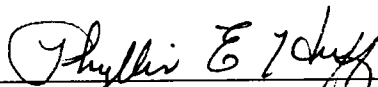
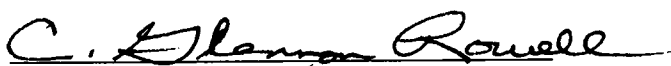


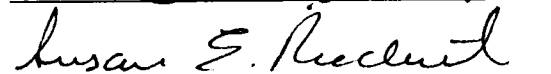
To the Graduate Council:

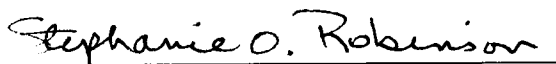
I am submitting herewith a dissertation written by Alan A. Hazari entitled "A Survey of Specific Individualized Instruction Strategies in Elementary Science Methods Courses in Tennessee Teacher Education Institutions." I have examined the final copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Education, with a major in Education.


Phyllis Huff, Major Professor

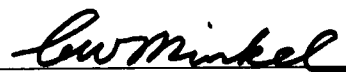
We have read this dissertation
and recommend its acceptance:







Accepted for the Council:


Associate Vice Chancellor and
Dean of The Graduate School

**A Survey of
Specific Individualized Instruction Strategies
in Elementary Science Methods Courses
in Tennessee Teacher Education Institutions**

A Dissertation

Presented for the

Doctor of Education

Degree

The University of Tennessee, Knoxville

Alan A. Hazari

December 1997

DEDICATION

To my parents, my brothers and my sisters

*To my brother George
who started me on the road
to the doctorate degree back in 1964*

*To my wife Marcelle
and our three children
Jessica, Patrick and Nicole
for their patience, understanding and encouragement*

*To Arlene Garrison
who has done everything possible to
“get me graduated”*

ACKNOWLEDGMENTS

There are many people to whom I owe my deepest gratitude for their friendship and support throughout my doctoral program. I am profoundly grateful to my dissertation committee chair Dr. Phyllis Huff for her perceptive guidance and help throughout the dissertation process. I would also like to extend my thanks to my dissertation committee: Dr. Glennon Rowell, for introducing me to the Individualized Instruction Program at the University of Tennessee, Knoxville and for his continued support; Dr. Stephanie Robinson who gave me insight, information and counsel and insisted that my dissertation be significant to myself and to science education as a whole; and Dr. Susan Riechert, for her generous assistance especially with the statistical analysis of the data.

A special thanks to Dr. Ted May, a former classmate and a good friend, who helped me tremendously with the writing and refining of the Tennessee Survey.

I also appreciate the assistance and friendship of Dr. Laura Barden who got me started in the Ed.D. program; Dr. Claudia Melear and Dr. Charmaine Mamantov, both of whom helped with the survey; Dr. Arlene Garrison, who proofread the dissertation several times; and Dr. Sarah Dugger for her encouragement.

I want to thank the administration, faculty and staff of the chemistry department at the University of Tennessee, Knoxville, especially, Dr. William Bull, for the support and work flexibility provided during my doctoral program.

Finally, I am deeply grateful for the help, patience and love of my family.

ABSTRACT

The purpose of the study was to determine the status of individualized science instruction in Tennessee teacher education institutions. Specifically, the study sought to investigate the extent of teaching about and/or use of 31 strategies for individualizing instruction in elementary science teaching methods courses. The individualized instruction frameworks, with strategies for individualizing instruction, were developed by Rowell, et al. in the College of Education at the University of Tennessee, Knoxville.

A review of the literature on the preparation of preservice elementary science teachers for individualized instruction in K-8 classrooms revealed very limited research. This investigation sought to identify how the elementary science teacher educators prepared their preservice elementary science teachers to (1) learn about the children they will teach, (2) determine differences among learners, (3) plan for individualized science instruction in the elementary school classroom, and (4) help attend to individual student differences.

The researcher prepared and used a 31-item survey to poll elementary science teacher educators in Tennessee. The participants included K-8 educators from 40 state-approved teacher education institutions. The high teacher education institution response rate (72.5 %) brought input from institutions of varying sizes, operated privately or publicly across the state of Tennessee.

In general, Tennessee elementary science teacher educators reported that they tended to teach about and/or use a *fair* number of the 31 individualized instruction

strategies that involve both *learning about K-8 students and their differences*. On the other hand, many of these educators provided preservice teachers with *quite a bit* of the strategies that *lead to planning for individualized science instruction and to attending to individual student differences*.

The two strategies that were the most taught about and/or used in elementary science methods by Tennessee educators were *planning for and maintaining an interactive classroom* and *implementing cooperative learning groups*. The two strategies with the lowest rating were *using a computer-tracking system to keep student profiles* and *using commercial tests to determine student placement*. Almost 42 % of the strategies in the survey were rated high to very high. This indicated that Tennessee educators do regularly include many of these 31 strategies in their elementary science methods courses. Examples include hands-on approach, cooperative learning, thematic and project teaching, learning centers, and the use of the Tennessee Instructional Model.

The study also showed that Tennessee science teacher educators in church-related institutions appeared to utilize more of the 31 strategies for individualizing instruction in K-8 classrooms than do the educators in non-church-related institutions. Tennessee K-8 teachers could be better prepared if exposed to as many different and effective pedagogical tools and practices as possible during their education and preparation. A strong science program rich in content and a variety of instructional strategies (including individualized instruction) is needed to help maximize the science learning opportunities for all Tennessee students.

TABLE OF CONTENTS

CHAPTER	PAGE
1. INTRODUCTORY SECTIONS	1
Introduction	1
The Problem	2
The Purpose	5
Rationale	5
Assumptions	9
Limitations	9
Delimitations	10
Definition of Terms	10
Organization of the Study	11
2. LITERATURE REVIEW	12
Introduction	12
Elementary Science Teacher Education: In General	12
Elementary Science Teacher Education: In Tennessee	15
Individualized Science Instruction	18
What is Individualized Instruction?	19
History of Individualized Instruction	20
Pre-1960s	20
1960s-1980s	21
Individualized vs. Conventional Instruction	24
What Aspects of Learning Can be Individualized?	25
Why Individualize?	26
Interest and Achievement	26
Kinds of Instruction	29
Science Attitudes	30
Teacher Preparation	30
Summary	32

3. METHODOLOGY	33
Introduction	33
Survey Development	34
The Pilot Survey	34
The Tennessee Survey	36
Survey Population	38
Survey Implementation	39
Survey Data Management and Analysis	40
 4. THE TENNESSEE SURVEY: DATA AND ANALYSIS	 43
Introduction	43
Survey Results: An Overview	43
Survey Ratings, Comments and Analysis	45
<i>Section I</i> : Learning About the Children	45
<i>Section II</i> : Determining Differences Among Learners	50
<i>Section III</i> : Planning for Individualized Instruction in the Elementary School Classroom	54
<i>Section IV</i> : Attending to Individual Student Differences	59
Demographic Subgroup Analysis	75
 5. CONCLUDING SECTIONS	 76
Introduction	76
Summary of the Study	76
The Research Questions	78
Research Question 1	78
Research Question 2	80
Research Question 3	81
Research Question 4	82
Implications	83
Recommendations for Further Study	84
Conclusion	85
 BIBLIOGRAPHY	 87

APPENDICES	98
Appendix A: UTK Individualized Instruction Program: Program Description and the 31 Frameworks	99
Appendix B: Five-Year Semester-by-Semester Schedule of Prospective UTK Elementary Education Teachers with Focus on Individualized Instruction	150
Appendix C: The Pilot Survey	152
Appendix D: The Tennessee Instructional Model (TIM): Modified Version Used by the UTK Individualized Instruction Program	159
Appendix E: The Tennessee Survey	162
Appendix F: Correlation of the Frameworks: UTK, The Pilot Survey, The Tennessee Survey	174
Appendix G: The Tennessee Survey: Demographic Data from Surveys	177
Appendix H: The Tennessee Survey: Elementary Science Teacher Educator Comments	180
VITA -- Alan A. Hazari	183

LIST OF TABLES

TABLE		PAGE
1	Type of Institutions and their Student Population	40
2	<i>Section I</i> Strategies: Means and Standard Errors (Confidence Intervals)	46
3	<i>Section I</i> Strategies: Analysis of Variance	49
4	<i>Section II</i> Strategies: Means and Standard Errors (Confidence Intervals)	51
5	<i>Section II</i> Strategies: Analysis of Variance	53
6	<i>Section III</i> Strategies: Means and Standard Errors (Confidence Intervals)	55
7	<i>Section III</i> Strategies: Analysis of Variance	58
8	<i>Section IV</i> Strategies: Means and Standard Errors (Confidence Intervals)	60
9	<i>Section IV</i> Strategies: Analysis of Variance	62
10	<i>Section I</i> Strategies: Significance and Correlation of Means at 0.05	66
11	<i>Section II</i> Strategies: Significance and Correlation of Means at 0.05	67
12	<i>Section III</i> Strategies: Significance and Correlation of Means at 0.05	68
13	<i>Section IV</i> Strategies: Significance and Correlation of Means at 0.05	69
14	<i>Section I</i> Strategies: Analysis of Variance for the Religious and Non-Religious Institutions	71

15	<i>Section II</i> Strategies: Analysis of Variance for the Religious and Non-Religious Institutions	72
16	<i>Section III</i> Strategies: Analysis of Variance for the Religious and Non-Religious Institutions	73
17	<i>Section IV</i> Strategies: Analysis of Variance for the Religious and Non-Religious Institutions	74
B.1	Five-Year Semester-by-Semester Schedule of Prospective UTK Elementary Education Teachers with Focus on Individualized Instruction	151
C.1	The Pilot Survey: Results	157
F.1	Correlation of the Frameworks	175
G.1	The Tennessee Survey: Demographic Data from Surveys	178
H.1	The Tennessee Survey: Elementary Science Teacher Educator Comments	181

LIST OF FIGURES

FIGURE	PAGE
1 <i>Section I</i> Strategies: Means and Standard Errors	47
2 <i>Section II</i> Strategies: Means and Standard Errors	52
3 <i>Section III</i> Strategies: Means and Standard Errors	56
4 <i>Section III</i> Strategies: Means and Standard Errors	61
5 Effect Test on All 31 Strategies	65
6 <i>Section I</i> Strategies: Means and Standard Errors for the Religious and Non-Religious Institutions	71
7 <i>Section II</i> Strategies: Means and Standard Errors for the Religious and Non-Religious Institutions	72
8 <i>Section III</i> Strategies: Means and Standard Errors for the Religious and Non-Religious Institutions	73
9 <i>Section IV</i> Strategies: Means and Standard Errors for the Religious and Non-Religious Institutions	74

CHAPTER 1

INTRODUCTORY SECTIONS

Introduction

Today, education at all levels is under intense scrutiny. Nothing is more important to the economic and political well-being of a nation in the long run than having a well-educated populace. Quality education cannot exist without quality teachers (DeRose, et al., 1979).

Since teacher competency is related to the overall quality of educational programs, much attention has been and continues to be focused on teacher education and preparation. Training teachers has been the subject of criticism and concern among educators and lay people as well. If improvements are to be made in teacher education programs, there is a reasonable need to determine the status of the existing programs and indicate directions of change.

To the education community the new century heralds a time of scientific literacy for all students, carrying with it new ways of reflecting about the role of teachers, learning environments, and the nature of student and teacher learning. Schools and higher education institutions, as well as professional societies, are taking a good look at how best to prepare and support science teachers to teach today's and tomorrow's students. Underlying many of these endeavors are the themes and concepts represented in the National Science Education Standards published by the National Research Council (NRC) in 1996. The standards provide guidelines and content for creating learning environments that will improve the scientific literacy of *all* students.

Science is perceived as a neglected subject in many elementary schools in the U.S.

Many elementary school teachers feel unqualified and uncomfortable when asked to teach it (Barrow, 1987; Whybrew, 1982). In 1985 Stronck conducted a survey of over 1,000 elementary science teachers in British Columbia to determine their perceptions of needed revisions in teacher education programs. A majority of the respondents did not feel that their college work (preservice teacher education program) had prepared them to teach science (Stronck, 1985).

Science teachers today have the task of accommodating a much broader range of student abilities, interests, and needs than ever before. A typical class of twenty-five (or more) elementary students has many commonalities but there are also tremendous differences among the students. The NRC's Standards for Science Teaching remind teachers to "recognize and respond to student diversity and encourage all students to participate fully in science learning" (NRC, 1996, p. 32). One way for a teacher to provide effective instruction for a class of students with a wide range of abilities and needs lies in individualized instruction. Individualization of the instruction provides alternatives to fit the learning styles, individual needs and capacity of the learner. By contrast, conventional or traditional teaching is a "teacher-centered, (class-oriented), lecture-demonstration, cookbook laboratory approach to teaching" (Marchese, 1977, p. 699).

Preparing prospective elementary school teachers to properly individualize science instruction could help solve the problems of differing student abilities and interests and could produce efficient learning in science (Knapp, 1982; Marchese, 1977).

The Problem

In this study, there was an investigation of the status of the preparation of pre-service teachers for individualizing science instruction in grades K-8 classrooms. More specifically, this investigation sought answers to the following *four questions* which were

asked of K-8 science teacher educators from 40 (of 41) state-approved teacher education institutions in Tennessee. The University of Tennessee, Knoxville (UTK), where the targeted program originated, was excluded from this study. The program in question is the UTK Individualized Instruction Program which was developed in the College of Education by Rowell, et al. (1995). A comprehensive description of the program is in *Appendix A*.

Started in 1995, the UTK Individualized Instruction Program is a collaborative model that incorporates teachers and administrators from the Knox County Public Schools in East Tennessee. The curriculum (coursework) is delivered by *a team* of UTK *education* and *content (Arts & Sciences)* professors at four public school sites. This program addresses the problems of inadequate preparation time and the integration of courses and experiences, thus providing the opportunity for strong mentoring relationships. The focus is on *individualized instruction* that aligns theory with practice, promotes effective teaching and represents a significant departure from the typical teacher preparation program.

The UTK Individualized Instruction Program's goals and objectives are focused on four beliefs. These are: (1) All children should be treated as individuals and are capable of learning, (2) each student has a unique set of needs and individual learning styles, (3) teachers can be taught specific strategies to incorporate individualized instruction at all grade levels and in all subjects (including science), and (4) teachers can be taught specific techniques to develop and implement grouping practices that would enhance the students' learning styles.

A series of 31 frameworks (*Appendix A*) has been developed to introduce concepts and techniques necessary for the implementation of the above-mentioned beliefs (Rowell, et al., 1995). The frameworks include themes and strategies that cut across and unify the large array of experiences students get in core education courses, methodology courses,

and internship. While the strategies are not limited to programs that emphasize individualized instruction, the *emphasis is on detecting differences and following through with individualized instruction in small group settings*. The frameworks basically define or explain the meaning of the individualized instruction strategy, its value, and basic procedures for implementing it.

A five-year semester-by-semester schedule of prospective UTK elementary education teachers *with special focus on individualized instruction* is in Table B.1.

Based on the strategies (frameworks) for individualized instruction identified in the UTK Individualized Instruction Program, the research questions are:

1. What is the extent of preservice elementary science teachers' preparation in specific strategies for learning about the children they will teach?
2. What is the extent of preservice elementary science teachers' preparation in specific strategies on how to determine differences among learners?
3. What is the extent of preservice elementary science teachers' preparation in specific strategies that lead to planning for individualized instruction in the elementary school classroom?
4. What is the extent of preservice elementary science teachers' preparation in specific strategies that help attend to individual student differences?

Although several status studies have been conducted on various aspects of elementary teacher education programs, there is little available research to provide answers to the above questions. Availability of information relative to the present components of elementary science teacher education programs is essential for those wishing to accomplish productive program changes in their elementary science methods courses.

The Purpose

The purpose of this study was to investigate the extent of teaching about and/or use of specific strategies for individualizing instruction in elementary science methods courses. The selection of strategies used to survey the elementary science teacher educators in the state of Tennessee was based on the frameworks (*Appendix A*) included in the UTK Individualized Instruction Program.

This study sought to identify how the elementary science teacher educators prepared their preservice elementary science teachers to: (1) Learn about the children they will teach, (2) determine differences among learners, (3) plan for individualized instruction in the elementary school classroom, and (4) help attend to individual student differences. Findings are to be shared with interested researchers and science methods educators through professional journal articles and presentations at professional meetings.

Rationale

Literature on preservice science teachers shows that the preparation of teachers is inadequate. In 1985, six techniques and topics were identified by British Columbia grades 1-10 preservice science teachers as the most inadequately emphasized in their preservice training (Stronck 1985). These were: Safety, reading and writing in science, problems of science teaching, science curriculum development, and the use of community resources. Gilbert (1992) described a study which examined the content of secondary science methods courses in 58 institutions in three mid-western states. Many topics and strategies (e.g., safety, nature of science, concept map, cooperative learning) were mentioned as being covered. However, only a few self- instructional (or individualized instruction) modules were introduced and used by the science teacher educators in the courses. In

another study, 41 preservice elementary teachers were surveyed on their perceptions of the impact of their teacher preparation program upon their success in student teaching. Following student teaching these teachers were found to exhibit "less confidence when using nontraditional approaches to teaching, particularly...individualized instruction,..." (Gormley, et al. 1991, p. 1). In another study, Gee, et al. (1996), found that, in general, only a small number of elementary student teachers regularly incorporated innovative educational strategies in their science lessons.

In the 1970s and through the early 1980s, in a number of studies (Gallagher, 1970; Green, 1982; Kapuscinski, 1982; Marchese, 1977; Plewes, 1979; Shymansky, 1980; Willett, et al., 1983), there were comparisons of various aspects of individualized instruction with conventional teaching. A review of this literature shows that, compared with conventional teaching, individualized instruction

provides for greater student participation and acceptance of responsibility, ... (as well as) an increased ability for the student to evaluate his/her own progress. (Further,) individualized instruction attains just as much, and sometimes more, learning of subject matter (science)... (and) seems to produce a more positive attitude toward the students themselves, the school and the subject (science) (Marchese, 1977, p. 701).

