AN ABSTRACT OF THE THESIS OF

GERALD CLAYBERG LUDLOW (Name) for the DOCTOR OF EDUCATION (Degree)

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Title: A COMPARISON OF STUDENT ACHIEVEMENT IN INDIVIDUALIZED AND TRADITIONAL ELECTRICITY-ELECTRONICS PROGRAMS AND THE EFFECTS OF EDUCATORS' ATTITUDES

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Dr. J. Larry Heath

Purpose of the Study

The study was designed to determine if students using the individualized instruction method, scored significantly higher on a 30 question achievement test than did students in more traditional group paced programs. The study also attempted to determine if attitudes displayed by educators, as measured on an attitude scale, aided in the implementation of individualized instructional programs. The specific questions formulated to investigate this study were:

1. Do students who have been taught in individualized instruction programs achieve at a higher level than students taught in more traditional graded programs?
2. Are the attitudes of educators who implement innovative programs the same as the attitudes of educators who continue with traditional teaching methods?
3. Does in-service training dealing with solving implementation problems have any appreciable effect on the attitudes of educators who are implementing innovative programs?

4. Is a positive attitude towards innovation by teachers, counselors and administrators evident and measureable?

Procedure

The selected population of students and instructors participating in the study was from Oregon's community colleges and secondary schools. Fifty-four high school and community college educators responded to both pre-test and post test instruments by the cut-off date resulting in an 87% return. One hundred sixty-three high school students and 107 community college students responded to a pre-test and post test instrument by the cut-off date resulting in a 70% return.

Student achievement was measured by an achievement test (Appendix A) administered by each participating secondary school and community college teacher in a pre-test/post test design as outlined by Campbell and Stanley (1963). The raw scores were compiled and recorded according to population category.

The attitudes of the teachers, counselors and administrators were measured with the use of the Rokeach Dogmatism Scale (Appendix A). All of the teachers, counselors and administrators who were involved with the electricity-electronics students responded to the scale. The scales were administered in the same pre-test/post test pattern as the student achievement test and at the same point in time. The scores were compiled and recorded according to population category.

Analysis of Data

The one-way analysis of covariance with unequal n's was used to analyze the statistical significance of (1) student achievement levels

at both secondary schools and community colleges, and (2) teachers', counselors' and administrators' attitudes towards innovation at both secondary schools and community colleges. The statistical analysis was accomplished by computer programming.

Summary of Findings

1. The results of the study indicated there was no difference in the achievement levels of secondary school students taught by individualized instruction methods as compared to traditional methods in electricity-electronics courses. According to the questionnaire scores in this study, the type of teaching method used in this particular subject indicated no substantial difference in student achievement.
2. Further results indicated there was no difference in the achievement level of community college students taught by individualized instruction methods as compared to traditional methods in electricity-electronics courses or electronics technology courses. According to the questionnaire scores in this study, the type of teaching method used for this particular subject indicated no substantial difference in student achievement.
3. Based upon the scores of the modified Rokeach Dogmatism Scale both secondary school and community college educators exhibited equal supportive attitudes towards those people they worked with.
4. Secondary school and community college educators did differ sharply in their dogmatic attitudes depending upon whether or not they were involved in implementing innovative programs. The scores as indicated on the modified Rokeach Dogmatism Scale showed that the

innovative group was much less dogmatic than the traditional group in the pre-test and that this difference widened significantly at the post test.

5. The control group of educators exhibited a rigid attitude at the pre-test and this attitude became more rigid at the post test. The experimental group, on the other hand, tended toward a flexible attitude at the pre-test and this attitude was even more flexible at the post test.

6. The increasingly less dogmatic and flexible attitudes of the experimental group of educators as shown by the scores on the post test indicated that in-service training might have been a factor in reinforcing positive attitudes towards innovation and towards continued implementation of innovative programs.

7. The scores of the experimental group of educators clearly indicated that teachers, counselors and administrators had to be in accord before implementation and continuation of innovative programs was successful in both secondary schools and community colleges.

A Comparison of Student Achievement in Individualized and Traditional Electricity-Electronics Programs and the Effects of Educators' Attitudes

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in charge of major

Redacted for privacy

Head of Department of Industrial Education

Redacted for privacy

Dean of Graduate School

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I. INTRODUCTION

Background to the Problem

The educational process practiced in the majority of our public school systems is essentially the same at the present as it was at the turn of the century. The lecture and large group paced instruction remained as the paramount vehicles in the learning strategies utilized by the teacher. To be sure, films, video tapes and other audio-visual materials had become important aids to the two methods used above and in certain disciplines were extremely effective as indicated in a study by Nish (1969). The fact remained, however, that for the most part, students were still being educated in groups varying from 20 to 30 in the typical classroom and in groups of as many as several hundred in the required classes at large universities.

Teaching methods which treated each student as an individual while creating a learning climate that promoted individualized instructional strategies throughout educational systems remained a problem of long standing. McLoughlin (1972) in a recent article noted that "nearly every prominent educator from Plato to present has commented on the implications of human variability for instruction."

Educators had only recently begun to implement methods which attempted to treat the student as an individual. No one had ever disputed the fact that each student learned most effectively at his

own best rate and that rate was likely to be considerably different from other members of his class in school. While many teachers had made efforts to teach students individually as Conant (1959) indicated

> it was the brighter students who received the attention while the rest of the class labored en masse. Therefore, the bell shaped grading curve was still standard in those schools using large group instructional methods.

Conant went on to comment that "each student was placed on this curve without regard for his ability and/or intelligence and had to fit on this curve some place."

Individualized Instruction

Blake and McPherson (1969) stated that "schools throughout the nation are currently testing numerous individualized instructional programs of one kind or another". The same study indicated that in these schools the method which was rapidly becoming standardized was that of rewriting the course content into small discrete elements which normally contained a concept or a group of closely related concepts. Ideally, each student moved through the elements or learning packages at a rate best suited to himself.

With this type of instruction a student entered the class at any time during the year without penalty and was not expected to keep pace with the group. He could start on a learning module where he was best fitted and proceed from there. In many of the individualized instruction systems the student could, by successfully passing pre-tests, be given credit for prior learning and/or experience. This allowed the student to be placed in the course at his own level of achievement.

Problems with Individualized Instruction

Individualized instruction was not without its problems, however. The Individualized Curriculum for Electronics Progress Report (1971) detailed a number of these problems. The primary ones were outlined as follows: (1) Teachers had rejected the individualized process after a trial period on the grounds that it simply was too much work for any one teacher to do. With this type of instruction it was conceivable that with a large class students could be working all the way from the very basic level to the most advanced. This required that the teacher be prepared to answer questions over most of the course material, possibly on the same day. Mager (1962) claimed that this was a considerable change from the old methods of going through the course material lecture by lecture and answering questions concerning only those lectures which had been covered. (2) Demands on the teacher's time were great. Most of the individualized instruction systems which used learning packages included tests in each learning package. Correcting these tests and discussing the answers with each student was extremely time consuming for the teacher.

The report also indicated that in each class there were only a few self-starting students who could move through the individualized packages independently. The majority of students had to have specific assistance or directions and the teacher could not afford to let them wait too long for attention before they lost interest entirely.

Student Problems

The Individualized Curriculum for Electronics Progress Report (1971a) further indicated that students, too, had problems. They had been motivated for many years by the threat or promise of grades. In the individualized method if they were to learn at their own best rate the teacher could not set a minimum number of learning packages for the student to complete. The fact remained, however, that today's students, like students throughout the centuries, needed a propelling force. The individualized classroom was an excellent place for the student to procrastinate because he was responsible for much of his own progress. Teachers found they had to set goals for students and in some cases threaten with failing grades.

Administrative Problems

The school administration was also presented with a whole new set of problems when individualized courses were implemented.

Most individual learning packages were written in performance terms. In a study by McQueen (1971) she reported that the student either achieved a minimum performance or he did not and repeated the learning process. He was no longer matched against the rest of the class but with stated performance objectives. It followed that letter grades were not effective in this situation. Part of the administrator's job was the task of changing over the grading system and explaining this new system to his school board and to concerned parents.

In an investigation by Finch and Impellitteri (1970) they claimed

that along with changing the grading system, the administrator had to work out a method for giving students credit for whatever part of the learning packages they had completed as well as providing for flexibility in scheduling. Some students might complete the course well before the end of the school year while others might complete much less.

Further, the administrator who was convinced that this was a better method had to be willing to support this innovative approach, even in the face of skepticism on the part of other teachers and staff.

The Counselors' Role

Counselors in their guidance roles could be an assistance or a deterrant to the innovative process depending on their understanding and support of the new methods. Selection of students for the new program and these students' initial concepts of the new methods were largely influenced by counselors. Blocker (1969) maintained that "the counselor is a behavior changer"; therefore, the success and acceptance of the new method depended partially on the counselor displaying a positive attitude toward the programs as he gave prospective students guidance information.

At that time individualized instruction was being tested in many disciplines in the schools and community colleges in the state of Oregon. The objectives of these programs was to give the student a better opportunity to achieve his educational goals. The assumptions made by the educators using the individualized methods were that, besides those factors listed above, the individualized process could become an answer to a striving for a more efficient means of educating

students to take their place in our highly technological society by fitting the school to the student rather than the student to the school.

The Problem

The problem to be investigated was one of determining the influence of two key elements in the implementation of individualized instruction in the classroom. These two elements were (1) was the achievement level of students in individualized programs higher than that of students in the traditional graded programs, and (2) what effect did the attitude of teachers, counselors and administrators have on student achievement in the programs?

The purpose of this study was first to determine if students involved in individualized programs at secondary school and community college levels attained a higher achievement level than did students in the standard lecture-laboratory course. Secondly, it was to determine if the attitudes of teachers, counselors and administrators involved in the individualized programs were conducive in creating a learning climate in which students would learn more.

Question #1

In courses which have essentially the same content, does the instructional method make a difference in student achievement?

1.0 Ho: There will be no significant difference in achievement level among control and experimental groups.

1.1 Ho: There will be no significant difference in achievement level between secondary school

control groups compared with experimental groups.

1.2 Ho: There will be no significant difference in achievement level between community college control groups compared with experimental groups.

Question #2

Do the teachers, counselors and administrators who are attempting to implement an individualized program in their school have a different attitude toward innovation than teachers, counselors and administrators who are not using individualized programs?

2.0 Ho: The attitude of teachers, counselors and administrators will not have any effect on the student achievement in their respective schools.

2.1 Ho: There will be no significant difference in the supportive attitudes of teachers, counselors and administrators who are implementing individualized programs as compared to those who are using the standard lecture program.

2.2 Ho: There will be no significant difference in the dogmatic attitudes of teachers, counselors and administrators who are implementing individualized programs as compared to those who are using the standard lecture program.

2.3 Ho: There will be no significant difference in the

flexibility attitudes of teachers, counselors and administrators who are implementing individualized programs as compared to those who are using the standard lecture program.

