THE EFFECTS OF INDIVIDUALIZED INSTRUCTION IN SCIENCE UPON THE ACHIEVEMENT, ATTITUDE, AND SELF-CONCEPT OF INNER-CITY SECONDARY STUDENTS

DISSERTATION

Presented to the Graduate Council of the North Texas State University in Partial Fulfillment of the Requirements For the Degree of DOCTOR OF EDUCATION

By

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This study examined the student's achievement, attitude toward science, and self-concept of ninth grade physical science students in an individualized science program and ninth grade physical science students in a traditional science class. The research was conducted to ascertain the effect of individualized instruction upon the achievement, attitude, and self-concept of inner-city junior high school science students, and to analyze the implications of these effects for administrators, teachers, counselors, and others who are interested in the optimum achievement of students to science instruction. The sample size was 150 ninth grade physical science students enrolled in an individualized science program and 150 ninth grade physical science students enrolled in a traditional program. The students were administered the Stanford Achievement Test: Science, Remmer's Attitude Toward Any School Subject Scale, and the Piers-
Harris Children's Self-Concept Scale. The experimental design of the study was patterned after the posttest only control group design. Preliminary data were obtained for each student within each participating class. The preliminary data were used for establishing group equivalence and as a concomitant observation in the analysis of covariance. The preliminary data were obtained from the permanent records of each participating school and involved the student's age, I.Q., natural science achievement level, and composite achievement level.

In order to establish the fact that the control and experimental groups represented the same basic population, a series of t-tests were run utilizing the preliminary data. The t-test calculations indicated that there were no significant differences between the control and experimental groups in terms of age, I.Q., background in natural science, and composite achievement level. The second step in analysis of the data involved the use of the analysis of covariance in order to test for significant differences between the control and experimental groups in terms of the dependent variables of achievement in science, attitude toward science, and self-concept.
From the data found in this study and in the related research, the following conclusions were drawn:

1. Physical science students taught by the individualized science program do not achieve at a significantly higher level, as measured by a standardized achievement test in science, than do students taught by the traditional method.

2. Physical science students taught by the individualized program do not differ significantly from the students of traditional physical science in attitude toward science.

3. Physical science students taught by the individualized program do not differ significantly from the students of traditional physical science on a standard self-concept scale.

4. The student variables of I.Q., background in natural science, and composite achievement level are important factors in successful achievement in physical science.

5. The student variables of I.Q., background in natural science, and composite achievement level are important factors in attaining a high positive attitude toward science. The I.Q. of the student seems to be the most important of the above factors.
6. The student variables of I.Q. and natural science achievement are important factors in attaining a high self-concept.

7. There was a significant relationship between grade point average in science and student achievement in science.

8. There was a significant relationship between grade point average in science and attitude toward science.

9. There was a significant relationship between grade point average in science and self-concept.
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CHAPTER I

INTRODUCTION

Fostered by the technological revolution of the sixties, increased monetary support, the knowledge explosion, and new curriculum studies, science education is at the forefront of educational change in the United States (12). Because of this increased concern, about what is taught and how it is taught, newer methods and techniques must be considered. The knowledge explosion has made it necessary for us to consider a larger quantity of information. A current estimate holds that more gains have been made in the world's knowledge in any recent year than in 100,000 years of the Stone Age, and Robert Oppenheimer (19) has said that knowledge of the physical sciences can be doubled every eight-and-a-half to twelve years. The process of increasing knowledge is not merely an additive one. Some past knowledge becomes negated and must be discarded. The knowledge explosion has required the educator to become more selective and be more critical of his methods (7).
Educators have long talked about the ideal school program as one in which the student moves along at his own pace of learning in a curriculum designed to meet his needs (22). With this general objective in mind there have been many programs designed to meet student's needs. There has been a tremendous amount of experimentation with special programs. The need for these individual programs has long been recognized. The scare of Russia's Sputnik accelerated curriculum development in the area of science. American teachers had learned that almost anything they taught could be made too difficult for pupils to learn, or so easy as to prove frustrating. Most of them apparently did not believe, with the investigators in the Eight Year Study, that what one learned was often less significant than the way one went about learning it (3). Some of the programs have been highly innovative and practical but some of the others have to be evaluated as failures. The concern about individualized instruction as a concept is not new. Like "problem solving," the phrase "individualizing instruction" has been in the educator's vocabulary for years, but until the current reformation it has been more dream than reality (16).

The problem of individualizing instruction is compounded when one begins to consider special students. Although
considerable effort has been made in identifying differences, some factors have remained troublesome. There are, for example, areas of individual differences which have not been taken fully into consideration in planning educational opportunities. Such areas of intellectual development as creative thinking or divergent thinking abilities represent one such facet. Analyses of both the processes of teaching and of the effects of teaching styles on the nature of student achievement represent another dimension. The impact of the school and the community social milieu represent still another dimension. It is the cumulative interaction of the student, staff, content, method, resources, school and community environment, and family relationships which directly effects the development of the individual's potential.

Since there are so many factors affecting the true potential of the individual, there is a need for a more thorough construct of teaching atypical children. The resources, community, and family relationships of most inner-city youths differ considerably from those of the typical middle-class child. Because of these differences there should be some special considerations in the development of programs for these students (9).
Statement of the Problem

The problem of this study is to study the effects of individualized instruction in science upon the achievement, attitude, and self-concept of inner-city junior high students.

Purposes of the Study

The purposes of this study are (1) to ascertain the effect of individualized instruction upon the achievement, attitude, and self-concept of inner-city junior high science students, and (2) to analyze the implications of these effects for administrators, teachers, counselors, and others who are interested in the optimum achievement of students in science instruction.

Hypotheses

To carry out the purposes of this study, the following hypotheses have been formulated.

1. The individually instructed group will achieve a significantly higher mean grade average in science than will the traditionally instructed group
   a. At the end of the first nine weeks;
b. At the end of the second nine weeks;
c. At the end of the third nine weeks;
d. At the end of the fourth nine weeks.

2. The individually instructed group will attain a significantly higher mean score on the Stanford Achievement Test: Science, than will the traditionally instructed group.

3. The individually instructed group will attain a more positive attitude toward science as measured by Remmer's Attitude Toward Any School Subject Scale, than the traditionally instructed group.

4. The individually instructed group will achieve a higher mean score on the Piers-Harris Children's Self-Concept Scale than will the traditionally instructed group.

5. There will be a significant relationship between grade point average in science and student achievement in science as measured by the Stanford Achievement Test: Science.

6. There will be a significant relationship between grade point average in science and attitude
toward science as measured by Remmer's Attitude Toward Any School Subject Scale.

7. There will be a significant relationship between grade point average in science and self-concept as measured by the Piers-Harris Children's Self-Concept Scale.

Background and Significance of the Study

Research has established the following areas as those to be considered in individualizing science instruction. These critical areas are (1) emphasis on the structure of science, (2) emphasis on open-ended evaluation, (3) emphasis on self-concept development, and (4) emphasis on development of values. Taking these four areas independently:

1. Emphasis on the structure of science has been increasingly evident since the publication in 1962 of The Process of Education. In that book Jerome Bruner suggested that teaching the structure of a discipline (2) makes the discipline more understandable and comprehensible; (b) allows for greater comprehension of detail; (c) fosters transfer of learning; and (d) facilitates narrowing the gap between the advanced and elementary knowledge (4).
2. Emphasis on open-ended evaluation was influenced by the work of perceptual psychologists Abraham Maslow, Arthur Combs, Carl Rogers, and others who stressed the effect that failure or success has on the self-concept of pupils.

3. Emphasis on self-concept development. All students possess feelings about themselves as persons and as learners. The importance of facilitating the development of an adequate self-concept has been increasingly apparent to educators.

4. Emphasis on development of values. Louis E. Raths and his associates, in *Values and Teaching*, state that there are too many children in schools who do not learn as well as they might because they are unclear about what they value (2).

Based essentially on the belief that students can and should be encouraged to be their own teachers, the concept of independent study has only recently gained a serious role in schools (2, p. 30). The trend toward increased individualization of instruction includes independent study programs more or less tailored to fit in with the local curriculum. The role of educational media in independent study programs has not yet been completely established. It might be assumed that it would have great importance, since many types of media have high content and impact quality in compact easy-to-use forms (10). However, William M. Alexander and Vynce A. Hines
in 1967 published a study of thirty-six schools, with the conclusion that the library was the most important facility for independent study programs (1).

How does the teacher in individualized instruction determine the needs of each child and set up a custom-made program to meet those needs? First, he decides what skills he wants the student to learn; he tests to find out which of these skills the student can demonstrate. Then the teacher supplies the student with material that will ensure his learning the skills that need to be acquired (33). Certain criteria must be met—(1) student features, (2) teacher features, (3) behavioral objectives, (4) multiple activities, (5) study requirements, and (6) student evaluation.

The literature contains many practical instructional programs that are adaptable to the individualized approach. Some of the programs that are of special interest are Issue-centered Science (20); Computers, How and Why Use Them in High School (17); Research Participation, as a Motivational Technique (34); Physical Science Project—An Individualized Two-Year Chemistry-Physics Course (24). Regardless of the program that one uses, there are certain basic strategies necessary for a worthwhile program. The
most frequent goal of the teacher is to integrate the learner and that which is to be learned.

An instructional management strategy for individualized learning (12) includes four phases of instruction. The four phases of instruction, which have been advocated by innovators such as Robert Bush, Ned Allen, and Lloyd Trump, include large-group instruction, small-group instruction, laboratory instruction, and independent study. One key to providing for individualized instruction is the preparation of individualized learning units or packages. If a strategy for individualizing instruction is to be effective, it should begin with the currently existing program as perceived by teachers and students. In devising a strategy several assumptions must be made. First Assumption--The pupil's responsibility is to learn and the teacher's responsibility is to make available to the pupil that which is to be learned. Second Assumption--The subject matter of a course must be appropriate to the learner with reference to (1) the pace of instruction, (2) the level of difficulty of the instructional material, (3) the relevance of the instructional material as reality as perceived by the student, (4) the student's level of interest, and (5) the individual learning style of the student. Third Assumption--The size of a group, the
composition of a group, and the time allotted to a group should be appropriate to the purposes of the group. Fourth Assumption—Before truly individualized instruction can become a reality, learning packages are needed which will provide for self-paced rather than group-paced instruction. The learning packages should contain (1) concepts, (2) instruction objectives, (3) multidimensional learning materials, (4) diversified learning activities, (5) pre-evaluation, (6) self-evaluation, (7) post-evaluation, (8) quest—pupil initiated and self-directed activity (17).

