.

A significant part of this study included the development of the instructional management system to be tested. This teaching/learning methodology was designed to incorporate organized components of instruction and management which would provide a student managed, individualized program that would increase student responsibility and initiative in the teaching/learning process. The instructor's role was that of a manager of the learning process and environment as well as a personal tutor and counselor.

Comparison of the traditional teacher/learner mode of instruction and classroom management with the instructional management system was also aimed at providing answers to the following subordinate questions:

- 1). To determine if one of the two instructional management designs more adequately met the interests and abilities of the students.
- 2). To determine the instructional management design that provided the greatest degree of learning by students.
- 3). To identify weaknesses and strengths of each instructional management methodology.

In addition to the questions previously identified, the results of the study were to generate information concerning:

- 1). Recommendations for an improved instructional management strategy.
- 2). Changes or modifications in the existing instructional program.

The major hypotheses of the study were resolved through the use of a one-way analysis of variance, using the F statistic. A subsidiary test used to assess differences among means was the Least Significant Difference (LSD) Test. Relationships between several variables within the study were measured by means of the Pearson

product-moment correlation coefficient ( $r$ ).

The study's samples included three groups of vocational graphic arts students who were selected through a random computerized scheduling procedure. These senior high school students included both boys and girls from the tenth, eleventh, and twelfth grades.

The experimental treatment, an instructional management system, was given for a nine week period. Two instruments designed as part of the study were used to assess a student's achievement in the technical area, as well as a student's attitude towards the teaching/learning method, role of the teacher, and personal achievement. The achievement test and attitude rating scale instruments were submitted to a jury of experts in the field and pilot tested with a group of students prior to revision and subsequent data collection.

A review of the literature identifies strong support for experimentation with teaching/learning strategies and classroom management. A broad review of literature covering teaching methods and strategies; individualization of instruction; a systems approach to education; and comparative studies on teaching method provided guidance and insight into the development and progress of this study. The individualization of instruction, coupled with a systems approach to educational procedures, is encouraged

by authors as a way of adding to and reinforcing more traditional instructional methods and strategies.

### Conclusions

The conclusions are based upon data obtained through the use of an achievement test and an attitude rating scale. The conclusions are confined to populations similar in grade and interest level. Purposes other than the comparison of two instructional management methods and conclusions derived from the results were not explored in this study. The conclusions suggested from the significance testing are as follows:

1. Students in the experimental group (x), who experienced the instructional management system, were significantly different on the achievement evaluation from students in the traditional teacher/learner mode control groups. Higher scores on the post-achievement evaluation are attributed to the instructional management system treatment.

2. Students in the experimental group (x) who experienced the instructional management system, showed no significant difference in attitude rating from students in the traditional teacher/learner mode control groups. Student's attitudes relating to teaching/learning method, role of the teacher, and personal achievement, showed no statistical difference when comparing the post-

rating scale evaluation for the three groups.

3. A comparison of post-achievement test means, between control group (x) and control group (y) indicated a small degree of pre-test influence. While some pre-test contamination did exist, pre/post achievement differences in each group are attributed to each of the two treatments.

In looking at relationships between several variables resulting from the study, the following conclusions were drawn:

1. The number of days a student was absent from class had less effect on course grade within the instructional management system than within the traditional program.

2. There appeared to be no significant relationship between pre-achievement test scores and pre-rating scale scores within the groups, nor was there any relationship within each group on the same post evaluations.

3. There was a negligible relationship between pre/post-achievement scores for the experimental group; a moderate relationship existed between pre/post-achievement scores in the control group. Achievement within each group was attributed to each of the treatments.

4. Within both groups a substantial relationship existed between pre and post-rating scale scores. Students' attitudes remained very consistent during the treat-



ment period.

Analysis of items on the attitude rating scale provided data that were helpful in drawing conclusions and making recommendations. Selected items from the attitude rating scale were calculated in percentages for a clump of responses (ie., SD and D; A and SA) and summarized as follows:

1. An average of 84% of all students evaluated in all groups indicated that students should have responsibility for their own classroom management (ie., attendance, record keeping, etc.).

2. Within the instructional management system group 72% of the students did not want to be told what learning activities to work on, as compared to 60% of the traditional control group.

3. Students in the instructional management system were 92% in agreement that they would work in class if the teacher were not present, as compared to 88% in the traditional control group.

4. The instructional management group were in 64% agreement that the teacher should not always control classroom activities, as compared to 52% in the traditional control group.

5. Both groups of students average 64% agreement that a lot of time was not wasted while waiting for the

teacher to help them.

6. There were 76% of the students in the instructional management system group who wanted the teacher to demonstrate and talk about a machine operation or process before they did it, as compared to 84% in the traditional control group.

7. The instructional management system group were in 80% agreement that assignments and lab activities should not be determined by the teacher, as compared to 64% in the traditional control group.

8. Using audio-visual equipment and material to learn information, new processes, and the use of equipment was favored by 64% of students in the instructional management system, as compared to 44% of students in the traditional group.

Student responses to all items on the attitude rating scale provide insight and direction for recommending improvements and modifications in teaching/learning strategies and methods. A summary of responses on all attitude rating scale items is found in Appendix H.

### Implications

On the basis of the findings and conclusions drawn in this study the following implications are provided:

1. The traditional teaching/learning mode should continue to hold its earned place in the instructional

program, but should be modified and balanced with many facets of the instructional management system utilized in this study.

2. Continue development of individualized instructional procedures to augment student progress and provide spontaneous, remedial, supplementary, or make-up instructional opportunities.

3. Utilize instructional management notebook procedures, with revised forms and informational materials.

4. Provide students with a choice of teaching/learning methodology where practical, while utilizing traditional lecture-demonstration methods where it enhances the overall program and student goals.