Importance of the Study

The major objective of this study was to investigate whether students being taught in individualized instructional programs were actually learning at a higher level than students who were in the standard lecture classes and were these achievement levels greatly dependent on the attitudes of the educators who instituted and promoted the innovative programs. If this study determined that students achieved significantly more in individualized programs and that educators who implemented these programs had a difference in attitude toward innovation, the conclusion would then provide, in part, a basis for isolating the key elements of a successful implementation procedure for individualized instruction. These strategies could then be utilized to assist in providing individualized instruction in educational institutions which would not ordinarily attempt to implement innovative instructional practices.

Individualized Instruction Achievement Research

Little research existed nationally that compared the specific elements which might be integral in the successful implementation of an innovative method of instruction.

Research specifically concerning student achievement in individual-

ized instruction as compared to the standard lecture method and measurement of attitudes of educators in these programs using the design of this study was sparse.

McLoughlin (1972a) wrote that individualized instruction, though old in concept, was relatively new in practice. It was, perhaps, not firmly enough entrenched in the public schools for detailed studies to be made.

The majority of studies of individualized instruction were conducted within a single institution with two or more randomly selected classes. Student achievement was normally the only variable measured. The study done by Rutledge (1970) of freshman graphics students was typical.

Theoretically, individualized instruction had been conceded to be more effective than the standard lecture method; however, research supporting this theory was not widespread. In some educational institutions where the individualized method had been implemented, studies indicated that it was successful. Shavelson and Munger (1970) stated that

> preliminary systems effectiveness data indicates that individualized instruction involving individual lectures and labs with small group discussions (N=10) and self pacing is superior to the existing science education systems at Cubberly High School.

While this research indicated that individualized instruction was a better method, more research was necessary to substantiate the claim. Research conducted in several schools and at different levels would serve to give educators a more substantial basis with which to decide whether or not to implement individualized programs in their schools.

Research concerning attitudes of educators and what effect, if any, these attitudes might have had on establishing conditions leading to higher achievement of students in innovative programs, was not definitive. This study might produce evidence which would be useful for developing a structure to aid in implementing individualized instruction in educational institutions.

Assumptions for the Study

The assumptions are as follows:

1. The items on an electricity-electronics student achievement test are valid for both secondary school students and community college students.
2. The secondary schools and community colleges selected for the study are representative of secondary schools and community colleges in Oregon.
3. The Rokeach Dogmatism Scale measures attitudes that can be assigned score values for data processing and analysis.
4. The content of electricity-electronics and electronics technology programs, as listed in catalogs and course descriptions, taught at experimental secondary schools and community colleges is similar.
5. The two variables in this study, instructional method and attitudes of educators are key elements in successful innovation.

Terminology Pertinent to this Study

For purposes of this study the following operational definitions

are offered:

Achievement level. Refers to the knowledge or proficiency gained by an individual or group in something that has been learned or taught.

Attitude. Refers to a "predisposition to think, feel, perceive, and behave toward a cognitive object", Kerlinger (1965).

Classroom. Refers to a place where the teacher employs the instructional method. It may be a meeting room, a shop, or a laboratory.

Control group. Refers to a group not receiving treatment given to experimental group.

Experimental group. Refers to the group that is manipulated or given the independent variable treatment.

Individualized curriculum. Refers to a course or group of courses whose subject matter content has been rewritten into small discrete elements or learning packages.

Individualized instruction. Refers to the instructional method which is organized in such a fashion as to allow each student to move at his own pace under the guidance of the teacher.

In-service training. Refers to the training sessions devoted to orienting teachers, counselors and administrators to the ramifications of individualized instruction.

Standard programs. Refers to the traditional instructional method which has as its key elements the lecture and group paced instruction.

Limitations of the Study

This study was delimited to:

1. Teachers, counselors and administrators in Oregon secondary

schools and Oregon community colleges.

2. Secondary schools and community colleges in Oregon offering electricity-electronics programs.
3. Students currently enrolled in electricity-electronics programs in secondary schools and community colleges in Oregon.
4. The instrument used to measure achievement levels of electricity-electronics students was possibly inadequate. No standard instrument was found which specifically measured achievement of electricity-electronics students at the levels tested in this study.

II. REVIEW OF RELATED LITERATURE

It was important in this study to determine critical factors involved in successfully implementing an innovative curriculum in educational institutions. These factors may be expressed in the form of questions:

1. Do students who have been taught in individualized instruction programs achieve at a higher level than students taught in more traditional graded programs?
2. Are the attitudes of educators who implement innovative programs the same as the attitudes of educators who continue with traditional teaching methods?
3. Does in-service training dealing with solving implementation problems have any appreciable effect on the attitudes of educators who are implementing innovative programs?
4. Is a positive attitude towards innovation by teachers, counselors and administrators evident and measureable?

This review of literature summarized the findings with respect to the above factors. To obtain the opinions and evidence of these variables by other researchers and writers, a review of research articles and studies was conducted. References which specifically dealt with questions one through three could not be located. Many articles and studies did deal with the more general areas. Research or articles that involved counselors and administrators with the process of implementation in the classroom were particularly sparse. Studies which attempted to measure the effect of in-service training

involving teachers, counselors and administrators also were meager. The bulk of literature in this area dealt almost exclusively with teacher attitudes toward curriculum change with data collected from a group of teachers within a single school. The same was true of studies which compared groups of students in experimental programs. These studies, without exception, were confined to a single educational institution. This literature did, however, provide a basis for this study.

The Problem of Implementing Change in the School

The educational process involved almost every citizen of the United States within its huge complex. A report by the U. S. Office of Education (1963) stated that this process was the second largest expenditure of the federal tax dollar and required a large part of the local tax dollar. It had developed into a vast and monolithic enterprise which had become stratified into a bureaucracy.

It was within the content of this great educational complex that innovation had to take place. To be sure, the educational process with all its ramifications and complications was responsive to the needs and priorities of the society it served. Change within the educational system might be, at best, ponderous due to a lack of clear cut methods or procedures to effect necessary changes. Passon (1962) made this point when he wrote:

> We have not developed within school systems any realistic structures or policies for acting on proposed curriculum changes coming from within the system. We have not developed policies or structures for proposals coming from outside the system.

Change, when it came about in the individual school system, was the result of many factors. Passage or failure of local bond issues reflected the influence of the voter on the school system and consequently, on anticipated changes. Parent groups and pressure groups served to bring about change when the groups were aroused about particular issues affecting the schools. The final analysis indicated that change within the school was affected by more than those who were responsible for its everyday operation.

Reluctance to Change

There were many factors involved in change or innovation within the classroom. Many new and innovative educational processes and equipment had fallen by the wayside for some reason or another. The primary fault for the failure of these new methods had been fixed on either the classroom teacher or on the administration, depending on the view of the writers. The unwillingness to accept new processes or to change might be in the basic nature of the human being.

Miller (1970) contended that this was the reason for the reluctance to change when she stated "humans are both the most commonly cited obstacles to and the facilitators of educational change". And she concluded her statements with "... greater attention must be given to the human element by those responsible for educational change".

Ultimately, every new instructional method had to be tested in the classroom. It was there that success or failure was decided. If it was successful there were likely to be many in the school who were ready to take the credit. If it was a failure, the classroom teacher

was the one who was generally given the blame. For this reason, studies involving change in the classroom were devoted almost exclusively to teachers.

The Teacher as the Change Agent

Chambliss (1968) conducted a study to examine teachers' attitudes toward adopting innovations in education and to examine teachers' perceptions for the support of these attitudes. Two hundred thirty-eight subjects from six junior high schools were asked to respond to the following instruments: the Innovation Scale, the Rokeach Dogmatism Scale and a brief questionnaire. Statements negative to adopting innovation were endorsed by 59% of the respondents. The conclusion resulting from the study was that educators interested in promoting innovations had to concentrate upon creating discontent with present outcomes and to provide encouragement to teachers to overcome their uncertainty. Discontent with the status quo had to be stimulated so that the attitude of tolerance with the present method was upset and the climate was conducive to change.

In a study conducted to determine what teachers judge to be barriers to curriculum change, Dempsey (1963) related these barriers to the teachers' readiness to change. Four hundred teachers from several secondary schools reacted to a Readiness to Change Scale and a questionnaire designed by the researcher. The conclusions were that younger male secondary teachers perceived fewer barriers to change than did teachers without the same attributes. The final conclusions were not significant, in that specific groups of teachers would react either

negatively or positively to curriculum change. However, some groups could be identified that were amenable to change.

Teacher Production of Innovative Materials

Teachers were not only expected to be the primary change agent for innovation, but they were also expected to generate much of the innovative materials.

Seemingly, the logic which was used to explain teacher production of instructional materials was that they were the experts in the subject area and were able to convert their knowledge into viable and innovative course materials. A report by Milstein (1960) investigated the extent and direction of changes in classroom practices which might be expected from the production of their own curriculum guides by teachers. A group of 50 competent classroom teachers participated in the study. Twenty-five participated in the curriculum development project while 25 were designated as a control group. The researcher found that teacher growth that might have been attributed to this project was reflected in the classroom to only a small extent and that this was an ineffective attempt to change behavior.

An article by Popham (1972) stated that "however, many busy classroom teachers do not possess the time, or perhaps the ingenuity to carve out measureable indicators of some of their more elusive goals". Demands on the teacher's time while he was at school precluded his taking on the enervating chore of researching background materials and writing innovative curriculum for his own use. The problem of innovation, at least for the teacher, could be alleviated to some extent if

the materials were developed elsewhere for his use. Morrison (1969) reinforced this view when he wrote:

> With the instructional plan and materials before them the teachers could see exactly what was intended--they were not being asked to buy a "pig in the poke"--and much of the flailing at straw men ceased. What I interpreted first as bull-headed resistance to change actually was fairly reasonable objection to what was thought by teachers to be an impending, unfair demand for time and for skills in analysis and materials development they knew they could not provide.

The Administrator as the Change Agent

True innovation involved the whole educational community. Teachers and administrators had to work together in common accord to change the daily mode of operation in the school. Administrators had to give support to new concepts before truly successful implementation could come about. Characteristics of administrators who were amenable to innovation have been studied by Hearn (1972) who wrote:

> Youthful staffs, especially administrative staffs, are usually associated with adoption of innovations. However, my study of ESEA Title III adoptions suggests that often old administrators are also risk takers. The older administrators, those who have "arrived" and are personally secure, or who are near retirement and have little to lose, also bring with them the maturity and necessary skills to innovate. Youth brings enthusiasm and energy, but associated traits of impatience and naivete' tend to cause as many problems as they solve.

And he went on to describe the ideal administrator in these terms: "several studies indicate that the most successful innovator is a younger man with a doctor's degree, born in a rural area, who has traveled extensively".