Teachers in inner-city schools have unique problems, just as the students. It is unrealistic to expect successful performance on the part of many inner-city teachers as long as they are overburdened with large classes, provided little practical help from supervisors, given inadequate materials and equipment, treated as objects of blanket community distrust, and experiencing repeated failure in the classroom (23). Some of the practices that seem to have been successful in improving conditions of the inner-city teacher are teacher participation in decision-making, formation of clusters and use of the cluster concept, parent involvement, orientation toward students, and improved training and supervision.
The changes which have facilitated the individualization of instruction are instructional practices such as (1) independent study programs, (2) nongraded or continuous progress programs, (3) programmed learning, and (4) modular scheduling. Individualized instruction also utilizes technological techniques, such as (1) tape recorders, (2) copy machines, (3) programmed learning, (4) computers, (5) projectors, and (6) audio-video-tutorial systems. There have also been many architectural innovations such as (1) flexible structures, (2) better planned and equipped laboratories, and (3) innovative classroom design. Changes in length of class periods, scheduling on the basis of purpose and need, pupil programs based on maturation, interest, and achievement, varied instructional tools, and new physical arrangements will not in themselves bring about individualization of instruction, but they provide teachers an opportunity to individualize (16). These innovative changes provide teachers with the means to organize their classroom experience with the individual in mind. Teachers do not have to plan to be continually working with large groups. Teachers have an opportunity to employ a problem-solving approach allowing the greater involvement of students in the teaching-learning act.
Owens and Steinhoff (23) identify a behavioral strategy which emphasizes improving the quality of interpersonal relations as a prelude to the development of more effective educational practices. They conclude that in attempting to improve the effectiveness of inner-city schools, we must pay attention to the forces which promote effectiveness. There is evidence that the established behavioral norms in many inner-city schools inhibit their staffs in identifying problems, discussing them openly and frankly, and developing new responses to them. Under the stress of contemporary pressures, inner-city schools often attempt to strengthen their organization by the practice of emphasizing control and stressing maintenance of the organization. Thus the seeds of rigidity, sluggishness, and even organizational pathology are sown. The administrators and teachers must begin to place a new value on the primary human aspects of the school enterprise and believe that change in the quality of the school's living system is the first essential step toward more effective educational practices. In order to reach these youngsters at their particular level of development, the design of a program geared to their abilities and potential is imperative (20).
The science instruction should place the student in learning situations similar to scientific endeavor. This involvement must be carefully geared to their ages, backgrounds, and abilities. The program should help each individual to realize maximum potential. Each student's abilities must be assessed before the program begins. Evaluations of students should be based upon individual achievements and not on ability to compete with the so-called "average" student. An instructional program should be developed around student-centered activities. Discrimination in selecting, implementing, and evaluating such activities is necessary for successful teaching. The instructional program must serve those students who terminate their science studies at the secondary school level, as well as those who are preparing for more advanced courses (23).

Science teaching in the secondary school encompasses a broad realm of subject matter and the presentation to fit the needs of the students. There are several principles, for teaching inner-city science students, which are implemented through the utilization of an individualized program. They are as follows:
1. Teach one concept at a time through repeated experiences. Teacher verbalism should be kept to a minimum. Use simple short sentences. Concrete examples should reinforce verbal instructions.

2. Carefully structure each task or experience to help overcome disturbances in thinking processes.

3. Associate a meaning with a suitable model.

4. Begin instruction and experience with the simple, and progress to the complex and unfamiliar.

5. Be consistent in demands. Use positive suggestions rather than negative commands. Rewards and encouragement are more effective than scolding and punishment. Most individualized programs have reinforcement built into them.

6. Help students to develop word attack and other reading skills. Use reading materials of appropriate level.

7. Have several student goals that may be obtained. Do not push or pressure students beyond ability. A variety of materials and methods should be used.
8. Be specific rather than general. Individualized packages have specific activities for the student to engage in.

9. Provide evaluation instruments that require limited recall and written expression.

10. The assignments can be adapted to the physical needs of the student.

11. The activity-centered approach is designed to keep distractions at a minimum.

12. Instruction and classroom management can be calm and positive.

13. Students can finish assignments in a specified length of time. Frequent evaluations are utilized.

14. Individuals and small groups are involved in projects. This gives the withdrawn student an opportunity to participate.

15. The teacher can be alert to recognize good behavioral traits of any student when the opportunity arises.

16. Teachers should be free to counsel students and to help them realize their potential (38, p. 18).
Most educators agree that the most important area of instruction, as far as students in the inner-city are concerned, is the classroom climate (38, p. 19).

A wholesome classroom climate would have the following characteristics:

1. A willingness on the part of the teacher to respect the worth of the student regardless of his standards or mores.

2. A teacher who feels that it is a challenge to teach culturally different students.

3. A belief that a student must be reached before he can be taught.

4. A continuing evaluation of the growth of each individual, with no attempt to compare or contrast individuals.

5. A genuine appreciation for the contributions of each student.

6. A genuine respect for ideas and for differences of opinion.

7. An atmosphere which nurtures and encourages the slightest evidence of creativity and in which a sense of humor is present.
8. A willingness to try new ideas, techniques and methods.

9. An acceptance of the fact that some approaches may not work but something else can be done.

10. A flexible atmosphere in which the basic skills of speaking, listening, reading, and writing may be done through laboratory activities.

11. A teacher who is patient, consistent, and firm.

12. A room that exhibits evidence of the subject matter being taught (38, p. 16).

There are several programs designed to fulfill the criteria mentioned previously. Two such programs seem highly adaptable to the inner-city science program. Program for Learning in Accordance with Needs (PLAN) (34) was developed by the American Institutes for Research and Westinghouse Learning Corporation with the cooperation of twelve school districts in California, New York, Pennsylvania, Massachusetts, and West Virginia.

Intermediate Science Curriculum Study (ISCS) (37) was developed at Florida State University. ISCS development has been a group effort. It began with conferences in 1962. The recommendations of the conference were converted into tentative plans. A group of Florida State University faculty
members developed a set of instructional materials. Pilot curriculum materials were developed from small-scale writing sessions conducted at Florida State University in 1964. The original material has been revised three times. More than 150 writers and more than 175,000 children in 22 states, have been involved in the field testing of these materials. ISCS is one of the most extensively field-tested programs available. The theme throughout the program is individualization.

PLAN and ISCS are individualized instructional systems that were developed to provide each student with an individual academic program of studies tailored to meet their unique needs, interests, and abilities. The first aspect of the programs is the subject matter content. The second aspect emphasizes teaching the skills of decision making. To assist the student in achieving these goals, PLAN and ISCS have six major components. These components are (1) a comprehensive set of educational behavioral objectives, (2) teacher-learner units, (3) testing as feedback, (4) guidance and individual planning systems for each pupil, (5) evaluation systems, and (6) teacher development.

The teacher can design a list of activities for each student. Each student then has a list of activities that are
designed especially for him, based on his abilities, interests, background, and needs. The students work through these teacher-learner units at their own pace. The teacher serves as a consultant to the students. The teacher is available to assist those students who need special attention. If the student runs into problems, he and the teacher schedule counseling sessions to consider the difficulties. Flexibility is built into the programs to allow the students to extend their involvement in a particular area.

The principles and objectives of an individualized program are worthwhile because they focus upon the individual. The programs focus upon the abilities, needs, and interests of each individual. All good programs require diagnosis and evaluation of the student at the beginning of the program. Periodic tests or check-up activities are necessary to evaluate the progress of the students.

A good individualized instructional program, in science, will contain at least three major divisions. These divisions are as follows:

1. An overview or introduction. A general discussion of the concept that is to be emphasized. An overview may be in the form of films, film strips, short readings, tapes, or teacher-pupil discussions.
2. The suggested activities should be provided for the students. These activities may be in the form of worksheets based on the concept, laboratory exercises, or research activities.

3. Periodic evaluation of the student and the program.

Each teacher will have to evaluate and re-evaluate the program to determine its strengths and weaknesses. The teacher must recognize the need for individualized instruction and make an attempt to design programs to meet the needs of the students. Previously designed programs such as PLAN and ISCS are helpful to teachers who are looking for a guide to use in developing their own programs. Programs such as PLAN and ISCS have been developed to provide teachers with the means to individualize their instruction.

Definition of Terms

For the purposes of this study the following definitions have been formulated:

1. Individualized Instruction: Refers to systems developed to provide each student with an individual academic program of studies tailored to meet his unique needs, interests, and abilities.
2. Traditional Instruction: Refers to any secondary physical science program utilizing materials other than individualized materials. Typically, the traditional course is less laboratory-centered, and emphasis is placed upon lectures and group work. As used in this study, traditional instruction is group-centered and teacher-paced.

3. Achievement: Achievement in science is defined in terms of the measures obtained on the Stanford Achievement Test: Science.

4. Attitude: Refers to a predisposition to react favorably or unfavorably toward ideas, objects, persons, events, or situations. As used in this study, attitude is defined in terms of measures obtained on Remmer's Attitude Toward Any School Subject Scale.

5. Self Concept: Refers to a student's conscious admission of how he feels about himself. It is the self as viewed by the individual at the time of the reaction. In this study, self-concept is defined in terms of the measures obtained on the Piers-Harris Children's Self-Concept Scale.

6. Inner-City: Refers to a geographical area exhibiting the following characteristics: the area contains disappearing taxable property and declining real estate;
there is a high degree of segregation of pupils racially; the schools are predominantly black, racially; and often more importantly, the socio-economic level is low. The adults often have rural and impoverished backgrounds; their level of formal schooling is low; they take pride in their own cultural traditions; and they are willing to learn on their own terms. These students are not culturally inferior, but they are culturally different.

Limitations

This study is limited to those students attending two selected junior high schools in Southeast Texas during the spring of 1974 who meet the requirements of being inner-city youths. This limitation is imposed because of time limitations.

Basic Assumptions

It is assumed that no unusual conditions existed which adversely affected the subjects.

Procedures for Collecting Data

Permission was obtained from the principals of the selected junior high schools to conduct this study. The study
was conducted with students enrolled in ninth-grade physical science classes.

The experimental design for the study is patterned after the Post-test Only Control Group Design as described by Campbell and Stanley in *Experimental and Quasi Experimental Designs for Research* (7, p. 25). Concerning the post-test design, Campbell and Stanley have stated that (7, p. 26)

> While the pretest is a concept deeply embedded in the thinking of research workers in education and psychology, it is not actually essential to true experimental designs. . . . Covariance analysis and blocking on subject variables such as prior grades, test scores, parental occupation, etc. can be used thus providing an increase in the power of the significance tests very similar to that provided by a pretest.