5. Students should be given responsibility for laboratory instruction and management; however, students who cannot function in this environment should be directed toward a more structured program.

6. The teacher's role should be modified to allow time to work with individual students; however, the teacher should also provide large and small group experiences when appropriate.

The implications resulting from this study are appropriate for a similar program with similar constraints and assumptions. The implications are very appropriate for existing industrial/vocational education programs

within the Minnetonka Public School District.

It is apparent that many of the techniques and strategies within the instructional management system would lend themselves to various school programs in other areas. The implications derived from the study should guide the implementation of such a strategy.

Future studies are needed to ascertain the specific relationship of variables in relation to the instructional methodology. Larger populations should be utilized and a variety of educational areas analyzed in the conduct of similar research.

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## APPENDICES

INSTRUCTIONAL MEDIA

Note: The following instructional media items were utilized within the instructional management system.

- (1) Cassette Tape Recorder
- (10) Cassette Tape Players
- (1) Slide Projector
- (2) Tabletop Projection Units
- (2) Filmstrip-Cassette Player
- (10) Multiple Listening Stations
- (20) Headphones
- (5) Sound-Page Systems
- (2) Sound-on-Slide Systems
- (1) 35mm Camera and Accessories

A wide variety of software and resource materials were purchased or developed as needed.

\* \* \* \* GRAPHIC COMMUNICATIONS \* \* \* \*  
COURSE INFORMATION

WELCOME

A warm welcome to you as a student in the area of Graphic Communications. Your participation in this Industrial Education program at Minnetonka should help to increase your career information, aid in career decision making, and enhance future career goals and options.

You have a unique opportunity to gain first-hand knowledge and "hands-on" experience in one of the largest and important technological fields within our society.

You have the opportunity to participate in a wide variety of learning experiences which are aided by individualized and/or group instruction.

You will share in the selection of educational experiences and the management responsibilities associated with this instructional program

We are proud of our facility and hope you will also become part of that pride by helping fellow students and teachers keep the lab an orderly and safe place to work.

Please read the following information carefully, as it should help guide you toward reaching goals and objectives within the graphic communications program.

STUDENT "MANAGEMENT NOTEBOOK"

You will be assigned your own personal "management notebook" for use in the lab. The notebook is color coded according to your class period. The number on the notebook is your laboratory number (Lab #) and should be used as an identifying number, after your name, on all materials which belong to you. As you enter the lab, please pick up your "management notebook" and take it to the area in which you will be working.

The notebook contains information and forms which shall

be used by you each day. This is an opportunity for you to develop responsibility and abilities to be self-sufficient, productive, and adaptable. Please return your "management notebook" to the rack at the end of each class period.

### INSTRUCTIONAL AREAS

The major areas of the Graphic Arts Laboratory are:

- Planning - Resource Area
- Silk Screen Area
- Letterpress Area
- Lithography Area
- Photography Area

These areas represent physical divisions within the lab and are used for a great number of other graphic communications activities.

As you work within the various areas of the lab you should be aware of the location of tools, materials, and equipment, so that they may be returned to the proper location.

### SAFETY

You are expected to know and obey all laboratory safety rules and regulations. Power equipment or guillotine paper cutter should not be used until you have received proper instructions and permission where required. (Refer to Student Performance Record) Any injury, no matter how slight, is to be reported to the instructor AT ONCE. Any student with allergies or sensitive skin should be extremely cautious when working with solvents and chemicals. BE SURE to advise your instructor if special care must be exercised to assure complete safety and healthy working conditions for you as an individual. (Refer to sheet on Safety Rules for the Graphic Arts Lab)

### STUDENT PERFORMANCE RECORD FORM

This form is for your use in recording your activities in the lab. As you complete an activity, a process, or use a piece of equipment which is listed, mark in front of the appropriate listing. If you do an activity that is not listed, record it on the appropriate area blank. Be sure to obtain your instructor's signature for a machine safety check when indicated on the performance record form or on the machine.



MATERIAL COST RECORD FORM

Materials needed to carry out "basic" learning experiences for the course shall be made available at no cost to you. Additional materials used for more personalized and "special" activities shall be available to you at minimal cost.

Please record all materials and supplies which you use, along with the cost of each item. (Refer to price sheets in lab) Materials may be paid for near the end of each nine week period. Be certain to obtain a receipt which has been signed by your instructor.

ATTENDANCE AND TIME UTILIZATION FORM

Mark this sheet for each day you are in class. Refer to the key at the top of the sheet to see the different things you should mark. Note the examples shown on the form. This information shall be used to evaluate your participation in class activities and should be carefully kept up-to-date.

PRODUCTION PLANNING SHEET

Each activity or graphic product must have a completed "production planning" form made out before starting work. Ask to have your instructor check the plan if you are not sure of its accuracy. The plan should include all sketches, list of procedure, and other necessary information. Be sure to include a listing of materials and cost. Place the planning sheet in your "management notebook" with the appropriate instructional unit information.

CONTRACT FORM

Activities not identified as part of an instructional unit must be approved by your instructor. Complete a contract form and obtain your instructors signature before starting the activity. Use this form for "extra" or more challenging instructional activities which will help you to attain your course objectives. Place the approved form in your "management notebook".

USE OF REFERENCES AND RESOURCES

In the Planning - Resource Area (as well as other locations) you will find many pieces of equipment and resource

materials to use in learning about tools, machines, processes in the lab, and for helping you solve the problems you may encounter as you carry out learning experiences.

Equipment, such as cassette tape recorders, film-strip projectors, sound-on-slide, sound-page, etc., are available to help you as an individual. Software (instructional materials) is continually being developed and shall be listed in the Planning - Resource Area and on instructional unit sheets.