It was not often that a school system was blessed with such an

administrator as described by Hearn. To be realistic about the changes taking place within educational systems, all sorts of administrators were involved and did support innovation to some degree. Whether the administrator initiated the proposed change or not, he was still faced with making the key decisions concerning the fate of the change. These decisions had to be handled with tact. As Johanson (1967) explained:

> Administrators as participants must behave in such a manner that the teacher participants do not gain the impression that the curriculum decisions result predominantly from positional hierarchical influence.

Johanson was supported by Foshay (1970) who maintained that teachers need the administrator to "express support of experimentations in the system". Obviously, without positive, cooperative attitudes on the part of both teachers and administrators, change was not likely to take place.

A study by Spaziani and Courtney (1971) indicated that assisting administrators to initiate and maintain programs was given high priority on a list of competencies responded to by instructors. In that study, the instructors recognized that innovation required the involvement of the total educational community.

Educational innovation required the development of new materials and instructional processes. The changes brought about by these new materials and methods had to become a matter of routine by the total educational complex before they could be classified as innovative educational practices. If schools across the nation implemented an obviously better educational method, or used better educational materials, then true change had taken place.

Teacher-Administrator Cooperation Necessary for Change

Introducing innovative curricula or teaching methods into an educational process which seemingly, for all intents and purposes, was satisfactorily meeting its goals, required the full cooperation of teachers and administrators.

Carter (1955) investigated this aspect in his study in which he gathered data from 228 teachers and principals from several schools in a school system to determine their perceptions relative to seven elements of the curriculum, its study, and improvement. These elements were: (1) definition, (2) status, (3) desirable directions of change, (4) organizations for study and improvement, (5) resources for effecting change, (6) degree of flexibility, and (7) responsibility for study and improvement. Data was collected by the use of a curriculum concept inventory. The main conclusion of the study was that there was some degree of faculty readiness to work on curriculum problems and change if they were worthwhile and that curriculum study should be a cooperative enterprise of teachers and administrators.

In a similar study Noda (1952) attempted to identify and analyze major blocks to curriculum development in the secondary school and to formulate and project a set of generalizations that would serve as a basis for any curriculum reorganization or change. Data for the study was secured from two questionnaires. A preliminary questionnaire was mailed to 50 leaders in the field of education to identify and verify the major blocks to curriculum improvement. A revised questionnaire was then mailed to 226 teachers in 15 states and to 75 selected admini-

strators, curriculum workers and supervisors. Twenty-five major blocks to curriculum improvement were identified. A second questionnaire was sent to 330 key teachers, administrators and curriculum supervisors to try to identify successful practices to remove the blocks. From the data collected, the researcher was able to derive a set of generalizations which would serve to remove the identified blocks and some recommendations for the use of these generalizations.

The conclusion was that the commitment to changing curriculum, whether it be whole-hearted or not, had to be made by both the teachers and administrators. It was only when all these educators were attuned to the same goals that successful innovation took place.

Impact of Technology on Curriculum Change

Technology had considerable impact in every sector of our society. Certainly education, which accounted for one of the greatest portions of the tax dollar, was a fertile field for technological advances in the educational process. Some years ago there were predictions that the advent of educational television would soon replace the classroom teacher. The predictions were followed by similar prognostications each time a new instructional device was introduced by the educational technology industry. The evolving of commercial teaching systems became a major industry. Eye, Garrison and Kuhn (1969) supported this with the statement that "the school administrator today is swamped with blandishments of the new technology borne by advertisements, exhibits and salesmen".

How many of these administrators had been sold on a particular

teaching system and committed considerable resources to its purchase only to see it become rapidly obsolete was open to conjecture. Certainly, many educators became hesitant to invest resources in these systems. Perhaps this led to the statement by Kiel (1969) when he pointed out that "the teaching community seems reluctant to utilize programmed materials".

Involving Teachers

Possibly administrators felt they were relieving the teacher of some of his load if they introduced an efficient new teaching device or method into the classroom. However, unless teachers had been involved with the decision regarding the usefulness and feasibility of the new system, it was likely to become another failure. This involvement of the teacher was given support by Burns (1969) with this statement:

> Through the mail I have received several inquiries pertaining to the problem of how to involve school personnel, especially teachers in the tasks associated with new instructional systems, learning labs, programmed instruction, CAI, video systems, and other innovations, finding it difficult to involve the classroom teachers--but unless they are involved, new programs are unlikely to succeed.

A critical element in the successful implementation of the innovative teaching method or instructional system was the orientation to the anticipated change given to the teacher. Complete new systems thrust upon a teacher might be construed by that teacher as a strong indication that he was not performing his teaching duties as he should have been. Bringing the teacher into the initial planning for innovation and keeping him informed was a necessity.

In-Service Training a Key Element in Curriculum Change

Positive attitudes created toward innovation within the total education community involved several factors. Paramount among the factors was in-service training for teachers and administrators alike. While this was likely the final step, if included at all, in the lengthy process of evolving a new teaching system, it was perhaps the most important. However successful the new teaching system might have proven itself in experimental testing or in other classrooms, it was usually doomed to failure unless the teachers and administrators who were going to use it were trained in its use. Berman (1969) maintained that

> educational innovation is basically a two-step process. First comes research in which variables found empirically to affect learning are identified. This work is usually carried out by educational and learning psychologists, or by educators themselves. The second step is to translate the findings of the basic research into techniques which can be implemented into real life settings, i.e., the schools. Both these steps involve a number of substeps. For example, to be successful, implementation efforts must be concerned with promoting the acceptance of new techniques by demonstrating they are more effective and efficient than extant techniques in their classrooms. The main avenue of innovation is teacher training.

A notable study involving classroom innovation accompanied by in-service training for teachers was conducted by Hummel and Cox (1970). The purpose of this study was to produce an aggregate of conditions supportive of innovation in the organizational climate and structure of schools. A basic element in this study was the training of a cadre of change agents from the personnel from each participating school. These trained change agents conducted in-service training activities within their own schools to promote interest in innovational practices among

their colleagues. Data identifying any attitude change was obtained by a questionnaire from teachers in four participating and four comparison schools. A pre-test was administered and after an 18 month period a post test was given. The conclusion indicated a slight attitudinal shift in the experimental teachers toward adopting innovative practices.

In-service training for teachers was only one segment of the total innovation picture. True change did not affect only the teachers. Any drastic classroom change had to involve the complete organizational procedure of the school and consequently, the administrators. Any in-service training which did the job properly, had to include the counselors who also played a key role in change but did not generally devote a majority of their time to teaching and, therefore, were categorized with the administrators.

Changing Attitudes

Positive attitudinal change involved the total faculty and staff and, therefore, any factors which were considered expedient to change had to take all these people into consideration. Coffey and Golden (1957) supported this view when they wrote that "changing curriculum also involves changing individuals". Changing attitudes of individuals from contentment with the status quo to one of originating or accepting innovation was not a simple matter. There were internal as well as external blocks which each individual who was concerned with change was going to have to resolve for himself or have resolved for him. In-service training appeased many of these trepedations by convincing the individual that the proposed innovation was the better method as

compared to the existing method. Taba (1962) found that new curricula instituted unilaterally by administrators lasted only a short time. She observed that the rejection of these new curricula was "because the changes in curriculum were not accompanied by changes in the skills and attitudes of teaching personnel". She went on to say

> perhaps the greatest deterrant to creative curriculum change lies in the fact that there is no methodological sequence in which to tackle curriculum change, nor yet a clear-cut way of appraising the extent or the quality of the changes taking place.

As these statements indicated, curriculum change or any innovative practice was rarely accompanied by comprehensive in-service training.

Teacher Participation Necessary for Implementation

The inference could be drawn that the majority of teachers were faced with implementing innovative practices in their classrooms with which they were completely unfamiliar. If the new curriculum or method was a radical departure from the existing curriculum or method the teachers would adopt it only because it was imposed upon them and eventually would abandon it. Ahrens (1956) supported this when he reported that

> curricula that are planned and developed without participation of all concerned ... are usually ineffective ... changes in approaches, content, and methods take place only when there are changes in the thinking of those who are concerned.

The lack of a viable method to persuade teachers that an anticipated new curriculum or teaching method was superior to the old way appeared to be one of the major internal, as well as external, blocks to change.

Individualized Instruction

If teachers perceived that a new curriculum or teaching method provided for greater student motivation in the subject at hand as well as higher overall student achievement, the task of implementation could be lessened to a great degree. Individualized instruction appeared to possess, among others, the two attributes mentioned above. This method of instruction, though certainly not new on the educational scene, had gained considerable credibility and its use was spreading rapidly as indicated by Blake and McPherson (1969a) who reported that "schools throughout the nation are currently testing numerous individualized instructional programs of one kind or another".

Certainly a great many educators must have had reason to believe that individualizing instruction was a more efficient and student-centered method of transmitting instructional material or it would not have gained the attention it received. Bolvin (1968) supported this statement when he wrote:

> One of the basic themes permeating the educational reform movement today is the individualization of instruction. Granted this is not a new theme in education; however, the intensity of interest in it is far greater today than ever before.

The Individualized Curriculum

Basically, individualizing a curriculum meant that the student was no longer competing with fellow students for standard achievement criteria such as grades. Rather, the student had performance and/or behavioral objectives set for him to which he had to attain at some

specified criterion level. As Blake and McPherson (1969b) put it:

> Individualized instruction means that the learning program for each curriculum area is organized in such a manner as to allow each child to move at his own pace under the guidance of the teacher. Instruction is non-graded, enabling each child to go as far in each subject as his ability permits.

Further, individualized instruction provided (in ideal circumstances) for the student to be given credit and placement according to his previous education and experience. This was generally construed by teachers who used this method as providing for advanced placement. Other benefits in the optimum individualized instruction program were that there could be provisions for students entering the curriculum at any time during the year and still receive the full course. Also, a student could drop out of the program and rejoin it some time later with no appreciable instructional lag. These qualities had persuaded many teachers and administrators that individualizing their existing curricula was a necessity. Baker and Goldberg (1970) emphasized the importance of individualizing learning systems by stating that

> the system never ceases to adapt to the ever-changing abilities and needs of the students, and it is this quality that makes individualized learning an absolute necessity in our schools of today and tomorrow.

In two other studies in this same area, Sharp (1969) and Fremont (1963) both indicated that students having experienced individualized instruction were significantly above the achievement levels of students taught by the traditional lecture method.

Teacher Reaction to Individualized Instruction

In the study by Spaziani and Courtney (1971a) the respondents

ranked the teacher competency of developing classroom instruction based upon the needs of the individual learner seventh in a total of 99 ranked competencies.

A study which also involved individualization of instruction and behavior of teachers was conducted by Holden (1967). The research investigated changes in the instructional behavior of teachers who used computer processed material designed to individualize instruction as compared to teachers who did not use the material. The data was collected from groups of experimental and control teachers by a team of trained observers. Both groups were given pre-tests and post tests using Jason's Instruction Observation Record. The following conclusions were made from the study: (1) there was a difference in behavior of teachers using computer based material as compared to the control teachers, and (2) use of the computer processed material failed to produce significant changes in other dimensions.

