Individualized Science Instruction in the Middle Schools & Junior High Schools in Kentucky

Rita Byars

Western Kentucky University

Follow this and additional works at: https://digitalcommons.wku.edu/theses

Part of the Curriculum and Instruction Commons, Elementary and Middle and Secondary Education Administration Commons, Elementary Education Commons, Science and Mathematics Education Commons, and the Secondary Education Commons

Recommended Citation
https://digitalcommons.wku.edu/theses/2205

This Thesis is brought to you for free and open access by TopSCHOLAR®. It has been accepted for inclusion in Masters Theses & Specialist Projects by an authorized administrator of TopSCHOLAR®. For more information, please contact topscholar@wku.edu.
Byars,

Rita S.

1977
INDIVIDUALIZED SCIENCE INSTRUCTION IN THE MIDDLE SCHOOLS AND JUNIOR HIGH SCHOOLS OF KENTUCKY

A Project
Presented to
the Faculty of the Department of School Administration
Western Kentucky University
Bowling Green, Kentucky

In Partial Fulfillment
of the Requirements for the Degree
Specialist in Education

by
Rita S. Byars
August, 1977
INDIVIDUALIZED SCIENCE INSTRUCTION IN THE MIDDLE SCHOOLS AND JUNIOR HIGH SCHOOLS OF KENTUCKY

Recommended 8 July 1977

Director of Project

Approved August 12, 1977

Dean of the Graduate College
ACKNOWLEDGEMENTS

The writer wishes to express appreciation to all those who assisted in the collection of information for the writing of this study. Gratitude is expressed to those principals, supervisors and science teachers in the commonwealth who took time from busy schedules to answer the questions in the survey which supplied the data for the study.

Acknowledgement for guidance and assistance is conveyed to the members of the committee who advised and directed during the progression of the study: Dr. V. J. Christenson, Dr. Claude Frady, Dr. Gene Farley and Dr. David Shannon.

A special debt of thanks is expressed to my husband, Samuel, for his interest, patience and understanding.
# TABLE OF CONTENTS

ACKNOWLEDGEMENTS ........................................ iii

LIST OF TABLES ........................................ vi

ABSTRACT ................................................ viii

Chapter

I. INTRODUCTION .......................................... 1
   Statement of the Problem ................................ 7
   Purpose and Justification ................................ 9
   Limitations and Delimitations of the Study ............ 11
   Definition of Terms ...................................... 14
   Organization of the Study ................................ 21

II. REVIEW OF RELATED LITERATURE ...................... 23
   Introduction ........................................... 23
   Definition and Characteristics of Individualized
   Instruction .............................................. 24
   History of Individualized Instruction ................ 34
   Systems for Administering .............................. 39
   Science Education. ...................................... 39
   History ................................................ 39
   Project Science ....................................... 42
   Individualized Science Programs ...................... 54
   Research and Evaluation of Individualized
   Instruction .............................................. 61
   Summary ................................................ 70

III. METHODS AND PROCEDURES ........................... 73
   Introduction ........................................... 73
   Method ................................................ 77
   Administering Plans .................................. 80
   Individualization Strategies ........................ 86
1. Models of Individualization ..................... 56
2. Edlin' Model of Individualization ............... 59
4. Number of Schools with Different Enrollment by Grade Levels .................. 100
5. Kinds of Science Courses Offered in Traditional and Individualized Science Programs in the School Year 1976-1977 ................. 102
7. Ages of Individualized Science Programs ............. 107
9. Behavioral Objectives Emphasized in Individualized Programs .................. 111
10. Different Strategies Used by Schools to Individualize Science .................. 113
11. Number of Strategies Used by Schools to Individualize Science .................. 112
12. Comparison of Number of Strategies Used to Positive Results Obtained ............... 115
13. Changes of Materials Needed by an Individualized Science Plan .................. 117
A study was made of the individualized science instruction in the middle schools and junior high schools of Kentucky. The status of the programs was investigated by an information survey. The instrument sought answers as to the size of the schools, organization of the schools, kinds of science taught and the frequency of use of individualized science approaches. Methods of financing and the administering plans, the objectives of the plans, and the strategies implemented to achieve these were parts of the study. Questions designed to elicit details about the requirements of an individualized program included the increase in laboratory activity directions needed, the amounts of laboratory equipment and all materials made necessary by the individualized plans. Facts about faculty reactions and evaluation of the method were also items in
The instrument was sent to 173 middle schools and junior high schools with a response of 68 percent. Individualized science programs were in use in 41 percent of the respondent schools. These plans were most often self-administered and 70 percent of them were financed by local boards of education and the general school funds, while 4 percent were supported by federal or state research funds. A higher percentage of schools with enrollments of 600-900 or more pupils used more of the individualized plans than did the smaller schools.

Most plans emphasized a combination of affective and cognitive objectives and used an average of four strategies to implement their programs. An increase of all materials was thought necessary by the majority of the schools responding. Most faculty reactions were positive although admitting the necessity of more hours of preparation entailed by the individualized program.

Evaluation of the success of the programs in the cognitive domain revealed that 52 percent of the schools found that students in the individualized programs made higher scores on standardized and teacher-made science achievement tests. In the affective domain, positive success was seen with the pupils of 65 percent of the populations.
showing more self-discipline and the students of 83 percent of them showing improved attitudes after being enrolled in individualized science classes.

The individualized programs were rated moderately successful by 58 percent of the respondents and definitely successful by 40 percent of the respondents.
CHAPTER I

INTRODUCTION

The attention of the United States citizenry is today focused on the public schools. Increased demands from the public for more accountability of school personnel force the educator’s continuous reappraisal of the methodology and expertise employed in all school programs. The news media, along with interested patrons of the schools, indict the public institutions as having been delinquent in their duties of properly educating the pupils. Criticisms are made that the schools are dysfunctional due to their responses to the pressures of some critics who, through ignorance, promote wrong and unconsciously destructive methods.¹

Lower test scores and student success as measured by standardized achievement tests are cited along with the drops in the scores of the students who took college

entrance examinations. These data support the accusations that public education has delivered a poor performance.\(^2\)

Students who were interviewed have revealed their inability to accurately measure, compute, find phone numbers or write job resumes.\(^3\)

The failure of many of the nation's youth to meet the educational requirements of the military for its armed forces further reinforces the charges that schools have failed some of their students. Coupled with the reports of businessmen that the personnel hired are ill-equipped for their necessary duties and the students' admissions that they cannot qualify for employment, the educational system stands accused of many shortcomings.

Though today's schools equip more people better for later activities than did former schools, their accomplishments are often overlooked. The tests scores of sixth and eleventh grade students who took certain tests in reading vocabulary and comprehension and in arithmetic reasoning and fundamentals in the thirties and forties were compared


\(^3\)Omens from Test Scores," U. S. News and World Report, November 22, 1976, p. 58.
to the scores of students who took the same tests today.
In spite of the fact that many more students who would have
dropped out of school were still in attendance today,
today's students ranked higher. Such positive reports
of the successes of most graduates of the nation's schools
are obscured by some obvious weaknesses. Schools are,
therefore, forced to conscientiously try to use new pro-
cedures which will be more successful for a greater num-
ber of pupils.

Kentuckians have long been known for their inde-
pendence of thought and their self-determination. The
State's schools have become vulnerable to the injunction
that the public schools destroy the creativity and ingenu-
ity of the children in attendance.

The loss of student interest in attending school
regularly indicates unmet personal and academic needs of
the students who are enrolled. Schools are described as
"creeping glaciers, cold and distant from those they are
designed to serve." The differences in people confirmed

4 Students Score Better than Parents Did in California

5 Thomas D. Clark, The Kentucky (New York: J. J.
Little and Ives Co., 1942), p.5.

6 Virgil M. Howes, Individualization of Instruction,
p.4.
by biologists as essential for the perpetuation of the species are not always allowed for by the methods seen in some public institutions. Men are not always created equal in ability and development, though some schools have steadfastly tried to treat everyone enrolled as much alike as possible. 7

Recognition of differences of abilities and cultures of present day students demands that the objectives and techniques of the schools be re-evaluated. As more busing occurs between adjoining school districts, renewed attention to the individual's problems is mandated. Treatment of children who are out of their natural environment of home community requires more skill and a more open type of instruction than the traditional schools have offered. 8 An anonymous statement, "There is nothing so unequal as equal treatment of the unequal," may best express the necessity of changing education to reach more varied types of children.

The separate disciplines within the schools have addressed themselves to the facts of loss of interest

7 Ibid., p. 6.

of pupils and the deterioration of cooperative attitudes toward the particular subject areas.\textsuperscript{9}

The science departments of the schools have noted less interest among students of the higher and advanced grade levels and in all scientific studies. This loss of interest is evidenced by the decreases in enrollment and by criticisms from those enrolled of the clinical nature of science courses. Science curricula have been charged with lacking humanity and giving little recognition to personal values, beliefs and attitudes as they bear upon individual choices concerning science.\textsuperscript{10}

Particularly in the physical sciences, fewer students have registered for the higher level courses to prepare them for scientific or related careers. The students fear the difficulty of courses; and in a survey made recently, American science pupils ranked seventh with the students of other nations in a comparison of general science knowledge.\textsuperscript{11}


The natural curiosity and innate inquisitiveness of the boys and girls of the lower grades in school appear to have degenerated or even disappeared by the time they reach adolescence. Spontaneity of thought and performance seems to have migrated from scientific precocity to knowledge of sporting events and television shows of types other than scientific. Decisions made in the junior high school and middle school years may be irreversible, and this period may be the time to capture the desire to pursue science further.\textsuperscript{12}

Though we have lived in a technological age for many years, study after study shows that the general public has little understanding of scientific knowledge--how it is generated, validated or used.\textsuperscript{13}

Schools in the commonwealth of Kentucky have tried various innovative programs and experimental strategies thought by educators to be improved from the psychological and academic viewpoints. One of the techniques now being implemented for improved performance of Kentucky's children


is that of individualization of instruction. Some schools have changed the traditional curriculum of the whole school to one of individualization of all subjects; but frequently, only certain areas and grade levels have used the method.

The middle grades and the science area, where interest in school itself—and in science particularly—diminishes and noticeably for many students, may have been the ideal place for new programs.

There does not seem to exist a coherent report of efforts of Kentucky's schools to individualize science education in the junior high or middle school years. The knowledge of the existence of such programs, the successes and failures of those in existence and the advisability of experimentation with such methods are unknown details regarding individualized education. It is from this setting that this study found its direction.

**Statement of the Problem**

The status of individualized instruction in science in the middle schools and junior high schools of Kentucky is unknown. The lack of knowledge of such programs which do exist directs attention to the following subproblems:
1. The knowledge of how many junior high schools and middle schools are employing individualized methods in the science area is not readily available to science teachers.

2. The systems used for administering the individualized plans and the success of the systems are not recorded.

3. The types of science courses offered to students in individualized programs in the middle years and the objectives of these programs are also areas in which much could be learned.

4. The strategies used by schools to implement an individualized approach are of vital concern to other schools considering such an innovation.

5. The successes of programs in current practice and the desirability of such innovations for other schools are intriguing questions to the science teachers of the commonwealth.

There is a shortage of data concerning individualized science programs offered to middle school and junior high school students in Kentucky. This study is designed to provide some serious information regarding this subject.
Purpose and Justification

This study was undertaken to provide teachers, school planners, board members, and laymen some additional information concerning the science instruction in Kentucky's middle schools and junior high schools. Data regarding science instruction by an individualized plan in the intermediate school years are difficult to find. There exists no comprehensive data on the accomplishments of Kentucky's middle and junior high schools in using an individualized approach in teaching science.

The underlying question of the desirability of individualizing instruction lacks documentation. Its effectiveness in the science area is still unresolved, though its practice is under experimentation in many places.

The changing role of faculties involved in a program of individualization needs clarification to professional teachers. The effects of changing from the traditional authoritarian approach to one which requires teachers to become facilitators of coordinated classroom activities in a diagnostic and prescriptive capacity pose some unanswered questions.

The actual purpose of such a program as individualized instruction needs clarification to many teachers and patrons of the schools. The successes of the programs
and their goals of developing more self-reliance and self-discipline among students are in the process of being evaluated.

Objectives of existing science programs in Kentucky's middle schools and junior high schools demand critical attention. Information about programs now in progress and about their successes and failures has relevance for all the schools of the commonwealth.

There is no comprehensive list of individualized science programs in Kentucky's middle and junior high schools to which researchers may turn to secure data for the identification of strategies providing such instruction.

It is the purpose of this paper to:

1. Identify the number of individualized science programs used in Kentucky's middle schools and junior high schools.

2. Note the systems now used for administering the programs.

3. List the types of science programs and objectives of those involved in an individualized approach.

4. Record the strategies used in the implementation of the individualized programs.

5. Present information collected regarding the
objectives of the program and successes in meeting them.

6. Present a summary, findings from the data of the survey, and conclusions which confirm or reject the theory that other schools should find individualizing science useful.

Delimitations and Limitations of the Study

One of the delimitations of this study is that this research included only those schools of Kentucky which were listed in the Kentucky School Directory for 1975-1976 as middle schools or junior high schools.\(^{14}\) When this document was published in October, 1975, 184 school districts were named. In these districts, 74 schools were called junior high schools, and 89 schools were classified as middle schools.\(^{15}\) Usually, the schools called middle schools included grades 6, 7, and 8; and the schools listed as junior high schools included grades 7, 8, and 9. A random check of schools which were organized as elementary schools with grades K-8 or K-12 was made by including 10

---

\(^{14}\) The State Department of Education had not made a new directory available to schools for the year 1976-1977 at the time this study was begun.

schools with this organization plan in the population of the study.

Another delimiting factor is that the study deals with science instruction in the schools and does not investigate methods used by any other discipline. It deals specifically with the science programs which used some kind of individualized approach in teaching science.

In addition, the data will identify the behavioral objectives which were met by the plans, the systems for administering the plans, financing of the plans, details of the plans, and the evaluation of the programs. Recommendations to other schools as to the advisability of their embarking upon such a program will be considered as a general examination of each program is made.

The limitations to the study are those dictated by circumstances which previously existed and variables which were beyond the control of the investigator. One of the most evident limits is that the facilities available for teaching science before instituting an individualized approach were not known. The information received, therefore, can only indicate a change in regard to whatever equipment and materials already existed within a school. However, the data will indicate whether or not an increase of supplies was deemed worthwhile and if their uses were considered successful in the individualized method by the
A second limitation is due to the change in classification of junior high schools, as listed in the directory, to middle schools or vice versa. A few schools, when reporting, indicated that they are actually now organized as K-8 or K-12. The reports from such schools are included in the category most suitable for their present organization.

Furthermore, the survey submitted to the schools could not include many detailed questions due to the necessity for brevity. Such pertinent things as the philosophy and general objectives of the schools were intentionally omitted.

The information survey could not include a definition of individualized education, so assumption must be made that all respondents were discussing the same type of science methods. Semantics must always interfere in such an instrument, but the writer assumed that the respondents held a mutual understanding of certain key terms. For example, the meaning of individualized instruction should commonly be interpreted as that method of instruction which varies the teaching and learning

16 See Appendix, pages 134-137 for copy of survey.
processes according to the interests, preferences, learning styles, abilities and achievements of the students. 17

Another restricting variable in the determination of successes of programs would also be the lack of knowledge of teacher workload. Teachers, already burdened with excessive preparations and extracurricular activities, might be less able to cope with additional responsibilities or changes in their duties.

Definition of Terms

Different writers use different connotations for the same thing. The terms used in this paper are selected after a survey of many writers' works for the most common meanings. The definitions contained in this paper are in agreement with the writer's view as the most appropriate ones for use in defining the terms relating to individualized instruction in science.

Administering systems. The nationally known plans for organizing, developing and actuating a program of individualized instruction. These include methods of

training personnel, providing facilities, and preparing curriculum.\textsuperscript{18} The best known systems are identified as:

- **IGE.** Individually Guided Education.
- **IPI.** Individually Prescribed Instruction.
- **PERT.** Project Evaluation Review Technique.
- **PLAN.** Program for Learning in Accordance with Needs.
- **PSI.** Personalized System of Instruction.

**Competency-based instruction.** A flexible-individualized program that frees both students and teachers to work at their own rates without the fear of failure; emphasis is placed on existing competencies, and student growth from that point is expected.

**Concept.** A mental construct achieved by a grouping of common elements; a network of inferences stemming from observation of objects and events resulting in the selection of common elements.

**Conceptual science.** Science instruction with the main objective to teach the child to understand ideas and science principles in a way that will enable him to apply them to any circumstance in which they are found; it eliminates the memorizing of myriads of facts by enabling the child to understand factors which are due to or the cause of the facts.

\textsuperscript{18}For description and origin of each plan, see text of paper, Chapter III, pages 81-86.
Custom-tailored learning. A system of individualized instruction which is planned and devised for each student, designed to meet his specific needs and abilities.