An analysis of the literature on science teaching and learning for the past 30 years showed that: (1) There is deterioration in student interest and achievement in science, (2) because children are different, there is a need for different kinds (individualized as well as small group) of science instruction (3) individualized instruction seems to improve learning and student science attitudes, and (4) teachers at all levels need to be properly trained in individualized instruction (Anderson & Butts, 1980; Ben-Chaim, et al., 1994; Campbell,

1978; DeRose, et al., 1979; Fraser-Abder, 1992; Green, 1982; Hedges, 1975; Johnston, 1990; Jones, 1977; Lunetta & Dyrli, 1971; Newport, 1973; NSF, 1975; O'Neil, 1991; O'Toole, 1968; Yager & Penick, 1984).

What are the attributes of an elementary science teacher education program that focuses on individualized instruction? To find the answer, an ERIC database search was conducted; however, no "real" research studies were identified by the search. In one such study, Roach and Hammond (1981) cited that at Cardiff, a British educational establishment, individualized instruction units were used to teach Keller Plan (a.k.a. the *Personalized System of Instruction* or *PSI*) principles to education students. [*PSI* is "a learning-teaching system in which individual students go through parts of a course of study at their own pace; with mastery required at every step; with guidance and encouragement, and provisional evaluation by selected peers; and with maximal reward upon completion of their tasks" (Keller 1981, p. 37)]. In 1985, Welker described a science course for prospective elementary school teachers which used the Keller approach to provide individualized instruction (Welker, 1985). Daus (1986), at Utah State University, reported on an elementary science methods course with a hands-on individualized curriculum.

The lack of "real" studies comes as no surprise. Individualized instruction (*as a truly systematic school-wide learning system*) is a somewhat recent (early 1960s) educational innovation. Altman (1981) listed nine general reasons that cause curricular or pedagogical innovations to fail. These are:

- (1) A lack of sustained institutional support, (2) a lack of time for faculty to prepare, (3) faculty fears of new programs or procedures, (4) the tendency of a regression toward the mean of established programs, (5) faculty unwillingness to evaluate and be evaluated, (6) time required for ongoing

duties prohibits innovation, (7) curricular or pedagogical innovation ranks low in the academic reward structure, (8) lack of any accepted theory of reform for the curriculum, and (9) the idiosyncratic nature of innovation (Altman, 1981, pp. 23-24).

Individualized instruction usually requires more time, effort and materials than does conventional teaching (Jones, 1977; McAnarney, 1977; Zeitler, 1975). For many of these reasons, one can see that individualized instruction is less likely to receive strong backing from science teacher educators. As a result, teaching how to effectively individualize science instruction in the elementary school will not be a part of the preservice teacher's education, preparation and experience.

Individualization of instruction was designed to solve problems that are still with us today. If anything, students in schools are becoming even more diverse. "For effective science teaching in a diverse classroom, the teacher must create learning environments that are conducive to learning for all students" (Clark, 1996, p. 64). One of the eleven actions suggested by Clark (1996) to create a positive science classroom climate was "making provisions for as much *individualization* as possible" (p. 65). Studies have revealed that the major problem in many schools has not been due to the inappropriateness of any particular teaching method or strategy or to poor quality of any instructional materials. According to Baker and Goldberg (1970) and Plimmer (1981), the problem has been traced to the failure of many school systems to deal with the differing abilities, interests and demands of today's students. An individualized approach to improve curriculum skills would permit students to learn at their own pace and learning style.

The present study was therefore undertaken to provide information and useful instructional insights to guide preservice teacher educators as they prepare elementary science teachers to work with all students into the year 2000 and beyond. Maximizing the

learning opportunities for *all* students is instructing for success and is the symbol for *good and effective teaching*.

Assumptions

The researcher will make the following assumptions:

1. Quality science education in K-8 classrooms can be attained best through effective and adequate individualization of instruction.
2. The peculiarity of the individual student in terms of his/her needs, interests, abilities, rate and style of learning must be addressed in achieving instructional goals set by teachers and students.
3. There is a need to shift from the traditional teacher-directed and class-oriented instruction to individualized instruction to suit the diversity of current and future students (NRC, 1996).
4. Existing research is accurate concerning: (a) Preservice elementary science teacher education and (b) individualized science instruction.
5. The participants (Tennessee K-8 science teacher educators) will respond to the survey instrument openly and honestly.

Limitations

The use of a survey for data collection may exclude possible participants due to misinterpretation of questions. Differences in use of terminology may cause difficulties for some participants when answering the questions. The assumption has been made that the survey will be answered honestly by the participants.

The subjects for this study were K-8 science teacher educators in 40 (of 41; the University of Tennessee, Knoxville was excluded) state-approved teacher education institutions (programs) in Tennessee. The results of this study are not necessarily applicable to any other population of educators.

Programs like individualized education (or inclusive schooling) and gifted education will not be discussed here.

Delimitations

This study will be delimited to K-8 science teachers educators in Tennessee teacher education institutions. It is designed to reflect the extent of preparation for individualization of science instruction in elementary science methods teaching courses.

Definition of Terms

The following terms will be used throughout this study:

elementary level -- the term for a child's schooling from Kindergarten through 8th grade.

elementary science methods course -- a course with hands-on, process-oriented, and inquiry-based activities and appropriate science content to use with K-8 students.

individualized instruction -- a teaching strategy that suggests a flexible combination of various materials and procedures designed to meet the varying learning styles, needs, and characteristics of students in a class. It does not require an extensive one-to-one relationship, for it also makes provision for temporary groupings to foster dynamics, teamwork, and cooperation among students, who may or may not have the same abilities.

preservice teachers -- future teachers who are still working toward certification at a college or university.

science education -- the curriculum, strategies, and methodology used in the formal teaching and learning of scientific information.

teacher education institution -- any educational institution significantly concerned with professional education of teachers, whose program is appropriately recognized by state teacher certification agencies.

teacher preparation program -- a program or sequence of courses designed to prepare specifically for particular types of teaching positions and fulfill appropriate certification requirements for teaching.

Tennessee Instructional Model (TIM) -- an instructional strategy or model developed by the Tennessee State Department of Education. The model encompasses six specific instructional steps: (1) terminal objective, (2) instructional objective, (3) set, (4) instruction, (5) closure and (6) options for further instruction (Field, 1988; Tennessee Department of Education, 1984).

Organization of the Study

This study is divided into five chapters of which this, the *Introductory Sections* is the first. The following four chapters are Chapter 2, *Literature Review*, Chapter 3, *Methodology*, Chapter 4, *The Tennessee Survey: Data and Analysis*, and Chapter 5, *Concluding Sections*.

CHAPTER 2

LITERATURE REVIEW

Introduction

This chapter presents a summary of the research reports and publications related to elementary science teacher education (in general and in Tennessee, in particular) and the instructional strategy of individualized instruction. The summary of the extensive survey of literature is organized in this chapter under two basic headings: (1) Elementary science teacher education and (2) basic concepts, characteristics and merits of individualized science instruction.

Elementary Science Teacher Education: In General

For many years, teacher preparation programs across the country tended to be diverse in terms of the number and general types of experiences they provided students. Also, the information on science teacher education programs and their status was more in the form of reports and recommendations than actual practical changes. In 1968, the Research on Science Education Survey (ROSES) was the first major research effort to provide baseline data on the education of science teachers. The ROSES report helped introduce changes in preservice teacher programs. However, in the 1970s and 1980s, inservice programs got more attention than preservice science teacher education (Anderson & Mitchener, 1994).

Elementary (and high school) teachers need training that leaves them excited about science and ready to engage their students in active learning. However, current literature

on preservice elementary teachers shows that their preparation is inadequate. Stronck (1985) conducted a survey of over 1,000 teachers in British Columbia to determine their perceptions of needed revisions in teacher education programs. A majority of the respondents did not feel that their college work (preservice teacher education program) had prepared them to teach science. Six techniques and topics were identified by these grades 1-10 preservice teachers as the most inadequately emphasized in their preservice training. They were: Safety, reading and writing in science, problems of science teaching, science curriculum development, and the use of community resources.

In 1982, Mechling, Stedman, and Donnellan reported on a 45-institution, nationwide study on elementary teachers' perception of their preparation for teaching science. The authors found that in the typical science program at these institutions, process, methods and techniques were more stressed than science content. Gilbert (1992) described a study which examined the content of secondary science methods courses in 58 institutions in three mid-western states. Many topics and strategies (e.g., safety, nature of science, concept map, cooperative learning) were mentioned as being covered. However, only a few self-instructional (or individualized instruction) modules were introduced and used by the science teacher educators in the courses.

In another study, Gormley, et al. (1991) surveyed 41 preservice elementary teachers on their perceptions of the impact of their teacher preparation program upon their success in student teaching. Following student teaching these teachers were found to exhibit "less confidence when using non-traditional approaches to teaching, particularly ...individualized instruction,..." (p. 1). Gee, et al. (1996), reported that, in general, only a small number of elementary student teachers regularly incorporated innovative strategies in their science lessons. For these and other reasons, preparation of science teachers is now recognized as the focal point in science education reform (Brunkhorst, et al., 1993; DeRose, et al., 1979).

Several model science teacher education programs have been reported in the literature (Andersen & Gabel, 1981; Brunhorst, et al., 1993; DeTure, et al., 1990; Yager, 1988). In one study, Yager (1988) described five indicators of exemplary efforts and programs that illustrate his teacher education model. One such indicator is "... providing (preservice teachers with) multiple school experiences..." (p.1). At Indiana University, elementary science teacher preparation consists of three elements which include content, planning and field experiences (Andersen & Gabel, 1981). Brunhorst, et al. (1993) summarized the activities of the Salish Consortium, a group interested in developing collaborative models of science teacher preparation and development.

DeTure, et al. (1990) and MacMahan and Stevens (1993) reported on effective models to better prepare teachers by enhancing their content background. Integrated science courses were used along with a companion methods course to help the students be confident and prepared to teach science. Weiss (1994) found, in a nationwide survey, that poor or lack of science content still appears to be a major barrier for elementary teachers. Tolman and Campbell (1991) surveyed 321 institutions, all members of the American Association of Colleges for Teacher Education (AACTE), to compare science preparation requirements of preservice elementary teachers with 1983 National Science Teachers Association (NSTA) standards (Barrow, 1987; NSTA, 1983). Only 20 percent of the colleges have science content courses designed for elementary education majors. This was as predicted by a National Science Foundation (NSF) study that cited that "while science in elementary schools has been completely changed, most science courses for teachers at the college level have changed little or not at all" (NSF, 1975, p. 29). Science teaching techniques in 18 elementary teacher preparation programs in the state of Washington were investigated by Melchert (1990). The majority of the Washington institutions did not compare well with the above-mentioned NSTA standards for teacher preparation.

Many other different models of preservice science teacher education programs

exist and cover a wide spectrum of activities, topics and procedures. A number of these are described in Ben-Chaim, et al. (1994), Black (1994), Fraser-Abder (1992), Germann, et al. (1995), Reiter and Penick (1991), and Stepan, et al. (1995).

Elementary science teacher preparation programs are diverse and changing and will continue to be so. "Future K-8 teachers need a strong academic preparation in how to teach science. Their preservice program must prepare them to design hands-on, minds-on science activities, to know how to implement these lessons, and to be able to assess student performance during and after instruction is completed" (Barrow, 1992, p. 33). Teacher educators must remember that as knowledge of the profession grows, needs change and must be reinforced and reaffirmed at each stage of one's teaching career. Thus, strong preservice components are necessary and they must be cyclical in nature.

Elementary Science Teacher Education: In Tennessee

Tennessee has 41 state-approved teacher education institutions. They comprise public, church-related private, non-church-related private colleges and universities. About fifty percent of the Tennessee institutions are members of the American Association of Colleges for Teacher Education (AACTE). The lowest student enrollment in these institutions is about 300, the highest is about 26,000. The institutions generally follow the traditional teacher education model which include (1) liberal and general education, (2) an academic concentration or a major study, and (3) professional course work that includes student teaching and induction into classroom teaching (Anderson & Mitchener, 1994).

In October 1986, the Tennessee State Board of Education adopted nine principles setting forth a framework for the design of an improved teacher preparation system in Tennessee. The principles also identified the major areas of responsibility for higher education institutions, local school systems, and the state. One of the nine principles

involved research and inquiry to improve teaching and teacher education (Tennessee State Board of Education, 1993). A master plan is in place to improve Tennessee's higher education, including teacher preparation (Tennessee Higher Education Commission, (1987). In 1994, a report on Tennessee's progress toward meeting statewide higher education goals outlined in the 1989 Tennessee Challenge 2000 was prepared. In it, by the year 2000, the state of Tennessee will have higher education institutions that are ranked among the nation's best in teacher preparation (Tennessee Higher Education Commission, 1994).

A limited number of studies describe the activities of elementary teacher preparation programs in the state of Tennessee. Ayers (1981 and 1986) and Birdwell (1989) reported on the study of education graduates from Tennessee Technological University (in Cookeville, TN). The specific objective for the use of this longitudinal model was the evaluation and subsequent modification and improvement of the teacher education programs.

In 1991, Austin Peay State University (in Clarksville, TN) was one of seven U.S. programs recognized by the National Science Teachers Association's Search for Exemplary Preservice Elementary Science Programs (Reiter and Penick, 1991). These university programs exhibit many of the desired features of an ideal program as recommended by NSTA's Committee on Teacher Education. The features are:

- (1) A minimum of 12 hours of laboratory science courses especially designed for the elementary curriculum, (2) a special science methods course with appropriate content and hands-on activities, (3) lots of exposure to classroom science teaching, (4) instructors who are active, enthusiastic and professional and (5) opportunities for improving science literacy and attitudes toward science (Reiter & Penick, 1991, p. 22).

Relating to individualized instruction, the topic of this research study, the Reiter and Penick article cited a survey done at Austin Peay in 1980, where “ninety preservice teachers in preparatory classes at that university identified...meeting the individual instructional needs of students...” as one of the “competencies they wished to gain from their science education courses” (Reiter & Penick, 1991, p. 25).

Field (1988) described recent changes in elementary school science education in Tennessee. In 1984, the Comprehensive Education Reform Act (CERA) adopted by the Tennessee Legislature emphasized the need to improve science education in Tennessee (CERA, 1984). This was followed by the production and the implementation, in the mid-1980s, of the Tennessee Science Curriculum Framework. [This document was later revised in 1995 to be in alignment with national and state curriculum reform efforts, mainly the American Association for the Advancement of Science’s (AAAS) Benchmarks for Science Literacy and the National Science Education Standards (AAAS, 1993; NRC, 1996; Tennessee Department of Education, 1995)]. The science framework mandated the switch from a science program that was *reading*-oriented in 1975 to one that is *hands-on*-based (Field, 1988).

In 1986, the Center of Excellence for the Enrichment of Science and Mathematics Education at the University of Tennessee, Martin (UTM) made available for use a *Science Activities Manual K-6* as a classroom teacher hands-on guide toward the implementation of the state’s science framework. In addition, starting in 1987, the Elementary Science Education Institute (at UTM), “a research-based program that includes a unique combination of content instruction, field activity, and team leadership” (Prather & Hartshorn, 1989, p. 7), has helped many Tennessee elementary teachers use and implement hands-on science teaching methods in their classrooms (Field, 1988; Prather, et al., 1990).

Individualized Science Instruction

Students come to schools with tremendously different backgrounds and genetic matter, bringing their unique qualities, strengths and limitations, likes and dislikes, cultural environments, and experiential backgrounds to their classes (Keller, 1985; Stronk, 1980).

The goal of education in general, and science education in particular, is that *all* students learn regardless of their differences - whether academic or cultural (NRC, 1996). This is the main reason why educators must continue searching for techniques and strategies designed specifically to individualize the instruction provided to students. Maximizing the learning opportunities for *all* students will guarantee success in instructing the future generation.

"For effective science teaching in a diverse classroom (today), the teacher must create learning environments that are conducive to learning for all students" (Clark, 1996, p. 64). One of the eleven actions suggested by Clark (1996) to create a positive science classroom climate was "making provisions for as much *individualization* as possible" (p. 65).

Woodbury (1995) asked six *exemplary* fifth-grade teachers to describe the traits that made them a *good* teacher. "All the teachers mentioned their instructional abilities, good discipline, ability to modify instruction, and concern for the student" (Woodbury, 1995, p. 140). The specific teacher statements concerning modification of instruction and lessons were: "(1) Do not go straight by the book, (2) look for new materials, (3) hunt for new ideas, (4) make learning interesting, (5) read a lot, try to stay current, and (6) *individualize*" (the instruction) (Woodbury, 1995, p. 141).

Appropriate efforts and actions must take place as soon as children begin school, i.e., at the elementary (primary) school level (Johnston, 1990; Rice & Corboy, 1995). In 1980, Fred Keller, the founding father of the *Personalized System of Instruction (PSI)*,

said that "Currently,...educational reform" and support for individualized instruction "may reside within the field of elementary education" (Keller, 1981, p. 37). Most elementary school children do routinely use self-instructional materials and perform self-paced activities (Roach & Hammond, 1981). Children, at this early age, would benefit from good encounters and experiences with science through individual and/or group activities that are interesting, relevant and fun. Hopefully, these students would grow up liking and appreciating science more and would become science-literate citizens.

What is individualized instruction?

Definitions of individualization of instruction have varied widely among educators and lay people.

When pressed for a definition of individualization, some answers from the past include: (1) You should meet the needs of the students in your classroom, (2) take the student, as God made him/her, and his/her last teacher left him/her, and teach from that point forward, (3) it is a process rather than a method and (4) each student is unique and the school should attune the system to that uniqueness (Sandrin, 1987, p. 1).

In 1969, Ramsey and Howe broadly defined individualized instruction as an "attempt to provide a complete instructional program designed explicitly for each individual, taking into account his/her background experience, interests, and ability" (p. 73). To accomplish this, many of the individualized programs of the 1960s through the early 1980s (see p. 21) involved one-to-one, independent, programmed learning and computer-supported activities. In a number of these programs, students worked alone the

majority of the time.

In this study, individualized instruction is defined as *a teaching strategy that suggests a flexible combination of various materials and procedures designed to meet the varying learning styles, needs, and characteristics of students in a class. It does not require an extensive one-to-one relationship, for it also makes provision for temporary groupings to foster dynamics, teamwork, and cooperation among students, who may or may not have the same abilities.* This definition reflects today's increasing individual student variability (in the classroom) that must be dealt with appropriately if science instruction is to be maximally effective.