In another study, Tuckman (1969) regarded the individualized curriculum as a completely student-centered curriculum. He felt that though its implementation by teachers within the school systems would be a dramatic change, it was one that had to be accomplished.

Summary of the Literature

Four conclusions of importance to the study were drawn from the review of literature. The first was that student achievement levels were an important factor in the consideration by teachers and administrators in the anticipated implementation of innovative instructional methods. Further, both teachers and administrators, though for slightly

different reasons, agreed that new curricula must be student-centered.

The second conclusion was that for innovative curricula or instructional methods to be successful in school systems both teachers and administrators had to possess positive attitudes toward these innovations.

The third conclusion was that comprehensive in-service training for teachers and administrators was a necessity for bringing about the proper attitudes toward change and for implementation of innovative methods or systems.

The fourth conclusion was that while both the teacher and administrator were change agents within the school system, any innovation was doomed to failure unless there was close cooperation between the two.

III. DESIGN OF THE STUDY

The following is a description of the design and procedures employed in the study. Each step taken in the investigation is detailed.

Individualized Instruction Programs

The individualized instruction programs utilized in this study were the result of developmental work by Oregon community college and secondary school teachers in the area of electricity-electronics. The program was in the form of individualized learning packages. One hundred ninety-six of these learning packages covered the standard basic electricity-electronics theory. This program, known as the Individualized Curriculum for Electronics (ICE), was field tested during the 1971-72 school year in five community colleges and eight secondary schools in the state of Oregon. The field test was conducted by the Oregon State Department of Education to evaluate the effectiveness of ICE at the teacher and student levels. Physical location of the institutions involved in the study ranged from small semi-isolated towns to metropolitan areas.

In-Service Training

In conjunction with the field test of the ICE program, all directly affected educators in the secondary schools and community colleges whose institutions were selected for the evaluation did attend four in-service training sessions conducted over a four month period. The in-service training sessions were concerned with the

implementation and evaluation of individualized instructional methods. These meetings were taught by a consortium of instructors from Oregon State University, Clackamas Community College, Chemeketa Community College, Central Oregon Community College, Washington High School, the Occupational Skill Center and specialists from the Oregon State Department of Education. Approximately 20 clock hours of instruction were given to representative teachers, counselors and administrators from each institution.

Population of the Study

The population consisted basically of two groups. One group was composed of secondary school and community college students involved in electricity-electronics programs and the second group was made up of teachers, counselors and administrators from both secondary schools and community colleges. The teachers included in this study were electricity-electronics and electronics technology teachers.

The populations for the study were roughly matched according to geographical area, school population and program description. These school locations and populations were contained in the 1970-71 Oregon School Directory. The program descriptions were contained in the respective community college bulletins.

Experimental Group

The secondary school population was, in part, determined by those schools involved in field testing the Individualized Curriculum for Electronics (ICE). The field test was conducted by the Oregon State

Department of Education. Seven secondary schools in the state of Oregon were selected as participants in the field test of ICE and took part in this study. Four community colleges in the state of Oregon were also selected on the same basis. These secondary schools and community colleges comprised the experimental group.

Control Group

Seven control secondary schools within the state were selected according to the type of electricity-electronics program they offered, the geographical area and approximate school student population. The four control community colleges were selected on the basis of similarity of their electricity-electronics and/or electronics technology programs as compared with the experimental colleges.

The total student population responding to test instruments was 260. A total of 54 teachers, counselors and administrators responded to the dogmatism scale.

Selected Groupings

The population groups investigated were:

Ia. Eighty-six secondary school students enrolled in the first year electricity-electronics courses which were using individualized instruction in the form of ICE. (Group Ia).

Ib. Seventy-seven secondary school students enrolled in the first year electricity-electronics courses which were taught in the standard lecture method. (Group Ib).

IIa. Forty-six community college students enrolled in the first

year electricity-electronics or electronics technology courses which were using individualized instruction in the form of ICE. (Group IIa).

IIb. Fifty-one community college students enrolled in the first year electricity-electronics or electronics technology courses which were taught in the standard lecture method. (Group IIb).

IIIa. Twenty-two secondary school and community college teachers, counselors and administrators whose institutions were using individualized instruction in the form of ICE. (Group IIIa).

IIIb. Thirty-two secondary school and community college teachers, counselors and administrators whose institutions were using the standard lecture method in electricity-electronics or electronics technology courses. (Group IIIb).

Procedure

The procedure utilized to measure student achievement was for each secondary school and community college teacher to administer the achievement test (Appendix A) in a pre-test/post test design as outlined by Campbell and Stanley (1963). The raw scores were compiled and recorded according to population category.

The attitudes of the teachers, counselors and administrators were measured with the use of the Rokeach Dogmatism Scale (Appendix A). All of the teachers, counselors and administrators who were involved with the electricity-electronics students responded to the scale. The scales were administered in the same pre-test/post test pattern as the achieve-

ment test and at the same point in time. The scores were compiled and recorded according to population category.

Collection of Data

The following steps were followed in the collection of data:

1. The instruments were professionally printed as exhibited in Appendix A.
2. The investigator contacted each school tentatively selected to participate in the study to secure permission to conduct the study and to gain the cooperation of the electricity-electronics teacher.
3. The investigator personally visited each secondary school and community college participating in the study and delivered the student achievement tests and the Rokeach Dogmatism Scales. The students were given the test as part of their regular schedule. The teachers, counselors and administrators responded to the scale following the instructions included with each scale.
4. Two weeks later the investigator returned and collected the tests and scales. If the instruments were not complete, the participants were requested to mail the materials the following week. The three week period was established as the maximum length of time for completion of the materials so that enough time would elapse between the pre-test and the post test.
5. Four months after the pre-test was administered the post test was given in the same fashion and within the same time limits.

The instruments were collected by the investigator.

Data Collecting Instruments

Two instruments were involved in the collection of data.

Student Electricity-Electronics Achievement Test

The instrument used to collect data which measured student achievement was compiled by the researcher using questions from such standard references as Kaufman (1970); F.C.C. Study Guide (1955); Gillie (1969); Grob and Kiver (1966); Cooke and Adams (1970); Shrader (1969); and Grob (1965). The questions abstracted covered the first year of basic electricity-electronics courses as outlined by Zbar and Muth (1966).

Reliability was accomplished by submitting the questions to a panel of experts composed of Dr. J. Larry Heath, Oregon State University; Prof. Melvin Circle, Chemeketa Community College; Prof. Dan Liethoff, Clackamas Community College; John Havery, Washington High School; and Russ Roberts, Occupational Skill Center. Each of the experts had substantial background in electricity-electronics in industry and education.

In their opinion the instrument was useful for achievement testing in both secondary schools and community college first year electricity-electronics programs.

Rokeach Dogmatism Scale

The instrument used in this study to measure attitudes of teachers, counselors and administrators was titled Rokeach Dogmatism Scale. The

actual instrument was a combination of a dogmatism scale, the MMPI K Scale, and the California F Test developed by Sedgwick (1966). The dogmatism scale as developed by Rokeach (1960) was intended primarily to measure individual differences in openness or closedness of belief systems. The scale also was designed to measure general authoritarianism and general intolerance. Its reliability was determined by administering the instrument to college students, English automobile plant workers, and residents at a veterans administration domicilary. The data gathered from these sources was analyzed by using the Spearman-Brown split-halves formula. The reliability coefficient obtained by this method ranged from 0.68 to 0.93. The validity of the scale used was determined by the method of known groups. Two studies were conducted to assess the validity of the instrument with respect to general authoritarianism and intolerance. In the first study, a group of college professors were judged to be highly dogmatic and 16 subjects were judged to be low in dogmatism. The results indicated no differences between the two criterion groups. In the second study, graduate students in psychology selected high and low dogmatic subjects among their personal friends. The instrument was administered to 20 subjects; ten judged to be highly dogmatic and ten low in dogmatism. The results indicated the highly dogmatic subjects scored significantly higher than the low dogmatic subjects on the scale.

The MMPI K Scale

The MMPI K Scale was used in this instrument to measure supportiveness to aid other people as indicated in validation studies reported by

Gage (1963) and Barr et al. (1961).

In Sedgwick's (1966a) investigation he reported that a high score on this scale indicated that the respondent had less support for others. A low score indicated a more supportive attitude. A low score on this scale indicated that the person would be likely to adjust his mode in order to be more helpful to others. This scale actually looked at three elements:

1. Supportiveness of others.
2. Ego strength (ego integration). This is currently related toward Maslow's self-actualization theory.
3. Conformability. This is the ability to adjust a system or approach to a person's particular set of needs in order to get him to where he wants to go.

Elements one and two required an openness among people who were involved with the person. In addition, they required a relatively non-threatening situation as a normal part of the learning process.

The California F Test

The California F Test, Gough and Sanford (1952), was included in the California Psychological Inventory, where it was labeled Fx (Flexibility). This characteristic was described by Rokeach (1960a) as:

> ... to the extent that a person is said to be characteristically rigid (inflexible), his analytic thinking should suffer ... He cannot break down or overcome beliefs when they are no longer appropriate, in order to replace them with appropriate ones.

A low score on this scale was indicative of high flexibility.

Scoring Procedure

Student Achievement Test

The student achievement test was designed to measure student comprehension of the concepts presented in the typical first year electricity-electronics courses at both secondary schools and community colleges.

Student Achievement Test Scoring Procedure

The test consisted of 30 multiple choice questions. The total number of correct responses were tabulated and summed into raw scores for each student. The summation of the raw scores was then converted into the mean for that particular population group.

Rokeach Dogmatism Scale

The Sedgwick (1966b) version of the dogmatism scale was designed to measure attitudes in three distinct areas. They were: (1) Dogmatism; to assert an opinionated or arrogant attitude without supportive evidence. (2) Supportiveness; a warm and helping attitude (MMPI K). (3) Flexibility; rigidity or flexibility toward maintenance of a belief system indicating an open or closed minded attitude (California F Test).

Dogmatism Scale Scoring Procedure

The dogmatism section of the scale consisted of 40 items randomly placed throughout the scale. The summation of the composite total items in this section indicated where the person was positioned on the scale

from highly dogmatic to low dogmatic. The responses which indicated high or low dogmatic attitudes were scored as follows:

	Scale Value
a. I agree very much	1
b. I agree on the whole	2
c. I agree a little	3
d. I disagree a little	5
e. I disagree on the whole	6
f. I disagree very much	7

The greater the summed composite score indicated the more dogmatic the attitude of the respondent.

The California F Test Scoring Procedure

The California F Test contained 22 items randomly placed throughout the scale. The summation of the items in this section of the scale indicated the rigidity or flexibility of the respondent. The scoring was identical to that used in the dogmatism section. The greater the summed composite score, the more rigid the respondent.