The teachers for this study were matched on the basis of age, sex, experience, and training.

Two groups of approximately 150 students each were selected for the study. All classes of ninth-grade science utilizing the Individualized Program were assigned section numbers. These section numbers were placed in a pool. Six sections, totaling approximately 150 students, were selected by picking six numbers from the pool. All classes of ninth-grade science utilizing the traditional approach were assigned section numbers. These section numbers were placed
in a pool. Six sections, totaling approximately 150 students, were selected by picking six numbers from the pool.

Preliminary data were obtained for each student participating in the study. The preliminary data were obtained from the permanent record of each participating student and included the following:

1. Sex
2. Age in months
3. I.Q.
4. Background in Natural Science from Achievement Test Data
5. Composite Achievement Test Scores

The preliminary data were used to establish group equivalence and as a concomitant observation in the analysis of covariance.

Measurement of the dependent variables of achievement in science, attitude toward science, and self-concept were accomplished by the administration of selected instruments. The subjects were administered the Stanford Achievement Test: Science, Remmer's "Attitude Toward Any School Subject Scale," and the Piers-Harris Children's Self-Concept Scale.
Procedures for the Analysis of Data

The data obtained from the study were organized into five sections for presentation. The first section is designed to describe the population. Mean values, standard deviations, F-ratios and t-test values were tabulated for the equating variables. The second section is devoted to the presentation and analysis of the results of the analysis of covariance. Mean values, standard deviations, and F-ratio values for the dependent variables are presented. The third section is designed to present and analyze the data obtained from the study of attitude toward science. The fourth section is designed to present and analyze the data obtained from the study of self-concept. The fifth section is designed to present data obtained from the correlation study.

The decision as to the level of significance below which a hypothesis will be rejected was arbitrarily set at the 5 per cent level. Data are entered in tables for ease of presentation.
CHAPTER BIBLIOGRAPHY


CHAPTER II

REVIEW OF RELATED LITERATURE

This chapter presents a review of the literature related to research on individualized science instruction and its effects upon the achievement, attitude, and self-concept of inner-city secondary school students. A number of studies were reviewed which were to some extent related to this investigation. The reviewed literature that was of the greatest assistance follows under two central headings: research related to individualized science programs and research related to the Intermediate Science Curriculum Study (ISCS) Program. The studies under each central heading appear in chronological order.

Research Related to Individualized Science Programs

Hardy (6) investigated the achievement and level of critical thinking in CHEM Study and traditional chemistry. The sample was composed of 208 secondary school chemistry students in ten selected high schools in West Texas. The Post-test only Control Group Design was utilized. The
experimental group was composed of 104 students of CHEM Study chemistry. The experimental group was compared with 104 students enrolled in a traditional chemistry course. The results of a statistical analysis led to the following conclusions: (1) CHEM Study students achieved at a higher level than students in traditional chemistry; (2) there was no significant difference between treatment groups in level of critical thinking; and (3) there was no significant interaction between program, mental ability, and the dependent variables of achievement in chemistry and level of critical thinking.

Rowbotham (18) designed a study to test the effectiveness of the auto-tutorial method of presenting the physical science laboratory. Twenty-seven physical science students composed the experimental group and twenty-one students were in the control group. The experimental group received the auto-tutorial laboratory and the control group received a traditional laboratory following the "cookbook" style. Results of the statistical analysis led to the following conclusions: (1) the auto-tutorial group did not have a significantly greater knowledge of facts, laws, principles, theories, or physical quantities; (2) the auto-tutorial group did not have a significantly greater knowledge and
understanding of the physical science laboratory; (3) the auto-tutorial group was not any more effective in the interpretation of reading material in natural science; and (4) there was no significant interaction between method and ability as measured by any of the criterion tests.

Williams (22) conducted a study in which he compared the achievement of individually instructed and group-instructed ninth grade physical science students. The study involved 192 ninth grade physical science students. In this study, each of the two treatment groups and a reference group consisted of sixty-four students. The investigator found that achievement on semester examinations, standardized tests, and semester grades was enhanced when an individualized mode of instruction was provided.

Paden (16) conducted a study utilizing the computer to produce individually prescribed study guides for high school physics students. The same was composed of 30 high school physics students. The experimental group consisted of 15 students who received instruction that was individually prescribed. The control group received the traditional mode of instruction. The study reported significant gains in achievement. The achievement levels of the high school
physics students utilizing individualized instruction techniques were significantly higher than those of the group-instructed class.

Peterson (17) analyzed the physical science achievement of junior high school students, grades seven to nine, in individualized classes and in lecture-demonstration classes. Data was collected from fifty-eight classes, thirty-one of which were individualized while the remaining twenty-seven classes were taught by the lecture-demonstration method. An analysis of the data revealed significant gains in the achievement levels of the experimental group. The investigator concluded that students in individualized classes earned significantly higher gain scores than those in lecture-demonstration classes.

Shavelson and Munger (19) compared the effectiveness of an individualized secondary science instruction system with a traditional self-contained classroom approach. Ninety-six biology students were randomly selected and assigned to three treatment groups. The investigators found that achievement was significantly higher for those students involved with individualized study.

Summerlin (20) conducted a study to determine the effect of computer-assisted instruction in chemistry upon learning
time, attitudes, and achievement. He reported a substantial decrease in learning time with no adverse effects in attitudes or achievement.

Ketchum (9) compared the educational growth of ninth grade students enrolled in the Introductory Physical Science (IPS) Program. The control group was composed of twenty students who met three hours per week in one-hour sessions. The experimental group was composed of twenty students who pursued the IPS course on an independent-study basis. The experimental students had access to an open laboratory and were encouraged to work at their own pace. Both the control and experimental groups used the same classroom, the same apparatus, and were supervised by the same instructor. The results of this study indicate that there was no significant difference in the achievement between the group of students studying IPS on an independent study basis and a similar group studying IPS as a class.

Koenig (10) investigated the extent to which individualization of reading skills development affects science achievement when incorporated within the framework of an individualized science unit. A pretest, posttest, and questionnaire were administered to 856 students. A two-factor design was used to analyze the data. A statistical
analysis of the data revealed the following: (1) individualized reading and science activities incorporated in a teaching unit did not significantly affect students' science achievement at the .05 level of confidence; (2) reading activities should be included in an individualized science oriented teaching unit; and (3) the implementation of unit teaching and individualized instruction seems to be aided by the use of a computer-based resource unit.

Connor (2) studied the effects of presenting eighth grade science material in modular form. The purpose of the study was to investigate the effect of modularized instruction on (1) students' attitudes toward school, science class, scientists, and science, (2) student achievement of subject matter mastery in eighth grade science, and (3) the retention of the subject matter. The sample consisted of 198 inner city junior high school science students. The only difference between the experimental treatment and the control group was assumed to be the use of modules for the experimental group and nonmodularized instruction for the control group. No significant differences attributable to modularized instruction were found for either attitude change, cognitive gain, or cognitive retention. However, it was
found that the factor analysis of the data indicated a consistent association of activity with evaluation.

Denton (5) developed and evaluated an instructional model which utilized the computer to produce individually prescribed instructional guides to account for variations among secondary school physics students. The experimental group was exposed to individualized computer-produced instructional guides. The control group studied physics in the traditional manner. The concepts, principles, and examples of two chapters of P.S.S.C. physics served as the principal content source for both groups. The investigator reached the following conclusions: (1) the achievement level was not significantly increased by utilizing an individualized teaching model; (2) the material mastered can be significantly increased by utilizing an individualized teaching model; (3) the learning efficiency is not significantly increased; and (4) the attitude toward the course of physics does not change significantly as a result of exposure to an individualized teaching model.

Christensen (1) explored the possibility of utilizing a particular set of individual student characteristics to make decisions concerning the applicability of a particular learning method. Forty-nine students enrolled in high school
physics studied three units of content, each using a different individualized learning method. The individualized learning methods used were linear-programmed instruction (LPI), learning activity package (LAP), and student selected experiences (SSE). A pretest-posttest design was used to measure attitude, personality, intelligence, and cognitive mode. The results of the study indicated that there was no significant interaction between the learning methods and the content when achievement scores were used as the comparison criterion.

Research Related to the Intermediate Science Curriculum Study (ISCS) Program

James (7) compared the outcomes of two classes of seventh grade science. The experimental group was composed of thirty students who were taught utilizing methods similar to those suggested by ISCS. The control group was composed of thirty students who were taught utilizing group-instructional techniques. Both classes were taught by the same teacher.

The results showed that the slower students in the individualized treatment completed less, while faster students completed more material than the class taught with group-instruction techniques. The individualized class achieved
higher mean scores. Though not statistically significant, the adjusted means for the individualized class consistently surpassed those for the group-instructed class in the scores on standardized instruments used to measure the understanding of science, subject, preference, and attitude. A student questionnaire revealed that 80% of the individualized class would elect the individualized course the following year. A larger portion of the individualized class were inclined to think that the social interaction inherent in this class had helped them learn to get along better with their classmates.

Dasenbrock (3) conducted an investigation to determine the validity of the use of computer-assisted instruction as a tool in formative curriculum evaluation. Twenty students from the Florida State University Laboratory School received the computer-assisted ISCS program and forty students from Iowa, Illinois, Indiana, and Florida were involved in the non-computer-assisted ISCS program. Student performance in the two programs was correlated with logical reasoning, reading, and general ability measures. The results of the study indicated that the computer-assisted and non-computer-assisted student performance were not significantly different within the ISCS materials.
Teates (21) conducted a study to determine whether ninth grade students completing the third year of the Intermediate Science Curriculum Study (ISCS) instructional program performed differently on selected Piaget-type conservation tasks than ninth grade students who had not worked with the ISCS materials. The study utilized 249 ISCS and 239 non-ISCS students in classroom-size groups. The results of the study revealed no difference at the .05 level of significance in the performance of ISCS and non-ISCS students on the task test, and there was no significant interaction between treatment and ability group. However, there was a difference at the .05 level of significance in the performance of students of different ability levels. In both treatment groups, higher-ability students performed better than lower-ability students.

Kellogg (8) studied the effects of selected ISCS excursions in the Level One materials. Eighty-four seventh grade students were randomly assigned to do or not to do each of the first fifteen excursions in the ISCS Level One materials. Data revealed that in twenty-nine of thirty analysis of variance tests no differences were found in chapter self-test performance between students who did the excursions and students who did not do the excursions. In twenty-nine of
A thirty analysis of variance tests students who scored high on excursion tests scored higher on selected items of the chapter self-tests than those who did not score high on excursion tests.