History of Individualized Instruction

Pre-1960s

"Examples of individualized instruction can be seen as far back as ancient Greece with the teachings of Socrates" (Betrus, 1995, p. 247). Around the turn of this century, three individualized instruction plans, the Pueblo (in 1888), the Dalton (in 1922) and the Winnetka (in 1920s-1930s), were developed (Rowntree, 1981). Both the Pueblo and Dalton plans allowed students to pace their own coverage of the courses using self-instruction units and various modes of grouping. In the Winnetka plan, "students progressed at their own rate through individualized workbooks prepared by their teachers. Skills were introduced only after the student has demonstrated his/her readiness" (Lunetta & Dyrli, 1971, p. 122).

The 1960s-1980s

It may be true that certain ways of individualizing instruction (e.g., tutoring, remedial teaching) have been developed since schools started to operate; but it is also revealed by research that it was only recently (in the early 1960s) that concepts and procedures for implementing a *truly systematic school-wide individualized learning system* evolved. Individualized instruction, returned, in one form or another, and was the wave of the 1960s. This wave crested in the 1970s.

In 1971 a special report published in "Education U.S.A" by the National School Public Relations Association (NSPRA) described certain major programs of individualized instruction which have been found effective in American school systems. The varied major individualized instruction programs included in the report are the following: (1) Program for Learning in Accordance with Needs (PLAN), (2) Individually Prescribed Instruction (IPI), (3) Individually Guided Education (IGE), (4) Individualized Math System (IMS), (5) Hawaii: Independent Study Program, (6) The Duluth Plan for Individualization, (7) Programmed Logic for Automated Teaching Operations (PLATO), and (8) Miami Springs: Personalized Learning. A brief description of each program follows.

(1) ***Program for Learning in Accordance with Needs (PLAN)*** -- is a 1966 joint effort of private research, private industry and public schools which operates in grades 1-12 in language arts, mathematics, science and social studies. It is an ungraded, learner-oriented, computer-supported program where objectives, content, rate and instructional materials are tailored to the individual student (NSPRA, 1971).

(2) ***Individually Prescribed Instruction (IPI)*** -- started in 1964 and offers K-6 individualized programs in reading, spelling and mathematics, science and social studies. It is based on a set of specific objectives correlated with diagnostic instruments, materials,

strategies and evaluation (NSPRA, 1971).

(3) ***Individually Guided Education (IGE)*** -- (developed 1965-71) provides a framework for individualizing instruction for elementary schools. It is a way of achieving and integrating concepts like non-gradedness and team teaching. *IGE* calls for significant teacher and student involvement of the curriculum design. Its aims are to develop and encourage independent student thinking. Building more effective language and number skills is done in the context of problem solving and learning how to learn (NSPRA, 1971).

(4) ***Individualized Mathematics System (IMS)*** -- (developed in 1971) is an inexpensive, grades 1-6 brightly illustrated mathematics curriculum. It provides diagnostic tests that enable the teacher to prescribe the specific topic, level and learning style appropriate for each student (NSPRA, 1971).

(5) ***Hawaii: Independent Study Program*** -- a program for elementary school in grades 2-6 designed not only to provide self-selected learning activities for the good students but also to help motivate students with learning problems. A student selects what he/she wants to study and how to go about it (NSPRA, 1971).

(6) ***The Duluth Plan for Individualization*** -- a 1964 K-12 program that uses a multimedia approach that puts the student under contract on each assignment. This plan attempts to identify and use both the personal learning styles of students and the individual styles of teachers (NSPRA, 1971).

(7) ***Programmed Logic for Automation Teaching Operations (PLATO)*** -- (1960) a computer-assisted instruction program which allows students to work at their own pace in an individualized way. PLATO has been used in many different subjects (NSPRA, 1971).

(8) ***Miami Springs: Personalized Learning*** -- a program that uses a college-type schedule that allows the student to choose when he/she wants to attend school, what classes he/she wants to take and how much work he/she wants to cover. In their work,

students use a wide range of materials, including Learning Activity Packets (LAPs), films, slides and other media (NSPRA, 1971).

An obvious deduction to be drawn from the special report is that individualization in schools has taken many forms ranging from the simplest kind of tutoring to sophisticated independent study programs involving programmed learning and computer services (NSPRA, 1971; Silberman, 1971).

Some of the *science* programs of the 1960s through the early 1980s (Kyle, et al., 1982) include the following: (1) Conceptually Oriented Program in Elementary Science (COPES), (2) Elementary Science Study (ESS), (3) Individualized Science (IS), (4) Individualized Science Instructional System (ISIS), (5) Intermediate Science Curriculum Study (ISCS), (6) Science: A Process Approach (SAPA), and (7) Science Curriculum Improvement Study (SCIS). A brief description of each program follows.

(1) ***Conceptually Oriented Program in Science (COPES)*** -- a K-6 spirally constructed program which involves a series of learning experiences leading to an understanding of five major conceptual schemes. *COPES* features a hands-on curriculum involving active exploration in the learning of the concepts (Barnard, 1971; Victor, 1980).

(2) ***Elementary Science Study (ESS)*** -- a hands-on discovery-based approach which correlates well with interdisciplinary science study for grades K-9 students (DeBoer, 1991; Elementary Science Study, 1968; Victor, 1980).

(3) ***Individualized Science (IS)*** -- a science program for grades K-8 designed to involve the learner in dynamic, hands-on scientific investigations dealing with relevant themes (Klopfer, 1971; Victor, 1980; Zeitler, 1975).

(4) ***Individualized Science Instructional System (ISIS)*** -- a series of individualized minicourses for junior high schoolers covering topics of practical

significance (Burkman, 1974; Chiappetta, 1976).

(5) *Intermediate Science Curriculum Study (ISCS)* – a project designed for students in grades 5 through 12. The *ISCS* materials include independent study, lab investigations, discussion sessions, and self-pacing materials (Burkman, 1970; McDuffie & DeRose, 1982).

(6) *Science - A Process Approach (SAPA)* – an elementary science curriculum consisting of modules structured around the various processes of science (DeBoer, 1991; Victor, 1980).

(7) *Science Curriculum Improvement Study (SCIS)* – an elementary science course focused on both the processes and products of science and made extensive use of the laboratory (DeBoer, 1991; Karplus & Thier, 1965, Science Curriculum Improvement Study, 1985; Victor, 1980).

Summing up, all these programs and approaches that are designed to individualize instruction imply a shift from teacher-directed, group-oriented instructional strategies to an individualized and personalized instruction. This shift is directed toward an adequate consideration of the existing differences among students through a range of alternative learning opportunities. Students have more time to work together, independently or with the teacher and other persons in the school who can facilitate learning (Silberman, 1971).

Individualized vs. Conventional Instruction

In the 1970s and through the early 1980s, in a number of studies (Gallagher, 1970; Green, 1982; Kapuscinski, 1982; Marchese, 1977; Plewes, 1979; Shymansky, 1980; Willett, et al., 1983), there were comparisons of various aspects of individualized science instruction with conventional teaching. A review of this literature shows that, compared

with conventional teaching, individualized instruction

provides for greater student participation and acceptance of responsibility, ... (as well as) an increased ability for the student to evaluate his/her own progress. (Further,) individualized instruction attains just as much, and sometimes more, learning of subject matter (science)... (and) seems to produce a more positive attitude toward the students themselves, the school and the subject (science) (Marchese, 1977, p. 701).

Which Aspects of Learning Can be Individualized?

An answer to the question of which aspects of learning can be individualized can be answered with some or all of the following: (1) Students progress through a series of objectives and activities at their own *rate*. (2) Students choose from a variety of *learning options* designed to meet the same objectives. (3) Students have some choice in what they study (*content*) as well as how. (4) Students are provided with *varying degrees of teacher direction*. (5) Students spend *different amounts of time* on a unit and explore a topic *at different levels*.

There is no one best way to individualize science instruction. Some of the large variety of methods that the teacher can use include *individualized reading materials, learning options, activity kits, contracts, independent study, computer-assisted instruction, open-ended problems, group work, science learning centers* and *peer teaching* (Burkman, 1970; Clark, 1996; Jones, 1977; Klopfer, 1971; Lunetta & Dyrli, 1971; McAnarney, 1977; Victor, 1980; Zeitler, 1975).

It is important to note here that a number of these individualized instruction methods are still in use today. Additional specific approaches (e.g., cooperative learning),

assessment techniques (e.g., portfolios), and technology are available to teachers. The teacher needs to choose those procedures that best suit his/her particular situation and educational philosophy. He/she should not be limited to one kind of teaching. An eclectic approach to teaching that provides variety and flexibility in both science content and methodology is the best way to maximize learning for all students (Clark, 1996).

Why Individualize?

An analysis of the literature on science teaching and learning for the past 30 years showed that (1) there is a deterioration in student interest and achievement in science, (2) because children are different, there is a need for different kinds (individualized as well as small group) of science instruction, (3) individualized instruction seems to improve learning and student science attitudes, and (4) teachers at all levels need and can be taught strategies to incorporate individualized instruction in the science classroom (Anderson & Butts, 1980; Ben-Chaim, et al., 1994; Campbell, 1978; DeRose, et al., 1979; Fraser-Abder, 1992; Green, 1982; Hedges, 1975; Johnston, 1990; Jones, 1977; Lunetta & Dyrli, 1971; Newport, 1973; NSF, 1975; O'Neil, 1991; O'Toole, 1968; Yager & Penick, 1984). Analysis of the studies and reasons for individualizing the instruction are explored next.

Interest and Achievement

Yager and Penick (1984) analyzed the results of the 1978 and 1983 assessments in science by the National Assessment of Educational Progress. These two studies dealt with the affective mode of science instruction. The data came from 9,000 in two age groups, thirteen years old and seventeen years old. Yager and Penick found that both groups valued the study of science and felt it was a beneficial area of study.

A number of authors, Bredderman (1982), Fraser-Abder (1992), Green (1982), Lunetta and Dyrli (1971), O'Neil (1991), Sigda (1983), Rossman (1983), Worthy (1982) and Yager and Penick (1983) indicated that there is a need for a change in the present way science is taught in the schools. Students in many science classrooms today are expected to memorize science knowledge and spill it back on the test. Rossman (1983) considered this type of learning as impersonal, causing students to become frustrated and lose interest. Changes in science instruction need to reflect more active student participation.

Science instruction should shift from being textbook-oriented to involving students in more discovery and inquiry-based activities that are interesting to the student. Green (1982) stated that inquiry processes are a basic objective of science education. Students learn these processes by actively participating in them. Green discussed the importance of individualized instruction in facilitating student learning. He suggested that teachers needed to combine lecture with individual or group activities. These activities would provide variety, be easily available and at an appropriate level and style for students. It is through these techniques that students will be motivated and enthusiastic to continue work in science.

This need for learner involvement is also mirrored in Wise and Okey (1983). They synthesized findings of various science teaching strategies and their effect on achievement. They concluded that an effective science classroom should have the following six characteristics: (1) Students are aware of the instructional objectives. (2) Students receive feedback on progress toward these objectives. (3) Students are physically engaged with materials and in activities. (4) Instructional procedures can be changed to increase impact. (5) Verbal and questioning interactions follow a plan. (6) Students are responsible for defining tasks.

The data relative to the effect of individualization on cognitive achievement appear to be inconclusive. No significant differences in achievement were found when Anderson

and Butts (1980), Garren and Gathmann (1974), and Bangert, et al. (1983) compared a number of group *and* individualized instruction classes. Anderson and Butts (1980) used an *Elementary Science Study (ESS)* "Electricity" unit and compared sixth grade preference for instruction. One class had group instruction and the other class had individualized instruction. The authors found no differences in either achievement or attitude between the two groups. Garren and Gathmann's (1974) study compared achievement test scores in a life science course with students in either an audio-tutorial class or a conventional lecture-laboratory class. They concluded that student achievement, as measured by tests, did not significantly vary. Bangert, et al. (1983) analyzed 51 individualized instruction studies covering grades 6-12. They reported that individualization of the instruction had little or insignificant effect on test performance as well as on attitudes.

Plewes (1979), on the other hand, found that mixed-ability science classes, taught using individualized methods, performed a bit lower (about 2 %) in tests of comprehension than ordered classes taught as whole groups. The study was carried out on 160 11-12 year olds in two equal blocks, each being split into four mixed-ability tutorial groups, deliberately arranged to ensure a full spread of IQ scores.

A number of authors (Dunkleberger & Knight, 1981; Hedges, 1975; Khan, 1980; Lazarowitz & Huppert, 1982; Netburn, 1975; Novak & Musonda, 1991; Repicky, 1978) reported that individualized instruction produced significantly greater achievement gains than the traditionally taught groups. Lazarowitz and Huppert's (1982) study involved two groups of ninth grade science students. Both groups used the "Unity" topic in the Yellow version of *Biological Sciences Curriculum Study (BSCS)*. [BSCS is a 1959 NSF project aimed at improving biological education through the development of curriculum materials. Blue, Green, and Yellow versions of the BSCS course emphasize the molecular, community, and cellular levels of biology, respectively (DeBoer, 1991)]. The experimental group was taught by the audio-tutorial method and the control group was taught by the

frontal classroom-laboratory method. The authors concluded that the individualized method was effective in increasing achievement and motivation. The results showed that 70 % of the individualized audio-tutorial students achieved the mastery level while only 30 % of the frontal classroom-laboratory group reached the same level.

In studies on grouping and its effect on achievement, Foster and Penick (1985), Gallagher (1970), Humphreys, et al. (1982), and Okebukola and Ogunniyi (1978) found that cooperatively grouped students, compared with competitive and individualistic science lab instruction groupings, showed the most positive achievement gains.

Kinds of Instruction

Studies by Dunn and Dunn (1987), Gabel and Herron (1977), Gettinger (1983), Melton (1978), and Newport (1973) examined individuals and different styles of learning. The authors found that students do have individual differences and that students varied in the style that was most appropriate for learning. Gabel and Herron (1977) studied 1,022 seventh-grade *Intermediate Science Curriculum Study (ISCS)* students in 43 Indiana classrooms. They researched the effects of grouping and pacing on learning rate, retention and attitude. It was concluded that students learned more effectively and showed increased retention when allowed to pace themselves. The results of grouping were inconsistent. All students in the study had a favorable attitude towards the *ISCS* program. Since there are many instructional approaches available to the science teacher, then, the question should not be, "Which one to use today?" but rather, "Which approach is best for *this* (particular) *student*?" The suggestion here is that teachers need to start tailoring science instruction into a more personal approach (individualized instruction).

Science Attitudes

Results similar to those found for achievement (p.26) were also concluded on individualization in science classes and student attitudes. Most studies showed either no change or a more positive one. Anderson and Butts (1980) and Bangert, et al. (1983) found no significant differences in attitude. Marchese (1977), in a comparison of studies on individualized and conventional modes of instruction, indicated that individualized instruction "produces a more positive attitude toward science" (p. 701).

Positive attitudes were also reported by Bredderman (1982), Fraser and Butts (1982), Garren and Gathmann (1974), Krochover and Malcolm (1978), and McMillan and May (1979). Students in these studies enjoyed their science classes partly because they were interesting, career-relevant and also because students were allowed to be active participants. The authors concluded that the more positive attitudes were associated with greater individualization.

Krochover and Malcolm (1978) conducted research to see if instruction with the *Science Curriculum Improvement Study (SCIS)* program would improve a student's attitude toward science. The study involved 307 students in 12 (grades 3-6) science classes. Within each grade level, two classes were selected to be the experimental groups and one the control. They found that the experimental groups in all grades, except the fourth, showed positive science attitude gains.

Teacher Preparation

Lunetta and Dyrli (1971) suggested that "science teachers can (and should) move in the direction of individualized instruction and that an individual teacher begins at any level he/she can" (p. 125). However, the proper introduction and administration of

individualized instruction in the classroom would require appropriate preservice (and inservice) teacher education (Ben-Chaim, 1994). As stated in Chapter 1, individualized instruction usually requires more time, effort and materials than does conventional teaching (Jones, 1977; McAnarney, 1977; Zeitler, 1975).

Schools which have adopted individualized instruction techniques generally agree they will never return to the traditional classroom. Individualization also scores high with most (80 %) teachers (NSPRA, 1971). On the other hand, teachers who have never tried individualized instruction or who do not have the conviction will probably continue to have something negative to say about individualized instruction. James (1972) compared group vs. individualized instruction of 60 seventh grade science students. One of his conclusions was that the use of individualized instruction techniques in the classroom was possible and manageable. Thus, many of the problems (disadvantages) mentioned above could be eliminated.

Individualization in the classroom takes getting used to. In a 1971-1975 case study, McDuffie and DeRose (1982) analyzed the performance of 2,800 students in grades 7-9 enrolled in an *Intermediate Science Curriculum Study (ISCS)* program. The authors concluded that with time the teachers and students became more effective and efficient in the *ISCS* program. Campbell (1978), Flenning (1980), and Kapuscinski (1982) found that teachers are the *real key* to the success or failure of this instructional innovation in the school. Through training in individualized instruction, teachers would hopefully see many more advantages, than disadvantages, in individualizing the instruction in their classrooms. Furthermore, "if strong preservice (and inservice) teacher education programs model strategies for individualized instruction and top school administrator commitment to an individualized program come together, the future may be bright for...individualized instruction" (Sandrin, 1987, p. 22). In summary, all components of the program (students, teachers, course of study, facilities and materials, administration and community) need to

work together in order for positive results to be produced (Kapuscinski, 1982; McDuffie & DeRose, 1982).

Summary

Research demonstrates that students in any single classroom are different from each other. In general, and in science learning in particular, students have different interests, different experiential backgrounds, different capacities for learning, different learning styles, and different attention spans. Even where students have been grouped according to a targeted factor, such as same capacity for learning, differences exist and must be dealt with appropriately if science instruction is to be maximally effective.

College science teacher educators should frequently review the content and pedagogical standards and strategies for the preparation of elementary teachers of science as well as work with colleagues in other university departments to institute changes in the way future teachers are prepared (Saunders, 1986; Tennessee State Board of Education, 1993). Of course, these changes must be based specifically on the national science standards and generally on current reform in education.