Diagnosis. A determination of a student's competencies; the child's abilities, achievements, interests and needs, level of development of skills, tolerance of failure and frustration, learning style and self-concept.

Earth science. A study of the earth's spheres; its air, water and crust and the energy systems which control and interact with the spheres.

Evaluation. A process of determining whether an object, product, process, or attitude is good, adequate or poor, worthwhile or not worthwhile, desirable or undesirable.

General science. A study of the basic concepts and methods of a variety of sciences; among these are astronomy, biology, chemistry, meteorology, paleontology, and physics, along with their relationships with each other.

Hardware. Instructional equipment such as projectors, tape recorders, record players which are designed to last for a period of time and which are needed to present materials classified as software.
**Humanizing education.** A method of educating which allows an individual to grow as rapidly as he can along self-directed paths; it stresses human relations and the importance of interaction as the individual learns to work with others as well as to work alone.

**Individualized instruction.** An arrangement of instruction which allows each child to move at his own pace through a learning program tailored to meet his needs, interests and abilities; it makes possible learning the things that are most appropriate for each individual.

**Individually prescribed instruction.** A method of providing a curriculum which is prescribed for each student by the teacher who, by skillful diagnostic techniques, has ascertained the pupils' needs.

**Inquiry science.** A method of teaching science which requires students to develop inductive mental processes and academic reasoning; it employs the use of investigation as a skill for answering questions.

**Junior high school.** An educational plan designed to meet the needs, interests and abilities of boys and girls during early adolescence, preferably a three-year program including grades seven through nine.
Laboratory science. A method of teaching science which emphasizes the use of student-performed laboratory experiments to answer inquiries and questions and to illustrate concepts.

Learning resource. Any material or procedure that is designed to aid the student in the attainment of goals; these may differ in function, format, instructional strategy and in the social setting.

Learning style. The manner in which different elements of the basic stimuli affect a person's ability to absorb and to retain information.

Life science. A branch of science dealing with living organisms and their vital processes.

Middle school. A school designed for pre and early adolescents in that age group that spans the traditional elementary and secondary years--usually grades six through eight, occasionally including grade five; curriculum is designed for the interests and abilities of this age pupil.

Modular program. A program made of discrete units which are self-supporting and may be taught in a non-sequential pattern.

Open structure. A term for individualized education when the methods use open arrangement of classroom facilities.
and permit open choices for the students to make in curriculum selection.

**Personalized instruction.** A term for individualized instruction indicating that the curriculum is designed to meet the personal needs and abilities of different students; it recognizes the personal dimension of teaching people with different skills.

**Physical science.** An area of science which deals with non-living things as its primary subject matter.

**Process science.** Science education which instructs children in a single specified kind of science content consisting of the intellectual processes used in science; it teaches them to work and think as scientists.

**Programs.** The execution and performance of activities and selected activities and resources according to an outline of objectives and desired goals; a general term for an educational plan of action.

**Project science.** Science programs which appeared in an effort to upgrade science curriculum by concentrating upon teaching inquiry, process and conceptual science as laboratory sciences. Some of the best-known projects are:

**Elementary School Projects:**

**AAAS.** American Association for the Advancement of Science Commission on Science Education.
ESS.  Elementary Science Study.
IS.  Individualized Science.
SCIS. Science Curriculum Improvement Study.

Junior High School Projects:

ESCP.  Earth Science Curriculum Project.
ESS.  Elementary Science Study (expanded to include junior high grades).
IIS.  Ideas and Investigating in Science.
IPS.  Introductory Physical Science.
ISCP.  Interaction Science Curriculum Project.
ISCS. Intermediate Science Curriculum Study.
IST.  Individualized Science Investigations.
TSS.  Intermediate Science Study; University of Illinois Astronomy Project.
MMST. Minnemast; Minnesota Mathematics and Science Teaching.
PPS. Patterns and Processes of Science.
SSCP.  School Science Curriculum Project.
SSSP. Secondary School Science Project.
TSM. Time, Space, and Matter.
U & I. Universe and I.

Senior High School Projects:

BSCS. Biological Science Curriculum Study.
CBA. Chemical Bond Approach.
CHEM. Chemical Education Materials Study Group.
PP.  Harvard Project Physics.
PSSC. Physical Science Study Committee.19

Science instruction. Instruction which attempts to explain natural phenomena; it is concerned with direct experience, collection of information, organization and interpretation of information with aspects of explaining and extending experiences.

19 For detailed identification of projects, see Chapter II, pages 42-52.
Sequential programs. A science program which begins with simple ideas and progresses to more complicated ones, building in difficulty gradually and systematically; a hierarchy of subjects is planned, and it is essential that it be taught in this way, not as a revolving modular program.

Software. Films, slides, tapes, film loops and teacher-made printed materials to be used in equipment called hardware.

Strategies. Techniques used for the motivation, presentation and organization of materials for any method of teaching.

Strategies for individualization. Different methods of instruction adapted to individualization of instruction. Stylized learning. A term for individualized instruction which emphasizes the learning style of the pupil being taught.

Organization of the Study

Chapter I presents the setting of the study, its purpose and justification, its basic limitations and de-limitations. This chapter also includes definitions of

20See Chapter III, pages 86-911, for identification of specific strategies used in individualizing instruction.
terms and the organization of the study.

Chapter II is a survey of literature on individualized instruction. It defines individualized instruction, its characteristics and its purpose. It also cites the psychological bases which support the ideas of improved instruction by individualizing. A brief history of individualized instruction and the national plans which may be used to administer it will be discussed briefly. Science education and its goals, as related to individualized methods, are discussed along with evaluation of past successes and failures. Research data on individualized instruction is used to reveal arguments for and against the method. Science programs in Kentucky are not included in the survey of literature since there seems to be little information available.

Chapter III defines the method used to ascertain the definite facts about individualized science programs in the junior high schools and middle schools of Kentucky.

Chapter IV presents the summary, findings, and conclusions drawn from the study.
CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction

Individualized instruction, often misunderstood and inappropriately identified, has been called by various names. Some of these connotations are diagnostic teaching, personalized instruction, humanized education, open structure, custom-tailored learning, competency-based instruction, individually prescribed instruction, and stylized learning. Though different designations have been used to emphasize slight differences in the thrust of the programs, all versions involve essentially the same approach—an effort to adapt curriculum to the individual student. Individualizing instruction is seen by one writer, Gaynor Petrequin, as rather a change of goal from teaching for group results to one of developing the unique potential of each student just as far as possible within the parameters of human and material resources.¹

Chapter II reviews the literature regarding individualized instruction. Definitions of such education with its characteristics and purposes are stated according to the opinion of the majority of the writers. The philosophy and objectives on which individualization is based and its historical and psychological backgrounds are considered, also. Systems of administering individualized education are discussed, along with strategies for implementing it. The nature of science education and its suitability for such a program are reported as well as individualized methods of teaching science which are now in practice. Research as to successes and failures of individualized science programs is noted when possible, and information about such programs in the middle and junior high schools of Kentucky was sought.

**Definition and Characteristics of Individualized Instruction**

Individualized education is defined by one of its advocates, Helen McNamara, as an attempt to meet the needs of students by the selection and organization of content as well as by the creation of situations in which students are considered individuals but are permitted to work also as members of a group. She saw the aim of individualized instruction as helping students release potential useful to themselves.
and society and considered it an answer to the problem of individual differences. Another author, Dona Stahl, compared the reality of expecting children born the same year to perform the same to expecting all cars of the same year to perform the same regardless of purpose or design. Individualization was thought by this author to be the achievement of the best possible match between the youngster's needs and the activities provided for him to pursue.

Any instructional system was called individualized by Theodore Esbensen, in his book *Working with Individualized Instruction*, when the characteristics of each student play a major part in the selection of objectives, materials, procedures, time, and the methods put into practice. Esbensen saw individualized education as an arrangement that makes it possible for each student to be engaged in learning those things most appropriate for himself as an individual.

Education which focused the emphasis of the instructional process on each individual student--his skills,

\begin{enumerate}
\end{enumerate}
abilities, interests, learning style, motivation, goals, rate of learning, self-discipline, problem-solving ability, degree of retention, participation, strengths, weaknesses, and prognosis for moving ahead in various curriculum areas and projects—was considered individualized by Rita and Kenneth Dunn. In agreement with this view, Joe Exline identified individualized instruction as a method of teaching that provides learning experiences based upon the interests, abilities, and needs of the pupils involved; and he recognized the technique as one that considers the ability of the learner as the primary allowance. He further stated, "The teacher must not only be aware of the essential skills but must help the student develop these skills. The teacher must work toward making the subject matter relevant and useful."  

Paul Plantz and James Neujahr in separate writings expressed a definition of individualized education as an approach which makes possible a one-to-one relationship between a student and what he learns and as a method which  


is distinguished by the individual attention given to each student.\textsuperscript{7} Neujahr continued to describe the characteristics of individualized instruction as being marked by its self-paced activities and differences in content according to the choices of the individual. He considered a requirement of individualizing to be a provision for placing each individual in a situation where he can successfully complete each stage in the learning process and go on to the next one without delay and comparison with other students, comparing rather to self.\textsuperscript{8}

Floyd Coppedge, an Assistant Professor of Education at Indiana University, listed in the publication \textit{The Clearing House}, in 1974, some outstanding and desirable features of individualized instruction:

1. Students are expected to perform commensurate with their ability and previous learning. To permit a student to do less than he is capable of doing is a waste of human potential, as well as a poor development of character.

2. Evaluation of student effort is based primarily on individual ability. It is a


must that each student put forth an honest effort; and when he has worked at or near capacity, the student deserves a passing grade.

3. There is more contact between teacher and student on a one-to-one basis. The very essence of individualization is to establish a close working relationship between the teacher and the student as they react to contact.

4. The student must become a full partner in the learning process. Individual effort in independent study is crucially important to individualization. Both during teacher lectures and independent study times, both student and teacher remain involved.

5. The teaching-learning process is a cycle of diagnosis, prescription, and evaluation. The diagnosis is based on standardized tests, previous grades, classroom performance, and unit pretests of attitudes and achievement to determine present levels of learning and ability. A guideline for prescription includes the use of the required, the expected, and the enriching materials. The required materials fill 25 to 30 percent of the content of the course. Expected materials comprise 30 to 60 percent of the learning experiences suitable for most students; and the enrichment materials, designed for the most highly motivated and capable pupils, are available as 25 to 50 percent of the course offerings. The evaluation has as its basic purpose improving the teaching-learning process.

6. Instructional planning is designed to promote student learning through continuous progress. These plans would include provisions for diagnosis, major concepts,
behavioral learning objectives, learning activities and evaluation devices, and quest activities for in-depth study.

Good individualized instruction programs are characterized by a balance of structured and unstructured activities and the new role demanded of the teacher, according to David Champagne in a book he wrote as a handbook for practitioners of individualizing. In it he stated that the teacher becomes an encourager, reinforcer, and value clarifier rather than a dispenser of information. 9 John C. Flanagan concurred with this view when he advised that the teacher of an individualized plan has knowledge of the educational status of the pupils as individuals and organizes materials with flexible assignments, permitting the instructors to direct the work rather than to hear lessons. 10


Objectives of individualizing instruction were explicitly identified by Coppedge as being motivation of students to perform at a level that matches their potential, as measured by intellectual ability and previous learning and excellence in performance. In a program with these objectives, each student should accomplish more, not less, than in conventional programs, realizing that the same would not be expected from the less capable as from the more capable, regardless of the reason for the difference. Student achievement would be limited only by ability, interest, skill development, and possible learning disabilities.12

Philosophy and Psychological Basis of Individualized Education

The use of individualized instruction is based on several general assumptions regarding the nature of learning by children. These were succinctly outlined by Stahl and Anzalone. They wrote:

1. No one teaching method meets the needs of all children.
2. The teacher cannot tell a child how to think but must provide him with freedom, encouragement, and the opportunity to do so.

3. Learning is an active, not a passive process.
4. The need for success experiences of children is consistent, but it varies greatly according to levels and rates of achievement.
5. Discovering uniqueness in children is a major goal of educating them.
6. Setting goals and evaluating progress are the privileges and responsibilities of the child and are essential to long-term learning.
7. Unstructured and inductive experiences which occur in a child's life are often the most profound and influential activities of childhood.
8. Individualized learning can have both positive and negative effects as children learn from each other.
9. Since it is more important for students to practice self-control than to be controlled, intrinsic motivation makes children capable of self-selection and self-correction of appropriate learning activities.\(^\text{13}\)

These beliefs about children and their learning are considered basic to the idea of individualizing instruction. In agreement with some modern psychologists, the needs of the children are the underlying reasons for the preference for individualizing school programs. Jean Piaget's studies presented a body of data which provided a basis for a progressive approach to education of a type offered by individualized approaches. As interpreted by

Stahl and Anzalone, Piaget's belief is that a child passes through various stages, each stage being delineated by a particular way of perceiving and reasoning. Although the eventual sequence of development is the same, there are individual differences in timing. Applying this developmental psychology to individualized teaching, these writers conveyed that the teacher of such a program should study each child to ascertain his individual timing. 14

Sayre and Ball summarized the Piagetian stages of development as the Sensorimotor Stage from birth to the age of two years, the Preoperational Stage from two to seven years, and the Concrete Operational Stage reached between seven and eleven years. Following these, the Formal Operational Stage should occur between eleven and sixteen years, timed by each individual's development. 15

The new set of mental operations, beginning as formal operational some time after the age of eleven, holds significance for the middle school and junior high school teacher. If the child's mental stage has reached

14 Stahl, , Individualized Instruction through Differentiated Learning Programs, p. 17.

the last level of the intellectual hierarchy, the adolescent could imagine possibilities inherent in a situation.\textsuperscript{16}

As Ginsberg and Opper interpreted the Piagetian theories, the implication for teaching science effectively to individuals is that the success of teaching would be dependent upon the ability of the individual to hypothesize, to design and perform experiments, to take into account many possibilities and to draw conclusions.\textsuperscript{17} These writers concluded that Piaget's philosophy implies grave deficiencies in traditional methods of instruction. The idea that a major part of learning depends upon self-regulatory processes means that students can be trusted to take a major share of the responsibility for the learning processes. Methods in which adults assume complete control of the child's learning can be self-defeating.\textsuperscript{18} The authors reinforced the adherence of advocates of individualized instruction to the Piagetian principles by a quotation


\textsuperscript{17}Ibid., p. 206.

\textsuperscript{18}Ibid., p. 226-229.
from Piaget's works. Piaget said:

The principal goal of education is to create men who are capable of doing new things, not simply of repeating what other generations have done—men who are creative, inventive and discoverers. The second goal of education is to form minds which can be critical, can verify and not accept everything they are offered. The great danger today is of slogans, collective opinions, ready-made trends of thought. We have to be able to resist individually, to criticize, to distinguish between what is proven and what is not. So we need pupils who are active, who learn early to find out by themselves, partly by their own spontaneous activity and partly through materials we set up for them; who learn to tell what is verifiable and what is simply the first idea to come to them. 19

History of Individualized Instruction

Maurice Gibbons suggested that individualized instruction must have occurred when learned men instructed an admiring group of scholars in the days of Archimedes and Plato. He also stated that its formal development began in the later decades of the nineteenth century as a reaction against the age-grade, lock-step system in which all students, regardless of differences among them, were constrained to study the same materials in the same way for the same length of time. He cited one of the first

---

efforts to individualize instruction as the correspondence courses which were available in 1873 and which, by 1882, had developed into a systematic plan for foreign language courses. Tracing the forerunners of individualized instruction, Gibbons pointed out that the Pueblo Plan, a self-paced laboratory course, was used by Preston Search in 1888. The idea grew and by 1890 educators had tried individualized assignments, continuous progress, and elimination of non-promotion. Buffie and Jenkins outlined the progress of the movement toward individualized instruction as a gradual development. Among the details of events were the following:

1. In 1895, in Cambridge, Massachusetts, efforts were made to provide for individual differences with a two-track system for pupils of differing abilities in the last six years of school.

2. By 1900, homogeneous grouping was tried in Portland, Oregon, when courses were divided into units and advanced pupils were placed in separate divisions and were permitted to complete elementary school a year early.

3. A similar effort was made in Batavia, New York, when classes were devised for the slow learner; these were the forerunners of the special education classes of today.

4. In North Denver, a Colorado Plan was used to separate the bright children and to give them additional instruction.

---

5. The Santa Barbara (California) Concentric Plan, devised by Frederick Burk, divided pupils into three groups of differing abilities. (This was not successful, but Burk moved to San Francisco and extended the Pueblo Plan there.)

6. The Platoon System appeared in Bluffton, Indiana, in 1900. It was designed by William A. Wurt and presented a work-study-play program which divided its pupils into two groups with some ability grouping. Departmentalization was an outgrowth of the Platoon System and was accepted widely in the twenties and thirties.

7. The Winnetka Plan was similar; it derived its name from Winnetka, Illinois, where Carlton Washburne utilized a task approach.