The MMPI K Scale Scoring Procedure

The MMPI K Scale was made up of 30 items randomly placed throughout the scale. The summation of the composite items in this section of the scale indicated the willingness to support or not support other people. These items were scored as follows:

	Scale Value
a. I agree very much	0
b. I agree on the whole	0
c. I agree a little	0
d. I disagree a little	1
e. I disagree on the whole	1
f. I disagree very much	1

The greater the summed composite score indicated that the respondent was less supportive to other people.

The total sum of scores for each section comprised the raw attitude score for each respondent.

Data from the instruments was scored manually. The mean scores were compiled according to categorical population groupings to assist in statistical analysis.

Analysis of Data

One basic statistical tool was utilized for this study: the one-way analysis of covariance with unequal n's utilizing the F test. As Courtney and Sedgwick (1969) described it the analysis of covariance was a statistical technique which combined the concepts of analysis of variance and regression to handle situations where the researcher cannot completely control all the variables in his study. It was a procedure for testing the significance of differences among means, accounting for the influence of uncontrolled factors in the experiment.

One-Way Analysis of Covariance with Unequal n's

The one-way analysis of covariance with unequal n's was used for hypotheses 1.1 and 1.2. Comparison of variance for each population group was made with a F test to determine if any variance existed between (1) the achievement levels between secondary school control groups and secondary school experimental groups, and (2) the achievement levels between community college control groups and community college experimental groups.

The data was collected for individual scores and mean scores which were computed for each categorized population group. The F test was utilized to determine if variance existed because of the concern that some variation might be present in the student population groups due to the variation in grade levels. As reported by Courtney and Sedgwick (1969a)

> although the assumptions of homogeneity of variance and normality are considered to be requirements before using the F statistic, there is considerable evidence to support the contention that departures from normality as well as substantial differences in variance do not greatly effect the use of the technique for decision-making purposes. This consideration further substantiates the robustness of the F statistic for testing means.

The analysis of covariance with unequal n's was also used to test hypotheses 2.1, 2.2 and 2.3. Comparison of variance for each population group was made with the F test to determine if any variance existed when comparing attitudes of teachers, counselors and administrators who were implementing individualized programs at the secondary school level as compared to those using the standard lecture programs. Also, the

attitudes of teachers, counselors and administrators who were implementing individualized programs at the community college level were compared to those using standard lecture programs.

Data was collected for individual scores and mean scores were computed for each section of the instrument and for categorized population groups. Since these groups were not precisely matched, the covariance technique was used for the reasons reported by Courtney and Sedgwick (1969b):

> Analysis of covariance has its most frequent use in situations where little or no control has been exercised over the independent variable used in the study. As far as design is concerned, covariance analysis increases precision by controlling error. The regression influence of the technique removes those effects which have not been controlled by matching.

IV. ANALYSIS OF DATA

The problems investigated in this study were to determine (1) if student achievement was greater in individualized instruction programs as compared to traditional graded programs, and (2) if educators' attitudes toward implementation of individualized programs enhanced the possibility of a high level of student achievement in these programs.

Student achievement was measured by a 30 question instrument. Educators' attitudes were established with the use of a modified Rokeach Dogmatism Scale.

The instruments were delivered to 14 high schools and eight community colleges. One hundred sixty-three high school and 97 community college students completed both the pre-test and post test achievement instrument. This represented a 70% return. Nineteen community college educators and 35 high school educators responded to both the pre-test and post test attitude instrument resulting in an 87% return. The 13% not responding were unavailable at the time the post test instrument was administered.

Analysis of Covariance Comparing Student Achievement

A one-way analysis of covariance was used to determine if there was any significant difference in the achievement level of the two groups of high school students. The same analysis was used to compare the community college students' achievement. The two null hypotheses were not rejected.

High School Students' Achievement Comparison

Using the one-way analysis of covariance the pre-test was designated the covariate which was the reference for comparison to the post test. The covariate means in this test were 12.61 for the control group and 13.65 for the experimental group. With 1 and 160 degrees of freedom a F value of 143.9 was obtained as indicated in Table 1. This value had no significance other than serving as a reference point.

The post test means were 14.88 for the control group and 15.67 for the experimental group. With 1 and 160 degrees of freedom a F value of .032 was obtained as indicated in Table 2. Using a significance test of F = .05, this F value denoted there was no significant difference in the achievement levels between the two groups. Therefore, Ho: 1.1 "there will be no significant difference of achievement level between secondary school control groups compared with experimental groups" was retained.

Table 1. One-way Analysis of Covariance Measuring High School Student Achievement. Establishing the Covariate as a Reference.

Source of Variation	d.f.	MS	F
Among groups	160	0	0
Two groups	1	1,474	143.9*
Error of Variance	161	10.8	

*Not significant.

Table 2. One-way Analysis of Covariance Measuring High School Student Achievement. Comparison of Covariate and Post Test.

Source of Variation	d.f.	MS	F
Among groups	160	0	0
Two groups	1	0	.032*
Error of Variance	161	12.3	

*Not significant.

Community College Students' Achievement Comparison

Using the one-way analysis of covariance the pre-test was designated the covariate which was the reference for comparison to the post test. The covariate means in this test were 18.05 for the control group and 16.95 for the experimental group. With 1 and 94 degrees of freedom a F value of 27.08 was obtained as indicated in Table 3. This value had no significance other than serving as a reference point.

The post test means were 20.13 for the control group and 19.36 for the experimental group. With 1 and 94 degrees of freedom a F value of .217 was obtained as indicated in Table 4. Using a significance test of F = .05, this F value denoted there was no significant difference in the achievement levels between the two groups. Therefore, Ho: 1.2 "there will be no significant difference in achievement level between community college control groups compared with experimental groups" was retained.

Table 3. One-way Analysis of Covariance Measuring Community College Student Achievement. Establishing the Covariate as a Reference.

Source of Variation	d.f.	MS	F
Among groups	94	0	0
Two groups	1	216	27.08*
Error of Variance	95	7.87	

*Not significant.

Table 4. One-way Analysis of Covariance Measuring Community College Student Achievement. Comparison of Covariate and Post Test.

Source of Variation	d.f.	MS	F
Among groups	94	0	0
Two groups	1	2	.217*
Error of Variance	95	7.95	

*Not significant.

Analysis of Covariance Comparing Educators' Attitudes

Comparison of Educators' Supportive Attitudes

The one-way analysis of covariance was used to determine if there was a significant difference in the supportive attitudes of educators as measured on the K-scale. The hypothesis was stated in the null form. The pre-test was the covariate in this analysis. The covariate means in this test were 13.31 for the control group and 14.50 for the

experimental group. With 1 and 51 degrees of freedom a F value of 1.78 was obtained as indicated in Table 5. This value had no significance other than serving as a reference point as shown in the similarity of the means.

The post test means were 15.90 for the control group and 14.86 for the experimental group. With 1 and 51 degrees of freedom a F value of .82 was obtained as indicated in Table 6. Using a significance test of F = .05, this F value denoted no significant difference in the supportive attitudes of the two groups. Therefore, Ho: 2.1 "there will be no significant difference in the supportive attitudes of teachers, counselors and administrators who are implementing individualized programs as compared to those using the standard lecture program" was retained.

Table 5. One-way Analysis of Covariance Measuring Supportive Attitudes of Educators. Establishing the Covariate as a Reference.

Source of Variation	d.f.	MS	F
Among groups	51	0	0
Two groups	1	47.0	1.78*
Error of Variance	52	25.4	

*Not significant.

Table 6. One-way Analysis of Covariance Measuring Supportive Attitudes of Educators. Comparison of Covariate and Post Test.

Source of Variation	d.f.	MS	F
Among groups	51	0	0
Two groups	1	22.0	.82*
Error of Variance	52	25.8	

*Not significant.

Comparison of Educators' Dogmatic Attitudes

A one-way analysis of covariance was used to determine if there was a significant difference in the dogmatic attitudes of the educators as measured on the F-scale. The hypothesis was stated in the null form.

The pre-test was the covariate for this analysis. The covariate means were 135.06 for the control group and 134.40 for the experimental group. With 1 and 51 degrees of freedom a F value of 213.05 was obtained as indicated in Table 7. This value was significant since the difference in the covariate means was not adjusted by the regression element of this analysis technique. This F value indicated that there was a significant difference of attitudes between the groups at the time of the pre-test.

The post test means were 142.56 for the control group and 130.18 for the experimental group. The mean of 142.56 for the control group indicated this group became increasingly dogmatic because the larger the score on the F-scale, the more dogmatic the respondent. The mean of 130.18 for the experimental group clearly indicated that this group

had become less dogmatic in its attitude while the control group became more dogmatic. With 1 and 51 degrees of freedom a F value of 13.62 was obtained as indicated in Table 8. Using a significance test of F = .05 (t.05 = 4.00) indicated there was a significant difference in the dogmatic attitudes of the two groups. Therefore, Ho: 2.2 "there will be no significant difference in the dogmatic attitudes of teachers, counselors and administrators who are implementing individualized programs as compared to those who are using the standard lecture program" was rejected.

Table 7. One-way Analysis of Covariance Measuring Dogmatic Attitudes of Educators. Establishing the Covariate as a Reference.

Source of Variation	d.f.	MS	F
Among groups	51	0	0
Two groups	1	28,354	213.05*
Error of Variance	52	13.5	

*Significant F = .05

Table 8. One-way Analysis of Covariance Measuring Dogmatic Attitudes of Educators. Comparison of Covariate and Post Test.

Source of Variation	d.f.	MS	F
Among groups	51	0	0
Two groups	1	7,813	13.62*
Error of Variance	52	13.5	

*Significant F = .05

Comparison of Educators' Rigidity-Flexibility Attitudes

The one-way analysis of covariance was used to determine if there was a significant difference in the rigidity-flexibility attitudes of educators as measured on the R-scale. The hypothesis was stated in the null form.

The pre-test was the covariate for this analysis. The covariate means in this test were 87.28 for the control group and 82.36 for the experimental group. With 1 and 51 degrees of freedom a F value of 160.55 was obtained as indicated in Table 9. This value was significant in that the wide variation in the covariate means was not adjusted by the regression analysis element of this statistical technique. This F value indicated that significance existed between the two groups of educators at the time of the pre-test.

The post test means were 90.25 for the control group and 81.04 for the experimental group. The mean of 90.25 for the control group indicated that this group had become increasingly rigid since the larger score on the R-scale, the more rigid the respondent. The mean of 81.04 for the experimental group clearly indicated a more flexible attitude. With 1 and 51 degrees of freedom a F value of 4.49 was obtained on the post test as indicated in Table 10. Using a significance test of F = .05 (t.05 = 4.00) indicated there was a significant difference in the rigidity-flexibility attitudes of the two groups. Therefore, Ho: 2.3 "there will be no difference in the flexibility attitudes of teachers, counselors and administrators who are implementing individualized programs as compared to those using the standard

lecture program" was rejected.

Table 9. One-way Analysis of Covariance Measuring Rigidity-Flexibility Attitudes of Educators. Establishing the Covariate as a Reference.