CHAPTER 3

METHODOLOGY

Introduction

The purpose of this research was to assess the status of the preparation of Tennessee's elementary teachers for individualizing science instruction in their classrooms. More specifically, this study sought answers to the following *four questions* which were asked of K-8 science teacher educators from 40 state-approved teacher education institutions in Tennessee.

The research questions, which are based on the strategies for individualized instruction identified in the UTK Individualized Instruction Program (*Appendix A*), are:

- (1) What is the extent of preservice elementary science teachers' preparation in specific strategies for learning about the children they will teach?
- (2) What is the extent of preservice elementary science teachers' preparation in specific strategies on how to determine difference among learners?
- (3) What is the extent of preservice elementary science teachers' preparation in specific strategies that lead to planning for individualized instruction in the elementary school?
- (4) What is the extent of preservice science teachers' preparation in specific strategies that help attend to individual student differences?

The research questions and procedures evolved from an extensive literature review as well as a series of meetings with the researcher's faculty committee. The committee consisted of Dr. Phyllis Huff, a professor in science education, Dr. Glennon Rowell, a holistic teaching/learning professor, director of the UTK Individualized Instruction

Program and the main author of the Individualized Instruction Frameworks (*Appendix A*), Dr. Stephanie Robinson, a professor of mathematics education and Dr. Susan Riechert, a professor of ecology and evolutionary biology. Additionally, input was obtained from other UTK science and science teacher educators, colleagues, school practitioners, pre-intern and intern students all in the East Tennessee area. A southeast U.S. pilot study was also conducted for this research.

The UTK Individualized Instruction Frameworks (*Appendix A*) were the basis of the survey instrument utilized in this study to poll elementary science teacher educators in 40 state-approved teacher education institutions in Tennessee. The purpose of the survey was to evaluate the status of teacher preparation for individualizing science instruction in K-8 classrooms.

Survey Development

The Pilot Survey

Prior to undertaking the essential research with Tennessee's elementary science teacher educators, the researcher constructed a "Pretest" survey, hereafter called the *Pilot Survey* (*Appendix C*), utilizing the UTK Individualized Instruction Frameworks. In March 1997, the Pilot Survey was sent to 30 elementary science teacher educators from selected (and mostly public) universities in 10 states in the southeast (see list in *Appendix C*), excluding Tennessee. Half of those surveyed are established science teacher educators and are members of the Council for Elementary Science International (a division affiliate of the National Science Teachers Association). The remaining surveys were directed to the "elementary science educator" in the College of Education of the other universities.

The main purpose of the Pilot Survey was to help the researcher develop and

refine an instrument, to be used in the state of Tennessee, to measure the extent of teaching about and/or use of specific strategies for individualization of instruction in elementary science methods courses. Additionally, field testing outside of the state of Tennessee provided broad support for the various survey items. The 30-item Pilot Survey (*Appendix C*) asked the southeast U.S. elementary science teacher educators to rate each item (strategy or framework) for individualized instruction as to the *degree of importance in elementary science teaching and learning*.

One of the UTK Individualized Instruction Frameworks, *Using the Tennessee Instructional Model (TIM)*, was omitted in the Pilot Survey because it is a comprehensive instructional model that was developed for one particular state. The “TIM” strategy was put back in when the survey was prepared and used in Tennessee. For the reader’s benefit, a modified version of the TIM, one which is used by the UTK Individualized Instruction Program, is in *Appendix D* (Field, 1988; Tennessee Department of Education, 1984).

Educators in the southeastern universities were asked to mark each item along a 5-point Likert scale from “1 = *No importance*” to “5 = *Very great importance*” for elementary science teaching and learning. Additionally, all educators were given the opportunity to comment on the 30 strategies and to indicate whether any of the survey items deserved to be omitted as well as any others that needed to be added to the list.

The field test, with return rate of 63.3 % (19 of 30), netted preliminary results and suggestions for improving the survey instrument. At least *one* survey was completed and returned from the surveyed universities in *each* of the 10 southeastern states. The results (Table C.1) of the Likert scale rating were analyzed, using STAT-STAR (a micro-computer-based data analysis program), by calculating means and standard deviation (SD) (MacDougall & Stevens, 1994). The overall average mean rating was 3.88 (SD 0.51).

The *highest* rating for any of the survey items was for item number 14 (average mean 4.58; SD 0.67), *Planning for and maintaining an interactive classroom*. Only two

items received an average mean score below 3.00 (*Moderate importance* for elementary science teaching and learning). These were item number 8, *Using video and audio tapes for assessment*, with an average mean of 2.95 (SD 0.69) and item number 13, *Using commercial tests to determine student placement*, with the lowest of all average means (2.50; SD 1.01).

Six respondents included written comments. One science educator said that, "The frameworks...are important for K-8 classrooms and would certainly apply to science classrooms as well." Another mentioned that while many of the survey items were "...good ideas...", most teachers did not have time to implement them. None of the respondents commented on the total number of survey items. No omissions or substitution of items were suggested. A few of the educators had some difficulty with the wording of the content of some of the items (e.g., the definition of the word "appropriately.") The main recommendation received was to include *a short explanation* of each of the individualized instruction strategies (survey items) so as to maximize completeness and clarity of the survey. The survey was modified and sent out to Tennessee educators (see below).

The Tennessee Survey

A sample of 30 elementary science teacher educators from selected universities in 10 states in the southeast, excluding Tennessee, were surveyed in a Pilot Study for this research. Information gathered during this preliminary survey as well as additional input was used to develop and refine the instrument in the Tennessee state-wide survey used in this research.

The following describes how the UTK Individualized Instruction Frameworks (*Appendix A*) were used, modified and finally arranged in survey form to produce the 31-item survey, hereafter called the *Tennessee Survey*, which is printed in full in

Appendix E. It should be noted that a correlation was made between the *numerical descriptions* of the items in the UTK Frameworks (*Appendix A*), the Pilot Survey (*Appendix C*) and the Tennessee Survey (*Appendix E*). This correlation can be found in *Appendix F*.

The UTK Individualized Instruction Frameworks are general and important teaching strategies for individualizing instruction in all content areas in K-8 classrooms. This research specifically asked Tennessee elementary science teacher educators to report on their teaching about and/or use of these strategies in their elementary science methods courses. In the survey, the 31 UTK Frameworks were grouped into *four* sections (*Sections I* through *IV*), each addressing one of the *four research* questions (p. 4) in this study. The grouping of the strategies into different sections was used to help educators focus on each of the research questions as well as to facilitate data analysis and presentation.

Next, each of the UTK Frameworks was refined to minimize length and maximize clarity and user-friendliness, thus encouraging greater input. A brief definition, description or explanation of each item was written and added below the statement of each of the strategies. The 31 strategies were then put into a survey format using a 5-point Likert scale. K-8 science teacher educators in Tennessee were asked to use the 5-point scale (“1 = *None*” to “5 = *A great deal*”) to respond as to the *degree to which they teach about and/or use a particular (individualized instruction) strategy in their elementary science methods courses*.

The survey included, for statistical purposes, a demographic data section that asked for information about the educators and their institutions. Lastly, comments upon the 31 strategies were solicited from the educators on the last page of the six-page survey.

Before printing the final survey, the draft survey was critically reviewed by faculty advisors and colleagues. Helpful and constructive suggestions led to extensive revisions in

wording and appearance of the survey. The full survey was printed on 11"x25.5" paper, then two-folded to an 8.5"x11" dimension.

Survey Population

The target population was defined in the *Delimitations*: "K-8 science teacher educators in Tennessee teacher education institutions" (p. 10). The list of state-approved teacher education institutions was obtained from the office of the Director of Teacher Education at UTK (*Appendix E*). This list had the name of the administrator (dean, chair, coordinator, or director of teacher education or certification) and address of each institution's college (school, division, or department) of education.

In late June, 1997, two copies of the survey packet (to be described in the *Survey Implementation* section) were sent to the administrator in each of the 40 teacher education institutions in the state of Tennessee. A total of 29 institutions returned surveys - a useable response of 72.5 percent - a very high response rate. Seventeen of these institutions are members of the American Association of Colleges for Teacher Education (AACTE). Three of the 29 institutions returned *blank* surveys with comments that they *did not have an elementary science methods course at their institutions*.

The number of educator-completed surveys received was 32 from 26 institutions. The reason for this is that six (about one fourth) of the 26 institutions had at least two educators who taught elementary science methods courses. As a whole, the survey responses reflect the views of K-8 science teacher educators in Tennessee teacher education institutions.

Demographics were obtained from the "About Yourself" segment of the Tennessee Survey to help in the interpretation of the data of the target population discussed above. The survey requested demographic information on: (1) Number of years

taught, (2) gender, (3) highest degree, (4) type of institution, (5) total enrollment, (6) enrollment in education, (7) science teacher education faculty number and type, and (8) science methods course requirement. Table 1 includes information about the 26 institutions (with educator-completed surveys) and their student population.

Survey Implementation

Salant and Dillman (1994) guidelines for survey implementation were generally followed with some modifications. The general Salant and Dillman sequence includes: (1) advance mailing, (2) survey mailing, (3) follow-up postcard, and (4) second survey mailing. A description of the process that was used in this study follows.

As was previously mentioned, each college of education administrator was sent two copies of the survey packet. In a cover letter, each was asked to give the packet to the K-8 science teacher educator(s) at his/her institution and to fill out and return a postcard with the name of the educator(s) who would be completing the survey. The survey packet included a cover letter to the K-8 science teacher educator, a copy of the survey and a researcher-addressed, postage-paid (a 32-cent *Tennessee* U.S. postal stamp) return envelope (*Appendix E*).

After an interval of about four weeks, a second mailing of the survey was sent to the college administrator or to the K-8 science teacher educator(s) who was/were identified by the administrator. This mailing included a reminder (*Appendix E*) and another copy of the survey. All surveys sent out had numbers written on the front which were associated with specific institutions. Black ink was used in the first mailing; the second mailing used green (or red) ink. This was done in the event that a differentiation between the first and second mailing was needed.

A total of 29 (of 40) institutions responded which represents a high response rate

Table 1: Type of Institutions and their Student Population

"About Yourself" Demographic Data	Frequency	Percent
Type of Institution:		
Public	8	30.8
Private (church-related)	16	61.5
Private (non-church-related)	2	7.7
Total Enrollment* of Students in Institution:		
0 - 999	7	26.9
1,000 - 2,999	10	38.5
3,000 - 9,999	5	19.2
10,000 - 30,000	4	15.4
Enrollment* of Education Students:		
0 - 99	7	26.9
100 - 499	10	38.5
500 - 999	5	19.2
1,000 - 4,000	4	15.4

*Approximate numbers

of 72.5 %. Tennessee science teacher educators returned 35 surveys; 32 were *complete* and three were left *blank* (see reason on p. 38). These three surveys were deleted from the study.

Survey Data Management and Analysis

As surveys were received, they were recorded, dated for reference, and checked for completeness of response. Data (item ratings) from all 26 institutions that completed and returned surveys were entered into the 1995 *JMP* version of the SAS statistical analysis program.

The survey asked respondents to rate each item with respect to the degree to which the elementary science educator taught about and/or used the individualized

instruction strategy in his/her elementary science methods course. On each survey, each item was rated on a 5-point Likert scale with "1 = *None*" and "5 = *A great deal*."

It should be noted here that if an institution sent in two surveys (six institutions did), the average mean value of the rating of an item from both surveys became the "*value number*" that was entered for that institution. This was done because this research study targeted Tennessee teacher education institutions and *not* individual educators as such.

The wording of the survey (*Appendix E*) suggests that *items with high ratings are individualized instruction strategies believed to be taught about and/or used by the educator in his/her science methods course*. On the other hand, *items with low ratings are seen as strategies not emphasized in the elementary science methods course taught by the educator*.

The numerical data were analyzed in several ways. First, simple descriptive statistics of mean, standard deviation and standard error for each of the numerical items was completed. Then, analysis of variance (ANOVA) of the strategies in each of the four sections (*Section I* strategies 1-5; *Section II* strategies 6-13; *Section III* strategies 14-20; *Section IV* strategies 21-31) in the survey was computed. An effect test on the means of all of the 31 survey items was done. Finally, a nonparametric comparison of the items in each survey section was performed.

Table 1 (p. 40) shows information about the types of Tennessee institutions surveyed. A look at this information reveals that 16 (61.5 %) of the 26 institutions are private and church-related. Since this group seems to represent a *majority* of the teacher education institutions in Tennessee, an analysis was done to detect any differences between the educator responses in the 16 private church-related institutions (hereafter, called the *religious institutions*) and the remaining 10 institutions (hereafter, called the *non-religious institutions*). The enrollment in the religious institutions ranges from 400-3,000 students. The average is 1,300 students. The non-religious institutions average

about 10,000 students.

The survey requested demographic information. This is presented in Table G.1. Lastly, written comments (Table H.1) about the survey and the items were sought and were received from about one third (12 of 35) of the K-8 science teacher educators who returned surveys.

This chapter outlined the research project methodology. Findings from this study are presented in Chapter 4.

CHAPTER 4

THE TENNESSEE SURVEY: DATA AND ANALYSIS

Introduction

The objective of the survey was to provide information about the degree to which elementary science teacher educators in the state of Tennessee taught about and/or used specific individualized instruction strategies in their elementary science methods courses.

The Tennessee Survey, sent to educators in 40 state-approved teacher education programs in late June, 1997, resulted in input from 32 K-8 science teacher educators. The survey response rate was high (over 70 %). Variations in item average mean rating scores, coupled with educators' comments brought indications of relevance and analysis of the 31 individualized instruction strategies in the survey.

Survey Results: An Overview

The high teacher education institution response rate (72.5 %) brought input from a broad spectrum of science teacher educators across the state of Tennessee. An even higher response could probably have been obtained had this survey been done during the academic year and not in the summer when some (small) colleges are basically closed. The list of the state's teacher education institutions is in *Appendix E*. The K-8 science teacher educators demographic data can be found in Table G.1.

A total of 35 educators, representing 29 (of 40) Tennessee institutions, returned surveys. Thirty-two surveys were *complete* and three were left *blank* (see reason on p. 38). These three surveys were deleted from the study.

The range of survey answers on the 5-point Likert scale (1 = *None* and 5 = *A great deal*) had average means as low as 2.60 ± 0.21 and as high as 4.63 ± 0.18 . The average mean rating for all 31 survey items was 3.78.

The two strategies which received the highest rating (i.e., reported to be the most taught about and/or used in elementary science methods courses by the surveyed teacher educators in Tennessee) were strategy number 14, *Planning for and maintaining an interactive classroom* (average mean 4.56 ± 0.19) and strategy number 27, *Implementing cooperative learning groups* (average mean 4.63 ± 0.18). These two strategies (numbers 14 and 27) are in the third (*Section III*) and fourth (*Section IV*) sections of the survey which deal with planning and implementation of individualized instruction in elementary science classrooms.

The two strategies with the lowest rating were strategy number 5, *Using a computer-tracking system to keep student profiles* (average mean 2.69 ± 0.25) and strategy number 8, *Using commercial tests to determine student placement* (average mean 2.60 ± 0.21). These two strategies (numbers 5 and 8), listed in the first two sections (*Section I* and *Section II*) of the survey, can be used by teachers to acquire information about the students they will teach. It is possible that strategies 5 and 8 are not often introduced, discussed or emphasized in Tennessee elementary science methods courses.

Almost 42 % (13) of the 31 individualized instruction strategies in the survey received ratings of ≥ 4.00 . Tennessee science teacher educators reported teaching about and/or using these 13 strategies “*Quite a bit* (= 4)” to “*A great deal* (= 5)” in their elementary science methods courses.

Lastly, about one third (12 of 35) of the K-8 science teacher educators who returned surveys included comments about the survey/research as well as about their professional, general or personal experiences. Their comments are in Table H.1.

Survey Ratings, Comments and Analysis

The following data presentation begins with the general, then moves to the specific. The survey item-by-item numerical ratings provide support for the validity of the strategies which identify the elements which help preservice teachers prepare to effectively individualize science instruction in the K-8 classrooms. The comments of the elementary science teacher educators (Table H.1) also reinforce the support. Because of this, comments are made concurrently with the ratings.

The Tennessee Survey consisted of four sections (*Sections I through Section IV*). The grouping of the frameworks into the different sections, each of which had a minimum of five to a maximum of eleven strategies, was done to help the science teacher educators focus on each of the *four research questions* (p. 4) in this study.

Below is the presentation and analysis of the survey data. An examination of each survey section (*I through IV*) and the strategies within will be discussed. Elementary science teacher educator ratings for each item in the four sections of the survey are included. As indicated in Chapter 3, the wording of the survey (*Appendix E*) suggests that *items with high ratings are individualized instruction strategies believed to be taught about and/or used by the educator in his/her science methods course*. On the other hand, *items with low ratings are seen as strategies not emphasized in the elementary science method course taught by the educator*. The ratings of the 31 strategies will be followed by comments as appropriate.