8. A plan of continuous progress began in 1919 and continued in use until World War II; the idea was developed in Chicago, Illinois, by James E. McDade and in Bronxville, New York, by Willard W. Beatly.

9. In 1919-1920, Helen Parkhurst's Dalton Plan appeared. It emphasized an instructional methods center, free movement of students and attempts to systematize their programs. This began in a non-graded school and spread to public elementary and secondary schools. Academic subjects were organized sequentially and students progressed on an individual basis. There was a grade level requirement before pupils could move to advanced work.

10. A device for formal efforts at individualizing was the teaching machine, made in 1924, by Sidney L. Pressey.
11. In 1930, the Cooperative Group Plan was an attempt to have groups of teachers coordinate their efforts in planning and evaluation. It was not successful then, but it reappeared in the mid-fifties in the form of team teaching.

12. The Dual Progress Plan developed by George D. Stoddard at New York University in cooperation with Long Beach and Ossining, New York, offered courses divided onto the "cultural imperatives" and "cultural electives." Students were divided by grade levels according to ability.

13. In 1934, the Flexible Progress Plan was used in a nongraded school in Western Springs, Illinois. Several nongraded schools appeared. (Since 1939, a Continuous Progress Plan has been used in Athens, Georgia.)

14. Nongraded schools developed in the 1940's in Michigan, Ohio and Wisconsin. These were identified by Goodlad in 1955.

15. Momentum to individualize instruction was gained and in the fifties surveys indicated a steady increase in their numbers. In 1959, the United States Office of Education conducted a study indicating that 18 percent of the elementary schools were using the Primary Plan, a plan of organizing children into groups which allowed for individual differences in some ways.²¹

Gibbons continued the history of efforts to individuate education by citing more recent significant events. A summary of these follows:

In the sixties, the individualized movement disappeared until B. F. Skinner's programmed instruction using operant conditioning appeared in 1961 with his teaching machines. Claiming advantages in its self-pacing approach and psychological reinforcement, a proliferation of programmed packets appeared in many disciplines. The Trump Plan of Independent Study appeared in 1961, followed by a revival of the Montessori Method in 1962. Various kinds of heterogeneous and homogeneous group instructions were tried in the sixties and early seventies in efforts to construct a curriculum to meet differing abilities. Team teaching emerged as one such method intending to free teachers for more individual attention to students within a team. Progressive private schools experimented with individualized teaching in the sixties; and by 1965, writers were beginning to talk of prescriptive teaching and diagnosis of students needs.22

"Various kinds of individualized programs are now in existence, but few are refined enough to be recommended on the grounds of desirable increments in student accomplishment, . . . ." Gibbons reiterated.23

22 Gibbons, Individualized Instruction, A Descriptive Analysis, p. 6.

23 Ibid., p. 8
During the seventies, many publishers systematically prepared commercial packets and activities for schools to purchase when desiring to individualize instruction. Methods of administering the individualized programs were made available and are still in use. PERT, Program Evaluation Review Technique, is usually used in general administrative situations but could be used for curriculum development. Other plans are most adaptable to university and senior high school settings. Three nationally known plans have been often used for organizing individualized instruction in public schools at elementary and middle school levels. These are IGE, Individually Guided Education; IPI, Individually Prescribed Instruction; and PLAN, Program for Learning in Accordance with Needs.  

**Science Education**

**History**

Renner and Stafford in their book, *Teaching Science in the Secondary School*, agreed with Dunfee that science education is training in critical thinking and

---

24For details of the support plans, see Chapter III, page 81-86.
techniques of problem-solving. Science teaching was a concern of Eugene Lee; and in his book discussing this, he stated that the earliest purpose of teaching science is to train the mind. He noted that this objective is then replaced by nature study. He recalled that, later, science had occupied a declining position in the schools and that all students had not been privileged to study it while others were allowed to omit it from their curriculum if they desired to do so in the high school years. Recording the sequence of development of science training in the public schools, he recounted the evidence of the upsurge of interest in it in the 1950's and the renovation and updating of science teaching in efforts to compensate for the inadequacy of the existing programs of the pre-Sputnik era. Roger Bybee remembered the emphasis on the cognitive area of behavioral objectives that was seen, when, in the space-minded age, the majority of the new programs which appeared were laboratory centered and were inquiry and conceptual science. He stated also that process science with discovery methods became dominant approaches, spreading to all disciplines.


27 Bybee, Personalizing Science Instruction, p. 10.
In 1959, the Woods Hole Conference was held to review the role and function of science education. The conference emphasized as desirable goals of science the learning how to learn and to develop skills for problem solving and discovery. In 1966, the Educational Policy Commission's document "Education and the Spirit of Science" indicated that a shift from cognitive goals alone to include affective ones had been made. It identified the following seven values to be the bases for science education of the future:

1. longing to know and to understand
2. questioning all things
3. search for data and their meaning
4. demand for verification
5. respect for logic
6. consideration of premises
7. consideration of consequences

When the United States Congress passed the National Defense Education Act (NDEA), in 1958, it provided for the purchase of science equipment and facilities on a fundmatching basis for schools. These funds were administered through the United States Office of Education.

---


and the states' offices of education. Project science appeared as various educational research foundations and their sponsors experimented with new types of science instruction. The science projects encompassed all ages of public school pupils. Part of the projects were especially designed for elementary grades; others were for senior high school; and some were designed for pupils in grades six through nine.

Project Science

Elementary school projects follow:

**AAAS--American Association for the Advancement of Science**

This commission on science education originated in 1962, at Stanford University. Materials were developed and tested in 1963-64 and then revised in 1965. The theme of AAAS is science taught as inquiry with a scientific attitude toward scientific procedures and the use of experiments as the sharpest tools of science with attention to the interaction between living things and the environment. Its purpose is to teach basic scientific principles. The SAPA program was one result of this study.  

**ESS--Elementary Science Study.**

This study began as a non-profit organization by a group of scientists called Educa-

---

30 Lee, New Developments in Science Teaching, p. 68.
31 Ibid., p. 19.
tional Services, Incorporated. It was funded by the Federal government and private grants. Its emphasis is on style of teaching and presents science through student experimentation. Its publisher is McGraw-Hill Book Company under direction of the Educational Development Center in Newton, Massachusetts.

**IS--Individualized Science**

Individualized Science was developed at the Learning Research and Development Center at the University of Pittsburgh under the direction of Leopold E. Klopfer and Audrey B. Champagne. It was partly funded by the National Institute of Education. It is a multifaceted program to overcome gaps in existing science programs and is based on psychological principles of Gagné, Bruner and Piaget. Its thrust is to develop scientific literacy in its students by stressing four major elements—science subject matter and scientific inquiry, laboratory science, process science, and the social aspects of science; it provides for an educational environment adaptive to the needs of children. It is marketed by the Imperial International Learning Corporation of Kankakee, Illinois.

**SAPA--Science, A Process Approach**

This project was a product of the American Association for the Advancement of Science.

---

32 Ibid., p. 20.


of Science. It is designed to instruct children in a single, specified kind of science context—the intellectual processes used in science. A laboratory science, its exercises are arranged sequentially in a hierarchy of difficulty and with behavioral objectives to enable teachers to judge achievement. It is now published by Ginn and Company. 35

**SCIS—Science Curriculum Improvement Study**

Originating under the direction of Robert Karplus of Berkley, California, this study was funded by the National Science Foundation. It is a seven year articulated elementary inquiry and laboratory science program balanced between life science and physical science. 36 It is conceptually structured to develop concepts through preliminary activities. Units are of hierarchical structure with unifying threads. It is commercially available from the Rand McNally Publishers. 37

Some projects at the middle school and the junior high school levels are listed as:

**ESCP—Earth Science Curriculum Project**

This project was designed for the junior high school under the direction of Ramon E. Bisque and Robert L. Heller of the American Geological Institute during the years 1963-1966 when it was first taught. ESCP uses a one year, experience-centered interdisciplinary

---


36 Ibid., p. 220.

approach to investigate the earth. Its major goals are concept development, inquiry and emphasis on natural phenomena. A laboratory science, its experiments are open-ended, developing and expanding the concepts. Texts are published by Houghton-Mifflin with supplementary pamphlets available from Prentice-Hall Publishers. Tests are available from the Psychological Corporation; Encyclopedica Britannica has developed films to accompany the course. 38

ESS--Elementary School Science

This elementary project was expanded to include grades seven and eight. It consists of fifty units of a minimally structured, nonsequential science program to be used by small or large groups or by individuals. It is made available by McGraw-Hill Book Company, under the direction of the Educational Development Center of Newton, Massachusetts.

An outgrowth of this project was the University of Illinois Astronomy Program. This is a one-year sequential astronomy course designed for the junior high grades under the direction of J. Myron Atkin and Stanley P. Wyatt, Jr. It is published by Harper and Row. 39

IIS--Ideas and Investigating in Science

Dr. Harry Wong and Leonard Bernstein designed this program for unmotivated and academically limited students of the intermediate years. It emphasizes current slogans and humorous cartoons for motivation of the disinterested youngster. It is a laboratory science developed with a limited number of

38 Renner and Stafford, Teaching Science in the Secondary School, p. 239.

39 Ibid., pp. 221-23.
concepts and using simple laboratory or home-collected laboratory equipment. Publisher is Prentice-Hall.

IPS--Introductory Physical Science

This project was developed under the direction of URI-Haber-Schaim of the Educational Development Center. It was originally funded by Educational Services, Inc., and the National Science Foundation. Designed as a one-year course for grades 8 and 9, as a foundation course or a terminal one, it explores in detail a limited number of topics. It is a laboratory science with its central theme the introductory study of matter. It is suitable for large or small group instruction. Prentice-Hall is publisher and has developed a continuation course for IPS for grades nine and ten.40

ISCP--Interaction Science Curriculum Project

This project was developed by Rand McNally Publishers as a life science program for junior high schools. Its second experimental edition is now available. ISCP is an inquiry science, teaching advanced material in the seventh and eighth grades. It is based on the premise that junior high school students are curious and eager to learn but must be allowed freedom to explore subject areas. A laboratory science, the text relates to the investigations in discovering what man is doing to his biosphere and what this means to the future of the biosphere. It is composed of three parts: IMB--Interaction of Man and the Biosphere, IME--Interaction of Matter and Energy, and IET--Interaction of Earth and Time.41

40 Ibid., pp. 227-29.
41 Ibid., pp. 232-33.
ISCS—Intermediate Science Curriculum Study

ISCS was planned as a three-year sequential inquiry science for grades seven through nine, and was developed under the direction of Dr. Ernest Burkman of Florida State University. Its aim is to give pupils a taste of the structure of science and the way scientific knowledge is gained while developing skills and concepts to help students interpret natural phenomena and technology which confront them. Each student moves at his own pace through Energy in Grade 7; Matter in Grade 8; and Astronomy, Environmental Biology, Geology, Human Variation, Genetics, Space Science, Meteorology or Health and Disease in Grade 9. Publisher, since 1964 has been Silver Burdette and Company. 42

ISI—Individualized Science Investigations

This project was developed for secondary schools by the Educational Research Council of America. It is an individualized multidisciplinary modern laboratory science course for students who do not ordinarily elect science and are below average in achievement. It uses action cards to develop inquiry skills and is a self-paced plan. Publisher is Allyn and Bacon. 43

ISIS—Individualized Science Instructional System

ISIS is an individualized science project which, along with the science concepts it teaches, attempts to address some controversial issues. It was funded by the National Science Foundation. It was criticized

42 Ibid., pp. 225-27.
by the United States Congress recently for some of the social issues touched upon in its lessons. Some of the programs developed by this system are now available from Ginn and Company.

**MMST—Minnemast: Minnesota Mathematics and Science Teaching**

Beginning in 1964-65 at the University of Minnesota, under the leadership of Paul C. Rosebloom and James J. Wentz, MMST was funded by the National Science Foundation. Its purpose was to produce coordination of mathematics and science curricula for grades K-9. It includes nine units for K-7 science, science methods courses and sound films.44

**PPS—Patterns and Processes of Science**

Planned by Fred T. Weisbruch and others in 1968, PPS is a laboratory conceptual science with key concepts introduced by experiments. The three-year program is sequential and spiral in nature, developing processes and patterns of science in a progressively sophisticated and quantitative manner. Highly directed activities yield to open-ended experiences in analyzing data, problems, interpretation of graphs and tables, seeking out relationships, synthesizing ideas, and designing experiments. Publisher is D. C. Heath and Company.45

**SSCP—School Science Curriculum Project**

This project began at the University of Illinois under the direction of Rupert N. Evans. It was funded by the National


Science Foundation in 1965-66. Its purpose was to develop improved science materials for elementary and junior high schools.\textsuperscript{46}

**SSSP--Secondary School Science Project**

This project originated under the auspices of the Elementary Science Summer Study at Educational Services, Inc., under the direction of Fredrick L. Ferris. It was sponsored by the National Science Foundation and Princeton University. Its purpose is to present a program centered on geology for junior high school students through a series of their own interrelated, sequential investigations. Direct observation and inference are expected to give an understanding of the nature and history of the earth. Publisher is McGraw-Hill.

**TSM--Time, Space and Matter**

TSM was developed at Princeton University as a part of SSSP under the direction of George J. Pallrand.\textsuperscript{47} Its basic purpose is to collect information through examination of simple materials, then to proceed to interpretation, generalization and abstraction. Publisher is McGraw-Hill.\textsuperscript{48}

**U & I--Universe and I**

U & I was originated by the Kentucky Educational Television in 1973, under the direction of George Rasmussen with Timothy Tassie as project coordinator. Its purpose is to accompany its television presentations. It is a self-supporting modular

\textsuperscript{46}Ibid., p. 289.

\textsuperscript{47}Lee, New Developments in Science Teaching, pp. 26-29.

\textsuperscript{48}Renner and Stafford, Teaching Science in the Secondary School, p. 288.
Some projects for the ninth grade and senior high school are the following:

**BSCS--Biological Science Curriculum Study**

BSCS began at the University of Colorado under the leadership of Arnold B. Grabman. It was sponsored by the American Institute of Biological Sciences and the National Science Foundation in 1959. Its stated function was the improvement of education in biology in school and in the general population. It developed fundamental biological concepts by a laboratory-block approach. Three versions of biology are published.

The Blue Version deals with the molecular level of biochemistry and experimental physiology; the Yellow Version accents the cellular aspects of life and the functional systems; and the Green Version deals with the biome and the community with ecological emphasis. Now a highly developed curriculum, courses have been made available for the weak student and for the gifted. The Blue Version is published by Houghton Mifflin, the Green Version by the Rand McNally Company, and the Yellow Version by Harcourt Brace, Jovanovich. Doubleday and Company and Prentice-Hall publish supplementary materials and texts for the gifted and other exceptional pupils. 49

**CBA--Chemical Bond Approach**

This chemistry course originated in Portland, Oregon, but was later sponsored by the

49Ibid., p. 241.
Chemical Bond Approach Committee at Earlham College in Richmond, Indiana. It was funded by the National Science Foundation. It was designed to emphasize chemical bonding and process investigating in chemistry. McGraw-Hill publishes it.

**CHEM—Chemical Education Materials**

Dr. Glenn Seaborg directed this study of how to educate students to appreciate the importance of chemistry and an understanding of science. It was sponsored by the University of California, Harvey Mudd College and the National Science Foundation. It was later directed by Arthur Campbell. Several publishers make it available—W. H. Freeman, Raytheon Education, Prentice-Hall and Houghton Mifflin.\(^50\)

**HPP—Harvard Project Physics**

A grant from the Carnegie Corporation, Sloan Foundation and the United States Office of Education began this project in 1963-64. It is a one-year course to help stem the decline in physics enrollment and to allow greater diversity and flexibility in teaching physics. It is planned for either the scientifically gifted student or the science-shy. It includes self-instruction booklets on special topics. Holt, Rinehart and Winston published it in 1970 under the direction of Fletcher Watson, Gerald Holton and James Rutherford.\(^51\)

**PSSC—Physical Science Study Committee**

The Massachusetts Institute of Technology originated this study under the direction of Dr. J. R. Zacharias, and it

\(^{50}\text{Ibid., p. 247.}\)

\(^{51}\text{Ibid., p. 254.}\)
was sponsored by the Educational Services, Incorporated and the National Science Foundation. It was published in 1965, by the Physical Science Study Committee Educational Services, Incorporated.52

Today's science courses have encompassed the best methods and results of these experimental projects. Most publishing companies have acquired an acceptable science series using a project or emulating the project science programs. Educators have characterized science as the ideal discipline in which to use instructional methods to maintain creative thought and foster desire and respect for knowledge. The science class was named as the discipline with the purpose of correcting misconceptions and eliminating superstition and fear, as well as a place for improving skills.

Leslie Trowbridge pointed out in a recent article that the science programs endowed with this spirit and the challenge of bridging the gaps in science training at different grade levels have moved toward more integrated courses with processes more important than the separate disciplines. Science education with goals of developing scientific literacy of more people has appeared; it has included fewer college preparatory courses with more student-centered activities.