Source of Variation	d.f.	MS	F
Among groups	51	0	0
Two groups	1	10,393.0	160.55*
Error of Variance	52	63.5	

*Significant F = .05

Table 10. One-way Analysis of Covariance Measuring Rigidity-Flexibility Attitudes of Educators. Comparison of Covariate and Post Test.

Source of Variation	d.f.	MS	F
Among groups	51	0	0
Two groups	1	291	4.49*
Error of Variance	52	63.5	

*Significant F = .05

V. SUMMARY AND CONCLUSIONS

The Problem

The study was designed to determine if students using the individualized instruction method, scored significantly higher on a 30 question achievement test than did students in more traditional group paced programs. The study also attempted to determine if attitudes displayed by educators, as measured on an attitude scale, aided in the implementation of individualized instructional programs. The specific questions formulated to investigate in this study were:

1. Do students who have been taught in individualized instruction programs achieve at a higher level than students taught in more traditional graded programs?
2. Are the attitudes of educators who implement innovative programs the same as the attitudes of educators who continue with traditional teaching methods?
3. Does in-service training dealing with solving implementation problems have any appreciable effect on the attitudes of educators who are implementing innovative programs?
4. Is a positive attitude towards innovation by teachers, counselors and administrators evident and measureable?

The purpose of this study was to determine if there was any significant difference in the achievement levels of students in individualized instruction programs as compared to students in traditional programs and to measure the attitudes of educators who were implementing individualized instruction programs and educators who were not. It was

also to determine if the attitudes of the respective groups of educators were significantly different and if these attitudes could be reflected in student achievement.

The major significance of this study was to investigate whether electricity-electronics programs utilizing individualized instruction was a more efficient method of teaching than traditional large group methods because of educators' attitudes toward these programs, to isolate those attitudes that provided a positive climate for innovation and to determine if this positive climate affected student achievement to any degree.

Procedure

The selected population of students and instructors participating in the study was from Oregon's community colleges and secondary schools. Fifty-four high school and community college educators responded to both pre-test and post test instruments by the cut-off date resulting in an 87% return. One hundred sixty-three high school students and 107 community college students responded to a pre-test and post test instrument by the cut-off date resulting in a 70% return.

The selected control and experimental groups were categorized as follows:

Group Ia. Eighty-six secondary school students enrolled in the first year electricity-electronics courses which were using individualized instruction in the form of ICE.

Group Ib. Seventy-seven secondary school students enrolled in the first year electricity-electronics courses which were

taught in the standard lecture method.

Group IIa. Forty-six community college students enrolled in the first year electricity-electronics or electronics technology courses which were using individualized instruction in the form of ICE.

Group IIb. Fifty-one community college students enrolled in the first year electricity-electronics or electronics technology courses which were taught in the standard lecture method.

Group IIIa. Twenty-two secondary school and community college teachers, counselors and administrators whose institutions were using individualized instruction in the form of ICE.

Group IIIb. Thirty-two secondary school and community college teachers, counselors and administrators whose institutions were using the standard lecture method in electricity-electronics or electronics technology courses.

Students responded individually to a 30 question validated electricity-electronics measurement instrument for a pre-test and four months later, a post test.

Educators responded individually to a 92 question attitude scale which contained three distinct attitude measurements on a pre-test and four months later, a post test.

The pertinent raw data was entered on computer cards.

Analysis of Data

The one-way analysis of covariance with unequal n's was used to analyze the statistical significance of (1) student achievement levels at both secondary schools and community colleges, and (2) teachers', counselors' and administrators' attitudes towards innovation at both secondary schools and community colleges. The statistical analysis was accomplished by computer programming.

Summary of Findings

1. The results of the study indicated there was no difference in the achievement levels of secondary school students taught by individualized instruction methods as compared to traditional methods in electricity-electronics courses. According to the questionnaire scores in this study, the type of teaching method used in this particular subject indicated no substantial difference in student achievement.
2. Further results indicated there was no difference in the achievement level of community college students taught by individualized instruction methods as compared to traditional methods in electricity-electronics courses or electronics technology courses. According to the questionnaire scores in this study, the type of teaching method used in this particular subject indicated no substantial difference in student achievement.
3. Based upon the scores of the modified Rokeach Dogmatism Scale both secondary school and community college educators exhibited equal

supportive attitudes towards those people they worked with.

4. Secondary school and community college educators did differ sharply in their dogmatic attitudes depending upon whether or not they were involved in implementing innovative programs. The scores as indicated on the modified Rokeach Dogmatism Scale showed that the innovative group was much less dogmatic than the traditional group in the pre-test and that this difference widened significantly at the post test.
5. The control group of educators exhibited a rigid attitude at the pre-test and this attitude became more rigid at the post test. The experimental group, on the other hand, tended toward a flexible attitude at the pre-test and this attitude was even more flexible at the post test.
6. The increasingly less dogmatic and flexible attitudes of the experimental group of educators as shown by the scores on the post test indicated that in-service training might have been a factor in reinforcing positive attitudes towards innovation and towards continued implementation of innovative programs.
7. The scores of the experimental group of educators clearly indicated that teachers, counselors and administrators had to be in accord before implementation and continuation of innovative programs was successful in both secondary schools and community colleges.

Conclusions

1. For secondary school students enrolled in electricity-electronics programs there was no significant difference in achievement level

in individualized instruction programs as compared to traditional programs.

2. For community college students enrolled in electricity-electronics or electronics technology programs there was no significant difference in achievement level in individualized instruction programs as compared to traditional programs.
3. There was no significant difference in the supportive attitudes of educators whether or not they were implementing innovative programs.
4. Secondary school and community college educators who were implementing individualized instruction programs were significantly less dogmatic in their attitudes as compared to educators who were not implementing innovative programs.
5. Secondary school and community college educators who were implementing individualized instruction programs were significantly more flexible in their attitudes as compared to educators who were not implementing innovative programs.

Recommendations

Student Achievement

One major purpose of this study was to determine if students involved in electricity-electronics individualized instruction programs achieved at a significantly higher level than those in traditional programs. The results indicated conclusively that there was no difference in achievement levels. The following recommendations are offered to assist further research in this area.

1. The study should be repeated in other student populations to verify the findings of this study.
2. Similar studies should be done comparing the attitudes of students towards teaching methods used in individualized instruction and traditional graded programs.
3. A similar study should be done using achievement of performance objectives as a basis for comparison between students in individualized instruction programs and those in traditional graded programs.
4. A study should be conducted to determine which individual student aptitudes and characteristics are best suited for individualized instructional teaching methods.
5. A study should be conducted which determines the more effective of the two instructional strategies with groups of students having different characteristics.

Educators' Attitudes

The second major purpose of this study was to determine if attitudes of educators involved in implementing individualized instruction programs differed from attitudes of educators continuing with traditional programs and if the attitudes were reflected in student achievement. The following recommendations are offered to assist further research in this area.

1. The study should be repeated with other educator populations to verify the finding of this study.
2. Further studies should be conducted to isolate attitudes held

by educators which are important variables in the implementation of innovative programs.

3. A study identifying other positive attitudes of educators towards implementing innovative programs and the affect of these attitudes on student performances should be conducted.
4. The outcome of this study clearly indicated that the educators in the experimental group already possessed positive attitudes at the time of the pre-test. A further study should be made to identify the causation of the positive attitudes.

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APPENDICES

APPENDIX A

INSTRUMENTS

Letter of Permission,
Dogmatism Index Scale,
Student Questionnaire.

STOUT STATE UNIVERSITY
MENOMONIE, WISCONSIN
54751

December 10, 1971

Mr. Jerry Ludlow
1142 Wiltsey S. E.
Salem, Oregon 97302

Dear Mr. Ludlow:

This is to verify that you have my permission to use the instrument which was developed by Lorry K. Sedgwick at Stout State University which consists of the elements of dogmatism, the MM PI K Scale, and the California F Test. It is understood that the instrument will only be used for your dissertation work at Oregon State University and will not be commercially published or utilized as a profit-making device.

Sincerely,

Redacted for privacy

Lorry K. Sedgwick
Professor

LKS:jp

Dogmatism Index Scale

The following is a study of what the general public thinks and feels about a number of important social and personal questions. The best answer to each statement below is your personal opinion. We have tried to cover many different and opposing points of view; you may find yourself agreeing strongly with some of the statements, disagreeing just as strongly with others, and perhaps uncertain about others; whether you agree or disagree with any statement, you can be sure that many people feel the same as you do.

Mark each statement on your answer sheet according to how much you agree or disagree with it. Please mark every one. Mark +1, +2, +3, -1, -2, -3, depending on how you feel in each case.

Use a soft lead pencil. Make all marks dark. Place your mark within the circle. Leave no stray marks and erase completely when necessary.

+3	+2	+1	-1	-2	-3
I AGREE VERY MUCH	I AGREE ON THE WHOLE	I AGREE A LITTLE	I DISAGREE A LITTLE	I DISAGREE ON THE WHOLE	I DISAGREE VERY MUCH

Sample Question:

98. I am easily awakened by noise.

Sample Answer Sheet:

+3	+2	+1	-1	-2	-3
0	0	●	0	0	0

This indicates that you agree a little.

Name_____Class or Grade_____Date_____

Age_____Sex_____College Major, if you are in college_____

Name of School or College_____City_____State_____

+3 I AGREE VERY MUCH	+2 I AGREE ON THE WHOLE	+1 I AGREE A LITTLE	-1 I DISAGREE A LITTLE	-2 I DISAGREE ON THE WHOLE	-3 I DISAGREE VERY MUCH

Directions: Please answer each item by darkening the appropriate circle. If you change your mind, please erase completely your first response.