Reference books are available for your use in the lab. (Refer to the listing of Reference Books)

Please return all materials and equipment to the proper location, keeping it clean and in good working condition.

#### PERSONNEL PROGRAM

Each student in your class will be encouraged to participate in the personnel program which is designed to help provide an orderly, safe, and more comfortable working atmosphere in the lab.

Responsibility will be given to each student under each of the following personnel titles:

Lab Manager	(1)
Safety Supervisor	(1)
Area Foreman	(5-7)
Area Specialist	(remainder of class)

Please put away your work and clean-up the area you're working in at the end of each class period. Please allow two to five minutes to carry out your personnel assignment at the end of each class period. (Refer to personnel assignment sheet and instructions posted in the lab)

#### GENERAL AND SPECIFIC COURSE OBJECTIVES

To help guide you and provide written rationale for instructional activities within the graphic communications program, "broad course objectives" have been identified (Refer to "management notebook"). The general, or broad course objectives, provide support and get direction from

Goals and Objectives for Contemporary Industrial Education in Minnetonka, as well as in the State and Nation. (Refer to "management notebook")

It is hoped that you and your parents will read these objectives, so that the purpose and value of Industrial Education programs within the "total" educational program at Minnetonka may be better understood.

Specific course objectives are identified within each instructional unit. You are encouraged to develop and work toward your own additional objectives during this course.

### INSTRUCTIONAL UNITS

Many of the instructional areas within the graphic communication program have been developed as "instructional units" to assist you in carrying out an organized and more effective learning experience. Each instructional unit contains the following information to aid you:

- Title
- Introduction
- Performance Objectives
- Suggested Instructional Media
- Lab Activities
- Evaluation

Unless indicated, the instructional units do not have to follow in numbered sequence. You should start with unit one and then select any unit that may interest you. You should attempt to complete as many units as possible, to provide a broad educational experience. You and your instructor should work out an instructional plan for you to follow during the course.

Note: Some of the instructional units are in the development stage; check with your instructor for additional information.

### EVALUATION AND GRADING

All of the work completed in this course shall be evaluated by both the instructor and you (the student).

Evaluation is built into the instructional units in the form of a self-quiz and lab activities. Self-evaluation is an important aspect of this course.

As indicated in the objectives for the course, participation, demonstration of positive attitudes, and cooperation, are an important part of this program. These personal qualities aid in the development of a technical competency for the future.

At each grading period, you and your instructor shall determine a fair letter grade (A, B, C, D, or Inc.) that has been earned by you. The grade shall be based upon evaluation of the following criteria:

- Quiz scores and Technical Competency. . . . 50%
- Attainment of objectives related to attitudes. . 25%
- Participation in class activities. . . . . 25%

Because many elements in the evaluation are very subjective, each student plays an important part in the determination of a letter grade that will most accurately indicate his/her own progress within the traditional grading system.

Each student who works to their maximum capacity or potential has the opportunity to earn a maximum letter grade for the course.

LET'S GO TO WORK!!!

After you have reviewed the material in your "management notebook", you should start on UNIT #1 - INTRODUCTION AND ORIENTATION TO GRAPHIC COMMUNICATIONS.

Please use your instructor as a resource person when you need assistance. He is available to help you both during class and other times of the day that you may desire.

GOOD LUCK!!

\* \* \* GRAPHIC COMMUNICATIONS \* \* \*

BROAD COURSE OBJECTIVES

Every student, to the limit of his capacity, should have the opportunity to:

1. *demonstrate an understanding of the graphic communications processes in an instructional setting.*
2. *demonstrate a working knowledge of the impact of graphic communications upon daily life.*
3. *convert ideas into rough visual representations and layouts using the basic principles of planning, design, layout, color and other artwork activities.*
4. *demonstrate a working knowledge of methods and materials used in assembling images, from the development of a rough layout through typesetting to the finished piece of art.*
5. *convert black and white art into film; including basic methods of converting camera-ready images to film negatives and positives.*
6. *prepare a variety of printing plates and transfer images to paper using all of the basic graphic communications processes.*
7. *convert the printed sheet into finished products through a variety of finishing procedures.*
8. *collect and review data pertaining to the size and scope of graphic communications and its allied industries from a social and economic viewpoint; including the many facets of graphic communications occupations, their requirements and employment opportunities.*
9. *demonstrate pride in good workmanship and the ability to evaluate his own accomplishments objectively.*

10. *demonstrate good attitudes and practices concerning the health and safety of himself and others.*
11. *demonstrate positive attitudes toward himself, his work, and his daily relationships with others.*
12. *demonstrate attitudes of self-confidence, self-discipline, self-reliance, resourcefulness, independence, and industry which will enable him to plan his work well and to follow an orderly work procedure toward the completion of each task.*

*NOTE: The BROAD COURSE OBJECTIVES should be worked toward by each student enrolled in a GRAPHIC COMMUNICATIONS course.*

*YOU are encouraged to develop your own objectives which can guide your efforts in meeting individual needs. Your personal objectives should become an integral part of the broad course objectives worked toward.*

*Inform your instructor of personal objectives you wish to work toward.*

GOALS AND/OR OBJECTIVES  
for  
CONTEMPORARY INDUSTRIAL EDUCATION

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Definition of INDUSTRY:

*Industry is an institution within our society that applies technology and utilizes human and natural resources to develop, produce, distribute, and/or service something of value for society.*

Two Primary Goals of Contemporary Industrial Education:

- *Provide students the opportunity to develop an understanding of industry and its role in our society.*
- *Provide students the opportunity for occupational (career) exploration and/or for the acquisition of skills for employability related to industry.*

Contemporary Goals may be logically grouped in three categories:

INDUSTRIAL LITERACY

*Developing an understanding of industry and its place in our culture.*

TECHNICAL LITERACY

*Developing competencies necessary to complete tasks related to industrial production, maintenance and service.*

*Developing an understanding of technology as related to communications, structures, and systems.*

CAREER LITERACY

*Discovering and developing talents, interests, attitudes, and a realistic self-assessment as related to industrial-technical careers.*

Industrial Education courses in the Minnetonka Public School District 276 attempt to enable students to reach various levels and stages within each of the three categories of INDUSTRIAL LITERACY, TECHNICAL LITERACY, and CAREER LITERACY.