52 Ibid., pp. 250-52.
Prevalent trends were described as including emphasis on environmental problems and their solutions. 53

Most authors agreed that the junior high school and middle school seem to be the logical place to make students feel successful in science or to cause them to wish to abandon the study of it; most concurred that newer methods of instruction are needed in this area. Disenchantment with traditional teaching was expressed; and B. F. Skinner thought it to be riddled with aversive contingencies, to rob students of freedom, dignity and the desire to be creative. This noted behaviorist psychologist said that the dehumanizing of pupils, in school, was to blame for vandalism and anti-intellectualism, and the school was viewed as a place where little real life activity occurred. 54

A recent issue of the Journal of Research in Science Teaching reported on a study of junior high school students and their achievements in this science area. The writer stated emphatically that science instruction should be centered around the cognitive developmental level of


the students involved. In this study the scholastic
success of students in the science program was found to
be directly related to the cognitive development of the
students. Sayre and Ball administered tests to establish
the level of ability of students to carry out certain
tasks. The evaluation of student performance was compiled
on a Piagetian Task Instrument. Students who revealed
formal operational development on the task instrument
made higher scholastic grades because they were physically
and mentally able to do so. Conclusion was that different
science instruction should be provided for students in
the various stages of development. The study provided
strong evidence for individualizing instruction in
science. 55

**Individualized Science Programs**

The literature reviewed agreed that future edu-
cational needs would contain such a variety of new skills
and techniques that science training must provide expertise in how to cope with forces which will shape the
future and must develop favorable attitudes toward change.
Most writers agreed that the education for today

and for the future must, of necessity, accommodate different abilities and life styles. Relevant education for students of differentiated levels of development has, therefore, been attempted through individualizing instruction.

Models of individualized education include different degrees and goals of individualization. As described by C. H. Stedman, in some programs the teacher or some other authority other than the learner makes the value judgments regarding what is to be learned. Emphasis is on product as the final goal. If a school's goals were to develop individuals who could be proficient at a specialized task, the staff would make decisions for the pupils and direct them. They would follow the strategies outlined at the left side of the continuum of table 1. (See table 1, page 56.)

The most complete method of individualization provides the learner with ultimate freedom. This type of individualization permits the learner to set his own goals and objectives, to pursue them as he sees fit, and to evaluate them himself. The teacher only guides, directs, and facilitates the learning. If a school's goals were to develop individuals with ability to design and present creative ideas, its curriculum would permit more decisions to be made by the pupil and would function at
<table>
<thead>
<tr>
<th>Required Instructional Activities</th>
<th>No Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive and/or Affective Emphases</td>
<td>Cognitive and/or Affective Emphases</td>
</tr>
<tr>
<td>Highly Organized-Professional Staff</td>
<td>Student Organized</td>
</tr>
<tr>
<td>1. Behaviorally Stated Objectives</td>
<td>Self-Goals</td>
</tr>
<tr>
<td>2. Entry Behavioral Measures (Pretest)</td>
<td>Student Selected Materials</td>
</tr>
<tr>
<td>3. Sequenced Body of Material</td>
<td>High Trust</td>
</tr>
<tr>
<td>4. Self-Paced</td>
<td>Self Evaluation</td>
</tr>
<tr>
<td>5. Criterion Referenced Post-Test</td>
<td>Internal Structure (Idiosyncratic)</td>
</tr>
<tr>
<td>6. Evaluation Based Upon Specific Outcomes</td>
<td>Teacher Responds to Student</td>
</tr>
<tr>
<td>External Structure</td>
<td>Student is Active</td>
</tr>
<tr>
<td>Student Responds to Teacher</td>
<td>Continental</td>
</tr>
<tr>
<td>Student is Active</td>
<td>Student is Active</td>
</tr>
</tbody>
</table>
the right side of the continuum in the table. (See table 1, page 56.)

There could be positions in between the two extremes. Schools choose which degree of individualization to use by considering the individuals who are being educated and whether or not they require generalized or specialized training. Product is important and necessary but must be weighed against process; the same product is not seen as equally necessary and essential to all learners. 56

Another way of differentiating among approaches to individual education was made by Jack V. Edling, who made a national study of individual instruction programs for the United States Office of Education. After making an in-depth study of forty-six programs in twenty-three states he identified four approaches for elementary school instruction. If the objectives and media were both determined by forces outside the learner, the approach was called "Individually Diagnosed and Prescribed Learning." When the learner made the two decisions, Edling called it "Independent Study". If decisions were shared by the learner and others, the approaches were called "Personalized" or "Self-Directed".

A comparison of the greatest extremes of the individualizing is diagrammed in table 2. (See table 2, page 59).

Underlying the various plans of schools individualizing instruction for the middle grades was an acknowledged need for programs which allowed for the parallel progress of cognition and physical development of the pre-adolescent youngster. Some accounts of programs which attempted to do this were in the literature.

Such a plan was the program in effect in the Nova School in Broward County, Florida, near Ft. Lauderdale. The Developmental Research Center used a program of learning experiences in a systematic manner at a pace best suited for each individual. Each pupil was recognized as an individual with the right and ability to make decisions. Students chose learning media, activities, and time and mode of evaluation. They were helped to make decisions to progress toward self-chosen goals within an overall scheme of learning. LAP (Learning Activity Packets) were used in such a manner that a learner might enter, cycle, and recycle according to his needs. PERT was used for a support system and progress was reported to

TABLE 2

MODEL OF INDIVIDUALIZATION

Edling's Model

<table>
<thead>
<tr>
<th>MEDIA</th>
<th>OBJECTIVES</th>
</tr>
</thead>
<tbody>
<tr>
<td>School Determined</td>
<td>Learner Determined</td>
</tr>
<tr>
<td>Individually Diagnosed</td>
<td>Personalized</td>
</tr>
<tr>
<td>Self-Directed</td>
<td>Independent Study</td>
</tr>
</tbody>
</table>

Note: Read model by selecting one of the media for one objective, making four approaches.
parents at regular intervals. Though yearly course requirements and graduation were well above normal when compared to other schools in the vicinity, there was a great demand from students for admittance to the Nova School. This was considered as evidence of the success of the curriculum.  

Another successful program of individualization was reviewed from the Foxtail Middle School in the public schools of Bedford, New York. It was a program with the purpose of developing pupils who became self-directing and self-educating people. After a period of four years, the program was evaluated as highly successful and acceptable to the community.

A successful junior high school plan was cited as the Meadowbrook Junior High School in Newton, Massachusetts, where a new plan began in 1962. Organized as four schools within a school, the teams were staffed by a cross-discipline staff of teachers. It attempted to provide students with training in decision-making. Each


59 Ibid., p. 256.
student planned with his teachers at the beginning of a
unit, and the study plan provided for a continuous pro-
gress report. Academically gifted pupils did as well
or better as when in traditional programs. Pupils in
the individualized program showed more leadership and
attained higher averages, and a higher number of them
was admitted to colleges.\footnote{60}

Various plans for individualizing science
classes, such as the project sciences, are being used.
The most popular projects for the middle school and
junior high pupils have been IIS, ISCP, ISCS, ISI, and
SCIS.\footnote{61}

---

Research and Evaluation of
Individualized Instruction

Widespread disagreement over the use of tra-
ditional and individualized programs as teaching tech-
niques existed in the literature. Albert Einstein was
quoted as saying, of traditional education, "It is nothing
short of a miracle that the modern methods of instruction

\footnote{60}Maurice Blum and Ernestine R. McDonough,
"Student Responsibility for Learning," in Curriculum
Development for Nongraded Schools, eds. Buffie and Jenkins,
pp. 257-66.

\footnote{61}For identification of projects, see Chapter III,
pages 42-52.
have not yet entirely strangled the holy curiosity of inquiry; for this delicate little plant, aside from stimulation stands mainly in need of freedom; without this, it goes to wrack and ruin without fail."62

Attacking individualization of education as a poor solution to the problem of how to teach, G. L. Henderson stated, "Although Christ and Socrates would doubtless have ascribed to individualized instruction, it is not possible to determine for an individual what he should learn." He recounted seven attempts to revive individualized instruction in the last century. He disagreed with Skinner as to the effectiveness of programmed instruction and recommended a balance of group activities to ensure group interaction with its resultant benefits.63

Research into the success of individualized programs has been in progress since their beginning. Improvement in the affective behavioral areas of pupils


enrolled in individualized programs has been reported by Maltin, Cates, Schneiderhan and Powell in their separate works. These results included higher scores in attitudes toward school and self, evidence of more self-direction, and an increase in more appropriate behaviors among students in the individualized plans. The self-esteem of minority students increased when they were placed in individualized programs with students of high I. Q. and academic achievement.

Koepsel found that IGE students failed to show increase in self-esteem when enrolled in the individualized programs. However, the IGE schools were comparable to traditional middle schools in their abilities to enhance student self-esteem. A final report to the United States Department of Health, Education, and Welfare, in 1972, supported the positive results of individualizing when its data showed that for three years students


in an individualized school exhibited fewer discipline problems, improved attitudes, more self-motivation and independence -- in addition to better achievement.  

Data on the success of individualized science programs were sometimes inconsistent. While Keuscher and Klopfer applauded the individualized science methods as more democratic than traditional teaching, as nurturing creativity and teaching critical thinking, as the best way to develop positive attitudes toward inquiry in science, and as the most promising way to administer science instruction to make students scientifically literate, all research results did not agree.

In a recent issue of The Science Teacher, a summary of several studies of individualized instruction was given. These statistics did not indicate significant differences in science achievement between the tra-


ditional and individualized methods but did indicate a positive gain in cognitive objectives for the experimental programs. Understanding of science and the scientific enterprise was significantly greater for individualized treatment in two out of six studies included in the survey. 68

McDougal's comparison of science methods in upper grades found no significant differences in achievement of skills between traditional and new methods; but it revealed that teacher and pupils were more enthusiastic, and attitudes toward science were improved by the new method. 69 Schiller, in studying sixth grade achievement in the individualized programs, found similar results--students were better motivated,--but evidence of understandings gained by the program was inconsistent. 70


Meanwhile, men like McLoughlin still support individualized teaching as the best way to teach the understanding of concepts and the real purpose of science teaching. He compared educators who cling to traditional teaching to Australians who buy a new boomerang but just cannot throw the old one away.\textsuperscript{71}

Exhaustive examinations of individualized programs in junior high schools are continuously being made in the project science groups. Several evaluations of the ESCP Project have concluded that its activities are beneficial to its students. In 1975, Zach and Gilpin found that, after one year of ESCP training, students who had been low achievers because of reading problems began doing superior work in science. High achievers could advance and slow ones could be better motivated.\textsuperscript{72} Green's comparison of pupils in the junior high schools of Mississippi found that, for the students of normal ability, the individualized ESCP methods were better in regard to student understanding and retention of science principles.


and that total test scores were higher for the ESCP pupils. However, Humphrey and Kline found, in separate studies, that in the cognitive domain, the individualized approach of ESCP revealed no difference; however, in the affective domain, it showed higher interest in science and less conformity among the ESCP pupils. A ninth grade--measured by Patsy Boudreaux in a comparison of a teacher-textbook approach, multimedia approach, and multimedia activity packet approach against each other--showed the change in science achievement scores higher for students in the traditional program.

Other projects reported similar findings. The ESS program was found to make no significant difference in science achievement or cognitive development. However, 


ESS methods did make a difference in attitude, causing children to be more willing to explore their world.\textsuperscript{76}

The IPS program showed no difference in science achievement when one group was taught by a group method; however, the students exhibited a positive attitude toward their teachers in the individualized program.\textsuperscript{77}

In the IS Project, a method was designed to assess the children's attitude toward science and toward school and learning. The intent was to compare attitudes of children in IS with the children in non-individualized classes. Improvement was seen in the IS group in attitude toward science and in attitude toward school.\textsuperscript{78}

Studies of the ISCS Project schools were made by Lashier and Nieft, and also by Martinez-Perez. The Nieft study showed the ISCS program to be effective in


building a strong science foundation and furthering the growth of critical thinking in the junior high school students, but it noted no significant difference between ISCS students and non-ISCS students in intrinsic motivation.79 The seventh grade students in the Martinez-Perez study were compared to students in non-ISCS instruction to ascertain if any differences existed in self-concept and attitudes toward science. No significant differences were evident.80

SCIS studies found the SCIS pupils superior in the scientific processes of observing, classifying, measuring, experimenting, interpreting, and predicting. The SCIS students also exhibited a more aggressive approach to study and were more diverse in their experimental designs than were pupils taught by traditional methods.81


Dawson's research into student preferences pointed out that students who had previously been enrolled in an individualized program preferred it. The basis of the preference was a need for autonomy in learning. 82

No indications of the successes or failures of individualized science programs of Kentucky's middle schools and junior high schools were found in the literature, although this is the information sought through this study.

Summary

Though the definitions of individualized instruction vary slightly, the objectives and philosophies of the programs were found to be basically the same. Whether the individualization methods operate at the most extreme type of openness by allowing the student to choose the pace, strategies, and objectives or permit a more conservative approach which allows the teacher to set the pace, the strategies, and objectives by agreement with the pupil, the goals are to provide relevant and acceptable education for today's pupils.

The psychological foundation of such a program provides a convincing case for the continuance or development of an individualized science program. The Piagetian interpretation of child growth and development presents a logical basis for the planning of instruction according to the status of each child. Particularly, science education provides a suitable area for the use of a program which permits variation of activities according to a child's ability to comprehend, analyze, synthesize, and evaluate what he learns.

Individualization has historically reappeared and survived in different formats and different degrees as a method of teaching which attempts to permit pupils to be unique individuals and to permit them to succeed even with differences of ability. Various degrees of individualizing have appeared, but the project sciences have been foremost in developing more realistic approaches to teaching science.

Various schools have reported successful individualization systems. Statistical evidence regarding the success of these programs has revealed some inconsistencies in the results, but most of the studies have indicated more success in affective areas than in the cognitive ones. Most programs have reported better attitudes toward science
school, and self after being in individualized classes. In the middle grade programs, attitudes improved; but no evidence of better achievement was consistently proved. Statistical studies of the project sciences showed that of the studies reviewed, eight populations showed improvement in the affective areas; seven revealed better achievement in some facet of science learning and achievement.

Such an appraisal of an open curriculum shows that this method, like many others, affords no panacea. However, the results seem to balance the arguments brought forth by the critics of individualized instruction. A conclusion might be drawn with Fred Hechinger's idea that artist teachers achieve satisfactory results with students whether or not they use progressive or traditional methods.83

CHAPTER III

METHODS AND PROCEDURES

Introduction

This study, undertaken to ascertain the status of individualization of instruction in the science programs of Kentucky's middle schools and junior high schools, found related questions imperative to its progress. The type of individualized programs and the plans by which they were administered were found to be relevant. The requirements entailed by an individualized plan in the way of facilities, materials, instructional supplies, laboratory equipment, software, hardware, and other resources all needed to be considered. The knowledge of the hours of preparation required by the teacher in using the various media for individualizing was of vital importance. Expenses involved in considering or implementing an individualized plan were of significance.

The strategies used by the Kentucky teachers who are individualizing their science classes afforded pertinent ideas for others who might be interested in
such methods of teaching. The limitations and successes of individualized programs already in use need to be recorded as helpful data for teachers.

After surveying the literature dealing with individualized education in general, it became evident that there were different opinions regarding its use. While many writers who discussed it considered prescription education the answer to today's problem of education for more pupils with more differences in abilities and motivations and cultures, other authors clung to the traditional methods of teaching as more effective ones.

After studying the kinds, degrees, and different ways of individualizing education of all grades or classes or certain disciplines, the search became more specific. The literature was scanned for information regarding individualization of science programs for pupils of the middle school and junior high school ages. With our nation's new interest in middle school education, the use of an individualized approach was seen as more harmonious with the goals and aspirations held for the pre-adolescent youngsters.1 Middle schools were considered by many authors to be a basis for changes in school activities.

According to Ronald Billings, middle schools exist with alternative programs to the traditional junior high school offerings and present a wide range of educational experiences for its pupils. The middle school with its programs designed with ideals for improving self-concept and the chances for the personal success of the boys and girls enrolled, lends itself to a diagnostic and prescriptive type of curriculum.²

The fact that many schools with students in the intermediate school grades use a junior high school organization plan determined that attention be given to these schools. The junior high schools, with the necessity of change facing them, have in the past relied upon experimental development in improved time arrangements and upon more planning for the peculiar age level of its students.³ Some have included a plan of individualized instruction in an effort to meet student needs. Thus the population of the study included both junior high schools and middle schools.

Since the best method of teaching science was a pertinent part of the whole study, this information was

sought in regard to existing science programs. The plans used for teaching science in Kentucky's middle schools and junior high schools were the focus of the study with particular attention being paid to innovations which included an individualized approach.