Section I : Learning About the Children

Table 2 (p. 46) and Figure 1 (p. 47) present the educator ratings (means and standard errors) for the five individualized instruction strategies (numbers 1 - 5) that

Table 2: Section I Strategies: Means and Standard Errors (Confidence Intervals)
(n = 26 institutions)

1 = None 2 = Some 3 = A fair amount 4 = Quite a bit 5 = A great deal

Strategy Number and Description	Mean	Standard Error
1. Gathering and using demographic data on students	3.10	± 0.18
2. Acquiring information about services available for students	3.00	± 0.25
3. Using interest inventories to learn about students	3.23	± 0.21
4. Involving parents in the instructional program	3.58	± 0.22
5. Using a computer-tracking system to keep student profiles	2.69	± 0.25
Section I Strategies Summary	3.11	± 0.17

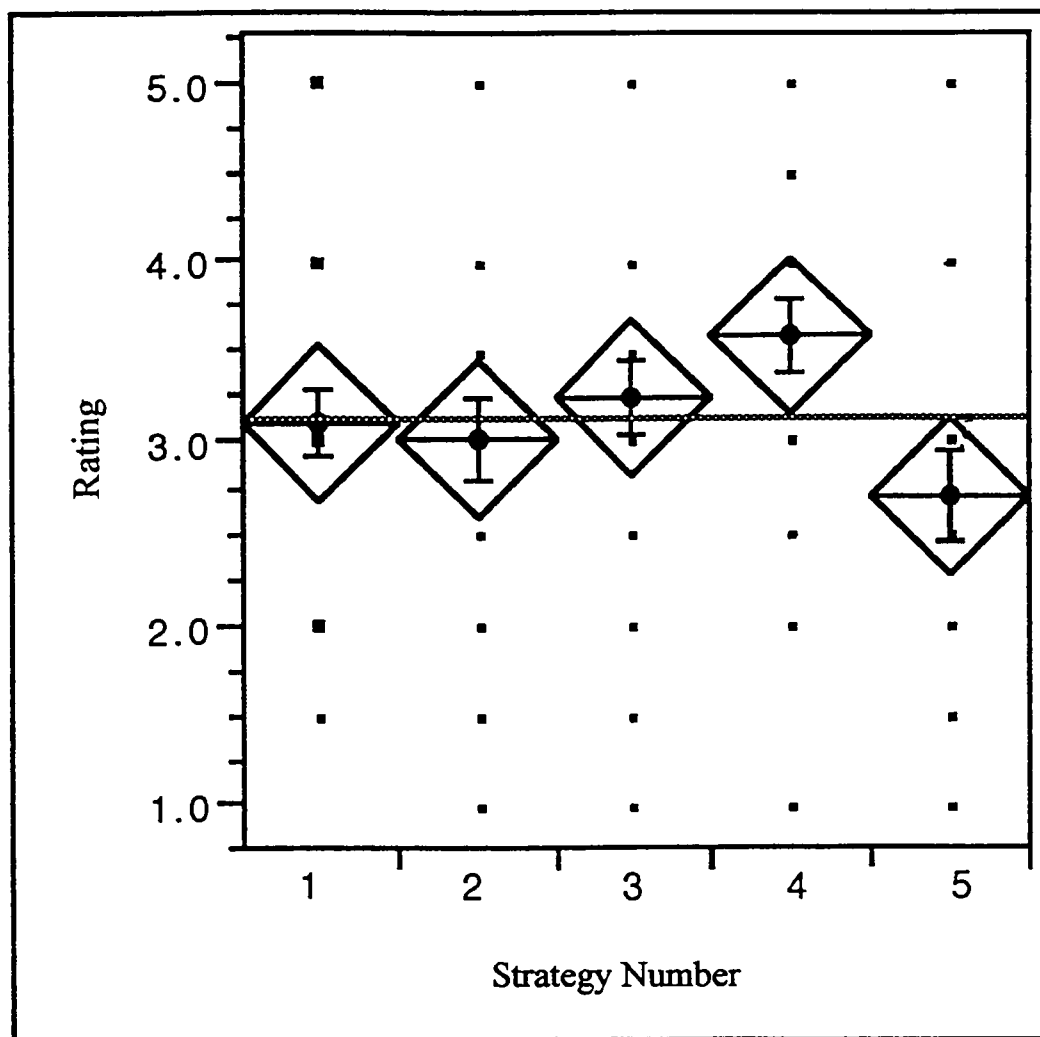


Figure 1: *Section I* Strategies: Means and Standard Errors

can be used by teachers to *learn about the children* that they will teach. Overall, the average mean score for the five strategies is 3.11 ± 0.17 . The strategies in this survey section are taught about and/or used (by the educators) a little more than “*Some (= 2)*” but not much of “*A fair amount (= 3)*.” As one educator commented, “*I do little of this because students take a course on Student, Parent and Community in which these topics are addressed in depth*” (survey number 79 in Table H.1). A note concerning this educator’s comment: Using Survey *Section I* strategies in context of science education is not the same as teaching them “in depth.” This educator seemed to have misperceived how these strategies are to be used (see *Limitations* in Chapter 1).

Finally, Table 3 (p. 49) presents the ANOVA for Survey *Section I* strategies. Analysis of this information shows that the utilization of the five strategies in this survey section is *not significantly different*.

Strategy 1. Gathering and using demographic data on students (average mean 3.10 ± 0.18 ; an average rated item). Information about students’ backgrounds can help the teacher individualize planning for each student.

Strategy 2. Acquiring information about services available for students (average mean 3.00 ± 0.25 ; an average rated item). To help meet the total needs of each student, acquiring complete background information becomes necessary.

Strategy 3. Using interest inventories to learn about students (average mean 3.23 ± 0.21 ; an average rated item). Teachers can use student interest surveys to tailor instruction of individual or a group of students. (See *Strategies 19, 20 and 25*).

Strategy 4. Involving parents in the instructional program (average mean 3.58 ± 0.22 ; an above average rated item). The educators seem to recognize the benefit of involving the parents in science classroom activities.

Table 3: *Section I* Strategies: Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Model	4	10.89	2.72	2.07	0.09
Error	125	164.01	1.31		
Total	129	174.90			

Strategy 5. Using a computer-tracking system to keep student profiles

(average mean 2.69 ± 0.25 ; a below average rated item). It is interesting to note this was one of the two strategies rated the lowest in this study. Availability and access to computer resources is essential in introducing and practicing this strategy. Lack of time (of the educator) to discuss, model, and practice this strategy may also be a reason for the low score (Altman, 1981; Jones, 1977; McAnarney, 1977; Zeitler, 1975).

Section II : Determining Differences Among Learners

Table 4 (p. 51) and Figure 2 (p. 52) present the educator ratings for the eight individualized instruction strategies (numbers 6 - 13) that can be used by teachers to *determine differences among learners*. Overall, the average mean score for the eight strategies is 3.61 ± 0.13 . The strategies in this survey section are taught about and/or used "A fair amount (= 3)" to "Quite a bit (= 4)" (by the educators) except for strategy number 8, *Using commercial tests to determine student placement* (average mean 2.60 ± 0.21).

Finally, Table 5 (p. 53) presents the ANOVA for Survey Section II strategies. Analysis of this information shows that the utilization of the eight strategies in this survey section is *significantly different*.

Strategy 6. Implementing portfolio assessment (average mean 3.92 ± 0.21 ; an above average rated item). Teaching about and/or using portfolios was reported being introduced and done in elementary science methods courses in Tennessee teacher education institutions.

Strategy 7. Using journals, logs, and progress-charting activities (average mean 3.96 ± 0.21 ; an above average rated item). Recording the progress toward an instructional objective is useful and seems to be emphasized by the educators.

Table 4: Section II Strategies: Means and Standard Errors (Confidence Intervals)
(n = 26 institutions)

1 = None 2 = Some 3 = A fair amount 4 = Quite a bit 5 = A great deal

Strategy Number and Description	Mean	Standard Error
6. Implementing portfolio assessment	3.92	± 0.21
7. Using journals, logs and progress-charting activities	3.96	± 0.21
8. Using commercial tests to determine student placement	2.60	± 0.21
9. Developing and using teacher-made tests	3.71	± 0.21
10. Observing children at work and determining academic and other needs	4.08	± 0.21
11. Implementing self-assessment procedures	3.62	± 0.21
12. Conferencing with students effectively	3.92	± 0.21
13. Using video and audio tapes for assessment	3.13	± 0.21
Section II Strategies Summary	3.61	± 0.13

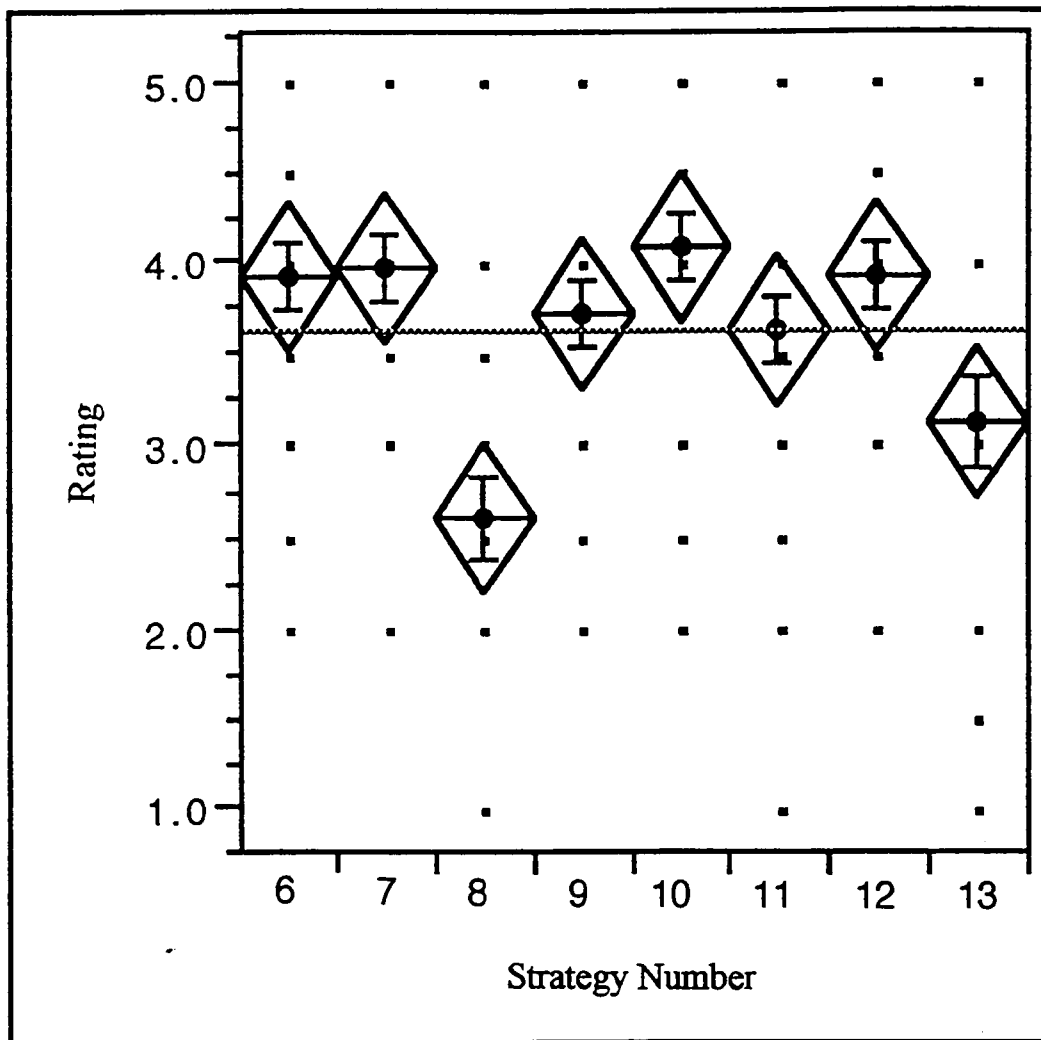


Figure 2: *Section II* Strategies: Means and Standard Errors

Table 5: Section II Strategies: Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Model	7	46.84	6.69	5.89	0.00
Error	200	227.03	1.13		
Total	207	273.87			

Strategy 8. Using commercial tests to determine student placement (average mean 2.60 ± 0.21 ; a below average rated item). This strategy was rated the lowest of all the strategies in this study. It is interesting to note that this strategy was not considered *important in science teaching and learning* in the *Pilot Survey* (see item 13 average mean in Table C.1). Educators seems to prefer to write their own tests.

Strategy 9. Developing and using teacher-made tests (average mean 3.71 ± 0.21 ; an above average rated item). (See comments on *Strategy 8*).

Strategy 10. Observing children at work and determining academic and other needs (4.08 ± 0.21 ; a high rated item). This strategy appears to be important in beginning to assess the academic and other needs of students.

Strategy 11. Implementing self-assessment procedures (average mean 3.62 ± 0.21 ; an above average rated item). Self-checking is important but probably time consuming.

Strategy 12. Conferencing with students effectively (average mean 3.92 ± 0.21 ; an above average rated item). Meeting and working one-on-one with students is a good way to individualize the instruction.

Strategy 13. Using video and audio tapes for assessment (average mean 3.13 ± 0.21 ; an average rated item). Technology may not be available at the institution and/or science teacher educators may be uncomfortable with it.

Section III : Planning for Individualized Instruction in the Elementary School Classroom

Table 6 (p. 55) and Figure 3 (p. 56) present the educator ratings for the seven individualized instruction strategies (numbers 14 - 20) that can be used by teachers to *plan for individualized science instruction in the elementary school classroom*. Overall, the

Table 6: Section III Strategies: Means and Standard Errors (Confidence Intervals)
(n = 26 institutions)

1 = None 2 = Some 3 = A fair amount 4 = Quite a bit 5 = A great deal

Strategy Number and Description	Mean	Standard Error
14. Planning for and maintaining an interactive classroom	4.56	± 0.19
15. Planning daily lessons for large groups and for individuals	4.25	± 0.19
16. Using the Tennessee Instructional Model (TIM)	4.17	± 0.19
17. Establishing long-range instructional goals and short-term objectives	4.09	± 0.19
18. Developing units and mini-units	4.29	± 0.19
19. Developing instructional objectives that vary in focus	4.37	± 0.19
20. Developing independent tasks for individual children	4.00	± 0.19
Section III Strategies Summary	4.25	± 0.14

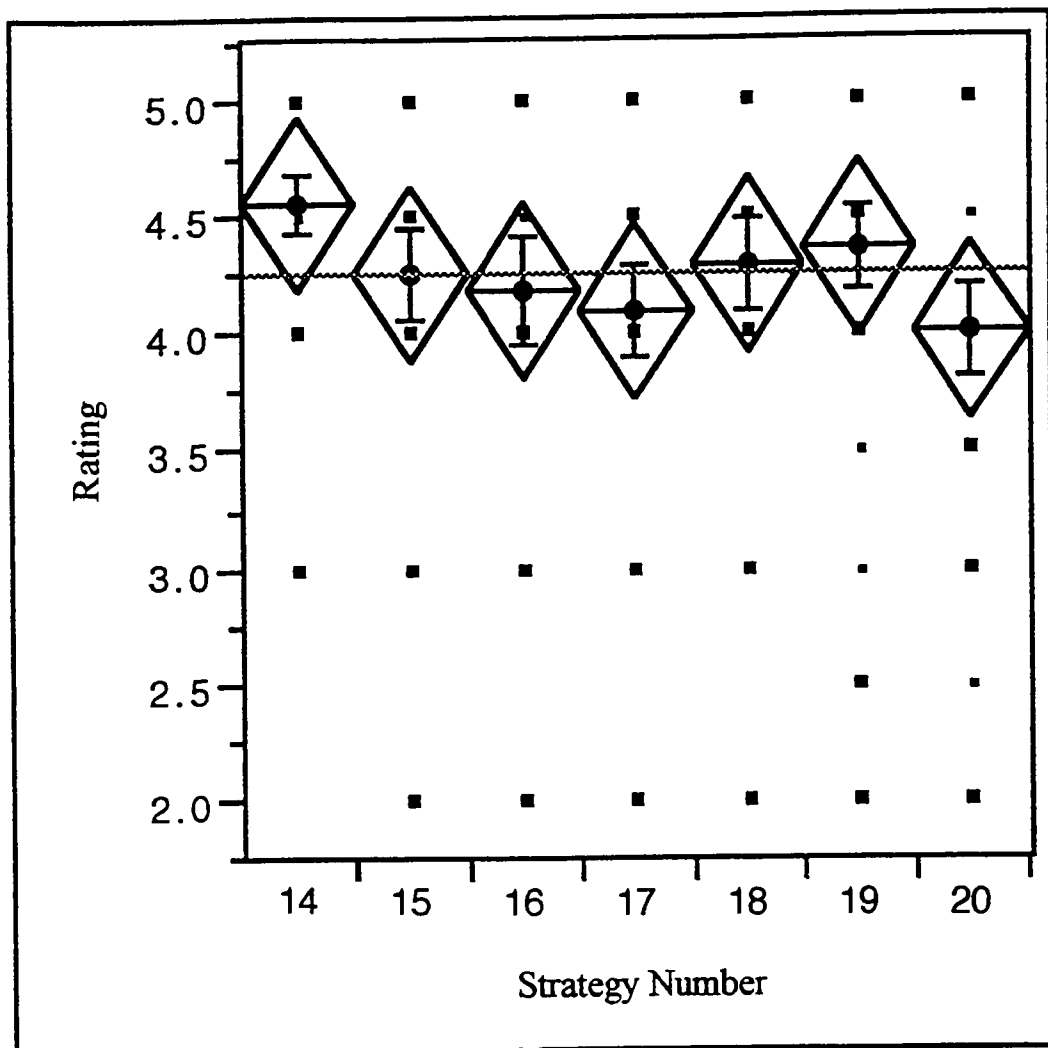


Figure 3: *Section III* Strategies: Means and Standard Errors

average mean score for the seven strategies is 4.24 ± 0.14 . The strategies in this survey section are taught about and/or used “*Quite a bit* (= 4)” to “*A great deal* (= 5)” by the educators. It is interesting to note that strategy number 14, *Planning for and maintaining an interactive classroom* (average mean 4.56 ± 0.19), was one of the two strategies rated the highest in this study.

Finally, Table 7 (p. 58) presents the ANOVA for Survey *Section III* strategies. Analysis of this information shows that the utilization of the seven strategies in this survey section is *not significantly different*.

Strategy 14. Planning for and maintaining an interactive classroom (average mean 4.56 ± 0.19 ; a very high rated item). The educators reported that interactive classrooms are essential to foster effective teaching and learning of science.

Strategy 15. Planning daily lessons for large groups and for individuals (average mean 4.25 ± 0.19 ; a high rated item). Educators seem to realize the importance of flexibility in the type of lessons and activities presented.

Strategy 16. Using the Tennessee Instructional Model (TIM) (average mean 4.13 ± 0.19 ; a high rated item). Surprisingly, this strategy did not get a perfect score from Tennessee elementary science teacher educators as one might expect. As a matter of fact, about five (of 32) educators from various institutions gave it a “2” rating. One of those educators stated that the reason for his low rating is that “*many of our students* (pre-service teachers) *do not remain in Tennessee* (after graduation).” On the other hand, two (of 32) educators were so enthusiastic about and supportive of using TIM in their science methods courses, that they added a “+” next to their rating of “5”.

Strategy 17. Establishing long-range instructional goals and short-term objectives (average mean 4.09 ± 0.19 ; a high rated item). Educators provided a good amount of instruction about the need to establishing various instructional goals and

Table 7: Section III Strategies: Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Model	6	5.24	0.87	0.90	0.50
Error	175	170.13	0.97		
Total	181	175.37			

objectives in K-8 science classes.