Individual course goals and objectives relate to "key concepts" within the categories and may be modified to meet individual student needs. The following are examples of "key concepts" within each group:

INDUSTRIAL LITERACY:

*Research and Development*

*Management*

*Finance*

*Manpower*

*Materials*

*Energy*

*Communication*

*Production (including construction)*

*Marketing/Distribution*

*Maintenance*

*Property*

*Procurement*

*Effect of Industry on Society*

*Effect of Society on Industry*

TECHNICAL LITERACY:

*Manipulative Skills*

*Operation*

*Maintenance*

*Service*



*Technical Information*

*Techniques*

*Application of scientific and  
mathematical principles, processes  
and materials*

CAREER LITERACY:

*Self Assessment*

*Interests*

*Physical Potential*

*Mental Potential*

*Occupational Opportunities (Industrial)*

*Educational Needs*

*Career Classifications*

*Employment Benefits*

*Retraining*

*Career Development*

*Desired Life-Style and Status*

*Anticipated Monetary Reward*

*Advancement, Goal Achievement*

*Responsibilities*

*Employment Conditions*

*Individual Characteristics*

*Human Relationships*

*Safety Consciousness*

*Quality and Efficiency in Performance Tasks*

NOTE: Students are encouraged to set their own objectives and work toward their attainment along with stated course goals.

INTRODUCTION AND ORIENTATION TO GRAPHIC COMMUNICATIONS

This unit is designed to introduce you to graphic communications and its impact upon daily life. An orientation to graphic communications in an instructional setting is intended to help you understand opportunities and expectations that should make your learning experiences very enjoyable and rewarding.

After completing this unit you should know:

- a. the broad course objectives (see attached sheet).
- b. the nature of the teaching/learning system being used.
- c. the specific requirements and evaluation techniques.
- d. general safety rules for the graphic arts lab (see attached sheet).
- e. how those in the world around us communicate ideas.
- f. the wide range of information and material within graphic communications.
- g. the basic stages of developing a graphic communication.
- h. new graphic communications terms.

Performance Objectives:\*

- \* *Performance will be measured by written and/or oral questions. Your achievement level will be acceptable if the responses meet or exceed ninety (90%) correctness.*

You should be able to:

1. demonstrate your understanding of the instructional program and lab by identifying:
  - a. broad course objectives
  - b. the teaching/learning system
  - c. course requirements and evaluation techniques
  - d. general safety rules for the graphic arts lab

2. define or explain the following terms:
  - a. communication
  - b. graphic communication
  - c. design (artwork)
  - d. image generation (image assembly)
  - e. preproduction (Image carrier preparation and photo conversion)
  - f. production (image transfer)
  - g. bindery operations (binding, finishing, packaging)
3. identify and diagram six commonly used graphic communication production processes.
4. identify three items which contain graphic communication produced by three different methods and identify the production method of each.

Suggested Instructional Media:\*

\* *You are strongly encouraged to utilize the instructional media identified below. You may wish to select other additional media for clarification or for gaining greater depth in this instructional unit. Please make use of outside references and resources whenever you have the opportunity.*

A. Information Sheets:

- a. broad course objectives
- b. the instructional management system
- c. course requirements and evaluation techniques
- d. general safety rules for the graphic arts lab

B. References: (in Planning-Resource Area)

<u>TITLE</u>	<u>AUTHOR</u>	<u>PAGES</u>
<u>Graphic Communications</u>	Broekhuizen	1 - 18
<u>Communicating With Graphics</u>	A.B. Dick Co.	All
<u>Graphic Communications</u>	Addressograph-Multigraph Corp.	All

C. Equipment Operation Sheets: (Instructional Media)

- |                    |    |
|--------------------|----|
| a. sound-page      | f. |
| b. sound-on-slide  | g. |
| c. filmstrip       | h. |
| d. audio cassette  | i. |
| e. slide projector | j. |

- D. Instructional Media: (Software - as additional material is developed it shall be listed.)

Lab Activities:\*

- \* Please complete the following lab activities. These are listed as a guide for you. You may wish to substitute other activities (with instructor's permission) and/or add to the activities indicated.
1. "Walk around the lab" - learn where each area is located and begin to learn the "language" of graphic communications.  
  
*Caution: Do Not Turn On Equipment Until You Have Received Proper Instruction. (Refer to safety procedures)*
  2. Read the instructions on operation of instructional media (hardware) and be able to use each one properly.
  3. Locate and identify the instructional media (software) available which can help you in your learning experiences. (Additional materials are continually being developed)
  4. Select four (4) graphic communication items from home. On one 8½ x 11 sheet of paper mount a sample (no larger than 3"x3") of each of the four items. Under each item identify the product and the production method used to produce the graphic communication. You should have at least three (3) different production methods represented. Place the finished sheet in your "management" notebook.
  5. Other (Optional)  
  
*You may "contract" for additional lab activities that will add to your learning experiences in this area. Please complete a CONTRACT form before beginning this activity. Place the completed contract in your "management" notebook.*

Evaluation:\*

- \* *Evaluation activities are designed to help you. Complete each activity carefully by yourself and do not be discouraged if you find it necessary to review and repeat an evaluation activity.*