The literature dealing with individualized science instruction of pupils in the pre-adolescent and early adolescent years was found to be limited in scope. Accounts of the activities of Kentucky's middle and junior high schools in this vein were practically nonexistent. A list of schools using one individualized project science, ISCS, was the only information readily available.\(^4\)

An attempt was made to analyze the literature, conduct personal interviews, watch programs in action, and gather data by use of an information survey.\(^5\) Information contained in this study was obtained from these sources, from books and periodicals, and from some unpublished materials. Knowledge of Kentucky's individualized science programs, methods of administering and financing, details of the programs, and evaluation of them were obtained.

\(^4\)Kentucky Department of Education, Letter from the State Science Consultant, October 8, 1976. (Typewritten.)

\(^5\)See complete questionnaire in Appendix, pages 133-37.
The instrument for securing the data from Kentucky's middle schools and junior high schools was an information survey accompanied by an explanatory cover letter and a stamped, self-addressed envelope. It dealt with the over-riding questions surrounding the individualized science instruction in each school contacted. Its foremost purpose was to identify the existing individualized science programs and to examine the subproblems connected with them.

The survey was mailed to the principals of the schools on January 15, 1977. A duplicate questionnaire was mailed on March 15, 1977, to those schools failing to reply to the first effort.

The population receiving the survey consisted of 173 schools which were listed in the 1975 Kentucky School Directory. This document listed 184 different school districts with a total of 260 separate schools. The 173 schools embraced by the study were classified in 74 cases as junior high schools and in 89 cases as middle schools. These were contacted along with a random sample of ten schools named as elementary and organized by the K-8 plan.6

---

The grades included were six, seven, and eight in the middle schools with a school occasionally listing grade five. The grades in the junior high schools included seven, eight, and nine. The schools organized by the K-8 or K-12 plan included all these grades, but answers pertaining only to grades six, seven, and eight were included in the survey.

The questions were designed to elicit accurate descriptions and evaluations of the individualized science programs now being used in Kentucky. Communication of statistical information included the organization of the school, the grades included, and the number of pupils enrolled in each grade. The kind of science taught in each grade was typified as life science, earth science, physical science, or general science; titles or publishers of textbooks could be named. To ascertain whether or not project science was taught, each school receiving a survey was asked to identify the school's science classes as conceptual science, ones of inquiry approach, classes with a process approach, groups in a laboratory science, or some combination of these. The presence of a project science in use seemed to indicate an attitude of reform and a desire for improvement of the traditional approaches to teaching science.

7 Copy of survey may be seen in Appendix, pages 132-137.
The science projects listed on the survey included some which apply only to ninth grade and others which are useful for all grades up to eighth. Some of the project sciences are designated by the educators who originated them as individualized in approach, while others are applicable to schools using traditional methods or some degree of individualization. Many are oriented toward the student with his special characteristics during the time he is in grades 6-9.

**Project Science**

The survey list included the following science projects:

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSCS</td>
<td>Biological Science Curriculum Study</td>
</tr>
<tr>
<td>CBA</td>
<td>Chemical Bond Approach</td>
</tr>
<tr>
<td>ESCP</td>
<td>Earth Science Curriculum Project</td>
</tr>
<tr>
<td>HPP</td>
<td>Harvard Project Physics</td>
</tr>
<tr>
<td>IPS</td>
<td>Introductory Physical Science</td>
</tr>
<tr>
<td>PSSC</td>
<td>Physical Science Study Committee Physics</td>
</tr>
<tr>
<td>SSSP</td>
<td>Secondary School Science Project</td>
</tr>
<tr>
<td>ESS</td>
<td>Elementary Science Study</td>
</tr>
<tr>
<td>IIS</td>
<td>Ideas and Investigating in Science</td>
</tr>
<tr>
<td>ISCP</td>
<td>Interaction Science Curriculum Project</td>
</tr>
<tr>
<td>ISCS</td>
<td>Intermediate Science Curriculum Study</td>
</tr>
<tr>
<td>MMST</td>
<td>Minnemast Minnesota Mathematics and Science Teaching</td>
</tr>
<tr>
<td>SCIS</td>
<td>Science Curriculum Improvement Study</td>
</tr>
<tr>
<td>SSCP</td>
<td>School Science Curriculum Project</td>
</tr>
</tbody>
</table>

A space was provided to enable the respondents to list any other project used but not named in the survey. Many projects have existed for several years and almost all publishers have now presented a type of project for purchase, although they may or may not be the originally designed
If the respondent school did use an individualized approach in teaching its science classes, it was asked to continue answering the remaining questions to the survey. First, the length of time the school had been using an individualized method was asked for as an indication of the validity of judgements made about its success.

The administrating plan was then identified to inform the researcher of the school's organization of its program. The national plans are larger in scope and they would require less ingenuity by the local staff in implementation.

**Administering Plans**

There are five better known plans for implementing individualized instruction. These are essentially systems for distributing the product of individualized education and do not include specifics as to content and the detailed operation of the plan. The designs contain ideas for efficient administration of a school program including the inspiration and preparation of the staff, the training of personnel in preparation of objectives and materials, the use of facilities to the best advantages, and the evaluation of the program. The plan may be applied

---

8 For detailed discussion of each project as to origin and purpose, see Chapter II, pages 42-52.
to a total school system, to an individual school, or to a single department or class within a school. Its goals and formats for instruction could be used by one or more teachers, particularly, the instruction in practical aspects such as how to prepare materials and the best use of space.

Some of the national plans utilized as support systems for individualized programs are discussed.

PERT--Program for Evaluation Review Technique

PERT is a general system used by administration and management. It has been applied to the management of research projects, schoolhouse construction or remodeling, and monitoring of curriculum development plans. This method is particularly valuable in that it shows not only what is happening in an overall activity but also how each activity affects all of the other activities. It requires as a first step the identification of the program objectives. Then the elements of the project are placed in a hierarchical order known as a workbreakdown structure, composed of task, function, and products. A network of events and functions is developed in necessary sequence, and schedules are developed for the accomplishment of the activities; responsibilities are assigned and deadline dates established. The project is reviewed and evaluated periodically and estimates made as to its time of completion and its success.

---


10 Ibid., p. 41.
PSI—Personalized System of Instruction

PSI is also referred to as Keller's Method, named for its founder Fred Keller who collaborated with Gilmour Sherman. It is a method of teaching which treats the student more on an individual basis than as a presupposed average student. The plan uses positive reinforcement methods. If a student fails an examination on the first try, he is allowed to restudy the material and retake the examination. It is a flexible method of teaching, and a determination of its effectiveness is hard to make. It is most often used in psychology and science in high schools and in university settings.

PERT was not included in the survey because it is more often used for general education purposes than for individualization. PSI was omitted because it is most often used in universities and senior high schools rather than in the elementary grades of public schools. However, if these were being used, the survey provided a space for the respondents to note the use of any system not listed.

IGE—Individually Guided Education

IGE has been under continuous development by the Wisconsin Research and Development Center since 1964. It is conceptualized as a comprehensive alternative system of schooling designed to produce higher educational achievements by providing effectively for differences among students in rate of learning, learning styles, and other

---

characteristics. Operating on two administrative levels—instructional improvement and as a research unit—IGE has seven major components:

1. MUSC—Multunit School Instructional—administrative Arrangement
2. IPM—Instructional Planning for the Individual
3. Evaluation of Student Learning
4. Curriculum Materials and Evaluation
5. Program of Home-school Community Relations
6. Environment to Facilitate IGE
7. Continuing Research and Development for Improvement of IGE

IGE began in embryonic form when a project called Maximizing Opportunities for Development and Experimentation in Learning in the Schools—MODELS—was begun at the Wisconsin Research and Development Center under the direction of Herbert J. Klansmeier as principal investigator. Experimental units replaced age-graded classes in some schools in Wisconsin. In 1969, the Research and Development Center and the Institute for Development of Educational Activities, IDEA, was authorized to use the materials. In 1971-1973, the MUSE, Multiunit School Instructional Arrangement, was selected by the United States Office of Education for nationwide implementation. It was then funded by three federal agencies. The National Institute of Education funded a small part of it; Sears-Roebuck Foundation, in 1972, funded the teacher-education part.

---


14 Klansmeier, "Alternative Form of Schooling," p.73.
IPI--Individually Prescribed Instruction

Since 1966, the Learning Development Center of the University of Pittsburgh and Research for Better Schools, Inc., under the direction of Robert Glaser, have been operating in the development, field testing and dissemination of IPI. It is an instructional system based on specific objectives and correlated materials and methods. Materials designed for the individual student have been created in mathematics, reading, science, handwriting and spelling. They are tailored to individual learning needs and to the unique characteristics of each student. It also prepares teachers to do a better job of diagnostic teaching and to use new approaches. IPI uses a pretest-prescription-posttest model of individualizing. The teaching modules are in discrete parts, each being capable of being completed in a relatively short period. Students progress at their own rates and may complete the modules in different sequences.

Its six distinguishing characteristics are these:
1. It provides detailed educational objectives.
2. There is ample organization of the methods to attain the objectives.
3. It determines each student's competencies in a given subject before beginning in the IPI materials.
4. It has daily evaluation and guidance.


5. It includes frequent monitoring of student progress.
6. Its materials provide for continuous evaluation and strengthening of the curriculum and the instructional procedures.

PLAN--Program for Learning in Accordance with Needs

PLAN is an individualized multimedia system of education built upon a data base of instructional objectives, learning resources, performance tests, and personalized programs of study in reading and language arts, mathematics, science, and social studies. It is marketed by the Westinghouse Learning Corporation. The basic building block in PLAN is the TLU, Teaching-Learning Unit, which includes instructional objectives associated with recommended learning activities and criterion tests. A guidance system uses data on students and draws upon a bank available to TLU's to recommend an individualized program of study--POS--for each student.

A computer facility is used in PLAN to collect information concerning the progress and performance of students from terminals located in the participating schools. This information is processed for feedback to students and teachers and is stored for record purposes.

The development of the PLAN system was conducted by Project TALENT Survey of 1960. This study, financed by the United States Office of Education, was made by the American Institute for Research, AIR. It included a two-day battery of tests and questionnaires and was given to 440,000 students in the ninth through twelfth grades of a stratified sample of secondary schools of all types throughout the United States. Great variability of abilities by the

students in a particular class suggested a real need for curriculum change. This project led to the development of PLAN.18

The survey instrument sought classification of the major educational objectives underlying the individualized program within the framework of Bloom's Taxonomy. The respondents were asked to identify the principal behavior objectives as affective, cognitive, psychomotor, or a combination of these.

Knowledge of the techniques used by the schools for carrying out their individualization was a necessary part of the questioning. The strategies for individualizing vary, but some of the most widely used ones are listed.

Individualization Strategies

Activity Cards--Cards on which a variety of exercises may be written; these may be small ones in packets or large ones posted at learning stations.

Activity Centers--Any area of the room designated for certain learning activities.

Circles of Knowledge--Small groups seated in circles in secluded parts of the room and prepared to discuss with the teacher topics all have studied or are preparing to study.

Contracts for Learning--A mutual understanding or agreement that exists between teacher and

student. The essential element is the exchange of student work or task performance for some kind of significant reinforcement or reward. It is a self-contained outline of study that indicates what the student is to learn, behavioral objectives, resources, alternative activities, reporting alternatives, self-assessment inventory, and teacher assessment.

Game Tables--Tables in different sections of the room for use at appropriate times. Games should be listed on the student's activity cards so that he can select those suitable to his ability or task. Games are useful to introduce a topic or concept, to apply information or concepts already studied, for motivation, to add variety to methods, to review, to offer remedial work, or to relax students.  

Independent Study--A learning activity largely motivated by the learner's own aims to learn and largely rewarded in terms of intrinsic values; it is tailor-made for the pupil and guided by his own needs and interests to develop his independence in learning.

Information Booth--One student looks up some topic and shares his information with others who then do not have to look it up.

Interest Centers--Small areas where students may congregate to learn; a variety of activities should be found here, but all would be focused on a centralized sphere of interest.

19 Rita and Kenneth Dunn, Practical Approaches to Individualizing Instruction, p. 51.

20 Sandra Kaplan et al., Ideas and Activities for Individualizing Instruction, p. 21.
Instructional Packages--Packets of teaching exercises for the students to work through as introductory or reinforcement resources.  

Job Sheets--Sheets which list the job instructions and the materials needed.

Large Groups--Groups of twenty-five or more students doing any exercise which does not require drilling, practice, and repetition; such activities as testing, hearing resource persons, and seeing movies lend themselves to this.

Learning Centers--An area in or out of the classroom which contains a collection of activities and materials to teach, reinforce, or enrich a skill or concept; it should contain a variety of activities of different ability levels.

Learning Sequences--Study sheets, contracts, or written directions in a sequential format, moving from simple to complex as required by the nature of the concepts.

Learning Stations--A place with accumulated materials where students select items and activities concerning certain concepts; activities contain objectives and instructions for attaining them.

Little Theaters--A section of the room that may be darkened or partitioned so that students may become involved in a series of projects that require application of the information they have learned; they may make

---

21 Dunn, Practical Approaches to Individualizing Instruction, p. 70.

22 Stahl and Anzalone, Individualized Teaching in Elementary Schools, p. 38.

23 Kaplan, Ideas and Activities for Individualizing Instruction, p. 21.
slides, filmstrips, photographs, costumes, rolled-paper movies, scrapbooks, or any presentation for others.

Magic Carpet--An informal area for small group interaction such as team learning or circles of knowledge; it should be separated, carpeted, and comfortable.24

Media Corners--A place with quantities of objects to manipulate, a variety of hardware, resource materials, and supplies for creative activities.25

Peer Tutoring--A technique in which students of the same age and grade help a pupil who does not understand concepts or who lacks skills.

Phase Teaching or Phase Electives--Choice of phase material is made by the student based on the questions which arise as his inquiry into a topic proceeds; phases are of different ability levels available on the same subjects.

Programmed Packets--A package of learning activities and exercises broken down into a series of small pieces leading directly into the next. Reinforcement in the form of immediate feedback concerning correct responses is a positive feature as is the self-paced nature of the instruction.26

Research Groups--Small groups of pupils or an individual is permitted to go to other learning centers, media centers, and the library to research their topics.

24 Dunn, Practical Approaches to Individualizing Instruction, pp. 69-70.


Small Group--Any organization of pupils for working, from one pair to several people.

Supplementary Activities--Alternative activities designed to increase the depth of understanding of topics studied. This can be used as a "catch-all" phrase for interest centers or any additional exercise.

Teacher Prescription-Diagnosis--A method in which identification of student strengths and weaknesses is ascertained in emotional, academic, and physical areas; teacher then prescribes suitable activities for the particular student.

Team Teaching or Team Learning--Two or more pupils working together cooperatively as a team or a large group of pupils receiving a formal presentation by one member of a team of teachers; material which is then discussed and worked through by tutors with smaller groups of pupils.27

Theme Center--A center composed of almost any topic of study; another name for an interest center.28

Topic Preference--A method by which students choose the subject they want to study within a certain area of the room; this is similar to phase electives.

Tutoring--A technique for remedial work and for enabling the gifted to proceed to advanced levels; teacher may instruct one or a pair or a small group of students.

27 James, Young Lives at Stake, p. 57.

Space was provided on the survey for a respondent to list any strategy which had not been named.

The need for facilities and science equipment was then explored in relation to the previously existing traditional program. Questions were concerned with materials, both hardware and software, necessary for a successful individualized program of instruction. Of concern were such things as whether more equipment or more varied laboratory equipment was needed, the number of setups needed at one time, and how many written laboratory sheets and lessons were needed. The use of all materials involved in laboratory science was explored.

Evaluation of the program was made in several ways. One way was to ask for a judgement concerning the responses of the pupils. Of vital concern was student response through self-discipline in study habits and improved behavior during class. Equally important was achievement in science and attitudes toward science. The survey also provided space for noting no observable change in the pupils.

Qualification as to how judgements were made was then sought by asking if students showed better attitudes as judged by teachers or by attitude tests. Changes in both teacher-made or standardized science achievement tests and
test scores were a following part of the evaluation.

Teacher judgment as to the overall success of the individualized program in meeting its objectives was solicited. Teachers were asked to rate the effectiveness of their program as definitely successful, moderately successful or definitely unsuccessful at each grade level.

Grading methods were also included in the questions. Attitudes of the faculty members toward the individualized program were considered. The amount of work required by the teacher involved in any method of teaching may defeat or advance it; therefore, questions were asked as to the amount of work and the advantages or benefits of additional time spent in teacher effort. The changed role of the teacher was a subject of inquiry also.

The effects of the individualized program on the school as a whole was discovered by asking if non-participating members of the faculty could see changes in those pupils working in the individualized program and whether changes indicated improvement or decline in performance.

As the surveys were returned, the results were tabulated by separating them into two groups--those using individualized plans of teaching science and those not using these plans. Among the schools who used individualized
teaching, detailed answers were totaled as to the number of schools using certain strategies and obtaining certain results. The totals indicated trends and methods used by Kentucky's middle schools and junior high schools in science.