Strategy 18. Developing units and mini-units (average mean 4.29 ± 0.19 ; a high rated item). Breaking units into tasks helps teachers take advantage of the individuality of students. This seems to be encouraged by the educators.

Strategy 19. Developing instructional objectives that vary in focus (average mean 4.37 ± 0.19 ; a high rated item). Tennessee science teacher educators appear to be *connecting* students' interests *with* the topic at hand.

Strategy 20. Developing independent tasks for individual children (average mean 4.00 ± 0.19 ; a high rated item). (See *Strategy 19*).

Section IV : Attending to Individual Student Differences

Table 8 (p. 60) and Figure 4 (p. 61) present the educator ratings for the eleven individualized instruction strategies (numbers 21 - 31) that can be used by teachers to *attend to individual student differences*. Overall, the average mean score for the eleven strategies is 4.13 ± 0.10 . The strategies in this survey section are definitely taught about and/or used "*Quite a bit* (= 4)" by the educators. It is interesting to note that strategy number 27, *Implementing cooperative learning groups* (average mean 4.63 ± 0.18), was rated the highest of all the strategies in this study.

Finally, Table 9 (p. 62) presents the ANOVA for Survey *Section IV* strategies. Analysis of this information shows that the eleven strategies in this survey section are *significantly different*.

Strategy 21. Using peer teaching (average mean 3.90 ± 0.18 ; an above average rated item). Tutoring is an long-standing individualized instruction technique. Peer teaching is helpful and seems to be encouraged by the educators.

Table 8: Section IV Strategies: Means and Standard Errors (Confidence Intervals)
(n = 26 institutions)

1 = None 2 = Some 3 = A fair amount 4 = Quite a bit 5 = A great deal

Strategy Number and Description	Mean	Standard Error
21. Using peer teaching	3.90	± 0.18
22. Providing academic and skill coaching	3.87	± 0.18
23. Setting up learning stations or centers	4.06	± 0.18
24. Using computers with individuals and small groups	3.88	± 0.18
25. Grouping students according to interests	3.64	± 0.18
26. Employing thematic and project teaching	4.50	± 0.18
27. Implementing cooperative learning groups	4.63	± 0.18
28. Using ability grouping appropriately	3.71	± 0.18
29. Setting up various kinds of small groups, including dyads/triads	4.08	± 0.18
30. Using graphic organizers, story frames, webbing and mapping strategies	3.81	± 0.18
31. Using manipulatives and games	4.52	± 0.18
Section IV Strategies Summary	4.13	± 0.10

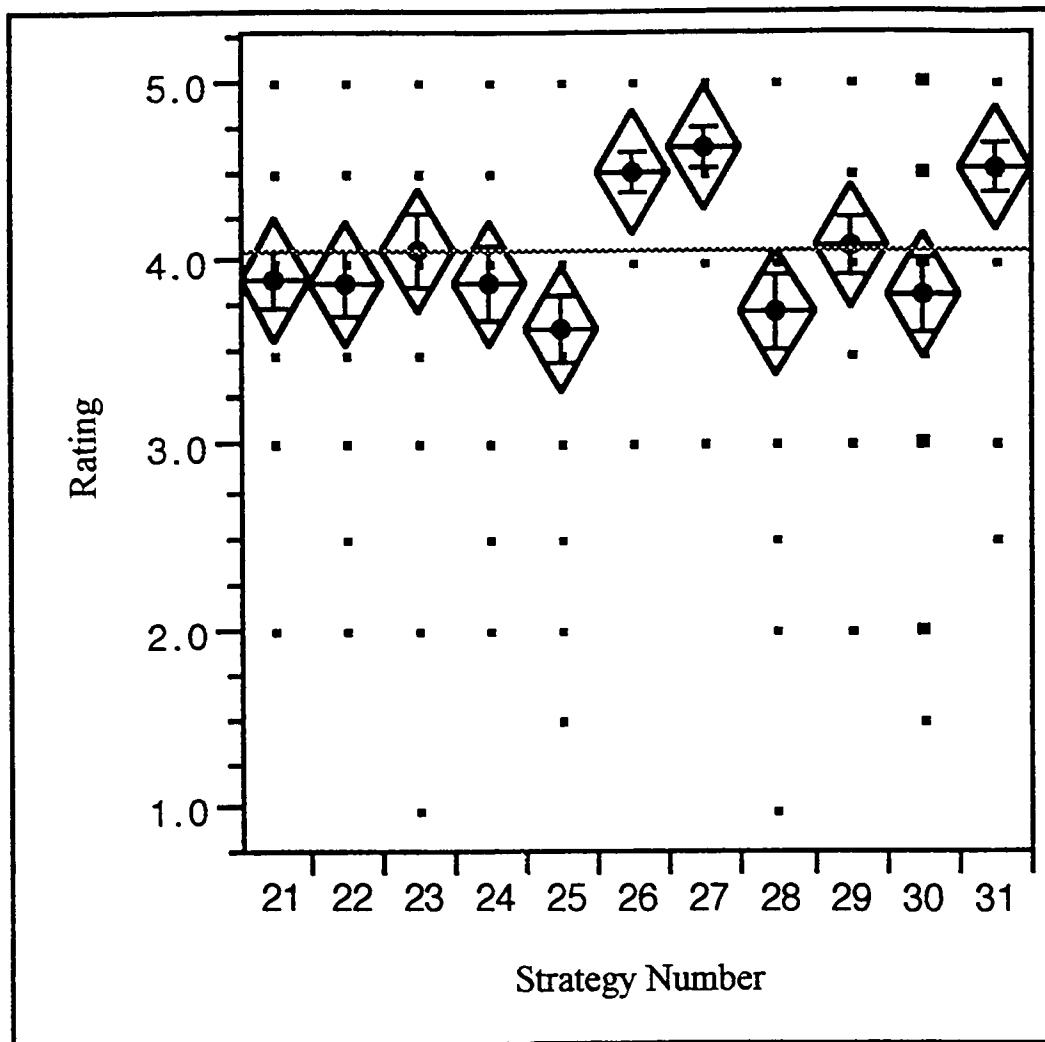


Figure 4: *Section VI* Strategies: Means and Standard Errors

Table 9: Section IV Strategies: Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Model	10	31.22	3.12	3.56	0.00
Error	277	243.00	0.88		
Total	287	274.22			

Strategy 22. Providing academic and skill coaching (average mean 3.87 ± 0.18 ; an above average rated item).

Strategy 23. Setting up learning stations or centers (average mean 4.06 ± 0.18 ; a high rated item). As one would expect, Tennessee science teacher educators indicated that they emphasize the setting up and working at science learning centers.

Strategy 24. Using computers with individuals and small groups (average mean 3.88 ± 0.18 ; an above average rated item). This rating is related to the availability of computers at the various teacher education institutions.

Strategy 25. Grouping students according to interests (average mean 3.64 ± 0.18 ; an above average rated item). Knowing about students' interests can come from inventories (*Strategy 3*). Educators did not seem to really highlight this important technique to help in individualization.

Strategy 26. Employing thematic and project teaching (average mean 4.50 ± 0.18 ; a very high rated item). The surveyed educators reported emphasizing this strategy in their science methods courses. Individual or group projects are generally well received in classrooms.

Strategy 27. Implementing cooperative learning groups (average mean 4.63 ± 0.18 ; a very high rated item). Actually, this is the highest in the study. The educators seem to be supporting the idea that "social interaction (from working together on various activities) is important for children to learn science" (Gee, et al., 1996, p. 9).

Strategy 28. Using ability grouping appropriately (average mean 3.71 ± 0.18 ; an above average rated item). The educators seem to teach about and/or use flexible grouping to help in instructing students with differing abilities.

Strategy 29. Setting up various kinds of small groups, including dyads and triads (average mean 4.08 ± 0.18 ; a high rated item). This strategy is related to *Strategy 27* above.

Strategy 30. Using graphic organizers, story frames, webbing and mapping strategies (average mean 3.81 ± 0.18 ; an above average rated item). These strategies are available and useful but are probably so time consuming that the educators did not rate them high.

Strategy 31. Using manipulatives and games (average mean 4.52 ± 0.18 ; a very high rated item). It appears that the Tennessee science teacher educators are emphasizing and/or using hands-on activities in their science methods courses. This is in line with state and national efforts and standards to make *science learning an active process*.

An "effect test" using the average means (from Table 2, p. 46; Table 4, p. 51; Table 6, p. 55; Table 8, p. 60) of the all of the 31 individualized instruction strategies, divided up by each of the four survey sections, was done. Figure 5 (p. 65) shows the result of the effect test which indicates that the strategies in each of the four sections of the survey are *significantly different* ($DF\ 3$, *Sum of squares* 5.29, *F Ratio* 12.43, *Prob* > *F* 0.00).

Tables 10-13 (pp. 66-69) present the significance and correlation of means at 0.05 for the strategies in each of the survey sections. Association of variables (strategies) in a correlation matrix can provide insights on the study. Seven sets of strategies (all in the first three sections of the survey) were highly correlated (Spearman correlation coefficient, $r_s \geq 0.70$).

From Table 10, in survey *Section I*, strategy 1, *Gathering and using demographic data on students* and strategy 2, *Acquiring information about services available for students* are highly related ($r_s = 0.82$) and complimentary to each other. They both can help preservice teachers with specific techniques about the children that they will teach.

From Table 11, in survey *Section II*, strategy 6, *Implementing portfolio assessment* and strategy 7, *Using journals, logs, and progress-charting activities*

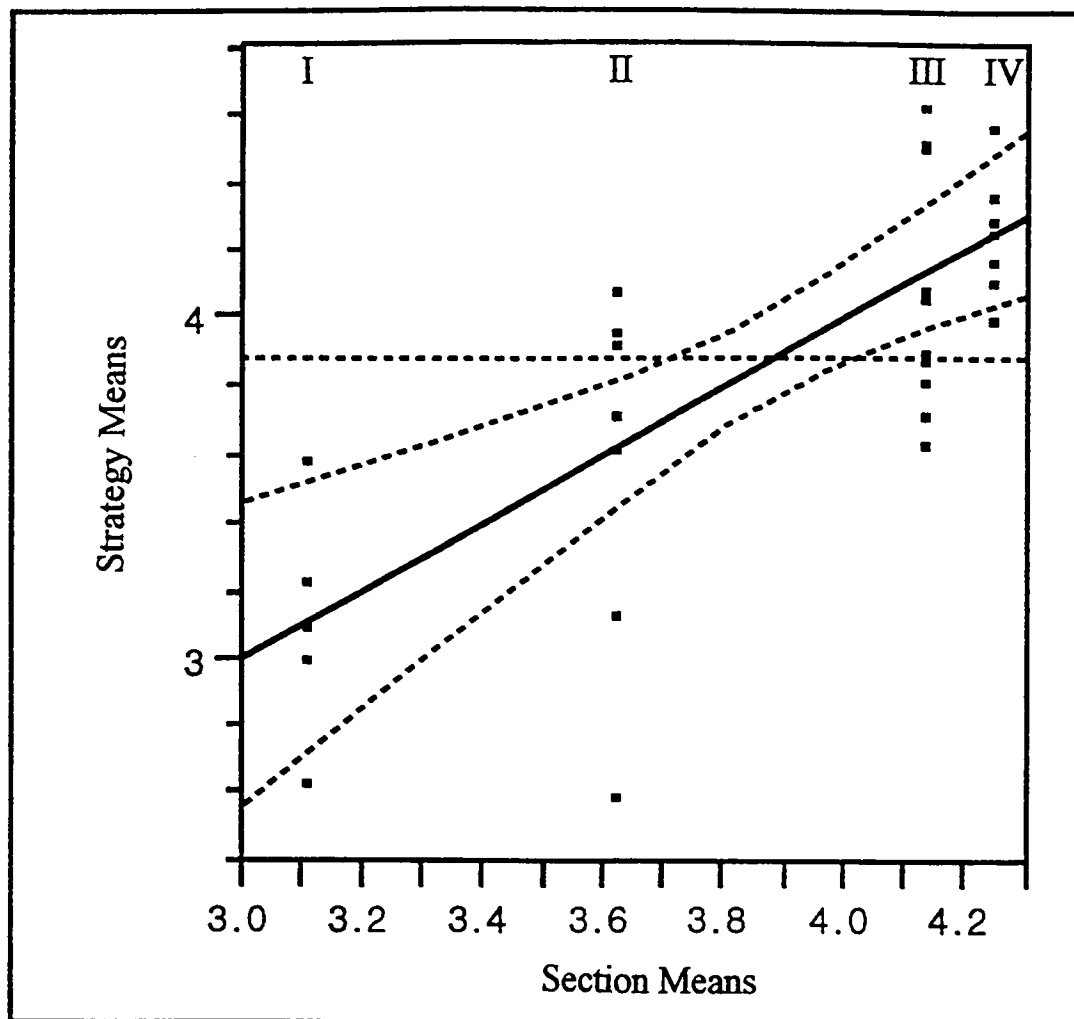


Table 10: Section I Strategies: Significance and Correlation of Means at 0.05
(Spearman correlation coefficients)

<i>Strategy</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>
<i>1. Gathering and using demographic data on students</i>		0.82	0.59	0.35	
<i>2. Acquiring information about services available for students</i>			0.57	0.40	
<i>3. Using interest inventories to learn about students</i>				0.49	
<i>4. Involving parents in the instructional program</i>					
<i>5. Using a computer-tracking system to keep student profiles</i>					

Table 11: Section II Strategies: Significance and Correlation of Means at 0.05
(Spearman correlation coefficients)

<i>Strategy</i>	6	7	8	9	10	11	12	13
6. <i>Implementing portfolio assessment</i>		0.78			0.58	0.55		
7. <i>Using journals, logs, and progress-charting activities</i>					0.60	0.70		
8. <i>Using commercial tests to determine student placement</i>				0.50	0.45			0.40
9. <i>Developing and using teacher-made tests</i>								
10. <i>Observing children at work and determining academic and other needs</i>						0.51	0.72	0.46
11. <i>Implementing self-assessment procedures</i>							0.41	0.42
12. <i>Conferencing with students effectively</i>								0.48
13. <i>Using video and audio tapes for assessment</i>								

Table 12: Section III Strategies: Significance and Correlation of Means at 0.05
(Spearman correlation coefficients)

<i>Strategy</i>	<i>14</i>	<i>15</i>	<i>16</i>	<i>17</i>	<i>18</i>	<i>19</i>	<i>20</i>
<i>14. Planning for and maintaining An interactive classroom</i>							
<i>15. Planning daily lessons for large groups and for individuals</i>			0.53	0.50	0.74	0.49	0.49
<i>16. Using the Tennessee Instructional Model (TIM)</i>				0.57	0.80		
<i>17. Establishing long-range instructional goals and short- term objectives</i>					0.73	0.46	0.52
<i>18. Developing units and mini-units</i>						0.61	0.51
<i>19. Developing instructional objectives that vary in focus</i>							0.70
<i>20. Developing independent tasks for individual children</i>							

Table 13: Section IV Strategies: Significance and Correlation of Means at 0.05
(Spearman correlation coefficients)

Strategy	21	22	23	24	25	26	27	28	29	30	31
21. Using peer teaching		0.44					0.54		0.50		
22. Providing academic and skill coaching					0.50		0.54	0.49		0.48	
23. Setting up learning stations or centers				0.42		0.55		0.55			0.54
24. Using computers with individuals and small groups					0.41						0.51
25. Grouping students according to interests						0.56		0.60			
26. Employing thematic and project teaching											
27. Implementing cooperative learning groups										0.47	
28. Using ability grouping appropriately											0.54
29. Setting up various kinds of small groups, including dyads/triads										0.45	0.42
30. Using graphic organizers, story frames, webbing and mapping strategies											
31. Using manipulatives and games											

($r_s = 0.78$); strategy 7, *Using journals, logs, and progress-charting activities* and strategy 11, *Implementing self-assessment procedures* ($r_s = 0.70$); and strategy 10, *Observing children at work and determining academic and other needs* and strategy 12, *Conferencing with students effectively* ($r_s = 0.72$) are related due to the fact that they all are (assessment) techniques that can help in determining differences among learners.

In Table 12, in survey *Section III*, strategy 16, *Using the Tennessee Instructional Model (TIM) (Appendix D)* and strategy 18, *Developing units and mini-units* are related ($r_s = 0.80$) only in that the TIM lesson design format asks the teacher to describe the unit (title and objective) of study in the lesson. Strategy 17, *Establishing long-range instructional goals and short-term objectives* and strategy 18, *Developing units and mini-units* are related ($r_s = 0.73$) in that a teacher needs to focus on a variety of objectives to guide him/her as he/she develops and teaches units in the science program. Strategy 19, *Developing instructional objectives that vary in focus* and strategy 20, *Developing independent tasks for individual children* show a close association ($r_s = 0.70$). These tasks should be built around interests of students, special needs that students have, objectives calling for students to analyze what is learned, synthesize materials, and evaluate what has been learned.

Figures 6-9 (pp. 71-74) include the means and standard errors for the science teacher educator responses from the 16 religious (church-related) and the 10 non-religious teacher education institutions in Tennessee. Tables 14-17 (pp. 71-74) present the ANOVA for these two types of institutions. The conclusion is that the educators in the *religious institutions* appear to be teaching about and/or using *more* of the 31 individualized instruction strategies (overall as well as for every survey section) than the educators in the *non-religious institutions*.