Luttrell (12) utilized fifty-two students in the Tallahassee, Florida, public schools to study the degree to which seventh grade students with reading difficulties who were provided with supplementary audio tapes performed differently after being exposed to ISCS--Level I. The control group studied the ISCS materials as they were originally developed, and the experimental group studied ISCS materials plus tape recordings that repeated orally the content dealt with in the ISCS printed materials. The study concluded that the performance of the students in the experimental group was not significantly different from that of the control group. This seems to suggest that the audio tapes do not help the poor reader taking the ISCS program.

Dawson (4) interviewed a sample of one hundred thirty-two tenth-grade students who had experienced three years of individualized junior high school ISCS science training and who were enrolled in a group-centered biology course. The purpose of the study was to determine their preference for individualized or group-centered science classroom learning.
conditions. Student preference for the individualized science classroom learning environment (ISCS) over the group-centered classroom learning environment was supported by the data obtained in this study. The statistical analysis showed this preference to be significant at the .05 level.

Lauridsen (11) compared the effectiveness of ISCS Level One with non-ISCS seventh grade science classes in 1) fostering positive growth in the scientific attitudes associated with the nature of scientific laws, the limitations of science, and the desirability of science as a vocation; 2) enhancing the self-reliance level of seventh grade students; 3) elevating the ranking seventh grade students give to science when they rank five classroom subjects in order of their preference. Responses were collected from 650 students who were enrolled in ISCS Level One and 200 non-ISCS students.

The investigator reached the following conclusions: (1) the ISCS group experienced a significant positive increase in the attitude associated with the nature of scientific laws, while the non-ISCS group did not undergo as large a positive change in this attitude; (2) the non-ISCS group experienced a significant negative change in the attitude associated with the desirability of science as a vocation,
and the ISCS group experienced a negative change in this attitude which was almost as great; (3) both groups experienced a slight, but not significant, increase in the attitude associated with the limitations of science; (4) both groups ranked science lower, but not significantly, in the preferential ranking of classroom subjects on the posttest than on the pretest; and (5) both groups experienced slight, but insignificant, increases in self-reliance.

Mann (13) examined the attitudes toward science of selected junior high school students after exposure to an individualized science program, the Intermediate Science Curriculum Study (ISCS). The study was designed to answer two questions: are the attitudes toward science held by non-ISCS students in grades 7, 8, and 9 different from those held by ISCS students in grades 7, 8, and 9? Do the attitudes toward science held by ISCS and non-ISCS students change during the time the students spend in the seventh grade, eighth grade, and ninth grade?

The attitudes of 350 students were assessed through the use of an interview instrument developed by the researcher. The data revealed that a larger number of ISCS students expressed an interest in science-related activities than non-ISCS students at each grade level.
Nieft (15) conducted a study to assess the effectiveness of ISCS Level I, as determined by measurements of student achievement, student attitudes toward science, and student perceptions of teacher characteristics and classroom activity. The Student Inventory, the Classroom Activity Checklist, and the Scientific Attitude Inventory were administered to 900 ISCS students and 200 non-ISCS controls.

Statistical analysis indicated that achievement and progress were not significantly related to the variables of the Student Inventory and that only on the Classroom Activity Checklist was there a significant difference between gain scores for ISCS and non-ISCS students. The study concluded that there were no significant differences between the gain scores of ISCS and non-ISCS students on the Student Inventory and the Scientific Attitude Inventory.

Martinez-Perez (14) examined the self concept, attitude toward science, students' self-grading, and the teacher's grading of seventh grade students in an Intermediate Science Curriculum Study (ISCS) class and seventh grade students in a non-individualized science class. The study was conducted with 109 ISCS students and 106 non-ISCS students. The students' self-concept was measured by the Piers-Harris
Children's Self-Concept Scale and the attitudes toward science by a modified version of the Scientific Attitude Inventory. The Pearson product-moment correlation coefficient was calculated between pairs of variables but no significant correlations were found at the .001 level. The mean teacher grading for the ISCS students was significantly lower than in the case of the non-ISCS teacher but the data failed to show any other significant differences at the .001 level between seventh grade ISCS students and seventh grade non-ISCS students.

When analyzing the related literature pertinent to the influence of ISCS upon achievement, it becomes evident that numerous research findings present conflicting results.

The following investigators found that ISCS significantly enhanced science achievement: Teates, Dawson, Lauridsen, and Mann. Still other researchers did not detect any significant differences. These include James, Dasenbrock, Kellogg, Luttrell, Nieft, and Martinez-Perez.
CHAPTER BIBLIOGRAPHY


CHAPTER III

METHODS AND PROCEDURES

The purposes of this study were to ascertain the effects of individualized instruction upon the achievement, attitude, and self-concept of inner-city junior high school science students and to analyze the implications of these effects for administrators, teachers, counselors, and others who are interested in the optimum achievement of students to science instruction. To accomplish this, three instruments (See Appendix A) were administered to the students participating in the study.

This chapter consists of descriptions of the subjects and the schools in which the research was conducted, descriptions of the instruments used in this study, the teachers participating in the study, the experimental program, the control group's course, and the procedures followed in collecting the data, and a description of the procedures for statistically treating the data.
Description of Subjects

The participants in this study were ninth grade physical science students in two secondary schools in a south Texas independent school district. The population consisted of 300 students who were enrolled in ninth grade science during the spring. The students were both male and female. All of the students in this study were of black ethnic origin. The experimental-group consisted of 150 students in six classes of individualized science. The control-group consisted of 150 students in six classes of traditional physical science.

I.Q. values for the total group, obtained from measurements recorded in the school permanent records, ranged from 46 to 125, with a mean value of 85. Composite achievement values for the total group ranged from a percentile score of 1 to 76, with a mean value of 23.5.

Teachers

The twelve classes were taught by four different teachers. Two teachers taught the experimental program and two teachers taught in the control program. The experimental program was taught by a black male, 35 years of age, with 12 years of experience and a bachelors degree. The second member of the experimental program was a white female, 26
years of age, with 5 years of experience and a master's degree. The traditional program was taught by a white male, 42 years of age, with 14 years of experience and a master's degree. The second teacher in the traditional program was a black female, 24 years of age, with 4 years of experience and a bachelor's degree.

School Settings

The experimental program was located in a modern school plant, rebuilt in 1966, having a tradition that goes back to the turn of the century. Located in the southwestern section of the city, the school houses grades seven through nine. The students reside in a long-settled black neighborhood. The parents are members of the working class. The work of the parents is primarily of the laborer, semi-skilled, and skilled type. During the 1973-74 school year, 1350 students were enrolled in grades seven through nine.

The traditional program was located in a modern plant, which although refurnished in 1960, has a long and rich tradition. The school is located in the west section of the city. The school population was once all-white and middle-class. A federal court order was issued during the fall of
1970 which led to the school's becoming an all-black inner-city school. During the 1973-74 school year, 1345 students were enrolled in grades seven through nine.

The Control Group's Course

The textbook used by the control group was The Physical Sciences: Investigating Man's Environment. The teachers in the traditional program utilized the lecture, demonstrations, group discussions, films, group laboratory exercises, and group assignments. The classes were textbook-oriented and teacher-paced.

The Experimental Program

Intermediate Science Curriculum Study (ISCS) is an individualized, activity-centered program which begins with physics-oriented activities and moves in the direction of those of a more chemical nature. It emphasizes the skills of measurement and developing operational definition.

An ISCS Level III type program was utilized for this study. Levels I, II, and III are individualized activity programs which begin with chemically-oriented activities and conclude with an interdisciplinary approach. Levels II and III build on the skills of Level I.
Instruments

The *Stanford Achievement Test - Science* was utilized to measure achievement in science. The listed purposes of the science questions are to measure knowledge of synonyms, simple definitions, and "ready associations," and "high-level comprehension of the concepts represented by words, and fullness of understanding of terms."

The *Seventh Mental Measurements Yearbook* states that the test is recommended for use in the analysis of differences and also differences in the abilities of individual pupils in various areas for purposes of planning for individualized instruction, grouping pupils for instructional purposes, determining and evaluating rate of progress, and evaluating achievement.

Four tests constitute alternate forms (W and X) of two levels of science achievement tests for grades 5, 5-6, 9 and 7-9. They are part of the *Stanford Achievement Test*.

All four forms of the tests consists of four-option multiple-choice items. The advanced-level tests contain 60 items and are designed to be completed in 25 minutes.

The *Seventh Mental Measurements Yearbook* states that all four tests are good tests from the viewpoint of interest, subject matter covered, degree of difficulty, and measurement
of the contemporary objectives of science—namely, knowledge and intellectual "performance," or thinking and reasoning. The Stanford Achievement Test - Science is considered to be one of the best standardized tests available for use with grades 5-9.

The Purdue Master Attitude Scales consist of nine scales. They are scales designed to measure attitude toward 1) any school subject, 2) any vocation, 3) any institution, 4) any defined group, 5) any proposed social action, 6) any practice, 7) any home-making activity, 8) individual and group morale, and 9) the high school. The manual (19) states that the scaling procedure for each of the scales is the psycho-physical principle that equally often observed differences are equal—often referred to as the Thurstone attitude scaling technique. Remmers reports, "Beyond their face validity, these scales have demonstrated validity both against Thurstone's specific scales with which they show typically almost perfect correlations and in differentiating among attitudes known to differ among various groups" (10,p.2). Reliabilities of the scales for various population samples ranged from .71 to .92. There are no norms reported because the norms are unique for each population, since what is being measured is the effective value of an attitude object defined
by the scale values of the items endorsed by the respondents. The scales are easy to read and require from five to ten minutes to answer. The instrument was administered during a regular class-period.

The instrument used for measuring self-concept was the Piers-Harris Children's Self-Concept Scale. This test is subtitled "The Way I Feel About Myself." It is a quickly completed (fifteen-twenty minutes) self-report instrument designed for children over a wide age range. The scale was designed primarily to measure the development of children's self attitudes. Norms for the test were established from 1,183 public school children in grades four through twelve.

The internal consistency was determined by use of the Kuder-Richardson Formula 21, with resulting coefficients ranging from .78 to .93. When the Spearman-Brown odd-even formula was applied for half of the grade ten sample, the resulting coefficients were .90 and .87, respectively.