Conclusions could be drawn by specific numbers of answers about practices employed and resulting attitudes. Factual statements about the status of individualized instruction in Kentucky's middle schools' and junior high schools' science classes could be stated in a comprehensive and accurate way.

Summary

The impetus of this paper is to identify the existence and successes of individualized science methods in the middle schools and junior high schools of Kentucky. The instrument used to ascertain facts about Kentucky's programs was an information survey which included specific questions about current science programs.

Recommendation to other schools as to the efficacy of attempting such a program was a vital part of the questioning. Practices which are effective for one place must not of necessity be considered as suitable for all places. However,
with adaptations for the respective locale, tested programs could, in most cases, be used for the improvement and further advancement of science education.
CHAPTER IV
SUMMARY, FINDINGS AND CONCLUSIONS

Introduction

This study was designed to ascertain the status of individualized science instruction in the middle schools and junior high schools of Kentucky. Chapter I presents a statement of the problem, the purpose of the study, and the limitations and delimitations. Definitions of terms commonly used in the discussion of individualized education are included.

A review of the literature concerning individualized education comprises the second chapter. Definitions and characteristics of individualized instruction are present with a brief history of the movement of education toward the individualized approach. The systems of administering the programs are considered along with the perspectives of science education and current trends in the school science programs. Science programs and their goals and objectives are investigated as a background for individualized
science education at the junior high school and middle school levels. The successes and failures of some programs now existing in the nation's schools and the research studies made of the effectiveness of individualization are also examined.

Chapter III describes the rationale and method of collecting data on the individualized science programs in Kentucky's middle schools and junior high schools.

Chapter IV is a summary of the study, a discussion of findings, and a list of conclusions that could be drawn about individualized science education in the state's middle schools and junior high schools.

Summary

Information about the nature and extent of individualization in the science instruction in Kentucky's schools was sought in the form of an information survey.\(^1\) This instrument consisted of seventeen questions designed to elicit specific details of the individualized science programs used in Kentucky schools during 1967-1977. The first group of questions dealt with the organization and size of schools, the kind of science taught, and whether or not project science or any individualized science

\(^1\)See the Information Survey in Appendix B, page 134.
programs were used. The questions which followed attempted to obtain a description of the individualized programs and their effects on the students and the schools.

The survey was mailed to 173 schools, and 118 replies were returned for a 68 percent response. Of the replies received, 48 respondents (41 percent) reported some form of individualized instruction in science classes; 70 respondents (59 percent) reported the use of a traditional science program. The replies indicated that fifty schools (42 percent) were organized as junior high schools; 60 schools (51 percent) were organized as middle schools; and 8 schools (7 percent) were organized by a K-8 or K-12 plan. (See table 3, page 98.)

Findings

The findings obtained from the survey are presented in this section of Chapter IV. The replies of the school officials to the items of the survey were totaled; and when the results were significant, percentages were computed. The frequent omission of answers to a question or inconsistent answers by the respondents affected the totals and percentages.

The information was first classified according to whether or not the schools maintained an individualized or a traditional approach in teaching science. Further
Table 3

SCIENCE PROGRAMS IN USE IN KENTUCKY SCHOOLS IN 1967-1977

<table>
<thead>
<tr>
<th>Organization of Schools</th>
<th>Traditional Approach</th>
<th>Individualized Approach</th>
<th>Total of Approaches</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number (1)</td>
<td>Percentage (2)</td>
<td>Number (3)</td>
</tr>
<tr>
<td>Junior High Schools</td>
<td>26</td>
<td>37</td>
<td>24</td>
</tr>
<tr>
<td>Middle Schools</td>
<td>41</td>
<td>59</td>
<td>19</td>
</tr>
<tr>
<td>K-8 or Other</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Totals</td>
<td>70</td>
<td>59*</td>
<td>48</td>
</tr>
</tbody>
</table>

NOTE: Percentages of traditional schools (column 2) based on 70 schools.
Percentages of individualized schools (column 4) based on 48 schools.
*Percentages based on 118 schools.
subdivisions of the reports were made according to the subjects of the questions in the survey.

Schools Using a Traditional Approach

Organization

The respondents from schools using a traditional approach in science classes reported that twenty-six schools (37 percent) were organized as junior high schools; forty-one schools (59 percent) were organized as middle schools; and three schools (4 percent) were organized by the K-8 or K-12 plan. (See table 3, page 98.)

Sizes

A survey question regarding school size classified them into four categories. These were (1) 0-100 in a grade, (2) 100-200 in a grade, (3) 200-300 in a grade, and (4) over 300 in a grade. The size of classes in schools using a traditional approach in science was most often reported as 100-200 pupils. The enrollment by grade levels is recorded in table 4, if such information is desired by the reader. (See table 4, page 100.)

Kinds of Science Taught

The kinds of science taught in the traditional schools sometimes included more than one kind within one school year--some science teachers rotated the courses within a
Table 4

NUMBER OF SCHOOLS WITH DIFFERENT ENROLLMENT BY GRADE LEVELS

<table>
<thead>
<tr>
<th>Enrollment</th>
<th>Traditional Approach</th>
<th>Individualized Approach</th>
<th>Total of Approaches</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grades</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6 7 8 9 Total</td>
<td>6 7 8 9 Total</td>
<td></td>
</tr>
<tr>
<td>Fewer than 100</td>
<td>2 12 13 6 33</td>
<td>5 6 6 2 19</td>
<td>52</td>
</tr>
<tr>
<td>100-200*</td>
<td>13 25 23 7 68</td>
<td>6 16 14 6 42</td>
<td>110</td>
</tr>
<tr>
<td>200-300</td>
<td>6 18 17 4 45</td>
<td>1 13 13 4 31</td>
<td>76</td>
</tr>
<tr>
<td>300-400</td>
<td>1 11 11 4 27</td>
<td>3 12 12 5 32</td>
<td>59</td>
</tr>
</tbody>
</table>

NOTE: Each school did not have all four grades; most schools reported three grades. Each school might report different sizes in different grades. All are counted in the totals. *Most common size for each grade.
grade level. However, most teachers taught one kind of science in one school year.

Life science was taught at the sixth grade level in four schools, at the seventh grade level in fifty-nine schools, and at the eighth grade level in seven schools. It was offered as an optional course with others in most ninth grades.

Earth science was taught to the sixth grades of two schools, to the seventh grades of six schools, and to the eighth grades of fifty-five schools.

Physical science was taught to the sixth grades of four schools, to the seventh grades of three schools, to the eighth grades of eight schools, and to the ninth grades of thirteen schools.

General science was taught to eighteen sixth grades, to eight seventh grades, to ten eighth grades, and to four ninth grades. (See table 5, page 102.)

The figures indicated that in 26 percent of the schools general science was taught at the sixth grade level, in 84 percent life science was taught at the seventh grade level, in 79 percent earth science was taught at the eighth grade level, and in 19 percent physical science was taught at the ninth grade level.
Table 5

KINDS OF SCIENCE COURSES OFFERED IN TRADITIONAL AND INDIVIDUALIZED SCIENCE PROGRAMS IN SCHOOL YEAR 1976-1977 (NUMBERS OF SCHOOLS USING EACH)

<table>
<thead>
<tr>
<th>Grades</th>
<th>Life</th>
<th>Earth</th>
<th>Physical</th>
<th>General</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Trad.</td>
<td>Ind.</td>
<td>Trad.</td>
<td>Ind.</td>
<td>Trad.</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>18</td>
</tr>
<tr>
<td>7</td>
<td>59</td>
<td>30</td>
<td>6</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>8</td>
<td>7</td>
<td>13</td>
<td>55</td>
<td>24</td>
<td>10</td>
</tr>
<tr>
<td>9</td>
<td>See</td>
<td>5</td>
<td>0</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

NOTE: 26% of traditional schools and 24% of individualized schools used general science in the sixth grade. 84% of traditional schools and 63% of individualized schools used life science in the seventh grade. 79% of traditional schools and 50% of individualized schools used earth science in the eighth. 19% of traditional schools and 27% of individualized schools used physical science in ninth grade.

___ indicates the choice of the majority of schools at this grade level.
Textbooks

The textbooks used by the traditional schools were chosen from the state adoption list and were of various selections. The respondents from several schools reported the use of more than one text in the same science course.

Project Science

The replies from some schools using a traditional approach in the science programs indicated that, though not conforming to the individualized approach intended by some planners of the project sciences, they utilized one of them. The projects reported by the teachers in traditional schools as being used in one or more grades were (1) ESS by eight schools, (2) IIS by ten schools, (3) ESCP by four schools, (4) ISCP by ten schools, (5) ISCS by three schools, (6) ISIS in one school, and (7) U & I in one school. Information about the uses of each project by grade levels is available on the accompanying table. (See table 6, page 104.)

Schools Using an Individualized Approach

Organization

The officials of schools using an individualized approach in teaching science reported that twenty-four schools (50 percent), included in the survey,

2For identification and explanation of projects, see Chapter II, pages 42-52.
Table 6

NUMBER OF SCHOOLS USING PROJECT SCIENCE IN SCHOOL YEAR 1976-1977

<table>
<thead>
<tr>
<th>Grades</th>
<th>ESCP</th>
<th>ESS</th>
<th>IIS</th>
<th>IPS</th>
<th>ISCP</th>
<th>ISCS</th>
<th>ISIS</th>
<th>SCIS</th>
<th>U &amp; I</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T</td>
<td>I</td>
<td>T</td>
<td>I</td>
<td>T</td>
<td>I</td>
<td>T</td>
<td>I</td>
<td>T</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>2</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>2</td>
<td>8</td>
<td>8</td>
<td>6</td>
<td>10</td>
<td>14</td>
<td>2</td>
<td>4</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>19</td>
<td>21</td>
<td>3</td>
<td>31</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Percentage</td>
<td>17</td>
<td>14</td>
<td>13</td>
<td>14</td>
<td>29</td>
<td>4</td>
<td>8</td>
<td>27</td>
<td>44</td>
</tr>
</tbody>
</table>

**NOTE:**
T = Traditional; I = Individualized
70 schools reported traditional approach.
48 schools reported individualized approach.
were organized as junior high schools, nineteen schools (40 percent) were organized as middle schools, and five schools (8 percent) were organized by a K-8 or K-12 plan. (See table 3, page 98.)

Sizes

Following the same designation of school size as used in the findings pertaining to the traditional schools, the respondents from the individualized schools most often reported a grade size of 100-200 pupils. The specific numbers of schools with enrollments of certain sizes in grade levels are listed in table 4, page 100.

Kinds of Science Taught

The teachers in the individualized schools reported that life science was taught to thirty seventh grades, to thirteen eighth grades, and to five ninth grades.

Earth science was taught to one sixth grade, to eight seventh grades, to twenty-four eighth grades, and to four ninth grades.

Physical science was taught to one sixth grade, to ten seventh grades, to twelve eighth grades, and to thirteen ninth grades.

General science was taught to twelve sixth grades, nine seventh grades, eight eighth grades, and three ninth grades.
These figures indicated that in 63 percent of the individualized schools life science was taught in the seventh grade while in 50 percent earth science was taught in the eighth grade and in 27 percent general science was taught in the sixth grade.

The replies from some schools indicated the use of more than one kind of science within one school year and grade level. The tabular lists include all kinds of science reported by a school, and the totals may appear to have some discrepancies which are due to this. (See table 5, page 102.)

**Textbooks**

Choices of textbooks varied greatly among the individualized schools. In some institutions more than one textbook and several supplementary texts were used. In some, resources other than textbooks were used.

**Project Science**

The teachers in schools using an individualized approach in science taught more of the project sciences than did the teachers in schools using traditional methods. The projects reported in use in one or more grades were (1) ESCP in eight schools, (2) ESS in six schools, (3) IIS in 14 schools, (4) IPS in four schools, (5) ISCP in twenty-one

---

3 For identification and explanation of project sciences, see Chapter II, pages 42-52.
schools, (6) ISCS in thirty-one schools, (7) ISIS in two schools, (8) SCIS in two schools, and (9) U & I in four schools. The identification of the grades which used each project may be found in table 6, page 104.

Ages of the Individualized Programs

The answers to the item in the survey regarding the age of the individualized programs revealed that the most typical length of time that the plan had existed was four years. The replies regarding the length of time the individualized programs had been used were as follows: (1) four years in eleven schools, (2) five years in four schools, (3) six to ten years in seven schools and (4) sixteen years in one school.

Table 7

AGES OF INDIVIDUALIZED SCIENCE PROGRAMS

<table>
<thead>
<tr>
<th>Years in Use</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Schools</td>
<td>1</td>
<td>2</td>
<td>6</td>
<td>6</td>
<td>11</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>
Administration of the Individualized Programs

A national plan of administering the individualized science program was employed in eighteen schools (38 percent). The support systems used were (1) Plan in 21 schools, (2) IGE in eight schools, and (3) IPI in four schools. In some schools a different plan was reported to be used by different grades and three plans were used in the same school in one instance. The individualized programs of the remaining thirty schools (62 percent) were administered without the aid of a national support system (See table 8, page 109.)

Financing the Individualized Programs

The details of financing the schools' individualized science programs were arranged in two categories. These were (1) schools using national plans and (2) schools administering their own programs.

The respondents from schools using a national plan reported that four programs were financed by research funds; two (4 percent) of these were by federal funds and two (4 percent) were by state funds. The teachers in two of the schools using research funds followed the PLAN System and in one school they followed IGE. Most of

\[4\text{For details of the national plans of administration of individualized programs, see Chapter III, pages 81-86.}\]
## Table 8

**FINANCING OF INDIVIDUALIZED SCIENCE PROGRAMS BY LOCAL AND NATIONAL PLANS IN SCHOOL YEAR 1976-1977**

<table>
<thead>
<tr>
<th>Financial Source</th>
<th>Schools with Self-Administered Plans</th>
<th>Schools with National Plans</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>IGE No. %</td>
</tr>
<tr>
<td>Departmental funds</td>
<td>10 21</td>
<td>2 4</td>
</tr>
<tr>
<td>General funds</td>
<td>15 31</td>
<td>3 6</td>
</tr>
<tr>
<td>Local school board funds</td>
<td>18 38</td>
<td>2 4</td>
</tr>
<tr>
<td>Personal funds</td>
<td>2 4</td>
<td>0 0</td>
</tr>
<tr>
<td>Research (Federal Funds)</td>
<td>2 4</td>
<td>1 2</td>
</tr>
<tr>
<td>Research (State funds)</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>47</strong></td>
<td><strong>8</strong></td>
</tr>
</tbody>
</table>

**NOTE:** Many schools used more than one source of revenue and all sources are included in the list. Percentages are based on 48 schools using individualized plans. Some schools used more than one plan at a time, in different grades.
the schools using a support system were financed by the schools' general funds and/or the local board of education. The reports of financing were (1) twelve schools (25 percent) by general funds, (2) ten schools (21 percent) by local board of education funds, (3) six schools (13 percent) by departmental funds within a school science area, and (4) one school (6 percent) by a teacher's personal funds.

Of the self administered plans, the school's officials reported the following: (1) two schools (4 percent) used research funds, (2) fifteen schools (31 percent) used general funds, (3) eighteen schools (38 percent) used local school board funds, (4) ten schools (21 percent) used departmental funds, and (5) two schools (4 percent) used personal funds.

In both self and system-administered plans, general funds supplied 34 percent of the schools' funds, while the local school boards contributed funds in 35 percent of the schools. Departmental funds helped fund 20 percent of the programs; federal research funds helped fund 5 percent of the programs; and state research funds helped fund 3 percent. (These percentages are based on a total count of a possible eighty arrangements of financing.) Most officials of the schools reported more than one source of revenue for their programs; some used one or more national plans for some grades but administered other grades' individualized
Behavioral Objectives

An item of the survey was concerned with affective, cognitive, and psychomotor objectives as a basis for the individualized science programs. The reports included: (1) in 30 schools (63 percent) an emphasis of a combination of objectives, (2) in 12 schools (24 percent) an emphasis on cognitive objectives, (3) in three schools (6 percent) an emphasis on affective objectives, and (4) in one school (2 percent) an emphasis on psychomotor objectives. (See table 9.)

Table 9

BEHAVIORAL OBJECTIVES EMPHASIZED IN INDIVIDUALIZED PROGRAMS

<table>
<thead>
<tr>
<th>Behavioral Objectives</th>
<th>Affective</th>
<th>Cognitive</th>
<th>Psychomotor</th>
<th>Combination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Schools</td>
<td>3</td>
<td>12</td>
<td>1</td>
<td>30</td>
</tr>
<tr>
<td>Percentage of Schools</td>
<td>6</td>
<td>25</td>
<td>2</td>
<td>63</td>
</tr>
</tbody>
</table>
Strategies of Individualizing

The strategies used in the promulgation of an individualized science plan encompassed a variety of arrangements. The school officials reported the following:

(1) in thirty-eight schools supplementary activities were used,
(2) in thirty-five schools team learning groups were used,
(3) in twenty-seven schools activity centers were used,
(4) in twenty-four schools learning sequences were used, and
(5) in twenty-three schools programmed packets were used.