*The evaluation is used to determine effectiveness of learning experiences and to provide direction for future changes and improvements in the instructional program.*

*If you are unable to complete the evaluation activities your instructor will help you design an alternate program to better meet your needs.*

1. *Mark operations and activities completed on your Student Performance Record. (Obtain instructor's initials before doing the operation if required for SAFETY check)*
2. *After using the instructional resources and completing lab activities you are ready to complete the UNIT QUIZ. (Obtain UNIT QUIZ from your LAB MANAGER)*

*Obtain answer key from your Lab Manager and mark the quiz (use red pencil).*

3. *If you have achieved 90% correctness or above turn in your quiz to the Lab Manager, record your quiz score on the Student Performance Record, and continue on to a new unit.*
4. *If you did NOT achieve 90% correctness review the instructional resources and repeat step 2 above.*

*Check with your instructor when you need HELP and/or desire alternate learning and evaluation activities.*

ART and COPY PREPARATION

This unit is designed to introduce you to the basic principles of planning, design, layout, color and related artwork activities which are needed for producing graphic communications. All graphic communications design and planning should begin with a consideration of the function (purpose of the message). "Message analysis" therefore becomes a critical stage in the development of a well designed graphic communication.

After completing this unit you should know:

- a. how to analyze a message to be communicated.
- b. the basic design principles of balance, contrast, rhythm, proportion and unity (harmony).
- c. the printer's system of measurement.
- d. the basics of typography (parts of type, family of type, type classifications, etc.).
- e. how to prepare sketches and layouts.
- f. the techniques of copyfitting.
- g. how to compute enlargements and reductions.
- h. new graphic communications terms.

Performance Objectives:\*

- \* *Performance will be measured by written and/or oral questions. Your achievement level will be acceptable if the responses meet or exceed ninety (90%) correctness.*

You should be able to:

1. identify and describe five basic principles of graphic design.
2. prepare three thumbnail sketches, and from these select and prepare one rough and one comprehensive layout.

3. use the printer's line gauge and specify units of measure within the point system of measurement.
4. identify the following parts of a piece of foundry type: nick, feet, neck (beard), face, and shoulder.
5. identify the type classification of six sample type styles.
6. use copyfitting techniques to determine if a sample copy, when set in type, will fit within a specified space.
7. compute enlargements and reductions using a proportional scale and the diagonal line method.

Suggested Instructional Media:\*

\* *You are strongly encouraged to utilize the instructional media identified below. You may wish to select other additional media for clarification or for gaining greater depth in this instructional unit. Please make use of outside references and resources whenever you have the opportunity.*

A. Information Sheets:

- a.
- b.
- c.

B. References: (in Planning-Resource Area)

<u>TITLE</u>	<u>AUTHOR</u>	<u>PAGES</u>
<u>Graphic Communications</u>	Broekhuizen	24 - 54
<u>Graphic Arts</u>	Kagy	7-8, 32-40
<u>Artwork</u>	A.B. Dick Co.	All

C. Instructional Media: (Software - as additional material is developed it shall be listed.)

- a. "Artwork Your Blueprint to Printing"; A.B. Dick Co.; (Filmstrip-Cassette)

- b. "Design Elements" : Contrast, Rhythm, & Harmony  
(Sound-Page)
- c. "Design Element" : Balance  
(Sound-Page)
- d. "Typography"  
(Sound-Page)
- e.
- f.

Lab Activities:\*

\* Please complete the following lab activities. These are listed as a guide for you. You may wish to substitute other activities (with instructor's permission) and/or add to the activities indicated.

1. Design a 2"x3½" name card to be set in type (10 point Century Schoolbook with 2 points between lines).

Information should include: Name  
Address  
Zip Code

On an 8½"x11" sheet of paper prepare two (2) thumbnail sketches and one (1) layout. Show copyfitting information near layout and indicate if type will be set flush left, flush right, centered, pyramid, etc.

Identify finished sheet with your name, class period, and Lab #. Submit finished sheet to instructor.

2. Design a "title page" for your Lab Notebook. Finished sheet size 8½"x11", with an image area of approx. 7"x10".

Complete thumbnail sketches (minimum of 3), a rough layout, and a comprehensive layout.

Information to include:

name of school  
name of course  
school year  
your name

*(Examples Only)*

Minnetonka Sr. High  
Graphic Arts  
1974-75  
Art S. Graphic



## 2. cont.

You may include any other information you feel is appropriate and considered important to the total design.

Include a design (picture or sketch) of no less than 4 square inches in area.

Use colored pencils on the comprehensive layout to show desired colors (two or three colors).

When assignment is completed, identify with your name, class period, Lab #, fasten sheets in upper left corner and turn in to your instructor.

3. Part A Select a picture (photograph) from an old magazine or newspaper. Picture should be no larger than 5"x7".

Using a proportion calculator identify the size that the picture would be if reduced to:

25%
80%
<u>enlarged to</u> : 120%
250%

Picture should be mounted on a single 8½"x11" sheet of paper (use rubber cement on four corners) and the appropriate picture size for each of the percentages should be indicated on that page.

- Part B On an 8½"x11" sheet of paper, and using the 120% picture size from Part A above, draw the pictures outline (use drafting instruments).

Using the "diagonal line method" show the outline for a 33 1/3% reduction and a 200% enlargement of the picture size you have sketched.

After completing Part A & Part B have your work checked and initialed (or signed) by a fellow student.

Be certain to identify sheets with your name, class period, Lab #, and then turn in to your instructor.