A retest after four months on one half of the standardized sample resulted in stability coefficients of .72, .71, and .72. The content validity was based upon Jersild's report made in 1952 concerning what children like and dislike about themselves.
The concurrent validity was checked by using Pearson's $r$ against Lipsitt's Children's Self-Concept Scale, Big Problems on SRA Junior Inventory, teacher ratings, peer ratings, Children's Social Desirability Scale, Children's Manifest Anxiety Scales, California Test of Mental Maturity, and California Achievement Test (9).

In measuring achievement in science, teacher-assessed grades in science were also used. Letter grades were converted to numbers, using the following conversion scale:

A = 4 points, B = 3 points, C = 2 points, D = 1 point, and E = 0 points.

**Procedures for Collecting Data**

Permission was obtained from the principals of the schools to conduct this study. The study was conducted with students enrolled in ninth-grade physical science classes.

The experimental design for the study is patterned after the Post-test Only Control Group Design as described by Campbell and Stanley in *Experimental and Quasi-Experimental Designs for Research* (4, p. 25). Concerning the posttest design, Campbell and Stanley stated that (4, p. 26)

While the pretest is a concept deeply embedded in the thinking of research workers in education and psychology, it is not actually essential to true experimental designs. . . . Covariance analysis
and blocking on subject variables such as prior grades, test scores, parental occupation, etc. can be used thus providing an increase in the power of the significance tests very similar to that provided by a pretest.

The teachers volunteered to participate in this study. They were matched on the basis of race, age, sex, experience, and training.

Two groups of 150 students each were selected for the study. All classes of ninth-grade science utilizing the Individualized Program were assigned section numbers. These section numbers were placed in a pool. Six sections, totaling 150 students, were selected by picking six numbers from the pool. All classes of ninth-grade science utilizing the traditional approach were assigned section numbers. These section numbers were placed in a pool. Six sections, totaling 150 students, were selected by picking six numbers from the pool.

Preliminary data were obtained for each student participating in the study. The preliminary data were obtained from the permanent record of each participating student and included the following:

1. Sex
2. Age in months
3. I.Q.
4. Background in Natural Science from Achievement Test Data

5. Composite Achievement Test Scores

The preliminary data were used to establish group equivalence and as a concomitant observation in the analysis of covariance. These data were recorded and kept on file for the duration of the study.

Measurement of the dependent variables of achievement in science, attitude toward science, and self-concept was accomplished by the administration of the selected instruments. The subjects were administered the Stanford Achievement-Science, Remmer's Attitude Toward Any School Subject Scale, and the Piers-Harris Children's Self-Concept Scale. The instruments were administered, by the investigator, in May, 1974.

Procedures for Treating Data

In analyzing the data, the .05 level of significance was chosen as the level of confidence for acceptance or rejection of hypotheses. All scores and grade equivalents were entered on computer cards and these data were analyzed by the Computer Center of North Texas State University.
CHAPTER BIBLIOGRAPHY


CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

The purposes of this study were to ascertain the effect of individualized instruction in science upon the achievement, attitude, and self-concept of inner-city junior high school science students, and to analyze the implications of these effects for administrators, teachers, counselors, and others who are interested in the optimum achievement of students to science instruction.

To test the hypotheses of this study, a design involving the Campbell and Stanley Post-test Only Control Group Design was used. The .05 level of significance was selected as the basis for accepting or rejecting the hypotheses.

The data obtained from the study are organized into five sections for presentation. The first section is designed to describe the population. Mean values, standard deviations, and t-test values are tabulated for the equating variables. The second section is devoted to the presentation and analysis of the results of the data obtained for the achievement criterion. Mean values, standard deviations
and t-test values are tabulated for the equating variables. The second section is devoted to the presentation and analysis of the results of the data obtained for the achievement criterion. Mean values, standard deviations, analysis of covariance, and correlations between achievement and selected variables are presented. The third section is devoted to the presentation and analysis of the data obtained for the attitude toward science criterion. Mean values, standard deviation, analysis of covariance, and correlations between attitude toward science and selected student variables are presented. The fourth section is devoted to the presentation and analysis of the data obtained for the self-concept criterion. Mean values, standard deviation, analysis of covariance, and correlations between self-concept and selected student variables are presented. The fifth section was devoted to the presentation of data obtained from the correlational study of the relationship between grade point average in science, attitude toward science, and self-concept.

Description of the Population

In the study data were obtained from students enrolled in two junior high schools in south Texas during the spring semester of 1974. The students were enrolled in
twelve separate physical science classes taught by four different teachers. The total student population of the study included 300 students. One hundred and fifty students, comprising the control group were enrolled in traditional physical science classes, while one hundred and fifty students comprising the experimental group were enrolled in an individualized science program.

Preliminary data for each student were obtained from the permanent records of the two schools. The preliminary data included the student's sex, age, I.Q., natural science achievement level, and composite achievement level.

The ages of the subjects in the two groups ranged from 173 months to 229 months. The mean age was 184.44 months. The I.Q. range was from 46 to 125 and the mean I.Q. of the combined group was 85.02. The I.Q. scores were converted to T-scores for purposes of analysis. The background in natural science achievement scores for the total group ranged from a percentile score of 1 to 86, with a mean value of 17.99. The composite achievement test scores ranged from a percentile score of 1 to 76, with a mean value of 23.53.

A series of t-tests was conducted, utilizing the preliminary data, to establish the fact that the control and experimental groups represented the same basic population.
The t-test calculations indicated that there were no significant differences between the control and experimental groups in terms of age, I.Q., background in science, and composite achievement level. Mean values and standard deviations for the control variables are presented in Table I.

**TABLE I**

MEAN VALUES AND STANDARD DEVIATIONS OF THE CONTROL VARIABLES

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control Group</th>
<th>Experimental Group</th>
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<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>S.D.</td>
</tr>
<tr>
<td>Age</td>
<td>184.03</td>
<td>6.09</td>
</tr>
<tr>
<td>I.Q.</td>
<td>85.79</td>
<td>10.94</td>
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<td>Natural Science</td>
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<tr>
<td>Achievement</td>
<td>18.57</td>
<td>17.29</td>
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<tr>
<td>Composite</td>
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<td></td>
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<tr>
<td>Achievement</td>
<td>24.25</td>
<td>16.71</td>
</tr>
</tbody>
</table>

The means of the control variables indicate the existence of small differences between the control and experimental groups. These differences were not significant at the .05 level. The t-test values for the control variables are presented in Table II.
TABLE II

t-TEST VALUES FOR THE CONTROL VARIABLES

<table>
<thead>
<tr>
<th>Variable</th>
<th>t-Test</th>
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<td>Achievement</td>
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</tbody>
</table>

The t-test values must exceed 1.980 to be significant at the .05 level. The t-test values indicate that any differences between the control and experimental groups were not significant. The second section of the analysis of data is devoted to the presentation of data obtained for the achievement criterion.

Student Achievement in Science

The grade point average in science constituted the subject of the first hypothesis. The analysis of variance provided a test for the following hypothesis:

Hypothesis 1. The individually instructed group will achieve a significantly higher
mean grade point average in science than will the traditionally instructed group

a. At the end of the first nine weeks,
b. At the end of the second nine weeks,
c. At the end of the third nine weeks,
d. At the end of the fourth nine weeks.

Mean values and standard deviations for the grade point average in science indicate that there were differences between the control and experimental groups. The subjects in the experimental group consistently performed at a higher level than did the control-group. The experimental-group experienced a rise in grade point average during the second and fourth nine-week periods. The control-group experienced a steady decline. Mean values and standard deviations for the grade point average in science are presented in Table III.

TABLE III

MEANS AND STANDARD DEVIATIONS OF GRADE POINT AVERAGE IN SCIENCE OF THE TWO GROUPS OF NINTH-GRADE SCIENCE STUDENTS

<table>
<thead>
<tr>
<th>Group</th>
<th>GPA Mean (1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>GPA Standard Deviation (1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>2.30</td>
<td>2.25</td>
<td>2.12</td>
<td>1.90</td>
<td>1.03</td>
<td>1.04</td>
<td>1.18</td>
<td>1.10</td>
</tr>
<tr>
<td>Experimental</td>
<td>2.42</td>
<td>2.48</td>
<td>2.33</td>
<td>2.73</td>
<td>1.04</td>
<td>1.03</td>
<td>1.15</td>
<td>.93</td>
</tr>
<tr>
<td>Total</td>
<td>2.36</td>
<td>2.36</td>
<td>2.22</td>
<td>2.32</td>
<td>1.03</td>
<td>1.04</td>
<td>1.17</td>
<td>.10</td>
</tr>
</tbody>
</table>
The results of the analysis of variance for the first nine week period are presented in Table IV. The results indicate that the experimental-group mean was higher than the control-group mean. However, this difference was not significant at the .05 level.

TABLE IV
ANALYSIS OF VARIANCE FOR GRADE POINT AVERAGE IN SCIENCE - FIRST NINE WEEKS

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Degrees of Freedom</th>
<th>Sum of Squares</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>1</td>
<td>0.9633</td>
<td>0.9015</td>
<td>0.3431</td>
</tr>
<tr>
<td>Within</td>
<td>298</td>
<td>318.4333</td>
<td>.</td>
<td>.</td>
</tr>
</tbody>
</table>

The results of the analysis of variance for the second nine-week period are presented in Table V. The experimental-group mean exceeded the control-group mean. This difference was significant at the .05 level.

TABLE V
ANALYSIS OF VARIANCE FOR GRADE POINT AVERAGE IN SCIENCE - SECOND NINE WEEKS

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Degrees of Freedom</th>
<th>Sum of Squares</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>1</td>
<td>3.8533</td>
<td>3.5905</td>
<td>0.0591</td>
</tr>
<tr>
<td>Within</td>
<td>298</td>
<td>319.8133</td>
<td>.</td>
<td>.</td>
</tr>
</tbody>
</table>
The results of the analysis of variance for the third nine-week period are presented in Table VI. The results indicate that the experimental mean exceeded the control-group mean. However, this difference was not significant at the .05 level.

TABLE VI
ANALYSIS OF VARIANCE FOR GRADE POINT AVERAGE IN SCIENCE - THIRD NINE WEEKS

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Degrees of Freedom</th>
<th>Sum of Squares</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>1</td>
<td>3.4133</td>
<td>2.5229</td>
<td>0.1132</td>
</tr>
<tr>
<td>Within</td>
<td>298</td>
<td>403.1733</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The results of the analysis of variance for the fourth nine-week period are presented in Table VII. The results indicate that the experimental-group mean exceeded the control-group mean. This difference was significant at the .001 level.