The use of interest centers and learning centers was reported in a few schools; the use of game tables and contracts was reported in others. (See table 10, page 113.)

As table 11 indicates, in most schools from two to five strategies were used to implement their individualized science programs.

Table 11

<table>
<thead>
<tr>
<th>Number of Schools</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Strategies</td>
<td>4</td>
<td>6</td>
<td>8</td>
<td>9</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

5 For details of strategies, see Chapter III, pages 86-90.
Table 10

DIFFERENT STRATEGIES USED BY SCHOOLS TO INDIVIDUALIZE SCIENCE

<table>
<thead>
<tr>
<th>Strategies</th>
<th>Number of Schools</th>
<th>Percent of Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplementary Activities</td>
<td>38</td>
<td>79</td>
</tr>
<tr>
<td>Team Learning</td>
<td>35</td>
<td>73</td>
</tr>
<tr>
<td>Activity Centers</td>
<td>27</td>
<td>56</td>
</tr>
<tr>
<td>Learning Sequences</td>
<td>24</td>
<td>50</td>
</tr>
<tr>
<td>Programmed Packets</td>
<td>23</td>
<td>48</td>
</tr>
<tr>
<td>Interest Centers</td>
<td>20</td>
<td>42</td>
</tr>
<tr>
<td>Learning Centers</td>
<td>19</td>
<td>40</td>
</tr>
<tr>
<td>Game Tables</td>
<td>11</td>
<td>23</td>
</tr>
<tr>
<td>Contracts</td>
<td>10</td>
<td>21</td>
</tr>
</tbody>
</table>

NOTE: Total schools using individualized strategies were 48. Most schools used more than one strategy and each one is counted separately.
Some school officials reported using a few strategies with a greater number of positive results than others who used a greater number of strategies. The reports were (1) in seven schools eight or more strategies were used with a composite of forty-seven positive results, (2) in six schools seven strategies were used with a total of forty-four positive results, (3) in six schools five strategies were used with thirty-five positive results, and (4) in nine schools four strategies were used with fifty-one positive results. A comparison of positive results to the number of strategies employed indicated that the use of four to six strategies was the most successful. (See table 12, page 115.)

Facilities and Materials Needed

The next item on the survey attempted to ascertain the effects of individualizing science on the needs of materials and equipment within a science department. These details included the amount of equipment, the variety of laboratory equipment, the number of set-ups for each experiment, the number of lessons to prepare other than the experiments, and the number of laboratory direction sheets for the experiments. The amounts of hardware, chemicals, and expendable articles were included in the list.

The replies indicated that in most schools teachers added equipment and materials for the individualization program.
Table 12

COMPARISON OF NUMBER OF STRATEGIES USED TO
POSITIVE RESULTS OBTAINED
(NUMBER OF SCHOOLS REPORTING)

<table>
<thead>
<tr>
<th>Number of Strategies Used</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>**</td>
<td>**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>***</td>
<td>**</td>
<td>***</td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*</td>
<td>**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td>*</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>TOTAL</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>11</td>
<td>6</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

NOTE: Comparison of number of strategies used to positive results obtained is seen where shaded blocks intersect.

Each * represents 1 school reporting. Totals are of schools reporting.

Vertical axis shows number of positive results reported. Horizontal axis shows number of strategies used.
The replies from the schools were as follows: (1) 34 needed more laboratory equipment, (2) twenty-eight needed more varied kinds of equipment, (3) twenty needed more chemicals and expendable items, (4) twenty-three needed more hardware, (5) eighteen needed more than the usual amount of laboratory direction sheets, and (6) twenty-four needed from two to five times the usual amount of lesson sheets to prepare. Teachers from six schools saw no change in the quantity of materials needed. (See table 13, page 117.)

Materials needed for an individualized program were compared to those needed for a traditional program. If no process science or laboratory science had been taught previously, the need for additional experimental equipment was increased; the preparation of laboratory direction sheets and activities also increased.

Grading of Pupils

The replies to the survey indicated that the conventional method of grading pupils with letters A B C D F prevailed among 81 percent of the schools in which science was taught by an individualized plan. Most of the schools graded with consideration of achievement, effort, and attitude. In about one-fourth of the schools the individual's native ability was considered in combination with his achievement. Reporting to parents by a conference was selected by officials of 31 percent of the schools while written progress
### Table 13

**CHANGES OF MATERIALS NEEDED FOR AN INDIVIDUALIZED SCIENCE PLAN**

<table>
<thead>
<tr>
<th>Nature of Changes of Materials Necessary</th>
<th>Number of Schools</th>
<th>Percent of Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Increase</td>
<td>Decrease</td>
</tr>
<tr>
<td>Amount of laboratory equipment</td>
<td>34</td>
<td>0</td>
</tr>
<tr>
<td>More varied laboratory equipment</td>
<td>28</td>
<td>0</td>
</tr>
<tr>
<td>Number of set-ups needed at one time</td>
<td>21</td>
<td>9</td>
</tr>
<tr>
<td>Number of lessons to prepare</td>
<td>24 (by 35)</td>
<td>2</td>
</tr>
<tr>
<td>Number of sheets of laboratory activities</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>Amount of hardware</td>
<td>23</td>
<td>0</td>
</tr>
<tr>
<td>Amount of chemicals and expendables</td>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td>Changes in quantity of all materials</td>
<td>42</td>
<td>6</td>
</tr>
</tbody>
</table>

**NOTE:** Percentages are based on total number of schools reporting (48). Most schools used several answers to the one question.
reports were sent from 21 percent of them. In five schools the methods of giving numerical grades and a point system were used. (See table 14, page 119.)

Evaluation of the Individualized Programs in Science

The survey questions regarding the evaluation of the individualized programs were intended to give a general perspective of the efforts at individualizing. The results were (1) in twenty-eight schools (58 percent) programs were rated as moderately successful, (2) in nineteen schools (40 percent) as definitely successful, and (3) in one school (2 percent) as definitely unsuccessful; these teachers planned to return to a traditional approach. In two schools teachers declined to pass judgement, and in two schools the program had been used for an insufficient time for judgement. (See table 15.)

Table 15

EVALUATION OF INDIVIDUALIZED SCIENCE PROGRAMS

<table>
<thead>
<tr>
<th>DEFINITELY SUCCESSFUL</th>
<th>MODERATELY SUCCESSFUL</th>
<th>DEFINITELY UNSUCCESSFUL</th>
</tr>
</thead>
<tbody>
<tr>
<td>40%</td>
<td>58%</td>
<td>2%</td>
</tr>
<tr>
<td>19 schools</td>
<td>28 schools</td>
<td>1 school</td>
</tr>
</tbody>
</table>

NOTE: Percentages based on 48 schools reporting individualized science programs.
Table 14

METHODS OF GRADING USED BY INDIVIDUALIZED SCIENCE PROGRAMS

<table>
<thead>
<tr>
<th>Methods</th>
<th>Number of Schools</th>
<th>Percent of Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Letters--A B C D F</td>
<td>39</td>
<td>81</td>
</tr>
<tr>
<td>Satisfactory or unsatisfactory</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Levels with letters</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Attitude, effort, and achievement</td>
<td>18</td>
<td>38</td>
</tr>
<tr>
<td>Achievement only</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Achievement in relation to native ability</td>
<td>14</td>
<td>29</td>
</tr>
<tr>
<td>Written progress reports</td>
<td>10</td>
<td>21</td>
</tr>
<tr>
<td>Progress reports at parent conference</td>
<td>15</td>
<td>31</td>
</tr>
<tr>
<td>Numerical grades</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Point system</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

NOTE: Occasionally a school used a combination of these ideas and all are counted.
Evaluation of Performance of Students
In Individualized Programs

Success of the individualized science programs was further measured by teacher judgment and by standardized instruments. The cognitive and affective areas were improved by an individualized science approach, according to the answers on the survey.

In the cognitive areas the answers were (1) fourteen groups (20 percent) made improved scores on teacher made science achievement tests and (2) eleven groups (23 percent) made improved scores on standardized science achievement tests.

In the affective area the answers were (1) thirty-four groups (71 percent) showed improved attitudes as judged by teachers, (2) six groups (13 percent) showed improved attitudes as measured by attitude tests, and (3) thirty-one groups (65 percent) showed more self-discipline in behavior and performance. On the basis of information submitted, it is assumed that fourteen groups (29 percent) either did not improve, or results were not reported by the respondents. The total indicated that twenty-five schools (26 percent) reported improvement in the cognitive area, and seventy-one schools (49 percent) reported improvement in the affective area. (See table 16, page 121.)
### Table 16

**EVALUATION OF INDIVIDUALIZED PROGRAMS ON STUDENT PERFORMANCE**

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Number of Schools</th>
<th>Percent</th>
<th>Behavior</th>
<th>Number of Schools</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Better Attitude (Attitude Tests)</td>
<td>6</td>
<td>13</td>
<td>Higher Science Scores (Standardized Tests)</td>
<td>11</td>
<td>23</td>
</tr>
<tr>
<td>Better Attitude (Teacher-Judged)</td>
<td>34</td>
<td>71</td>
<td>Higher Science Scores (Teacher-made Tests)</td>
<td>14</td>
<td>29</td>
</tr>
<tr>
<td>More Self-Discipline (Teacher-Judged)</td>
<td>31</td>
<td>65</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>71</strong></td>
<td><strong>49</strong></td>
<td></td>
<td><strong>25</strong></td>
<td><strong>26</strong></td>
</tr>
</tbody>
</table>

**NOTE:** The 48 schools reporting individualized programs could report more than one result. 144 total responses were possible in affective domain. 96 total responses were possible in cognitive domain.
Faculties implementing individualized science techniques encountered adjustments in the method and amounts of work necessary to provide a student-centered program instead of a group-centered program. Though some were enthusiastic—not only responding to the questions in the survey, but adding positive comments—other teachers indicated that they experienced difficulties in exercising their new roles in the instruction. The reports were as follows: (1) three teachers (6 percent) found it difficult to act as diagnostician and facilitator of instruction, (2) three (6 percent) found it difficult to organize well enough to advantageously implement the individualized method, (3) six teachers (13 percent) did not consider the results worth the amount of work entailed, (4) eight teachers (17 percent) considered the number of papers to check as prohibitive, (5) ten teachers (21 percent) desired to return to a traditional approach, (6) three teachers (6 percent) desired a blend of individualized and traditional methods, and (7) three teachers (6 percent) stated that they would not recommend the instituting of an individualized science program to other schools. (See table 17, page 123.)

The teachers who spoke positively of the individualized programs reported the following results: (1) twenty-four
Table 17

FACULTY REACTIONS TO AN INDIVIDUALIZED SCIENCE PROGRAM

<table>
<thead>
<tr>
<th>Positive Replies</th>
<th>Negative Replies</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of Schools</td>
<td>Percent</td>
<td>Number of Schools</td>
</tr>
<tr>
<td>More effective in teaching science concepts</td>
<td>28</td>
<td>58</td>
<td>3</td>
</tr>
<tr>
<td>More work but worth it</td>
<td>19</td>
<td>40</td>
<td>3</td>
</tr>
<tr>
<td>Would recommend to others</td>
<td>24</td>
<td>50</td>
<td>6</td>
</tr>
<tr>
<td>Improvement noted by non-participating staff members</td>
<td>13</td>
<td>27</td>
<td>8</td>
</tr>
<tr>
<td>Unable to organize for effective results</td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Difficulty in accepting new role</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Not worth the work</td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Prohibitive increase in papers to check</td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Would like to return to traditional approach</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Would advise to avoid individualizing</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Negative effect seen on other classes</td>
<td></td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>
teachers (50 percent) recommended it to others as desirable to try on the basis of their successes, (2) twenty-eight teachers (58 percent) considered it more effective in teaching science concepts, (3) nineteen teachers (40 percent) deemed the extra work worthwhile, and (4) thirteen schools (27 percent) reported that non-participating staff members noted improvements in the students from the individual classes. (See table 17, page 123.)

Conclusions

An information survey sent to 173 schools was returned by 118 schools (68 percent). The replies indicated that in 70 schools (59 percent) a traditional science program was employed while in 48 schools (41 percent) an individualized approach was used. The findings enable certain conclusions to be made about the status of science education in the middle schools and junior high schools of Kentucky.

Schools with Traditional Science Programs

1. Most of the traditionally organized schools enrolled 100-200 pupils in each grade or 300-600 in the whole school.

2. General science was most often taught to the sixth grade, life science to the seventh grade, earth science to the eighth grades, and physical and other sciences taught to the ninth
grades, as recommended by the State Department of Education. Those teachers desiring to do so had selected a project science, which did not follow this format.

3. A variety of textbooks on the state adoption list were used in the traditional schools.

Schools with an Individualized Science Program

1. Among the individualized schools, the most common size was 100-200 pupils in each grade or 300-600 pupils in the whole school.

2. General science was most often taught to the sixth grade, with life science in the seventh grade, earth science in the eighth grade, and physical and other sciences optional in the ninth grade, as recommended by the State Department of Education.

3. More variation from the state guidelines was reported in schools with individualized science programs than was reported in those with traditional science programs.

4. Project science was used in the individualized schools more often than in the traditionally organized schools.
5. A greater variety of textbooks and resources was used in the schools following an individualized plan than in those following a traditional plan in teaching science.

6. The individualized programs had been in existence in most cases for two to five years with extremes of less than one year to sixteen years. Fewer schools had begun individualized programs within the last two years; more had begun them four years ago.

7. The individualized program was administered in sixty-two percent of the schools without the aid of a national support system.

8. A combination of five sources for financing the individualized plans was reported. The local school boards were listed most often with general funds of schools second, followed by departmental science funds, research funds, and personal funds. A need to seek funding from sources other than local ones was not apparent.

9. Combinations of psychomotor, cognitive, and affective behavioral objectives were most often the basis of the individualized plans. The
programs were most successful in meeting the affective needs of students.

10. A variety of strategies was used for the implementation of the individualized programs. Most schools reported the use of two to five strategies though there was a range of one to eleven reported.

11. The number of strategies reported were not necessarily deciding factors in the success of the program. Some teachers reporting a few strategies found the program more successful than those using a greater number of strategies. Comparison of positive results in respect to the number of strategies used indicated that a plan using four to six strategies was the most effective.

12. An individualized program required more equipment and materials of all kinds, according to replies from most schools.

13. The grading methods of individualized schools was predominantly letter grades of A B C D F with 81 percent of the respondent schools using this means of reporting to parents. Some schools combined this with other methods.
14. Teachers from most of the schools gave positive evaluations of the individualized science programs with 98 percent of them finding the individualized approach moderately or definitely successful.

15. The success of the individualized method in the cognitive area was cited by 26 percent of the respondents; the success in the affective area was cited by 49 percent of the respondents.

16. Beneficial effects of the science program in the individualized schools were reported; improvement of the attitudes of pupils was reported by 71 percent of the school officials; and more self-discipline in the performance of pupils was noted by 65 percent.

17. The majority of faculties reacted favorably to the individualized science programs with 58 percent of the teachers considering them more effective in developing science concepts; 50 percent of them recommended such programs to other science departments.

18. Twenty-one percent of the participants desired to return to a traditional program.

19. School size may or may not be a determinant of decisions to use an individualized
plan. The individualized science programs were found in schools of sizes listed as:
(1) 27 percent of the schools enrolled more than 900 pupils, (2) 29 percent of the schools enrolled 600-900 pupils, (3) 29 percent of the schools enrolled 300-600 pupils, and (4) 15 percent enrolled 100-300 pupils.

20. The developmental level of the pupils would be a suitable subject for a later study of the relative effectiveness of individualized science programs in certain grades.

According to Arthur Combs, well-known psychologist, "Schools which have not produced self-directed citizens have failed everyone." The data collected in this study indicated the individualized science programs in Kentucky's middle and junior high schools have contributed to the development of self-direction in their pupils.
APPENDICES
APPENDIX A

COVER LETTER TO PARTICIPATING SCHOOLS
Dear Fellow Educator,

I am collecting information about the use of individualized science programs in Kentucky's middle and junior high schools. This study is part of a project for the Specialist in Education Degree from Western Kentucky University.

I would greatly appreciate the time you take to answer or to have some of your personnel answer the questions in the enclosed questionnaire.

Please return the answered form in the enclosed self-addressed envelope.

Thank you for sharing your time and information with me.