4. Other (Optional)

Evaluation:\*

- \* *Evaluation activities are designed to help you. Complete each activity carefully by yourself and do not be discouraged if you find it necessary to review and repeat an evaluation activity.*

*The evaluation is used to determine effectiveness of learning experiences and to provide direction for future changes and improvements in the instructional program.*

*If you are unable to complete the evaluation activities your instructor will help you design an alternate program to better meet your needs.*

1. *Mark operations and activities completed on your Student Performance Record. (Obtain instructor's initials before doing the operation if required for SAFETY check)*
2. *After using the instructional resources and completing lab activities you are ready to complete the UNIT QUIZ. (Obtain UNIT QUIZ from your LAB MANAGER)*

*Obtain answer key from your Lab Manager and mark the quiz (use red pencil).*

3. *If you have achieved 90% correctness or above turn in your quiz to the Lab Manager, record your quiz score on the Student Performance Record, and continue on to a new unit.*
4. *If you did NOT achieve 90% correctness review the instructional resources and repeat step 2 above.*

*Check with your instructor when you need HELP and/or desire alternate learning and evaluation activities.*

INDUSTRIAL EDUCATION DEPARTMENT  
MINNETONKA PUBLIC SCHOOLS

THE TEACHER'S ROLE . . .

(Listed in order of importance)

<u>INSTR/MGMT/SYSTEM</u>		<u>TRADITIONAL</u>
48.3	STUDENT GUIDANCE GUIDE STUDENT TO SOLUTION OF PROBLEM GUIDE HIM TO REFERENCES AND OTHER RESOURCES DISCUSS HIS IDEAS WITH HIM	10.7
33.3	PERFORMANCE EVALUATION DISCUSS WITH STUDENT HIS FEELINGS ABOUT HIS WORK, TALENTS, ABILITIES, AND FUTURE	5.0
6.7	DISSEMINATION OF INFORMATION LECTURING, DEMONSTRATING, TESTING, ANSWERING QUESTIONS, GIVING ASSIGNMENTS	35.7
11.7	MANAGING MATERIALS SELLING AND DISPENSING MATERIALS, KEEPING RECORDS, COLLECTING FEES, ETC.	29.4
0	PERFORMANCE MEASURING GRADING PROJECTS, ASSIGNMENTS, AND/OR TESTING ENTERING GRADES IN GRADE BOOK	12.0
0	CHECKING ATTENDANCE CALLING ROLL ENTERING ATTENDANCE IN BOOK	7.2

(Data adapted from TITLE III E.S.E.A. "Project  
Occupational Versatility", Highline School District,  
Seattle, Washington)

ACHIEVEMENT EVALUATION INSTRUMENT

Name \_\_\_\_\_ Class Period \_\_\_\_\_ Date \_\_\_\_\_

DIRECTIONS: Each of the following statements or questions is followed by a set of four words or phrases. Choose the one which answers the question or statement correctly. Use a #2 pencil to darken in your answer on the attached answer sheet. If you are not certain of the correct response please darken "e".

---

1. Halftone screens are used to break up the continuous tone of an original illustration. This is done by converting the photograph to a series of:
  - a. dots
  - b. broken lines
  - c. grid patterns
  - d. tones
  
2. When all elements of graphic design have been placed in a sense of equilibrium, the layout has been:
  - a. proportioned
  - b. harmonized
  - c. balanced
  - d. reduced
  
3. Which of the following characteristics best illustrates the major difference between Roman and sans-serif images?
  - a. width of letters
  - b. height of letters
  - c. curve of letters
  - d. cross strokes
  
4. Which of the following instruments should be used to mark guidelines on pasteup or direct image masters?
  - a. dark blue pencil
  - b. ball point pen
  - c. embossing pen
  - d. light blue pencil
  
5. Which of the following colors will not photo-convert as a black image without a special filter?
  - a. dark red
  - b. green
  - c. amber
  - d. black

6. Hot metal images transferred to paper or acetate are called:
  - a. flats
  - b. repros
  - c. mats
  - d. pasteups
7. The purpose of image assembly is to provide copy for:
  - a. planning a layout
  - b. photo-conversion
  - c. image transfer
  - d. image carrier preparation
8. The key link between photo-conversion and image transfer is:
  - a. halftone negative
  - b. image carrier preparation
  - c. finishing
  - d. artwork
9. The image area of an offset image carrier is:
  - a. water soluble
  - b. water receptive
  - c. ink receptive
  - d. a raised surface
10. Most masking sheets are red or \_\_\_\_\_ in color to shield the carrier from ultra-violet light.
  - a. blue
  - b. violet
  - c. transparent
  - d. goldenrod
11. The first solution used in processing an exposed image carrier is the:
  - a. image developer
  - b. process gum or desensitizer
  - c. plate gum
  - d. stabilizer or fixer
12. The process camera used in photo-conversion is designed to photograph:
  - a. three-dimensional objects
  - b. moving objects
  - c. great depth
  - d. flat copy

13. Panchromatic films can be safely handled under conditions of:
- a red safelight
  - a yellow safelight
  - a green safelight
  - total darkness
14. If the percentage tapes on the process camera are both set at 50 percent, what will the image size be?
- 50 percent larger than the copy
  - same size as the copy
  - twice the size of the copy
  - one-half the size of the copy
15. Color separations are produced from full color copy. These photo-converted images are used to make image carriers for \_\_\_\_\_ colors.
- blue, green and red
  - black, yellow and green
  - red, yellow and blue
  - yellow, cyan and magenta
16. The latent image becomes visible on the film emulsion by the action of the:
- stop bath
  - developer
  - fixer
  - Photo-flo
17. Which is not an offset lithographic system?
- dampening
  - collating
  - feeding
  - impression
18. The proper sequence for image transfer in offset lithography is:
- carrier-blanket-paper
  - blanket-carrier-paper
  - impression-blanket-carrier
  - blanket-paper-carrier
19. Color is given to the ink by the:
- drier
  - wax
  - binder
  - pigment