TABLE VII
ANALYSIS OF VARIANCE FOR GRADE POINT AVERAGE IN SCIENCE - FOURTH NINE WEEKS

<table>
<thead>
<tr>
<th>Source of Variations</th>
<th>Degrees of Freedom</th>
<th>Sum of Squares</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>1</td>
<td>50.4300</td>
<td>48.4019</td>
<td>0.001</td>
</tr>
<tr>
<td>Within</td>
<td>298</td>
<td>310.4867</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The results indicate that the experimental-group achieved higher mean grade point averages, in science, throughout the year. However, the second and fourth grading periods were significant at the .05 and .001 levels respectively.

The results of the analysis of covariance for the final grade point average in science are presented in Table VIII. The results indicate that the experimental-group mean was not significantly different at the .05 level.

The F-Ratio for the proper degrees of freedom must exceed 3.89 to be significant at the .05 level, and 6.76 to be significant at the .01 level. Since the calculated F-Ratio as presented in Table IV equaled .1322, the differences in the adjusted means were not significant at the .05 level.

Therefore, the first hypothesis, that the individually instructed group would achieve a significantly higher mean grade point average in science, must be rejected. However, the individually instructed group did have higher mean scores. It could therefore be assumed that the individualized program did enhance the achievement of the students.
TABLE VIII

ANALYSIS OF COVARIANCE FOR THE FINAL GRADE POINT AVERAGE IN SCIENCE

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Degrees of Freedom</th>
<th>Sum of Squares</th>
<th>Mean Squares</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>1</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.1322</td>
<td>1.000</td>
</tr>
<tr>
<td>Within</td>
<td>294</td>
<td>0.2969</td>
<td>0.0010</td>
<td>..</td>
<td>..</td>
</tr>
</tbody>
</table>

In order to be significant at the .05 level, F must exceed 3.89.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Treatment Mean</th>
<th>Adjusted Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>2.1400</td>
<td>2.3136</td>
</tr>
<tr>
<td>Experimental</td>
<td>2.4883</td>
<td>2.3147</td>
</tr>
</tbody>
</table>

The analysis of covariance provided a test for the second hypothesis:

Hypothesis 2. The individually instructed group will attain a significantly higher mean score on the Stanford Achievement Test: Science than will the traditionally instructed group.

Mean values and standard deviations for the Stanford Achievement Test: Science indicate that there were slight differences between the control and experimental groups.
Mean values and standard deviations for the Stanford Achievement Test: Science are presented in Table IX.

**TABLE IX**

MEANS AND STANDARD DEVIATIONS FOR THE STANFORD ACHIEVEMENT TEST: SCIENCE

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>19.1748</td>
<td>1.7012</td>
</tr>
<tr>
<td>Experimental</td>
<td>20.5918</td>
<td>2.1029</td>
</tr>
<tr>
<td>Total</td>
<td>19.8883</td>
<td>1.9270</td>
</tr>
</tbody>
</table>

The results of the test of the second hypothesis by analysis of covariance are presented in Table X. A study of Table X reveals a calculated F-Ratio of .3143.

**TABLE X**

ANALYSIS OF COVARIANCE FOR THE STANFORD ACHIEVEMENT TEST: SCIENCE

<table>
<thead>
<tr>
<th>Sources of Variation</th>
<th>Degrees of Freedom</th>
<th>Sum of Squares</th>
<th>Mean Squares</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>1</td>
<td>94.6875</td>
<td>94.6875</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within</td>
<td>294</td>
<td>88575.3750</td>
<td>301.2766</td>
<td>.3143</td>
<td>.5756</td>
</tr>
</tbody>
</table>

In order to be significant at the .05 level, F must exceed 3.89.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Adjustment of Means</th>
<th>Treatment Mean</th>
<th>Adjusted Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td></td>
<td>17.2933</td>
<td>19.1748</td>
</tr>
<tr>
<td>Experimental</td>
<td></td>
<td>22.4733</td>
<td>20.5918</td>
</tr>
</tbody>
</table>
The results of the analysis of covariance for the achievement criterion as presented in Table X indicate that the experimental-group mean exceeded the control-group mean. The difference in the adjusted mean was not significant at the .05 level. The F-Ratio for the proper degrees of freedom must exceed 3.89 to be significant at the .05 level.

Therefore, the second hypothesis, that the individually instructed group would attain a significantly higher mean score on the achievement criterion, must be rejected.

A correlation matrix was developed to determine whether there was any relationship between achievement, as measured by the Stanford Achievement Test: Science, and selected student variables.

The Pearson r values and levels of significance for the relationships indicated between achievement in science and the selected student variables are presented in Table XI.

For the combined group of 300 subjects the value of r must exceed .138 to be significant at the .05 level, and .181 to be significant at the .01 level. Therefore, the student variables of I.Q., natural science achievement, and composite achievement were found to be significantly related to the achievement variable at the .01 level, while the student variable of age was found to be not significant.
TABLE XI
CORRELATION BETWEEN ACHIEVEMENT IN SCIENCE AND SELECTED STUDENT VARIABLES-TOTAL GROUP

<table>
<thead>
<tr>
<th>Variable</th>
<th>r</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>-.1045</td>
<td>NS</td>
</tr>
<tr>
<td>I.Q.</td>
<td>.6147</td>
<td>.01</td>
</tr>
<tr>
<td>Natural Science Achievement</td>
<td>.5544</td>
<td>.01</td>
</tr>
<tr>
<td>Composite Achievement</td>
<td>.5262</td>
<td>.01</td>
</tr>
</tbody>
</table>

A correlation matrix was developed for the experimental and control groups, each consisting of 150 subjects. Pearson r values and levels of significance for the relationships between achievement in science and the selected student variables are presented in Table XII and Table XIII.

TABLE XII
CORRELATION BETWEEN ACHIEVEMENT IN SCIENCE AND SELECTED STUDENT VARIABLES-EXPERIMENTAL GROUP

<table>
<thead>
<tr>
<th>Variable</th>
<th>r</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>-.1600</td>
<td>NS</td>
</tr>
<tr>
<td>I.Q.</td>
<td>.6854</td>
<td>.01</td>
</tr>
<tr>
<td>Natural Science Achievement</td>
<td>.7221</td>
<td>.01</td>
</tr>
<tr>
<td>Composite Achievement</td>
<td>.6500</td>
<td>.01</td>
</tr>
</tbody>
</table>
The Pearson r for the proper degrees of freedom in the case of the experimental group must exceed .174 and .228 to be significant at the .05 and the .01 level. Table XIII presents the Pearson r and levels of significance for the experimental-group.

For the experimental-group of 150 subjects the value of r exceeded the tabled value at the .05 level and was also significant at the .01 level. Therefore, the student variable of I.Q., natural science achievement, and composite achievement variable was significant at the .01 level, while the student variable of age was not found to be significant.

TABLE XIII
CORRELATION BETWEEN ACHIEVEMENT IN SCIENCE AND SELECTED STUDENT VARIABLES—CONTROL GROUP

<table>
<thead>
<tr>
<th>Variable</th>
<th>r</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>-0.0356</td>
<td>NS</td>
</tr>
<tr>
<td>I.Q.</td>
<td>0.5559</td>
<td>.01</td>
</tr>
<tr>
<td>Natural Science Achievement</td>
<td>0.3764</td>
<td>.01</td>
</tr>
<tr>
<td>Composite Achievement</td>
<td>0.3951</td>
<td>.01</td>
</tr>
</tbody>
</table>

The Pearson r for the proper degrees of freedom in the case of the control group must exceed .174 and .228 to be
significant at the .05 and the .01 levels. Table XIII presents the Pearson r values and levels of significance for the control group.

Student Attitude Toward Science

The students' attitude toward science was the subject of the third hypothesis. The analysis of covariance provided a test for the following hypothesis:

Hypothesis 3. The individually instructed group will attain a more positive attitude toward science as measured by Remmer's Attitude Toward Any School Subject Scale, than will the traditionally instructed group.

Mean values and standard deviations for Remmer's Attitude Toward Any School Subject Scale indicate that there was a slight difference between the control and experimental groups. Mean values and standard deviations from Remmer's Attitude Toward Any School Subject Scale are presented in Table XIV.

The results of the test of the third hypothesis by analysis of covariance are presented in Table XIV. A study of Table XIV reveals a calculated F-Ratio of .3920.
TABLE XIV

MEAN AND STANDARD DEVIATIONS FOR REMMER'S ATTITUDE TOWARD ANY SUBJECT SCALE

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>6.7820</td>
<td>9.2059</td>
</tr>
<tr>
<td>Experimental</td>
<td>6.8604</td>
<td>10.4278</td>
</tr>
<tr>
<td>Total</td>
<td>6.8212</td>
<td>9.8273</td>
</tr>
</tbody>
</table>

The results of the analysis of covariance for the attitude toward science criterion as presented in Table XV indicate that the experimental-group mean did not exceed the control-group mean.

TABLE XV

ANALYSIS OF COVARIANCE OF ATTITUDES TOWARD SCIENCE

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Degrees of Freedom</th>
<th>Sum of Squares</th>
<th>Mean Squares</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>1</td>
<td>3625.0000</td>
<td>3625.00</td>
<td>0.3920</td>
<td>0.5318</td>
</tr>
<tr>
<td>Within</td>
<td>294</td>
<td>2718488.0000</td>
<td>9246.5547</td>
<td>.</td>
<td>.</td>
</tr>
</tbody>
</table>

In order to be significant at the .05 level F must exceed 3.89.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Treatment Mean</th>
<th>Adjusted Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>6.7820</td>
<td>6.8650</td>
</tr>
<tr>
<td>Experimental</td>
<td>6.8604</td>
<td>6.7773</td>
</tr>
</tbody>
</table>
The difference in the adjusted mean was not significant at the .05 level. The F-Ratio for the proper degrees of freedom must exceed 3.89 to be significant at the .05 level. Therefore, the third hypothesis, that the individually instructed group would attain a significantly higher mean score on the attitude toward science criterion, must be rejected.

A correlation matrix was developed in order to determine whether there was any relationship between attitude toward science, as measured by Remmer's Attitude Toward Any School Subject Scale, and selected student variables. The Pearson r values and levels of significance for the relationships indicated between attitude toward science and the selected student variables are presented in Table XVI.