Yours gratefully,

Rita S. Byars
APPENDIX B
INFORMATION SURVEY
INFORMATION SURVEY

Name of school _____________________________ Address _____________________________

Name of person replying to survey _____________________________ Position _____________________________

PLEASE PROPER RESPONSES: CIRCLE GRADRES WHICH APPLY

1. How is your school organized?______ graded _____ ungraded
   _____ as a middle school 5 6 7 8 9
   _____ as a junior high school 5 6 7 8 9

2. How many students are enrolled in each grade?
   fewer than 100 5 6 7 8 9
   100 to 200 5 6 7 8 9
   200 to 300 5 6 7 8 9
   more than 300 5 6 7 8 9

3. What kind of science is taught at each level?
   life science 5 6 7 8 9
   earth science 5 6 7 8 9
   physical science 5 6 7 8 9
   general science 5 6 7 8 9
   _____ other 5 6 7 8 9 (please name)

4. What are the major textbooks used?
   ______________ 5 6 7 8 9
   ______________ 5 6 7 8 9
   ______________ 5 6 7 8 9
   ______________ 5 6 7 8 9

5. Do you teach any of the following projects in science classes?
   BSCS Biological Science Curriculum Study 7 8 9
   CBA Chemical Bond Approach (Houghton-Mifflin) 7 8 9
   ESCP Earth Science Curriculum Study (Houghton-Mifflin) 7 8 9
   HPP Harvard Project Physics 7 8 9
   IPS Introductory Physical Science 7 8 9
   PSSC Physical Science Study Committee Physics 7 8 9
   SSSP Secondary School Science Project 7 8 9
   ESS Elementary Science Study (McGraw-Hill) 5 6 7 8 9
   IIS Ideas and Investigating in Science (Prentice-Hall) 5 6 7 8 9
   ISCP Interaction Science Curriculum Project (Rand-McNally) 5 6 7 8 9
   ISCS Intermediate Science Curriculum Study (Silver Burdette) 5 6 7 8 9
6. Do you use an individualized approach for your science program? 
   ____yes  ____no; if yes, for how many years?_______

IF YOU ANSWERED YES TO #6, PLEASE PROCEED TO THE REMAINING QUESTIONS.

7. Did you use one of the following systems for dispensing your program? 
   IGE Individually Guided Education 5 6 7 8 9 
   IPI Individually Prescribed Instruction 5 6 7 8 9 
   PLAN Program for Learning in Accordance with Needs 5 6 7 8 9 

8. How is your individualized program financed? 
   ____departmental funds  ____personal funds 
   ____general school funds  ____local board of education 
   ____research project: ____Federal; ____State 

9. What responses were most often observed among participating students? 
   more self-discipline in study habits 5 6 7 8 9 
   more achievement in science 5 6 7 8 9 
   better attitudes toward science 5 6 7 8 9 
   better behavior in class 5 6 7 8 9 
   no observable changes in behavior 5 6 7 8 9 

10. What behavioral objectives do you emphasize most in planning your program? 
    5 6 7 8 9 cognitive (knowledge, comprehension, application, analysis, synthesis, evaluation) 
    5 6 7 8 9 affective (receive, respond, value, organize, characterize) 
    5 6 7 8 9 psychomotor (limitation, manipulation, precision, articulation, naturalization) 
    5 6 7 8 9 combination of all three
11. What strategies are included in your program?

<table>
<thead>
<tr>
<th></th>
<th>activity centers</th>
<th>learning sequences</th>
<th>contracts</th>
<th>little theatres</th>
<th>&quot;game&quot;tables</th>
<th>media corners</th>
<th>information booth</th>
<th>phase electives</th>
<th>interest centers</th>
<th>programmed packets</th>
<th>learning centers</th>
<th>supplementary activities</th>
<th>team learning groups</th>
<th>other</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>56789</td>
<td>56789</td>
<td>56789</td>
<td>56789</td>
<td>56789</td>
<td>56789</td>
<td>56789</td>
<td>56789</td>
<td>56789</td>
<td>56789</td>
<td>56789</td>
<td>56789</td>
<td>56789</td>
<td></td>
</tr>
</tbody>
</table>

12. In comparing individualization with your old plan of teaching, what materials are required?

<table>
<thead>
<tr>
<th></th>
<th>more laboratory equipment</th>
<th>more varied kinds of laboratory equipment</th>
<th>fewer setups at a time for each different experiment</th>
<th>more setups at a time for each different experiment</th>
<th>number of lessons to prepare decreased</th>
<th>number of lessons to prepare increased; __ by 3; __ by 5</th>
<th>number of sheets of laboratory activities increased</th>
<th>amount of hardware (tape players, etc.) increased</th>
<th>amount of chemicals and expendable items increased</th>
<th>little or no change in quantity of materials</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>56789</td>
<td>56789</td>
<td>56789</td>
<td>56789</td>
<td>56789</td>
<td>56789</td>
<td>56789</td>
<td>56789</td>
<td>56789</td>
<td>56789</td>
</tr>
</tbody>
</table>

13. How do you grade your students?

<table>
<thead>
<tr>
<th></th>
<th>A, B, C, D, F</th>
<th>Satisfactory or Unsatisfactory</th>
<th>Levels with letters (Ex. 1-A, 2-A, etc.)</th>
<th>Attitude, effort and achievement</th>
<th>Achievement only</th>
<th>Achievement in relation to native ability</th>
<th>Written progress reports</th>
<th>Progress reports at parent conferences</th>
<th>other</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>56789</td>
<td>56789</td>
<td>56789</td>
<td>56789</td>
<td>56789</td>
<td>56789</td>
<td>56789</td>
<td>56789</td>
<td></td>
</tr>
</tbody>
</table>

14. How do you rate the overall success of your program in terms of meeting objectives?

<table>
<thead>
<tr>
<th></th>
<th>definitely successful</th>
<th>moderately successful</th>
<th>definitely unsuccessful</th>
<th>unable to judge</th>
<th>too early to judge</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>56789</td>
<td>56789</td>
<td>56789</td>
<td>56789</td>
<td>56789</td>
</tr>
</tbody>
</table>
15. How do you evaluate your program?
   5 6 7 8 9 better student attitudes as indicated by attitude tests
   5 6 7 8 9 better student attitudes as indicated by teacher opinion
   5 6 7 8 9 higher scores in science on standardized tests (achievement)
   5 6 7 8 9 higher scores in science on teacher-made tests (achievement)
   5 6 7 8 9 more self-discipline in behavior and performance of pupils

16. What is the reaction of the faculty who use the individualized plan?
   ___ unable to organize well enough to make it effective
   ___ have difficulty in accepting their new roles as diagnostician, etc.
   ___ find it more effective in teaching science concepts
   ___ consider it more work for them but not worth it
   ___ consider it less work
   ___ consider it more work for them but worth it
   ___ would like to return to traditional approach
   ___ number of papers to check increased prohibitively
   ___ would recommend it to others as good to try
   ___ would advise others to avoid individualizing the science classes

17. Were non-participating staff members able to see differences in the pupils?
   ___ no;  ___ yes, for the better;  ___ yes, for the worse
APPENDIX C

LIST OF RESPONDENT SCHOOLS
RESPONDENT SCHOOLS

The following is a list of all schools who replied to the information survey. Each public and non-public school is listed under the public school district in which it is located; each independent district is listed under the county district in which it is located.

ADAIR
John Adair Middle School . . . . . . . . . . Columbia

ALLEN
Allen County Middle School . . . . . . Scottsville

ANDERSON
Anderson County Junior High School . . Lawrenceburg

BALLARD
Ballard Memorial Middle School . . . . . Barlow

BARREN
Hiseville Junior High School . . . . . . Hiseville
Park City Junior High School . . . . . Park City
Temple Hill Junior High School . . . . . Glasgow
Glasgow Independent
Glasgow Junior High School . . . . . . Glasgow

BOONE
Ockerman Junior High School . . . . . Florence

BOURBON
Millersburg Military Institute Junior School .
Millersburg
Paris Independent
Southside Middle School . . . . . . . . . Paris

BOYD
Ashland Independent
Putnam Junior High . . . . . . . . . Ashland
<table>
<thead>
<tr>
<th>County</th>
<th>School</th>
<th>City</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOYLE</td>
<td>Danville Independent</td>
<td>Danville</td>
</tr>
<tr>
<td>BREATHITT</td>
<td>Sebastion Middle School</td>
<td>Jackson</td>
</tr>
<tr>
<td>BULLITT</td>
<td>Hebron Junior High School</td>
<td>Shepherdsville</td>
</tr>
<tr>
<td></td>
<td>Mount Washington Junior High School</td>
<td>Mt. Washington</td>
</tr>
<tr>
<td></td>
<td>Shepherdsville Junior High School</td>
<td>Shepherdsville</td>
</tr>
<tr>
<td>CAMPBELL</td>
<td>Newport Independent</td>
<td>Newport</td>
</tr>
<tr>
<td>CARLISLE</td>
<td>Carlisle County Middle School</td>
<td>Bardwell</td>
</tr>
<tr>
<td>CHRISTIAN</td>
<td>Barkley Middle School</td>
<td>Ft. Campbell</td>
</tr>
<tr>
<td></td>
<td>Christian County Middle School</td>
<td>Hopkinsville</td>
</tr>
<tr>
<td></td>
<td>Hopkinsville Middle School</td>
<td>Hopkinsville</td>
</tr>
<tr>
<td></td>
<td>Ft. Campbell Junior High School</td>
<td>Ft. Campbell</td>
</tr>
<tr>
<td>CLARK</td>
<td>Belmont Junior High School</td>
<td>Winchester</td>
</tr>
<tr>
<td></td>
<td>Conkwright Middle School</td>
<td>Winchester</td>
</tr>
<tr>
<td>DAVIESS</td>
<td>Burns Middle School</td>
<td>Owensboro</td>
</tr>
<tr>
<td></td>
<td>Daviess County Middle School</td>
<td>Owensboro</td>
</tr>
<tr>
<td></td>
<td>Owensboro Independent</td>
<td>Owensboro</td>
</tr>
<tr>
<td></td>
<td>Estes Middle School</td>
<td>Owensboro</td>
</tr>
<tr>
<td></td>
<td>Foust Middle School</td>
<td>Owensboro</td>
</tr>
<tr>
<td></td>
<td>Southern Middle School</td>
<td>Owensboro</td>
</tr>
<tr>
<td>ESTIL</td>
<td>Estil County Middle School</td>
<td>Irvine</td>
</tr>
<tr>
<td>FAYETTE</td>
<td>Beaumont Junior High School</td>
<td>Lexington</td>
</tr>
<tr>
<td></td>
<td>Crawford Junior High School</td>
<td>Lexington</td>
</tr>
<tr>
<td></td>
<td>Leestown Junior High School</td>
<td>Lexington</td>
</tr>
<tr>
<td></td>
<td>Miller Middle School</td>
<td>Lexington</td>
</tr>
<tr>
<td></td>
<td>Tates Creek Junior High School</td>
<td>Lexington</td>
</tr>
<tr>
<td></td>
<td>The Lexington School</td>
<td>Lexington</td>
</tr>
<tr>
<td>County</td>
<td>School Name</td>
<td>City</td>
</tr>
<tr>
<td>------------</td>
<td>------------------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>FRANKLIN</td>
<td>Bondurant Junior High</td>
<td>Frankfort</td>
</tr>
<tr>
<td></td>
<td>Frankfort Independent</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Good Shepherd Junior High School</td>
<td>Frankfort</td>
</tr>
<tr>
<td>GRAVES</td>
<td>Mayfield Independent</td>
<td>Mayfield</td>
</tr>
<tr>
<td></td>
<td>Mayfield Middle School</td>
<td></td>
</tr>
<tr>
<td>GRAYSON</td>
<td>Grayson County Middle School</td>
<td>Leitchfield</td>
</tr>
<tr>
<td>GREENUP</td>
<td>Russell Independent</td>
<td>Flatwoods</td>
</tr>
<tr>
<td></td>
<td>Russell Middle School</td>
<td></td>
</tr>
<tr>
<td>HANCOCK</td>
<td>Hancock County Middle School</td>
<td>Lewisport</td>
</tr>
<tr>
<td>HARDIN</td>
<td>Hardin Central Junior High School</td>
<td>Cecilia</td>
</tr>
<tr>
<td></td>
<td>James T. Alton Middle School</td>
<td>Vine Grove</td>
</tr>
<tr>
<td></td>
<td>Fort Knox High School</td>
<td>Ft. Knox</td>
</tr>
<tr>
<td></td>
<td>Macdonald Middle School</td>
<td>Ft. Knox</td>
</tr>
<tr>
<td></td>
<td>Elizabethtown Independent</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Talton K. Stone Junior High School</td>
<td>Elizabethtown</td>
</tr>
<tr>
<td>HARRISON</td>
<td>Harrison County Junior High School</td>
<td>Cynthiana</td>
</tr>
<tr>
<td>HENDERSON</td>
<td>Henderson Independent</td>
<td>Henderson</td>
</tr>
<tr>
<td></td>
<td>Barret Middle School</td>
<td>Henderson</td>
</tr>
<tr>
<td></td>
<td>Henderson County Middle School</td>
<td>Henderson</td>
</tr>
<tr>
<td>HENRY</td>
<td>Henry County Middle School</td>
<td>New Castle</td>
</tr>
<tr>
<td>HOPKINS</td>
<td>Madisonville Junior High School</td>
<td>Madisonville</td>
</tr>
<tr>
<td></td>
<td>Seminary Middle School</td>
<td>Madisonville</td>
</tr>
<tr>
<td>JEFFERSON</td>
<td>A Conway Middle School</td>
<td>Louisville</td>
</tr>
<tr>
<td></td>
<td>Brown School</td>
<td>Louisville</td>
</tr>
<tr>
<td></td>
<td>Carrithers Middle School</td>
<td>Jeffersonville</td>
</tr>
<tr>
<td></td>
<td>David Williams Middle School</td>
<td>Louisville</td>
</tr>
<tr>
<td></td>
<td>Duvalle Middle School</td>
<td>Louisville</td>
</tr>
</tbody>
</table>
Frost Middle School ................. Louisville
Holy Angels Academy ................. Louisville
Lassiter Middle School .......... Louisville
Newburg Middle School .......... Louisville
Parkland Middle School .......... Louisville
Samuel V. Noe Middle School ...... Louisville
Southern Middle School .......... Louisville
T. T. Knight Middle School ...... Louisville
Western Middle School .......... Louisville
Anchorage Independent
Anchorage Independent School .... Anchorage

JESSAMINE
Jessamine County Junior High School . Nicholasville

KENTON
Erlanger Independent
Tichenor Middle School ........... Erlanger

KNOX
Knox County School .............. Barbourville

LARUE
Larue County Junior High School .. Hodgenville

LAUREL
Hazel Green Junior High School ... East Bernstadt
Lily Junior High School .......... Lily
London Christian Academy ......... London
London Junior High School ....... London

LOGAN
Russellville Independent
Russellville Middle School ....... Russellville

MADISON
Berea Independent
Berea Community School ........... Berea

MARION
Lebanon Junior High School ...... Lebanon
St. Charles Junior High School .. Lebanon

MASON
Mason County Middle School ...... Maysville
Maysville Independent
Maysville Junior High School ... Maysville
MCCracken
Heath Middle School .................. West Paducah
Reidland Middle School ................ Paducah
Brazleton Junior High ................ Paducah
Jetton Junior High School ............. Paducah

Meade
Brandenburg Middle School ............ Brandenburg

Morgan
Morgan County Middle School .......... West Liberty

Muhlenberg
Hughes-Kirk Junior High School ........ Beechmont

Nelson
Bloomfield Junior High School ........ Bloomfield
New Haven Junior High School .......... New Haven
Bardstown Independent
Bardstown Transitional School .......... Bardstown

Oldham
Oldham County Middle School .......... Buckner
St. Francis School ..................... Goshen

Pendleton
Pendleton Middle School ............... Falmouth

Pike
Virgie Junior High School ............. Virgie

Powell
Powell County High School ............. Stanton

Pulaski
Somerset Independent
O. M. Meece Middle School .......... Somerset

Shelby
Shelby County East Middle School ....... Shelbyville
Shelby County West Middle School ...... Shelbyville

Simpson
Franklin-Simpson Middle School ........ Franklin
TAYLOR
Taylor County Middle School . . . . . . . . . . Campbellsville
Campbellsville Independent
Campbellsville Middle School . . . . . . . . . . Campbellsville

TRIGG
Trigg County Middle School . . . . . . . . . . Cadiz

UNION
Morganfield Junior High School . . . . . . . . Morganfield
Uniontown Junior High School . . . . . . . . . Uniontown

WARREN
Cumberland Trace Elementary . . . . . . . . Bowling Green
Bowling Green Independent
Bowling Green Junior High . . . . . . . . . Bowling Green

WASHINGTON
Springfield Middle School . . . . . . . . . Springfield

WAYNE
Wayne County Middle School . . . . . . . . Monticello

WHITLEY
Whitley County Middle School . . . . . . . . Williamsburg

UNIDENTIFIED
Four schools reported without names and addresses for identification.
BIBLIOGRAPHY
BIBLIOGRAPHY

BOOKS


PERIODICALS


Koepsel, Evelyn A. "The Effectiveness of Individually Guided Education or the Development of Self-Esteem in Middle School Students." Dissertation Abstracts (June 1976): 7954-A


Kentucky Department of Education. Letter from Frank Howard, State Science Consultant, 8 October 1976. (Type-written.)