	+3	+2	+1	-1	-2	-3		+3	+2	+1	-1	-2	-3		+3	+2	+1	-1	-2	-3
1.	0	0	0	0	0	0	32.	0	0	0	0	0	0	63.	0	0	0	0	0	0
2.	0	0	0	0	0	0	33.	0	0	0	0	0	0	64.	0	0	0	0	0	0
3.	0	0	0	0	0	0	34.	0	0	0	0	0	0	65.	0	0	0	0	0	0
4.	0	0	0	0	0	0	35.	0	0	0	0	0	0	66.	0	0	0	0	0	0
5.	0	0	0	0	0	0	36.	0	0	0	0	0	0	67.	0	0	0	0	0	0
6.	0	0	0	0	0	0	37.	0	0	0	0	0	0	68.	0	0	0	0	0	0
7.	0	0	0	0	0	0	38.	0	0	0	0	0	0	69.	0	0	0	0	0	0
8.	0	0	0	0	0	0	39.	0	0	0	0	0	0	70.	0	0	0	0	0	0
9.	0	0	0	0	0	0	40.	0	0	0	0	0	0	71.	0	0	0	0	0	0
10.	0	0	0	0	0	0	41.	0	0	0	0	0	0	72.	0	0	0	0	0	0
11.	0	0	0	0	0	0	42.	0	0	0	0	0	0	73.	0	0	0	0	0	0
12.	0	0	0	0	0	0	43.	0	0	0	0	0	0	74.	0	0	0	0	0	0
13.	0	0	0	0	0	0	44.	0	0	0	0	0	0	75.	0	0	0	0	0	0
14.	0	0	0	0	0	0	45.	0	0	0	0	0	0	76.	0	0	0	0	0	0
15.	0	0	0	0	0	0	46.	0	0	0	0	0	0	77.	0	0	0	0	0	0

	+3	+2	+1	-1	-2	-3		+3	+2	+1	-1	-2	-3		+3	+2	+1	-1	-2	-3
16.	0	0	0	0	0	0	47.	0	0	0	0	0	0	78.	0	0	0	0	0	0
17.	0	0	0	0	0	0	48.	0	0	0	0	0	0	79.	0	0	0	0	0	0
18.	0	0	0	0	0	0	49.	0	0	0	0	0	0	80.	0	0	0	0	0	0
19.	0	0	0	0	0	0	50.	0	0	0	0	0	0	81.	0	0	0	0	0	0
20.	0	0	0	0	0	0	51.	0	0	0	0	0	0	82.	0	0	0	0	0	0
21.	0	0	0	0	0	0	52.	0	0	0	0	0	0	83.	0	0	0	0	0	0
22.	0	0	0	0	0	0	53.	0	0	0	0	0	0	84.	0	0	0	0	0	0
23.	0	0	0	0	0	0	54.	0	0	0	0	0	0	85.	0	0	0	0	0	0
24.	0	0	0	0	0	0	55.	0	0	0	0	0	0	86.	0	0	0	0	0	0
25.	0	0	0	0	0	0	56.	0	0	0	0	0	0	87.	0	0	0	0	0	0
26.	0	0	0	0	0	0	57.	0	0	0	0	0	0	88.	0	0	0	0	0	0
27.	0	0	0	0	0	0	58.	0	0	0	0	0	0	89.	0	0	0	0	0	0
28.	0	0	0	0	0	0	59.	0	0	0	0	0	0	90.	0	0	0	0	0	0
29.	0	0	0	0	0	0	60.	0	0	0	0	0	0	91.	0	0	0	0	0	0
30.	0	0	0	0	0	0	61.	0	0	0	0	0	0	92.	0	0	0	0	0	0
31.	0	0	0	0	0	0	62.	0	0	0	0	0	0	93.	0	0	0	0	0	0

1. In times like these it is often necessary to be more on guard against ideas put out by people or groups in one's own camp than by those in the opposing camp.

2. If a man is to accomplish his mission in life it is sometimes necessary to gamble "all or nothing at all".

3. I have periods in which I feel unusually cheerful without any special reason.

4. Unfortunately, a good many people with whom I have discussed important social and moral problems don't really understand what's going on.

5. I try to follow a program of life based on duty.

6. It makes me impatient to have people ask my advice or otherwise interrupt me when I am working on something important.

7. I tend to be on my guard with people who are somewhat more friendly than I had expected.

8. There are a number of people I have come to hate because of the things they stand for.

9. In history of mankind there have probably been just a handful of really great thinkers.

10. I usually find that my own way of attacking a problem is best, even though it doesn't always seem to work in the beginning.

11. I worry over money and business.

12. I like to let people know where I stand on things.

13. I have a work and study schedule which I follow carefully.

14. Most of the ideas which get printed nowadays aren't worth the paper they are printed on.

15. I certainly feel useless at times.

16. I have never felt better in my life than I do now.

17. When it comes to differences of opinion in religion we must be careful not to compromise with those who believe differently from the way we do.

18. Man on his own is a helpless and miserable creature.

19. I am always careful about my manner of dress.

20. Most people will use somewhat unfair means to gain profit or an advantage rather than to lose it.

21. I do not enjoy having to adapt myself to new and unusual situations.

22. I have sometimes felt that difficulties were piling up so high that I could not overcome them.

23. Fundamentally, the world we live in is a pretty lonesome place.

24. A group which tolerates too much differences of opinion among its own members cannot exist for long.

25. I think nearly anyone would tell a lie to keep out of trouble.

26. At times my thoughts have raced ahead faster than I could speak them.

27. I find it hard to set aside a task I have undertaken, even for a short time.

28. Most people just don't give a "damn" for others.

29. I have often met people who were supposed to be experts who were no better than I.

30. Often I can't understand why I have been so cross and grouchy.

31. At times I feel like smashing things.

32. In times like these, a person must be pretty selfish if he considers primarily his own happiness.

33. What others think of me does not bother me.

34. It makes me uncomfortable to put on a stunt at a party even when others are doing the same sort of thing.

35. It is often desirable to reserve judgment about what's going on until one has had a chance to hear the opinions of those one respects.

36. The highest form of government is a democracy and the highest form of democracy is a government run by those who are most intelligent.

37. Of all the different philosophies which exist in this world there is probably only one which is correct.

38. I usually maintain my own opinions when many other people may have a different point of view.

39. It takes a lot of argument to convince most people of the truth.

40. I believe that promptness is a very important personality characteristic.

41. A person who gets enthusiastic about too many causes is likely to be a pretty "whishy-washy" sort of person.

42. The main thing in life is for a person to want to do something important.

43. It is only natural for a person to be rather fearful of the future.

44. Once I get wound up in a heated discussion I just can't stop.

45. To compromise with our political opponents is dangerous because it usually leads to the betrayal of our own side.

46. The United States and Russia have just about nothing in common.

47. It is only natural that a person would have a much better acquaintance with ideas he believes in than with ideas he opposes.

48. I find it hard to make talk when I meet new people.

49. I am often the last one to give up trying to do a thing.

50. I often become so wrapped up in something I am doing that I find it difficult to turn my attention to other matters.

51. The worst crime a person could commit is to attack publicly the people who believe in the same thing he does.

52. I have never done anything dangerous for the thrill of it.

53. I'd like it if I could find someone who would tell me how to solve my personal problems.

54. I think a great many people exaggerate their misfortunes in order to gain the sympathy and help of others.

55. At periods my mind seems to work more slowly than usual.

56. I prefer work that requires a great deal of attention to detail.

57. Criticism or scolding hurts me terribly.

58. It is only when a person devotes himself to an ideal or cause that life becomes meaningful.

59. I get mad easily and then get over it soon.

60. In a discussion I often find it necessary to repeat myself several times to make sure I am being understood.

61. It is better to be a dead hero than to be a live coward.

62. Even though freedom of speech for all groups is a worthwhile goal, it is unfortunately necessary to restrict the freedom of certain political groups.

63. I often think, "I wish I were a child again".

64. I prefer to stop and think before I act even on trifling matters.

65. I never miss going to church.

66. I think it is usually wise to do things in a conventional way.

67. In a heated discussion I sometimes interrupt others too much in my eagerness to put across my own point of view.

68. I find it easy to stick to a certain schedule, once I have started it.

69. The present is all too often full of unhappiness. It is only the future that counts.

70. I always put on and take off my clothes in the same order.

71. I am a methodical person in whatever I do.

72. I am against giving money to beggars.

73. If given the chance I would do something of great benefit to the world.

74. I have very few quarrels with members of my family.

75. My blood boils whenever a person stubbornly refuses to admit he's wrong.

76. In the long run the best way to live is to pick friends and associates whose tastes and beliefs are the same as one's own.

77. While I don't like to admit this even to myself, my secret ambition is to become a great man, like Einstein, or Beethoven, or Shakespeare.

78. I often find myself thinking of the same tunes or phrases for days at a time.

79. Most people just don't know what's good for them.

80. I dislike to change my plans in the midst of an undertaking.

81. A man who does not believe in some great cause has not really lived.

82. At times I am full of energy.

83. A person who thinks primarily of his own happiness is beneath contempt.

84. There is usually only one best way to solve most problems.

85. There are two kinds of people in this world: those who are for the truth and those who are against the truth.

86. I always finish tasks I start, even if they are not very important.

87. I frequently find myself worrying about something.

88. When in a group of people I have trouble thinking of the right things to talk about.

89. There is so much to be done and so little time to do it in.

90. At times I feel like swearing.

91. I usually check more than once to be sure that I have locked a door, put out the light, or something of the sort.

92. In this complicated world of ours the only way we can know what's going on is to rely on leaders or experts who can be trusted.

Instructions for Completion of Questionnaire

Go through the questionnaire as quickly as possible and answer the questions you feel you know. Return to the questions you are unsure of and attempt to work them out. If the question appears too difficult move on to another question until only the most difficult questions remain unanswered.

Directions for Marking Answers

Circle the letter preceding the answer you think is correct. Here is an example:

1. What is an ohm?

   a. A quantity of EMF.
   b. A quantity of current.
   (c) A quantity of resistance.
   d. A quantity of watts.

NAME _____

SCHOOL _____

DATE _____

1. Electric soldering irons and guns are rated by

   a. wattage.
   b. length of tip.
   c. length of iron.
   d. size of cord.

2. To drive a 10/32 slotted machine screw, which of the below tools would you use?

   a. #2 Phillips screwdriver.
   b. 3/32" slotted screwdriver.
   c. 1/4" slotted screwdriver.
   d. #4 Phillips screwdriver.

3. What type of switches are required to control a light from two points?

   a. Two way switch.
   b. Two two way switches.
   c. Three way switches.
   d. Four way switches.

4. The voltage used to compute any load according to the NEC is

   a. 115 volts.
   b. 115/230 volts.
   c. 230 volts.
   d. 440 volts.

5. How much current can cause death?

   a. 0 to 20 ma.
   b. 30 to 50 ma.
   c. 60 to 80 ma.
   d. 100 to 200 ma.

6. The physical size of a resistor indicates its ability to

   a. resist voltage.
   b. resist current.
   c. dissipate heat.
   d. store electrons.

7. If a spool of magnet wire cost $8.82, how many pounds of magnet wire did the spool contain if one pound cost $31\frac{1}{2}¢$?

   a. 8 pounds.
   b. 18 pounds.
   c. 28 pounds.
   d. 38 pounds.

8. A radio technician received $362.60 for 37 hours work. What was his rate of pay per hour?

   a. $6.80 per hour.
   b. $7.80 per hour.
   c. $8.80 per hour.
   d. $9.80 per hour.

9. Three resistors are in series. Their values are 600 ohms, 200 ohms and 800 ohms. The applied voltage is 320v. What is the voltage drop on each resistor?

   a. 60v, 20v and 80v.
   b. 30v, 10v and 40v.
   c. 120v, 40v and 160v.
   d. 240v, 80v and 320v.

10. If the collector current in a transistor is 12.5 ma and it increases 15%, what is the new collector current?

    a. 4.4 ma.
    b. 7.2 ma.
    c. 14.4 ma.
    d. 21.6 ma.

11. To convert a 1 ma meter to a 0-50v meter, what size resistor should be connected in series with it?

    a. 500 ohm.
    b. 2000 ohm.
    c. 100k ohm.
    d. 50k ohm.