**TABLE XVI**

**CORRELATION BETWEEN ATTITUDE TOWARD SCIENCE AND SELECTED STUDENT VARIABLES—TOTAL GROUP**

<table>
<thead>
<tr>
<th>Variable</th>
<th>r</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>-0.0581</td>
<td>NS</td>
</tr>
<tr>
<td>I.Q.</td>
<td>0.2549</td>
<td>.01</td>
</tr>
<tr>
<td>Natural Science Achievement</td>
<td>0.2445</td>
<td>.01</td>
</tr>
<tr>
<td>Composite Achievement</td>
<td>0.2638</td>
<td>.01</td>
</tr>
</tbody>
</table>
For the combined group of 300 subjects the value of $r$ must exceed .138 to be significant at the .05 level, and .181 to be significant at the .01 level. Therefore, the student variables of I.Q., natural science achievement, and composite achievement were found to be significantly related to the attitude toward science variable at the .01 level, while the student variable of age was found to be not significant.

A correlation matrix was developed for the experimental and control groups, each consisting of 150 subjects. Pearson $r$ values and levels of significance for the relationships between attitude toward science and the selected student variables are presented for both groups in Table XVII and Table XVIII.

### TABLE XVII

**CORRELATION BETWEEN ATTITUDE TOWARD SCIENCE AND SELECTED STUDENT VARIABLES—EXPERIMENTAL GROUP**

<table>
<thead>
<tr>
<th>Variable</th>
<th>$r$</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>-0.0666</td>
<td>NS</td>
</tr>
<tr>
<td>I.Q.</td>
<td>0.2715</td>
<td>.01</td>
</tr>
<tr>
<td>Natural Science Achievement</td>
<td>0.3407</td>
<td>.01</td>
</tr>
<tr>
<td>Composite Achievement</td>
<td>0.3640</td>
<td>.01</td>
</tr>
</tbody>
</table>
The Pearson r for the proper degrees of freedom in the case of the experimental group must exceed .174 and .228 to be significant at the .05 and the .01 level. Table XVII presents the Pearson r values and the levels of significance for the experimental group.

For the experimental group of 150 subjects the value of r was found to be significant at the .05 level, and also to be significant at the .01 level. Therefore, the student variables of I.Q., natural science achievement, and composite achievement were found to be significantly related to student variable of attitude toward science, while the student variable of age was not significant.

Table XVIII presents the Pearson r values and levels of significance for the control group.

<table>
<thead>
<tr>
<th>TABLE XVIII</th>
</tr>
</thead>
<tbody>
<tr>
<td>CORRELATION BETWEEN ATTITUDE TOWARD SCIENCE AND SELECTED STUDENT VARIABLES—CONTROL GROUP</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>r</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>-0.0517</td>
<td>NS</td>
</tr>
<tr>
<td>I.Q.</td>
<td>0.2404</td>
<td>.01</td>
</tr>
<tr>
<td>Natural Science Achievement</td>
<td>0.1404</td>
<td>NS</td>
</tr>
<tr>
<td>Composite Achievement</td>
<td>0.1499</td>
<td>NS</td>
</tr>
</tbody>
</table>
The Pearson r for the proper degrees of freedom in the case of the control group must exceed .174 and .228 to be significant at the .05 and the .01 level. The student variable of I.Q. was the only variable found to be significantly related to the control groups attitude toward science.

Student Self-Concept

The students' self-concepts constituted the subject matter of the fourth hypothesis. The analysis of covariance provided a test for the following hypothesis:

Hypothesis 4. The individually instructed group will achieve a higher mean score on the Piers-Harris Children's Self-Concept Scale than will the traditionally instructed group.

Mean values and standard deviations for the Piers-Harris Children's Self-Concept Scale indicate that there was a slight difference between the control and experimental groups. Mean values and standard deviations for the Piers-Harris Children's Self-Concept Scale are presented in Table XIX.
TABLE XIX

MEANS AND STANDARD DEVIATION OF THE PIERS-HARRIS CHILDREN'S SELF-CONCEPT SCALE OF THE TWO GROUPS OF NINTH-GRADE SCIENCE STUDENTS

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>56.8467</td>
<td>11.6445</td>
</tr>
<tr>
<td>Experimental</td>
<td>60.4600</td>
<td>10.7950</td>
</tr>
<tr>
<td>Total</td>
<td>58.6533</td>
<td>11.3541</td>
</tr>
</tbody>
</table>

The results of the analysis of covariance for the self-concept criterion as presented in Table XX indicate that the experimental-group mean exceeded the control-group mean.

TABLE XX

ANALYSIS OF COVARIANCE OF SELF-CONCEPT

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Degrees of Freedom</th>
<th>Sum of Squares</th>
<th>Mean Squares</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>1</td>
<td>370.5000</td>
<td>370.5000</td>
<td>3.0596</td>
<td>0.0813</td>
</tr>
<tr>
<td>Within</td>
<td>294</td>
<td>35601.1680</td>
<td>121.0924</td>
<td>.</td>
<td>.</td>
</tr>
</tbody>
</table>

In order to be significant at the .05 level F must exceed 3.89.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Treatment Mean</th>
<th>Adjusted Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>56.8467</td>
<td>57.2514</td>
</tr>
<tr>
<td>Experimental</td>
<td>60.4600</td>
<td>60.0551</td>
</tr>
</tbody>
</table>
The difference in the adjusted mean was not significant at the .05 level. The F-Ratio for the proper degrees of freedom must exceed 3.89 to be significant at the .05 level.

The F-Ratio was calculated to be 3.06. To be significant the F-Ratio must exceed 3.89. Therefore, the fourth hypothesis, that the individually instructed group will achieve a higher mean score on the Piers-Harris Children's Self-Concept Scale, must be rejected.

In order to determine whether there was any relationship between self-concept, as measured by the Piers-Harris Children's Self-Concept Scale, and selected student variables, a correlation matrix was developed. The Pearson r values and levels of significance for the relationships indicated between self-concept and the selected student variables are presented in Table XXI.

TABLE XXI

CORRELATION BETWEEN SELF-CONCEPT AND SELECTED STUDENT VARIABLES—TOTAL GROUP

<table>
<thead>
<tr>
<th>Variable</th>
<th>r</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>-0.0244</td>
<td>NS</td>
</tr>
<tr>
<td>I.Q.</td>
<td>0.2038</td>
<td>.01</td>
</tr>
<tr>
<td>Natural Science Achievement</td>
<td>0.0897</td>
<td>.01</td>
</tr>
<tr>
<td>Composite Achievement</td>
<td>0.0886</td>
<td>NS</td>
</tr>
</tbody>
</table>
For the combined group of 300 subjects the value of r must exceed .138 to be significant at the .05 level and .181 to be significant at the .01 level. Therefore, the student variables of I.Q. and natural science achievement were found to be significantly related to the self-concept variable, while age and composite achievement were not significantly related to the self-concept variable.

A correlation matrix for the experimental and control groups, each consisting of 150 subjects, was developed. Pearson r values and levels of significance for the relationships between self-concept and the selected student variables are presented for both groups in Table XXII and Table XXIII.

The Pearson r for the proper degrees of freedom in the case of the experimental group must exceed .174 and .228 to be significant at the .05 and the .01 level. Table XXII presents the Pearson r values and levels of significance for the experimental group.

For the experimental group of 150 students the value of r was found to be significant at the .05 level and also to be significant at the .01 level. Therefore, the student variables of I.Q. and natural science achievement were found to
be significantly related to self-concept while age and composite achievement were not significantly related to self-concept.

TABLE XXII

CORRELATION BETWEEN SELF-CONCEPT AND SELECTED STUDENT VARIABLES—EXPERIMENTAL GROUP

<table>
<thead>
<tr>
<th>Variable</th>
<th>r</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>-0.0790</td>
<td>NS</td>
</tr>
<tr>
<td>I.Q.</td>
<td>0.3808</td>
<td>.01</td>
</tr>
<tr>
<td>Natural Science Achievement</td>
<td>0.2632</td>
<td>.01</td>
</tr>
<tr>
<td>Composite Achievement</td>
<td>0.2184</td>
<td>.05</td>
</tr>
</tbody>
</table>

The Pearson r for the proper degrees of freedom in the case of the control group must exceed .174 and .228 to be significant at the .05 and the .01 level. Table XXIII presents the Pearson r values and levels of significance for the control group.

For the control group of 150 students the values of the r must exceed .174 to be significant at the .05 level and .228 to be significant at the .01 level. Therefore, the student variables of age, I.Q., natural science achievement, and composite achievement were found to be not significantly related to the self-concept variable.
TABLE XXIII
CORRELATION BETWEEN SELF-CONCEPT AND SELECTED STUDENT VARIABLES-CONTROL GROUP

<table>
<thead>
<tr>
<th>Variable</th>
<th>r</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.0212</td>
<td>NS</td>
</tr>
<tr>
<td>I.Q.</td>
<td>0.0523</td>
<td>NS</td>
</tr>
<tr>
<td>Natural Science Achievement</td>
<td>-0.0584</td>
<td>NS</td>
</tr>
<tr>
<td>Composite Achievement</td>
<td>-0.0215</td>
<td>NS</td>
</tr>
</tbody>
</table>

Correlation of Grade Point Average in Science With Achievement in Science

Pearson r calculations were made upon the variables of grade point average in science and achievement in science as measured by the Stanford Achievement Test: Science. The resulting correlation matrix was developed in order to test the fifth hypothesis:

Hypothesis 5. There will be a significant relationship between grade point average in science and student achievement in science as measured by the Stanford Achievement Test: Science.

Values for the grade point average in science variable were calculated from the students' final grade average in science. Values for the achievement in science variable were
obtained from the students' score on the Stanford Achievement Test: Science. Values of the Pearson r and levels of significance for the experimental group, control group, and total combined group are presented in Table XXIV. For the experimental and control groups, each consisting of 150 subjects, the values of r must exceed .174 and .228 to be significant at the .05 and .01 level respectively. For the total combined group of 300 subjects, the values of r must exceed .138 and .181 to be significant at the .05 and .01 level.

TABLE XXIV

CORRELATION OF GRADE POINT AVERAGE IN SCIENCE AND ACHIEVEMENT

<table>
<thead>
<tr>
<th>Group</th>
<th>Pearson r</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>0.4306</td>
<td>.01</td>
</tr>
<tr>
<td>Experimental</td>
<td>0.4287</td>
<td>.01</td>
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<tr>
<td>Total</td>
<td>0.4396</td>
<td>.01</td>
</tr>
</tbody>
</table>

The results of the Pearson r calculations as presented in Table XXIV indicate that the hypothesis that there is a significant relationship between grade point average in science and science achievement as measured by the Stanford
Achievement Test: Science must be retained. Grade point average in science appears to be related to science achievement as measured by the Stanford Achievement Test: Science and the relationship is significant at the .01 level of confidence.