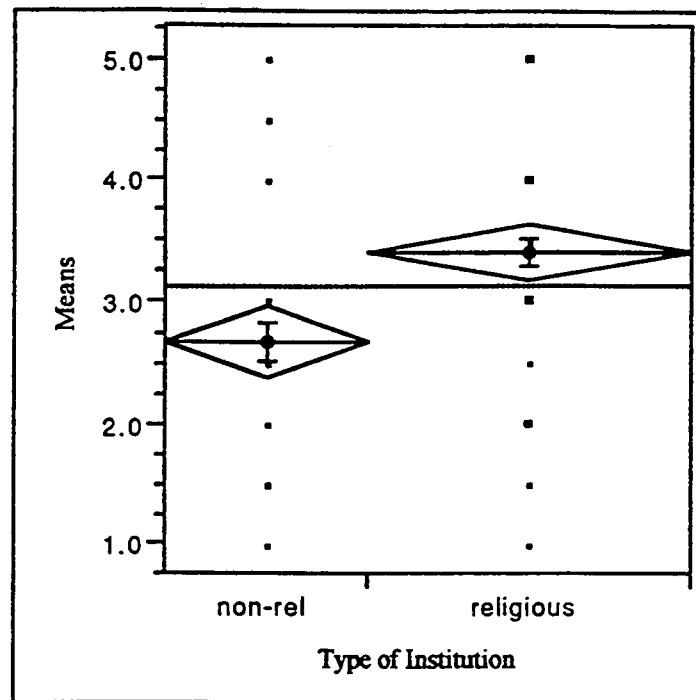


**Figure 6: *Section I* Strategies: Means and Standard Errors
For the Religious and Non-Religious Institutions**

**Table 14: *Section I* Strategies: Analysis of Variance
For the Religious and Non-Religious Institutions**

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Model	1	16.40	16.40	13.24	0.00
Error	128	158.51	1.24		
Total	129	174.91			

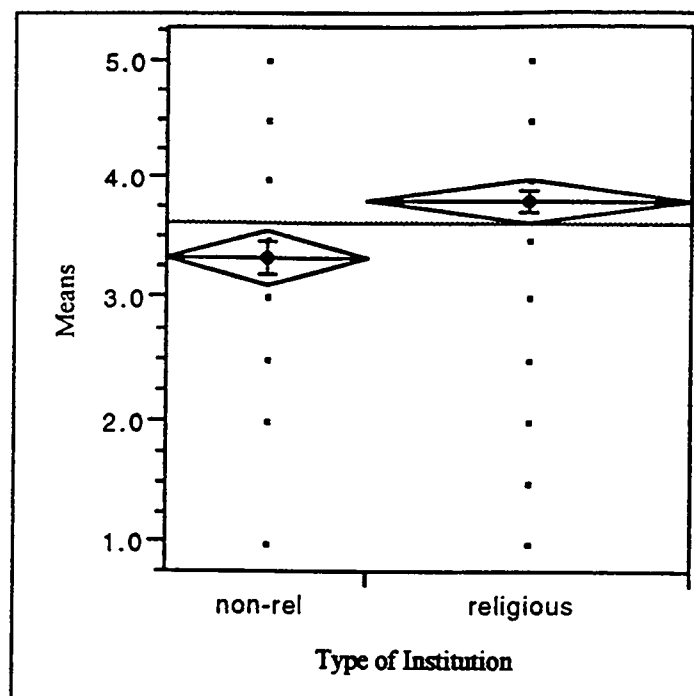


**Figure 7: *Section II* Strategies: Means and Standard Errors
For the Religious and Non-Religious Institutions**

**Table 15: *Section II* Strategies: Analysis of Variance
For the Religious and Non-Religious Institutions**

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Model	1	10.67	10.67	8.35	0.00
Error	206	263.19	1.28		
Total	207	273.86			

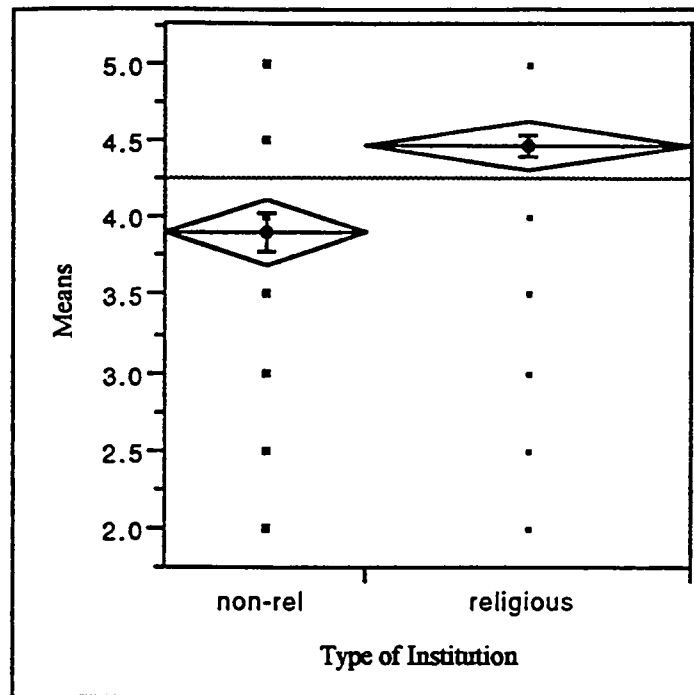


**Figure 8: *Section III* Strategies: Means and Standard Errors
For the Religious and Non-Religious Institutions**

**Table 16: *Section III* Strategies: Analysis of Variance
For the Religious and Non-Religious Institutions**

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Model	1	14.29	14.29	15.96	0.00
Error	180	161.09	0.89		
Total	181	175.38			

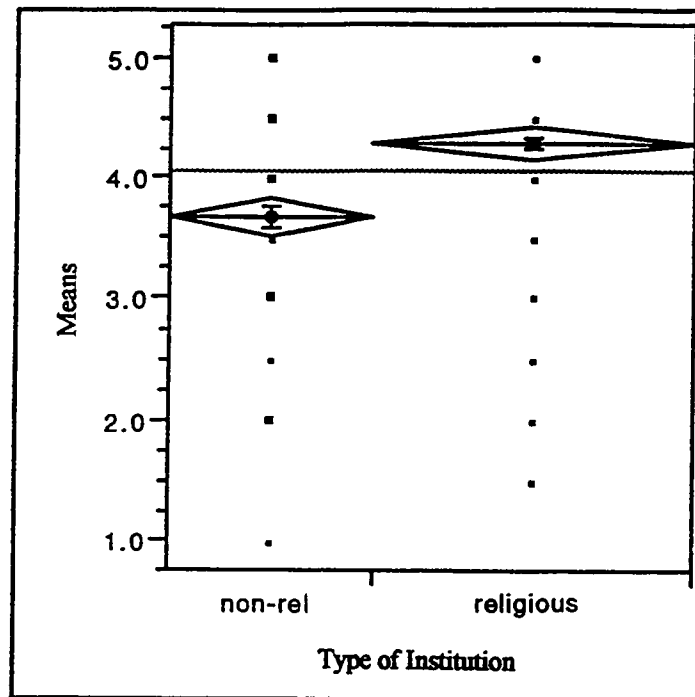


**Figure 9: *Section IV* Strategies: Means and Standard Errors
For the Religious and Non-Religious Institutions**

**Table 17: *Section IV* Strategies: Analysis of Variance
For the Religious and Non-Religious Institutions**

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Model	1	26.18	26.18	30.19	0.00
Error	286	248.06	0.87		
Total	287	274.24			

Demographic Subgroup Analysis

The target population for this research was K-8 science teacher educators in Tennessee teacher education institutions. Demographic information obtained from the "About Yourself" segment of the survey is in Table G.1. A summary is found below.

Almost 60 % of the educators in Tennessee teacher education institutions are female and have had over 20 years of teaching experience (56.3 %). About three out of four (71.9 %) of the educators hold a doctorate degree. The educators in this survey are similar in degree attainment to educators in Illinois, Ohio and Indiana (Gilbert, 1992) but had more females (59.4 % vs. 22%). More than half (61.5 %) of the institutions surveyed are church-related private institutions with small student enrollments (under 3,000). The number of "combined elementary/ secondary" science teacher educators is almost double that of either of the *elementary-trained* or the *secondary-trained* educators.

Lastly, 25 of the 26 Tennessee teacher education institutions (that returned *completed* surveys) require preservice elementary teachers to take a science methods course. As was previously mentioned (p. 38), three of the 29 responding institutions returned *blank* surveys (see comment of educator in survey number 41 in Table H.1). It is interesting to note here that the number of Tennessee institutions ($n = 25$ of 29 responding; 86.2 %) requiring a science methods course is about *ten percent lower* than that (97 %) of the 45 largest teacher education institutions in the U.S. surveyed by Mechling, et al. (1982), but is about *ten percent higher* than that (73.6 %) of New England institutions in Barrow's study (1987).

The survey results and analysis were presented in this chapter. In Chapter 5, there will be a discussion of research conclusions, implications and recommendations.

CHAPTER 5

CONCLUDING SECTIONS

Introduction

This chapter begins with a summary of the study's purpose, methodology, and results. The main body of the chapter will respond to the *four research questions* which ask Tennessee's elementary science teacher educators to describe the degree to which he/she teaches about and/or uses: (1) strategies for learning about the children they will teach, (2) strategies on how to determine differences among learners, (3) strategies for planning that leads to individualized instruction in the elementary school classroom, and (4) strategies that help attend to individual student differences. Next, implications for changes in elementary science teacher preparation in Tennessee will be discussed. A final section will recommend topics for further study.

Summary of the Study

The purpose of the study was to determine the status of individualized science instruction in Tennessee teacher education institutions. Specifically, the study sought to investigate the extent of teaching about and/or use of 31 specific strategies for individualizing science instruction in elementary science methods courses. The individualized instruction frameworks, with strategies for individualizing instruction, were developed by Rowell, et al. (1995) in the College of Education at the University of Tennessee, Knoxville.

A review of the literature on the preparation of preservice elementary science

teachers for individualized instruction in K-8 classrooms revealed very limited research. A few studies (Daug, 1986; Roach & Hammond, 1981; Welker, 1985) describe the use of individualized instruction as *the mode of instruction* practiced in elementary science methods courses.

The researcher prepared and used a survey to poll elementary science teacher educators in Tennessee. The participants in this research included K-8 educators from 40 state-approved teacher education institutions.

The survey identified how the elementary science teacher educators prepared their preservice elementary science teachers to (1) learn about the children they will teach, (2) determine the difference among learners, (3) plan for individualized science instruction in the elementary school classroom, and (4) help attend to individual student differences.

In general, the Tennessee science teacher educators reported that they tended to teach about and/or use *A fair amount* (= 3) of the individualized instruction strategies that involve both "learning about the (K-8) students (*Survey Section I*)" and "their differences (*Survey Section II*). On the other hand, many of these educators provided preservice teachers with *Quite a bit* (=4) of the strategies that "lead to planning for individualized instruction (*Survey Section III*)" and "to attending to individual student differences (*Survey Section IV*)."

Supported by research on individualization (in Chapter 2), the Pilot and the Tennessee studies brought further validation for the UTK Individualized Instruction Program frameworks. From the conducted surveys, a number of the frameworks had average means of ≥ 4.00 . This seems to indicate that the frameworks (16 of 30 in the Pilot Survey, Table C.1) are *important in science teaching and learning* and that 13 frameworks (of 31 in the Tennessee Survey, *Appendix E*) are *being discussed and/or incorporated* in Tennessee's elementary science methods courses. Comments from educators that support the findings are, "The frameworks...are important for K-8

classrooms and would certainly apply to science classrooms as well” (a comment from the Pilot Survey) and “I seek to model many of the (individualized instruction) strategies in this survey,...” (Tennessee survey number 80 in Table H.1).

The Research Questions

Research Question 1

What is the extent of preservice elementary science teachers' preparation in specific strategies for learning about the students they will teach?

The individualized instruction strategies here involve teaching preservice elementary science teachers about gathering background information on their students. These strategies focus on getting to know students so that the teacher can *properly* plan for each individual one. The study found that the strategies in this section were covered only in a “*A fair amount* (average mean 3.11)” during the K-8 preservice science teachers' preparation. The educators, in general, indicated that they did not teach about and/or used these strategies often in their science methods courses. The reason given was summarized in the comment made by one educator (survey number 79 in Table H.1) who mentioned that these strategies are usually the focus of other courses. While this does not generally guarantee that preservice teachers are exposed to the strategies, at least some discussion of these strategies in the science methods course can and should be included. This develops the awareness and the understanding needed to deal with each *individual* student that these future teachers will teach. Since individualized instruction is child-oriented, it requires a diagnosis of the child's development to determine the kinds of learning experiences he/she requires.

The importance of involving parents in their children's education is a theme that permeates modern thought regarding school reform. In addition to being resources in the classroom, parents can be the best possible partners in helping students learn how to learn. Surveyed Tennessee educators seem to encourage preservice teachers to *Involve parents in the instructional program* (strategy number 4; average mean 3.58 ± 0.22). One elementary science educator (survey number 69 in Table H.1) combines at least two (individualized instruction) strategies (numbers 15, 18, 19, 23, and 31) in highlighting the parental role in children's science education. Shoebox science (Hickey, 1992) is modeled by this educator as a way to reinforce science skills and processes in the elementary classroom as well as involving parents at home.

Learning to use computers is very important in today's world. "Computers can (among other applications) evaluate the individual student's progress at intervals and then prescribe suitable assignment options for further independent study" (Lunetta & Dyrli, 1971). Tennessee has recently moved toward "computerizing" schools (e.g., 21st Century classrooms and access to the Internet) but students (and teachers), at all levels, seem to be still a long way from being computer-literate. The low rating (average mean 2.69 ± 0.25 , and one of the lowest in this study) of strategy number 5, *Using computer-tracking system to keep student profiles*, indicated that the use of computers is limited in science methods courses. This is confirmed by the above average rating of strategy number 24 (average mean 3.88), *Using computers with individuals and small groups*. Another reason for the low rating could be the size of the college and the availability of computing facilities and resources. It is interesting to note here that seventeen (65.4 %) of the 26 Tennessee institutions surveyed are ranked as small (under 3,000 students).

Research Question 2

What is the extent of preservice elementary science teachers' preparation in specific strategies on how to determine differences among learners?

To determine differences among students, different assessment techniques should be used. The preparation of the preservice elementary science teachers here is "fair (average mean 3.61)." Tennessee respondents reported introducing and/or doing a variety of assessment techniques that help preservice teachers measure each (elementary) student's progress. The top four techniques (Table 4, p. 51) introduced by the science teacher educators for assessing student progress are: (1) systematic observation records, (2) journals, logs and progress charts, (3) portfolio, and (4) student-teacher conferences. Many of these assessment methods provide an opportunity for students to be involved in their learning (of science) and thinking about their progress (Berenson & Carter, 1995; Hewitt, 1974; Shepardson & Britsch, 1997).

Two of the eight strategies, in particular, were reported not to be favored by the educators. First, the educators did not see the benefit of strategy 8, *Using commercial tests to determine student placement* (average mean 2.60). This response is similar to the one from the educators in the Pilot Survey (Table C.1) who also rated this item the lowest ("limited importance"). The second strategy (number 13) involves *Using video and audio equipment (technology) for assessment purposes*. As was previously mentioned, many students and teachers may be afraid of computers and also uncomfortable with technology.

Skills that can be taught in a technologically enriched science classroom, such as problem solving, creative thinking, and a sense of open inquiry are becoming important. To succeed in the information age, students (and teachers) must be introduced to the skills they will need in their future workplaces. The tools of technology foster independence,

cooperation, communication, and the ability to organize, manipulate, and evaluate data and to use multiple resources. These are the skills that encourage and empower all to become lifetime learners and problem solvers.

Research Question 3

What is the extent of preservice elementary science teachers' preparation in specific strategies that lead to planning for individualized instruction in the elementary school classroom?

The study found elementary science teacher educators teaching about and/or using all seven strategies “*Quite a bit* (average mean 4.24).” The average means for *all* of the strategies in this section was above 4.00. All surveyed educators do every strategy in this section at least “*Some*” (rating of “2”) in their methods courses.

Tennessee educators seem to discuss and model numerous ways to *Planning for and maintaining an interactive classroom* (strategy number 14; average mean 4.56 ± 0.19). This could imply that Tennessee (and southeastern U.S. science educators alike; see item 14 in the Pilot Survey in Table C.1) agree on the need for this strategy for effective science teaching and learning. The findings are definitely a welcome change in science education from the old “read the science book and answer the questions at the end of the chapter” approach.

When asked whether they presented the Tennessee Instructional Model (TIM) (strategy number 16; average mean 4.13) in their courses, 23 (71.9 %) of the 32 educators who completed the surveys gave it a perfect score of “5”. Five of the remaining educators rated it as a “2.” In general, it appears that TIM is being discussed and used in science methods courses in Tennessee teacher education institutions.

Research Question 4

What is the extent of preservice elementary science teachers' preparation in specific strategies that help attend to individual student differences?

The preparation of Tennessee preservice elementary science teachers in ways to attend to student differences was found to be *high* (overall average mean 4.06). The strategy (number 27) of *Implementing cooperative learning groups*, which was ranked the highest (average mean 4.63 ± 0.18) in this study, seems to be a part of *every* elementary science methods course in the responding institutions. There were no scores below "3". This supports the idea that "temporary grouping" of students is a needed and desirable (and reform-oriented) strategy to not only foster teamwork but to also endorse and promote individualization (Foster & Penick, 1985; Gallagher, 1970; Humphreys, et al., 1982; Okebukola & Ogunniyi, 1978; Weiss, 1995).

Tennessee educators reported that they used a lot of *manipulatives and games* (strategy number 31; average mean 4.52) with their preservice teachers. This, again, emphasizes the way science should be taught (i.e., hands-on approach) which was mandated by the state of Tennessee in the mid-80s (Field, 1988; Knapp, 1982). In addition, the hands-on approach to science education is also highlighted and recommended in the National Science Education Standards which state that "learning science is an active process" with students engaging in investigations and inquiry (NRC, 1996). One educator (survey number 29 in Table H.1) reported a positive change in education students' attitude toward science after completing the "hands-on" methods course.

Implications

This study filled a void in elementary science education by gathering data about the teaching about and/or use of individualized instruction strategies in science methods courses in Tennessee teacher education programs. Overall, this study found that elementary science teacher educators taught about and/or used many of the 31 strategies aimed at individualizing science instruction in K-8 classrooms.

The study showed that Tennessee institutions have different teacher education programs. Although it was noted (in the *Demographic Subgroup Analysis* section, p. 75) that Tennessee does not differ much ($\pm 10\%$) from other states in terms of the requirement that elementary teachers take a science methods course, investigation of the contents and procedures used in these courses is by far more important. This study has just scratched the surface on these topics.