12. The internal resistance of a 1000 ohms per volt voltmeter set at a 100v range would be.

a. 100 ohms.
b. 5000 ohms.
c. 100k ohms.
d. 422 ohms.

13. A VOM will measure

a. volts.
b. ohms.
c. current.
d. all of the above.

14. The part of the atom that has a negative charge is the

a. proton.
b. neutron.
c. electron.
d. nucleus.

15. Current

a. is a flow of electrons through a conductor.
b. is a flow of protons through a conductor.
c. is a flow from negative potential to positive potential.
d. is measured in volts.

16. How many valence electrons do the most efficient conductors have?

a. 1
b. 4
c. 6
d. 8

17. A series circuit has a 1k ohm resistor and 15v applied. What is the current?

a. 15 amps.
b. 1.5 amps.
c. 15 ma.
d. 1.5 ma.

18. What is the efficiency of a 120v transformer which draws .25 amps of current in the primary and delivers 3 amps at 7v from the secondary?

a. 7%.
b. 33 1/3%.
c. 70%.
d. 98%.

19. The total voltage in any parallel circuit is equal to

a. $E_t = E_1 + E_3 = E_3$.

b. $E_t = I \times R$ of any branch.

c. $E_t = E_t - E_1 + E_2$.

d. $E_t = I - R$ of any branch.

20. Kirchhoff's current law is

a. voltage flowing into a junction equals current leaving that junction.

b. current is the same in all junctions.

c. current flowing into a junction equals current leaving that junction.

d. voltage is the same in any branch.

21. If the current in an AC power transmission line is reduced by one half, what happens to power?

a. Increased by two times.
b. Decreased by two times.
c. Increased by four times.
d. Decreased by four times.

22. What is the inductance of a coil which induces 500v when the current changes at the rate of 50 ma in 5 msec?

a. 5H.
b. 25H.
c. 50H.
d. .5H.

23. If the plate area of a capacitor is increased, its capacitance

    a. increases.
    b. decreases.
    c. remains the same.
    d. none of the above.

24. What is the total capacitance of a 2 microfarad, a 4 microfarad and a 6 microfarad capacitor connected in series?

    a. 12 microfarad.
    b. 10.9 microfarad.
    c. 1.09 microfarad.
    d. .109 microfarad.

25. What is the resonant frequency of a 10k pf capacitor and a .02mh coil?

    a. 356 Hz.
    b. 356 kHz.
    c. 3.56 kHz.
    d. 6.82 kHz.

26. What is the voltage of a carbon-zinc cell?

    a. .5v.
    b. 1.5v.
    c. 3.0v.
    d. 4.5v.

27. When a diode is forward biased, the depletion region is

    a. increased.
    b. depleted.
    c. decreased.
    d. resistance increased.

28. The battery connections required for proper operation of a NPN transistor are

    a. + to collector and - to emitter; - to base and + to emitter.

    b. - to collector and + to emitter; + to base and - to emitter.

    c. + to collector and - to emitter; + to base and - to emitter.

    d. - to collector and + to emitter; - to base and + to emitter.

29. What is the capacitive reactance of a 47pf capacitor at a frequency of 1.6 MHz?

    a. 2.1k ohms.
    b. 21.k ohms.
    c. 4.2k ohms.
    d. 134.2 ohms.

30. What value of capacitance must be connected in parallel with a motor drawing 10 amps at a .86 lagging factor from a 120v, 60 Hz source in order to obtain a unity power factor?

    a. 10 microfarad.
    b. 100 microfarad.
    c. 113 microfarad.
    d. 226 microfarad.

APPENDIX B

DATA

Group Ia: Secondary School Students Receiving Individualized Instruction.

Student #	Scores Pre-Test	Post Test	Student #	Scores Pre-Test	Post Test
1	13	15	44	21	21
2	14	23	45	11	11
3	23	22	46	22	18
4	11	20	47	12	19
5	11	15	48	18	21
6	10	22	49	9	15
7	10	17	50	10	12
8	14	19	51	6	11
9	18	21	52	4	7
10	14	16	53	10	13
11	18	22	54	9	11
12	22	21	55	8	15
13	22	22	56	11	12
14	13	10	57	5	12
15	22	17	58	7	14
16	19	18	59	7	12
17	18	19	60	10	13
18	18	19	61	12	14
19	13	13	62	12	15
20	16	20	63	11	12
21	15	18	64	10	10
22	11	8	65	13	16
23	7	16	66	11	10
24	11	15	67	10	10
25	13	20	68	14	14
26	12	14	69	14	17
27	16	14	70	17	19
28	8	10	71	19	20
29	12	6	72	19	20
30	10	12	73	9	12
31	10	15	74	9	10
32	17	12	75	8	9
33	11	16	76	5	7
34	14	7	77	14	15
35	14	13	78	22	22
36	15	16	79	20	25
37	8	14	80	11	18
38	16	22	81	16	23
39	14	17	82	20	20
40	16	19	83	18	18
41	19	13	84	18	18
42	22	20	85	13	12
43	19	18	86	20	19

Group Ib: Secondary School Students Receiving Traditional Method of Instruction.

Student #	Scores Pre-Test	Post Test	Student #	Scores Pre-Test	Post Test
1	11	15	40	9	11
2	7	15	41	12	13
3	5	11	42	14	13
4	12	14	43	14	14
5	11	8	44	14	13
6	15	13	45	14	16
7	7	16	46	20	23
8	11	6	47	19	22
9	5	9	48	20	24
10	8	10	49	7	14
11	6	9	50	21	24
12	10	11	51	10	16
13	6	14	52	11	16
14	10	12	53	13	11
15	4	6	54	22	23
16	15	16	55	12	15
17	8	9	56	10	16
18	15	17	57	14	23
19	13	13	58	12	17
20	13	12	59	16	14
21	12	20	60	17	21
22	14	16	61	21	21
23	10	10	62	15	19
24	10	14	63	14	16
25	16	17	64	13	18
26	16	17	65	21	15
27	12	13	66	12	10
28	17	18	67	22	24
29	6	5	68	13	15
30	9	15	69	11	7
31	7	15	70	19	14
32	8	9	71	15	18
33	13	16	72	9	15
34	10	21	73	15	14
35	16	20	74	12	12
36	9	13	75	11	14
37	16	17	76	16	17
38	17	18	77	10	13
39	11	15			

Group IIa: Community College Students Receiving Individualized Instruction.

Student #	Scores Pre-Test	Post Test	Student #	Scores Pre-Test	Post Test
1	13	19	24	19	19
2	18	23	25	12	15
3	18	19	26	12	21
4	20	17	27	13	18
5	14	18	28	15	23
6	17	15	29	15	22
7	19	17	30	17	25
8	21	18	31	19	25
9	18	19	32	18	21
10	17	21	33	15	12
11	18	22	34	21	21
12	20	22	35	12	12
13	20	20	36	22	16
14	18	21	37	13	14
15	20	23	38	9	16
16	16	16	39	17	16
17	17	21	40	22	18
18	15	20	41	19	17
19	19	25	42	19	19
20	15	19	43	21	26
21	14	22	44	21	19
22	15	16	45	11	18
23	19	20	46	17	25

Group IIb: Community College Students Receiving Traditional Method of Instruction.

Student #	Scores Pre-Test	Post Test	Student #	Scores Pre-Test	Post Test
1	24	25	27	18	21
2	22	24	28	21	22
3	17	24	29	19	21
4	20	20	30	15	15
5	14	18	31	21	20
6	10	13	32	17	17
7	16	22	33	20	18
8	16	15	34	20	20
9	23	25	35	15	20
10	12	16	36	10	19
11	18	22	37	19	20
12	19	24	38	12	19
13	21	24	39	20	20
14	16	20	40	16	19
15	18	23	41	18	22
16	18	22	42	20	18
17	15	23	43	14	17
18	24	21	44	22	22
19	21	21	45	17	15
20	18	21	46	19	24
21	21	21	47	19	19
22	20	22	48	14	17
23	21	18	49	20	22
24	19	17	50	10	13
25	24	22	51	18	24
26	20	20			

Group IIIa: Secondary School and Community College Educators Using Individualized Instruction.

Educator #	F-Scale		K-Scale		R-Scale	
	Pre-Test	Post Test	Pre-Test	Post Test	Pre-Test	Post Test
1	144	127	15	17	78	77
2	112	108	22	24	91	89
3	167	148	4	11	91	87
4	93	101	18	19	78	82
5	114	108	14	14	81	85
6	124	120	16	14	78	75
7	112	117	24	10	81	84
8	131	131	15	14	75	63
9	157	148	13	15	110	92
10	178	160	18	16	89	95
11	158	147	13	15	85	85
12	123	120	19	21	83	87
13	112	110	24	24	59	62
14	136	128	11	7	89	93
15	155	148	7	7	84	83
16	157	162	8	12	92	97
17	150	151	7	15	95	89
18	125	113	11	18	74	67
19	153	148	9	12	79	82
20	119	123	11	22	89	78
21	83	89	16	4	40	47
22	154	157	14	16	91	84

Group IIIb: Secondary School and Community College Educators Using Traditional Method of Instruction.

Educator #	F-Scale		K-Scale		R-Scale	
	Pre-Test	Post Test	Pre-Test	Post Test	Pre-Test	Post Test
1	159	163	18	22	86	91
2	125	128	10	14	77	79
3	130	135	10	13	96	103
4	147	145	14	22	96	89
5	138	172	15	19	83	94
6	108	124	15	10	90	78
7	158	144	10	24	99	114
8	110	116	21	12	71	78
9	120	123	16	14	81	83
10	196	202	9	16	107	107
11	133	149	16	22	102	114
12	149	178	18	11	107	121
13	165	140	10	15	117	104
14	142	149	9	17	116	103
15	127	133	14	22	85	101
16	183	164	10	10	102	95
17	157	180	8	12	73	81
18	96	101	20	15	66	54
19	105	96	14	14	71	82
20	127	138	11	15	97	97
21	139	144	12	9	82	75
22	114	125	11	23	67	65
23	114	108	21	9	69	75
24	122	134	17	17	63	70
25	110	135	18	18	65	73
26	135	159	13	24	88	99
27	129	127	9	20	95	107
28	180	209	9	23	97	108
29	110	118	16	11	65	64
30	149	146	13	15	97	88
31	76	89	11	15	63	54
32	169	188	8	6	120	132

APPENDIX C

LIST OF SCHOOLS THAT PARTICIPATED IN THE STUDY

COMMUNITY COLLEGES

Control	Experimental
Blue Mountain Community College	Central Oregon Community College
Lane Community College	Chemeketa Community College
Mt. Hood Community College	Clackamas Community College
Portland Community College	Southwestern Oregon Community College

SECONDARY SCHOOLS

Control	Experimental
Canby High School	Cascade Union High School
Dallas High School	Crook County High School
Grant High School	Estacada Union High School
John Adams High School	North Bend High School
Molalla High School	South Eugene High School
North Salem High School	Washington High School
West Linn High School	Wilson High School