20. The primary ingredient in paper pulp before it goes onto the paper-making machine is:
- water
  - pulp
  - coating
  - filler
21. Which side of bond paper is usually not used for image transfer?
- screen
  - felt
  - sized
  - calendered
22. The process of transferring colored foil to paper with heat and pressure is called:
- stamping
  - creasing
  - ruling
  - engraving
23. The type of layout that is used to explore the various graphic possibilities is the:
- thumbnail sketch
  - rough layout
  - comprehensive layout
  - mechanical layout
24. The character count per inch of pica typewritten copy is:
- 8
  - 10
  - 12
  - 14
25. A lens setting of  $f/8$  is one half the size of the opening at:
- $f/16$
  - $f/11$
  - $f/5.6$
  - $f/4$
26. One ream of paper contains:
- 250 sheets
  - 500 sheets
  - 750 sheets
  - 1000 sheets

27. In process photography film development, it is necessary to have the chemical solutions in four trays in the following left-to-right order:
- developer, fixer, stop bath, and running water
  - developer, stop bath, fixer, and running water
  - stop bath, developer, fixer, and running water
  - fixer, developer, stop bath, and running water
28. For accuracy in film development, the chemicals should be maintained at a temperature of:
- 65 degrees F.
  - 68 degrees F.
  - 72 degrees F.
  - 78 degrees F.
29. The unexposed silver of film emulsion is removed by the:
- stop bath
  - developer
  - fixer
  - wash
30. The process that creases paper without cutting, so that a fold may be made easily and smoothly is:
- scoring
  - die cutting
  - perforating
  - slitting

NOTE: PLEASE check to see that you have answered each item by darkening in one response for each of the questions. Be sure you have completed all identifying information on the answer sheet. Thank You.



Minnetonka Senior High School  
GRAPHIC ARTS DEPARTMENT

RATING SCALE

Name \_\_\_\_\_ Class Period \_\_\_\_\_ Date \_\_\_\_\_

INSTRUCTIONS: Circle the response that indicates your attitude or feelings toward each of the following statements.

RESPONSES: SD-Strongly Disagree, D-Disagree, U-Undecided,  
A-Agree, SA-Strongly Agree.

- 
- |  |             |
|--|-------------|
| 1. Students should have responsibility for their own classroom management (ie. attendance, record keeping) | SD D U A SA |
| 2. I want to learn all I can in school   | SD D U A SA |
| 3. I expect the teacher to provide a lot of help and leadership  | SD D U A SA |
| 4. I want to be told what learning activities to work on   | SD D U A SA |
| 5. I am excited about what I can learn in this course  | SD D U A SA |
| 6. The teacher prevents me from learning at a faster rate than other students in the class                 | SD D U A SA |
| 7. If the teacher wasn't around I would not work in this class   | SD D U A SA |
| 8. An important part of learning is helping other students to solve problems                               | SD D U A SA |
| 9. The way a class is managed does make a difference to me   | SD D U A SA |
| 10. The teacher should always control the classroom activities that I'm involved in                        | SD D U A SA |
| 11. I learn as much (or more) from my own reading and searching than from a teachers' lecture              | SD D U A SA |
| 12. I enjoy learning something "new" in this class   | SD D U A SA |
| 13. I usually waste a lot of time during the class period  | SD D U A SA |

cont.

- |     |  |             |
|-----|--|-------------|
| 14. | The teacher does not take a personal interest in my work   | SD D U A SA |
| 15. | I work hard in this course   | SD D U A SA |
| 16. | The learning materials in this course are interesting  | SD D U A SA |
| 17. | I am not concerned about the grade I receive for this course   | SD D U A SA |
| 18. | The learning materials are dull and confusing  | SD D U A SA |
| 19. | I waste a lot of time while waiting for the teacher to help me   | SD D U A SA |
| 20. | I have difficulty in reading the references and instructional materials  | SD D U A SA |
| 21. | I want the teacher to demonstrate and talk about a machine operation or process before I do any work with it         | SD D U A SA |
| 22. | The course is designed to meet the needs of the average student in this class  | SD D U A SA |
| 23. | Assignments and lab activities should be determined by the teacher   | SD D U A SA |
| 24. | My grade should be based on a comparison of the performance (grades) of my classmates                                | SD D U A SA |
| 25. | The instructor should be the primary source of information for students, and always available to answer my questions | SD D U A SA |
| 26. | I feel confused and frustrated by the teaching/ learning methods used in this course                                 | SD D U A SA |
| 27. | I have the opportunity to design my own learning activities and experiences  | SD D U A SA |
| 28. | It is the teacher's fault if I don't learn all that I need for this course   | SD D U A SA |
| 29. | I like to use audio-visual equipment and material to learn information, new processes, and the use of equipment      | SD D U A SA |
| 30. | This course is taught like all my other classes, with the teacher "telling" me what to do and "when" to do it        | SD D U A SA |

Jury of Experts

Note: The evaluation instruments designed as part of this study were submitted to this jury of experts and piloted with students for validation prior to revision and subsequent data collection.

Mr. Raymond Jezierski, Coordinator  
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Dr. Vern Thoreson, Vocational Director  
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Mr. Will Wachtler, Instructor  
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Mr. Herb Olson, Instructor  
Graphic Arts Department  
Mound-Westonka High School  
Mound, Minnesota 55364

Mr. Richard Kotschevar, Instructor  
Industrial Education  
School District 564  
Thief River Falls, Minnesota 56701

Mr. C. W. Flower, Assistant Principal  
Sault Area High School and Skill Center  
Sault Area Public Schools  
#1 Education Plaza  
Sault Ste. Marie, Michigan 49783

Mr. Ronald S. Walker, Instructor  
Industrial Education Department  
Moorhead State College  
Moorhead, Minnesota

Jury of Experts cont.