Correlation of Grade Point Average in Science With Attitude Toward Science

Pearson r calculations were made upon the variables of grade point average in science and attitude toward science as measured by Remmer's Attitude Toward Any School Subject Scale. The resulting correlation matrix was developed in order to test the sixth hypothesis:

Hypothesis 6. There will be a significant relationship between grade point average in science and attitude toward science as measured by Remmer's Attitude Toward Any School Subject Scale.

The students' grade point average in science was calculated from the final grade average. The students' score on Remmer's Attitude Toward Any School Subject Scale provided the attitude toward science variable. The Pearson r values
and levels of significance for the experimental group, control group, and total combined group are presented in Table XXV.

TABLE XXV

CORRELATION OF GRADE POINT AVERAGE IN SCIENCE AND ATTITUDE TOWARD SCIENCE

<table>
<thead>
<tr>
<th>Group</th>
<th>Pearson r</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>0.1589</td>
<td>NS</td>
</tr>
<tr>
<td>Experimental</td>
<td>0.2786</td>
<td>.01</td>
</tr>
<tr>
<td>Total</td>
<td>0.2242</td>
<td>.01</td>
</tr>
</tbody>
</table>

For the experimental and control groups, each consisting of 150 subjects, the value of \( r \) must exceed .174 and .228 to be significant at the .05 and .01 level, respectively. For the total combined group of 300 subjects, the value of \( r \) must exceed .138 and .181 to be significant at the .05 and .01 level.

The results of the Pearson \( r \) calculations as presented in Table XXV indicate that the hypothesis that there is a significant relationship between grade point average in science and attitude toward science as measured by Remmer's Attitude Toward Any School Subject Scale must be retained.
Grade point average in science appears to be related to attitude toward science as measured by Remmer's *Attitude Toward Any School Subject Scale* and the relationship is significant at the .01 level of confidence.

**Correlation of Grade Point Average in Science With Self-Concept**

Pearson r calculations were made upon the variables of grade point average in science and self-concept as measured by the *Piers-Harris Children's Self-Concept Scale*. The resulting matrix was developed in order to test the seventh hypothesis:

**Hypothesis 7.** There will be a significant relationship between grade point average in science and self-concept as measured by the *Piers-Harris Children's Self-Concept Scale*.

The students' grade point average in science was calculated from the final grade average. The students' score on the *Piers-Harris Children's Self-Concept Scale* provided the self-concept variable. The Pearson r values and levels of significance for the experimental group, control group, and total combined group are presented in Table XXVI.
For the experimental and control groups, each consisting of 150 subjects, the value of r must exceed .174 and .228 to be significant at the .05 and .01 level respectively. For the total combined group of 300 students, the value of r must exceed .138 and .181 to be significant at the .05 and .01 level.

TABLE XXVI

CORRELATION OF GRADE POINT AVERAGE IN SCIENCE AND SELF-CONCEPT

<table>
<thead>
<tr>
<th>Group</th>
<th>Pearson r</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>0.2153</td>
<td>.05</td>
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<tr>
<td>Experimental</td>
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<tr>
<td>Total</td>
<td>0.2409</td>
<td>.01</td>
</tr>
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</table>

The results of the Pearson r calculations as presented in Table XXVI indicate that the hypothesis that there is a
significant relationship between grade point average in science and self-concept as measured by the *Piers-Harris Children's Self-Concept Scale* must be retained. Grade point average in science appears to be related to self-concept as measured by the *Piers-Harris Children's Self-Concept Scale* at the .05 level of confidence for both the experimental and the control groups and at the .01 level for the total group.
CHAPTER BIBLIOGRAPHY


CHAPTER V

SUMMARY, FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

The purpose of this chapter is to summarize the study, to state the findings of the study, to make conclusions based on the findings, and to make recommendations for further study.

Summary of the Study

The problem of the study was the effect of individualized instruction in science upon achievement, attitude, and self-concept of inner-city junior high school students. The study compared students in an individualized science program with those enrolled in a traditional program.

The subjects of the study included 300 students of ninth grade physical science in two junior high schools in Southeast Texas. The experimental group consisted of 150 students in six classes of ninth grade physical science. The control group consisted of 150 students in six classes of traditional physical science. The twelve classes were taught by four teachers who were matched on the basis of age, sex, experience, and training.
The experimental program for this study was the Intermediate Science Curriculum Study (ISCS) Program. The ISCS program is an individualized, activity-centered program that is composed of three levels. Level I is physics-oriented and moves in the direction of a more chemical approach. Levels II and III begin with chemically-oriented activities and conclude with an interdisciplinary approach. Levels II and III build on the skills of Level I. An ISCS Level III type program was utilized for this study.

Data for the study were obtained from the permanent records of the subjects and responses to the following instruments: the Stanford Achievement Test: Science, Remmer’s Attitude Toward Any School Subject Scale, and the Piers-Harris Children’s Self-Concept Scale. The .05 level of significance was considered to be sufficient to reject a hypothesis.

Findings of the Study

Analysis and interpretation of the data revealed the following:

1. Hypothesis I stated that the individually instructed group would achieve a significantly higher mean grade point
average in science than would the traditionally instructed group. This hypothesis was not supported.

2. The individually instructed group achieved consistently higher grade point averages than did the traditional group. The individually instructed groups had significantly higher grade point averages in science for the second and fourth nine-week periods.

3. Hypothesis II stated that the individually instructed group would attain a significantly higher mean score on the Stanford Achievement Test: Science than would the traditionally instructed group. The experimental group attained a slightly higher mean score. This difference was not significant at the .05 level; therefore, this hypothesis was not supported.

4. The individually instructed group achieved a higher mean score than did the traditionally instructed group.

5. Hypothesis III stated that the individually instructed group would attain a more positive attitude toward science as measured by Remmer's Attitude Toward Any School Subject Scale than would the traditionally instructed group. This hypothesis was not supported.
6. Hypothesis IV stated that the individually instructed group would achieve a higher mean score on the Piers-Harris Children's Self-Concept Scale than would the traditionally instructed group. The experimental group achieved a higher mean score on the Piers-Harris Children's Self-Concept Scale but the difference was not significant at the .05 level.

7. Hypothesis V stated that there would be a significant relationship between grade point average in science and student achievement in science as measured by the Stanford Achievement Test: Science. This hypothesis was supported. The calculated r values exceeded the tabled values at the .01 level of significance.

8. Hypothesis VI stated that there would be a significant relationship between grade point average in science and attitude toward science as measured by Remmer's Attitude Toward Any School Subject Scale. The calculated r for the experimental group exceeded the tabled value at the .05 level of significance. The calculated r for the control group was not significant. The calculated r for the total group of 300 subjects was significant at the .01 level of significance. Therefore, there was a significant relationship between grade
point average in science and attitude toward science for the experimental group of 150 subjects.

9. Hypothesis VII stated that there would be a significant relationship between grade point average in science and self-concept as measured by the Piers-Harris Children's Self-Concept Scale. The calculated $r$ for the control group exceeded the tabled value at the .05 level of significance. The calculated $r$ for the experimental group exceeded the tabled value at the .05 level of significance. The calculated $r$ for the total group was significant at the .01 level.

Conclusions

From the data found in this study and in the related research, the following conclusions are drawn:

1. Physical science students taught by the individualized program (ISCS) do not achieve at a significantly higher level, as measured by a standardized achievement test in science, than do students taught by the traditional method.

2. The students in the individualized program achieved a higher mean score on the Stanford Achievement Test: Science.
3. Physical science students taught by the individualized program (ISCS) do not differ significantly from the students of traditional physical science in attitude toward science.

4. The mean attitude score for students in the individualized program exceeded the mean score of students in the traditional program.

5. Physical science students taught by the individualized program (ISCS) do not differ significantly from the students of traditional physical science, on a standard self-concept scale.

6. Physical science students taught by the individualized method had a higher mean score on the self-concept scale than did the traditionally instructed group.

7. The student variables of I.Q., background in natural science, and composite achievement are important factors in successful achievement in physical science.

8. The student variables of I.Q., background in natural science, and composite achievement are important factors in attaining a high positive attitude toward science. The I.Q. of the students appears to be the most important of the above factors.
9. The student variables of I.Q. and natural science achievement are important factors in attaining a high self-concept.

10. There is a significant relationship between grade point average in science and student achievement in science.

11. There was a significant relationship between grade point average and attitude toward science for the experimental group and the total group.

12. There was no significant relationship between grade point average and attitude toward science for the control group.

13. There was a significant relationship between grade point average in science and self-concept.

14. The students in the individualized program scored higher on the achievement, attitude, and self-concept criterion. This leads the investigator to conclude that even though the difference was not significant, the individualized program was superior to the traditional mode of instruction for this population.

15. Individualized instructional programs should be beneficial to other groups of similar students.
Recommendations for Further Study

Based on a survey of research findings and the data presented in this study, the following recommendations are made:

1. A replication of this study should be undertaken to determine whether the data are supported in other locations.
2. A replication of this study should be made using seventh grade science students involved in ISCS - Level I.
3. A replication of this study should be made using eighth grade science students involved in ISCS - Level II.
4. A longitudinal study comparing the effects of the two methods upon high school physics should be undertaken.
5. A study similar in nature should be made with a larger sample from a broader geographic area.
6. A study involving a broader range of I.Q.'s, and achievement levels should be undertaken.
7. A study should be undertaken to attempt to develop a physical science test of equal validity for the two different approaches.
8. A study utilizing other student populations of different racial groups should be undertaken.
APPENDIX A
<table>
<thead>
<tr>
<th>STUDENT NUMBER</th>
<th>SEX</th>
<th>AGE</th>
<th>IQ</th>
<th>SCIENCE ACHIEVEMENT</th>
<th>COMPOSITE ACHIEVEMENT</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<tr>
<td>GROUP</td>
<td>AGE IN MONTHS</td>
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<td>COMPOSITE ACHIEVEMENT</td>
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<td>40.23</td>
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## STANDARD DEVIATIONS ON THE CONTROL VARIABLES

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<td>11.20</td>
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# Mean Scores on the Dependent Variables

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<th>ATTITUDE</th>
<th>SELF-CONCEPT</th>
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</thead>
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<td>Control</td>
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<td>6.78</td>
<td>56.85</td>
</tr>
<tr>
<td>Experimental</td>
<td>20.59</td>
<td>6.86</td>
<td>60.46</td>
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<tr>
<td>Total</td>
<td>19.89</td>
<td>6.82</td>
<td>58.65</td>
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**Articles**


Unpublished Materials