Mr. Tom Ryerson, Industrial Education Supervisor  
Vocational-Technical Division  
State Department of Education  
Capitol Square Building  
St. Paul, Minnesota 55101

POST-ACHIEVEMENT TEST ANALYSIS OF VARIANCE  
DATA

#	Group (x) X	Group (y) X	Group (z) X	Group (x) X <sup>2</sup>	Group (y) X <sup>2</sup>	Group (z) X <sup>2</sup>
1	23	19	19	529	361	361
2	15	22	22	225	484	484
3	14	19	20	196	361	400
4	21	24	23	441	576	529
5	21	24	19	441	576	361
6	23	18	16	529	324	256
7	24	21	20	576	441	400
8	23	20	20	529	400	400
9	23	23	20	529	529	400
10	21	24	13	441	576	169
11	25	21	24	625	441	576
12	23	19	14	529	361	196
13	21	24	18	441	576	324
14	19	19	14	361	361	196
15	23	22	26	529	484	676
16	22	19	17	484	361	289
17	23	28	18	529	784	324
18	23	23	25	529	529	625
19	21	26	22	441	676	484
20	16	25	20	256	625	400
21	23	16	19	529	256	361
22	25	23	20	625	529	400
23	25	18	25	625	324	625
24	25	21	19	625	441	361
25	24	19	17	576	361	289
$\Sigma X =$	546	537	490	$\Sigma X^2 = 12,140$	11,737	9,886
$\bar{x} =$	21.84	21.48	19.6			
$\bar{X}_p =$	20.97					

POST-RATING SCALE ANALYSIS OF VARIANCE  
DATA

#	Group (x) X	Group (y) X	Group (z) X	Group (x) X <sup>2</sup>	Group (y) X <sup>2</sup>	Group (z) X <sup>2</sup>
1	132	110	103	17424	12100	10609
2	96	97	108	9216	9409	11664
3	103	118	127	10609	13924	16129
4	112	100	111	12544	10000	12321
5	113	100	111	12769	10000	12321
6	122	110	96	14884	12100	9216
7	107	100	90	11449	10000	8100
8	118	114	100	13924	12996	10000
9	121	113	103	14641	12769	10609
10	116	116	100	13456	13456	10000
11	112	109	113	12544	11881	12769
12	102	116	108	10404	13456	11664
13	123	101	102	15129	10201	10404
14	109	93	102	11881	8649	10404
15	119	113	103	14161	12769	10609
16	106	106	94	11236	11236	8836
17	125	113	102	11625	12769	10404
18	107	108	111	11449	11664	12321
19	113	104	119	12769	10816	14161
20	94	103	105	8836	10609	11025
21	113	109	103	12769	11881	10609
22	117	126	100	13698	15876	10000
23	115	105	127	13225	11025	16129
24	116	106	111	13456	11236	12321
25	132	100	94	17424	10000	8836
	$\Sigma X = 2843$	2690	2643	$\Sigma X^2 = 321513$	290822	281461
	$\bar{x} = 113.72$	107.60	105.72			
	$x_p = 109.01$					

## SUMMARY OF POST-RATING SCALE RESPONSES

#	% of Control (y)					% of Control (z)					% of Experimental (x)				
	SD	D	U	A	SA	SD	D	U	A	SA	SD	D	U	A	SA
1	0	8	4	52	36	0	4	16	56	24	0	4	12	36	48
2	0	0	4	72	24	0	0	28	40	32	0	0	4	52	44
3	0	4	32	56	8	0	8	40	40	12	0	12	28	56	4
4	20	40	24	16	0	16	48	20	12	4	8	64	16	12	0
5	0	0	16	72	12	0	12	8	56	24	0	4	4	40	52
6	24	64	16	4	0	24	60	12	4	0	40	40	12	8	0
7	28	60	8	4	0	28	60	12	0	0	52	40	4	4	0
8	0	4	12	76	8	0	0	16	76	8	0	0	12	56	32
9	4	4	4	72	16	0	0	16	52	32	12	4	4	44	36
10	8	44	28	20	0	12	20	40	28	0	28	36	28	8	0
11	4	32	16	48	0	4	40	44	0	12	4	32	36	16	12
12	0	0	4	80	16	0	0	16	44	40	0	0	0	44	56
13	8	68	20	4	0	16	44	20	20	0	16	72	4	8	0
14	4	64	12	20	0	12	32	36	16	4	16	40	36	8	0
15	0	0	24	68	8	0	12	24	60	4	0	4	20	68	8
16	4	4	12	72	8	0	8	20	52	20	0	0	4	60	36
17	44	48	8	0	0	20	76	4	0	0	48	44	8	0	0
18	16	40	32	12	0	24	32	20	24	0	36	36	20	8	0
19	12	56	28	4	0	12	16	24	44	4	20	40	28	12	0
20	3	48	4	32	4	12	28	32	20	8	24	52	12	8	4
21	0	0	16	72	12	0	4	12	40	44	8	4	12	48	28
22	0	0	8	92	0	0	8	8	84	0	0	8	8	84	0
23	16	48	24	12	0	20	44	20	16	0	12	68	0	20	0
24	24	40	20	16	0	48	20	20	12	0	60	16	12	12	0
25	0	16	20	52	12	4	24	20	36	16	8	24	16	52	0
26	8	72	20	0	0	8	40	36	12	4	16	68	8	8	0
27	0	0	20	72	8	0	12	12	56	20	0	0	0	80	20
28	12	76	12	0	0	40	40	16	4	0	36	56	8	0	0
29	4	20	32	44	0	4	12	40	32	12	0	36	0	60	4
30	8	68	20	4	0	28	60	4	8	0	40	56	4	0	0