A number of Tennessee educators, for a variety of reasons, ranked some strategies low and indicated that they did not fully discuss them in their science methods courses. Elementary science teachers could be better prepared if exposed to many innovative instructional practices so as to insure that they are ready for the next generation of students. If the individualized instruction strategies are not modeled in their science methods courses, future teachers are less likely to incorporate these innovations (Gee, et al., 1996).

One of the ways to address the variation in preservice teacher preparation is to identify and propose *standards* or *minimum requirements* for the content (topics, strategies and procedures) to be included in science methods courses. Another point here is the *uniformity* of the teaching within the same institution. The researcher did a *post hoc* comparison of the strategy ratings from the six (of 26) institutions which returned two surveys. He found that about one fourth (28 %) of all of the survey strategy ratings

differed by ≥ 2 points. This could imply that the teacher educators at the institution are *not in agreement* about what's being taught in their institution's elementary science methods courses.

Computers and technology in Tennessee are slowly moving into the many and varied educational institutions. Technology resources can help solve the continuing problems in independent, individualized instruction. More efforts are needed to modernize and to improve both computer and technology literacy among all learners and educators in Tennessee.

Finally, a section of this study analyzed educator responses from two groupings of Tennessee teacher preparation institutions. The 16 religious (church-related) and 10 non-religious institutions were compared. It was found that, at least on paper, the science teacher educators in the religious institutions taught about and/or used *more* of the 31 strategies for individualizing instruction in K-8 classrooms than do their counterparts in the non-religious institutions. Some of the reasons could be the small size of the religious institutions (average enrollment 1,300 students; range 400-3,000) which lends itself to *more personalized* interactions between educators and future teachers. The non-religious institutions average about 10,000 students. Another reason could be that educators in the religious institutions probably teach other subjects besides science. They may have an *eclectic* approach to education and teacher education. Finding the "actual" reasons for these results could be an interesting and involved research activity.

Recommendations for Further Study

It is hoped that this study will motivate and inspire educators at all levels seeking curriculum reform, innovation and science literacy for their students. The researcher would like to suggest further research be done on individualized science instruction,

science teacher preparation, and science education in general. As with most research, this study has raised a number of questions suggesting further investigation. A few recommendations would be:

1. Revisit the study redesigning the survey to investigate the content and details of each elementary science methods course in the 41 state-approved teacher education programs.
2. Conduct a nationwide study on the status of individualized science instruction in elementary teacher education programs using the 31 strategies employed in this study.
3. Construct a teaching model for elementary science teachers using several of the 31 individualized instruction strategies.
4. Conduct further research to identify additional effective strategies to individualize instruction in elementary science classrooms.

Conclusion

In today's world and into the 21st Century, individual student variability demands alternate approaches to instruction and learning. Preparing teachers to deal with the diverse needs and backgrounds of students is very important.

The focus of this study was individualized instruction strategies which can be used by elementary science teachers in their classrooms. This study acknowledges the fact that no single instructional strategy is optimum for all students. Teachers are often most comfortable with the way they have been taught. Hence, they should be exposed to as many different and effective pedagogical tools and practices as possible during their teacher education and preparation.

A strong science program rich with content and a variety of instructional strategies (including individualized instruction) is needed to help maximize the science learning opportunities for *all* students. Clearly, such a program would have the attributes for *good and effective teaching*.

BIBLIOGRAPHY

BIBLIOGRAPHY

- Altman, H.B. (1981). Individualized instruction and 'back to basics': Reconciling paradoxes. Journal of College Science Teaching, 11(1), 20-24.
- AAAS (American Association for the Advancement of Science). (1993). Benchmarks for science literacy. New York: Oxford University Press.
- Andersen, H.O., & Gabel, D.L. (1981). Science preparation of the elementary teacher at Indiana University. School Science and Mathematics, 81(1), 61-69.
- Anderson, C., & Butts, D. (1980). A comparison of individualized and group instruction in a sixth-grade electricity unit. Journal of Research in Science Teaching, 17(3) 139-145.
- Anderson, R.D., & Mitchener, C.P. (1994). Research on science teacher education. In D.L. Gabel (Ed.), Handbook of research on science teaching and learning (pp. 3-44). New York: MacMillan Publishing Company.
- Ayers, J.B. (1981). Study of the teacher preparation programs of Tennessee Technological University. Report 81-2. Tennessee Technological University teacher evaluation model-Year VIII. (ERIC Document Reproduction Service No. ED 211 488).
- Ayers, J.B. (1986). Study of the teacher preparation programs of Tennessee Technological University. Report 86-2. Tennessee Technological University teacher evaluation model--Year XIII. (ERIC Document Reproduction Service No. ED 275 635).
- Baker, G.L., & Goldberg, I. (1970). The individualized learning system. Educational Leadership, 27(8), 775-803.
- Bangert, R.L., Kulik, J.A., & Kulik, C.C. (1983). Individualized systems of instruction in secondary schools. Review of Educational Research, 53, 143-158.
- Barnard, J.D. (1971). COPES: The new elementary science program. Science and Children, 9, 9-11.
- Barrow, L.H. (1987). Professional Preparation and Responsibilities of New England Preservice Elementary Science Methods Faculty. Science Education, 71(4), 557-564.

- Ben-Chaim, D., Joffe, N., & Zoller, U. (1994). Empowerment of elementary school teachers to implement science curriculum reforms. School Science and Mathematics, 94(7), 356-366.
- Berenson, S.B., & Carter, G.S. (1995). Changing assessment practices in science and mathematics. School Science and Mathematics, 95(4), 182-186.
- Betrus, A.K. (1995). Individualized Instruction: A History of the critiques. (ERIC Document Reproduction Service No. ED 383 308).
- Birdwell, L.A. (1989). Teacher attitudes toward their preparation program and their profession. (ERIC Document Reproduction Service No. 303 457).
- Black, K.M. (1994). Improved science content for preservice teachers: Modeling of teaching strategies based on current science education reform literature. (ERIC Document Reproduction Service No. ED 369 647).
- Bredderman, T. (1982). What research says: Activity science - The evidence shows it matters. Science and Children, 20, 39-41.
- Brunkhorst, H.K., Brunkhorst, B.J., Yager, R.E., Andrews, D.M., & Apple, M.A. (1993). The Salish Consortium for the improvement of science teaching preparation and development. Journal of Science Teacher Education, 4, 51-53.
- Burkman, E. (1970). ISCS: An individualized approach to science instruction. The Science Teacher, 37(9), 27-30.
- Burkman, E. (1974). Unhooking high school science: The ISIS project. The Science Teacher, 41(7), 30
- Campbell, R.L. (1978). Effects of teacher training in the individualized science materials on achievement of first grade students. Science Education, 62(7), 523-527.
- Chiapetta, E.L. (1976). Evaluating ISIS minicourses: Study in individualization. The Science Teacher, 43(6), 43-44.
- Clark, J.V. (1996). Redirecting Science Education: Reform for a culturally diverse classroom (pp. 46-65). Thousand Oaks, CA: Corwin Press, Inc.
- CERA (Comprehensive Education Reform Act). (1984). Tennessee Code Annotated, 49.
- Daug, D.R. (1986). Foundations for an elementary science methods course. (ERIC Document Reproduction Service No. ED 272 390).

- DeBoer, G.E. (1991). A history of ideas in science education: Implications for practice (pp. 158-168). New York: Teachers College Press.
- DeRose, J.V., Lockard, J.D., & Paldy, L.G. (1979). The teacher is the key: A report on three NSF studies. Science and Children, 4, 35-41.
- DeTure, L.R., Gregory, E., & Ramsey, B.G. (1990). The science preparation of elementary teachers. (ERIC Document Reproduction Service No. 319 602).
- Dunkleberger, G.E., & Knight, C.N. (1981). Determination of the cognitive consequences derived from mastery-based science instruction. School Science and Mathematics, 81(5), 383-387.
- Dunn, K., & Dunn, R. (1987). Dispelling outmoded beliefs about student learning. Educational Leadership, 44(6), 55-62.
- ESS (Elementary Science Study). (1968). Newton, MA: Education Development Center, Inc.
- Field, M.H. (1988). A chronicle of changes for elementary science in Tennessee. Education, 108(4), 419-426.
- Fleming, P.J. (1980). Staff development needs in elementary schools that individualize instruction. (ERIC Document Reproduction Service No. ED 189 094).
- Foster, G.W., & Penick, J.E. (1985). Creativity in a cooperative group setting. Journal of Research in Science Teaching, 22(1), 89-98.
- Fraser, B.J., & Butts, W.L. (1982). Relationship between perceived levels of classroom individualization and science related attitudes. Journal of Research in Science Teaching, 19(2), 143-154.
- Fraser-Abder, P. (1992). How can teacher education change the downhill trend of science education? Journal of Science Teacher Education, 3(1), 21-26.
- Gabel, D.L., & Herron, J.D. (1977). Effects of grouping and pacing on learning rate, attitude and retention in ISCS classrooms. Journal of Research in Science Teaching, 14(4), 385-390.
- Gallagher, J.J. (1970). A comparison of individualized and group instruction in science: Effects on third grade pupils. Journal of Research in Science Teaching, 7, 253-236.
- Garren, D.R., & Gathmann, D.A. (1974). Audio-tutorial instruction and student-selected curricula. (ERIC Document Reproduction Service No. ED 097 890).

- Gee, C.J., Boberg, W.S., & Gabel, D.L. (1996). Preservice elementary teachers: Their science content knowledge, pedagogical knowledge, and pedagogical content knowledge. (ERIC Document Reproduction Service No. ED 393 702).
- Germann, P., Dumas, W., & Barrow, L.H. (1995). Preparation of middle school science teachers in major state research universities. Journal of Science Teacher Education, 6, (3), 143-145.
- Gettinger, M. (1983). Effects of learner ability and instructional modification. Journal of Educational Research, 16, 362-369.
- Gilbert, S.W. (1992). A survey of science methods courses and instructors in Illinois, Ohio, and Indiana. Journal of Science Teacher Education, 3(2), 33-39.
- Gormley, K.A., Rothenberg, J.J., & McDermott, P.C. (1991). Prospective teachers' perceptions about their teacher preparation and success in teaching: A preliminary report. (ERIC Document Reproduction Service No. ED 342 738).
- Green, E.L. (1982). Individualized learning in science. School Science Review, 64(226), 16 - 22.
- Hedges, L.V. (1975). Personalized introductory courses: A longitudinal study. (ERIC Document Reproduction Service No. ED 120 121).
- Hewitt, H.C. (1974). The individual science journal. Science and Children, 11(8), 30-31.
- Hickey, M.G. (1992). Science shoeboxes. Science Activities, 29(2), 15-19.
- Humphreys, B., Johnson, R.T. & Johnson, D.W. (1982). Effects of cooperative, competitive, and individualistic learning on students' achievement in science class. Journal of Research in Science Teaching, 19, 351-356.
- James, R.K. (1972). A comparison of group and individualized instructional techniques in seventh grade science. Journal of Research in Science Teaching, 9(2), 91-96.
- Johnston, J.M. (1990). What are teachers' perceptions of teaching in different classroom contexts? (ERIC Document Reproduction Service No. ED 320 867).
- Jones, M.A. (1977) Advantages and disadvantages of individualized instruction. Journal of College Science Teaching, 6, 232-233.
- Kapuscinski, B.P. (1982). Understanding the dynamics of initiating science instruction. Journal of Research in Science Teaching, 19(8), 705-716.

- Karplus, R., & Thier, H.D. (1965). The science curriculum study. The Instructor, 74, 43-84.
- Keller, F.S. (1981). PSI and Educational Reform. Journal of College Science Teaching, 11(1), 37-38.
- Keller, F.S. (1985). Lighting strikes twice. Teaching of Psychology, 12(1), 4-8.
- Khan, A.G. (1980). Effects of audiotutorial and conventional instructional techniques on cognitive achievements. Journal of Research in Science Teaching, 17(1), 47-53.
- Klopfer, L.E. (1971) Individualized science: Relevance for the 1970s. Science Education, 55(3), 441-448.
- Knapp, J. (1982). Ten commandments for teaching elementary science. Tennessee Teacher, 49(7), 17-18.
- Krochover, G.H., & Malcolm, M.D. (1978). Effects of the science curriculum improvement study upon a child's attitude toward science. School Science and Mathematics, 78(7), 75-584.
- Kyle, W.C., Jr., Shymansky, J.A., & Alport, J.M. (1982). Alphabet soup science. The Science Teacher, 49(8), 49-53.
- Lazarowitz, R., & Huppert, J. (1982). Comparison of grade distribution between Jr. high school biology students taught by the individualized Audio-Tutorial and the frontal classroom-laboratory methods. School Science and Mathematics, 82(3), 111-117.
- Lunetta, V.N., & Dyrli, O.E. (1971). Individualized instruction in the science curriculum. School Science and Mathematics, 71(2), 121-128.
- MacDougall, J.M., & Stevens, E.I. (1994). STAT-STAR. Palm Harbor, FL: Academy Software Incorporated.
- MacMahan H., & Stevens, S. (1993). Elementary school science: An integrated teacher education program. Journal of Science Teacher Education, 4(3), 89-91.
- Marchese R.S. (1977). A literature search and review of the comparison of individualized and conventional modes of instruction in science. School Science and Mathematics, 8(8), 699 - 703.
- McAnarney, H. (1977). Whither individualized science instruction in the elementary school? School Science and Mathematics, 77(7), 578-584.

- McDuffie, T.E., & DeRose, J.V. (1982) Five years of achievement in ISCS. Science Education, 66, 35-43.
- McMillan, J.H., & May, M.J. (1979). Study of factors influencing attitudes toward science of junior high school students. Journal of Research in Science Teaching, 16, 217-222.
- Mechling, K.R., Stedman, C.H. & Donnellan, K.M. (1982). Preparing and certifying science teachers. Science and Children, 20, 12-17.
- Melchert, S. (1990). Washington state elementary science teacher preparation programs. (ERIC Document Reproduction Service No. ED 324 216).
- Melton, A.L. (1978). Student progress in self-paced, competency-based individualized science classes in an alternative Philadelphia school. Education, 98, 440-443.
- NRC (National Research Council). (1996). National Science Education Standards. Washington, DC : National Academy Press.
- NSPRA (National School Public Relations Association). (1971). Individualization in schools : The challenge and the options. Education U.S.A. Special Report. Washington, DC: National School Public Relations Association.
- NSF (National Science Foundation). (1975). Are we having science today? We are, aren't we? Mosaic, 6(2), 28-33.
- NSTA (National Science Teachers Association). (1983). Recommended standards for the preparation and certification of teachers of science at the elementary and middle/junior high school levels. (An NSTA position statement). Science and Children, 21(1), 65-70.
- Netburn, A.N. (1975). Structured elementary science and the audio-tutorial approach. Science and Children, 12(5), 29-30.
- Newport, J.F. (1973). Alternative approaches in elementary school science. School Science and Mathematics, 73(8), 619-626.
- Novak, J.D., & Musonda, D. (1991). A twelve-year longitudinal study of science concept learning. American Educational Research Journal, 28(1), 117-153.
- Okebukola, P.A., & Ogunniyi, M.B. (1984). Cooperative, competitive, and individualistic science laboratory interaction patterns - Effects on students' achievement and acquisition of practical skills. Journal of Research in Science Teaching, 21, 875-884.

- O'Neal, J. (1991). Raising our sights: Improving U.S. achievement in mathematics and science. (ERIC Document Reproduction Service No. ED 342 651).
- O'Toole, R.J. (1968). The effectiveness of individualized elementary school science. Science Education, 52(4), 381-384.
- Plewes, J.A. (1979). Mixed-ability teaching. Journal of Research in Science Teaching, 16(3), 229 - 236.
- Plimmer, D. (1981). Science in the primary schools : What went wrong ? School Science Review, 62(221), 641-647.
- Prather, J.P., & Hartshorn, R.L. (1989). Evaluation of a model for reform of elementary science instruction in rural and small school systems. Journal of Rural and Small Schools, 3(3), 6-13.
- Prather, J.P., Hartshorn, R.L., & Walters, N.J. (1990). A survey instrument for qualitative and quantitative examination of hands-on science instruction using videotape-jury review techniques. Journal of Elementary Science Education, 2(1), 16-29.
- Ramsey, G.A., & Howe, R.W. (1969). An analysis of research on instructional procedures in secondary school science. Science Teacher, 36(4), 72-91.
- Reiter, P.J., & Penick, J.E. (1991). Elementary science teacher education: Seven exemplars. Journal of Science Teacher Education, 2(1), 22-27.
- Repicky, P.A. (1978). Another individualized science program? Yes, but. School Science and Mathematics, 78, 93-98.
- Rice, D.C., & Corboy, M.R. (1995). Elementary science instruction: Are teachers prepared to teach what their students must master? (ERIC Document Reproduction Service No. ED 387 327).
- Roach, D.K., & Hammond, R.A. (1981). Individualized instruction in Great Britain : A survey and a case study. Journal of College Science Teaching, 11(1), 25 - 29.
- Rossman, M. (1983). Why kids fail to learn science and what to do about it. Learning, 12, 76-80.
- Rowell, C.G., LeCoulre, M., & Crosland, W. (1995). Individualized instruction model for the preparation of elementary school educators, Unpublished manuscript, University of Tennessee, Knoxville.
- Rowntree, D. (1981). A dictionary of education. Totowa, NJ: Barnes & Noble Books.

- Salant, P., & Dillman, D.A. (1994). How to conduct your own survey. New York: John Wiley & Sons.
- Sanders, W.L., Saxton, A.M., & Horn, S.P. (1997). The Tennessee value-added assessment system (TVAAS): A quantitative, outcomes-based approach to educational assessment. In J. Millman (Ed.), Grading teachers, grading schools (pp. 41-66). Thousand Oaks, CA: Corvin Press, Inc.
- Sandrin, J.V. (1987). Readiness for individualization of instruction. An assessment of educational beliefs among four groups of educators. (ERIC Document Reproduction Service No. ED 277 681).
- Saunders, R.L. (1986). Efforts to reform the education of teachers: Implications for colleges of arts and science and colleges of education. (ERIC Document Reproduction Service No. ED 277 661).
- SCIS (Science Curriculum Improvement Study). (1985). Nashua, NH: Delta Education, Inc.
- Shepardson, D.P., & Britsch, S.J. (1997). Children's science journals: Tools for teaching, learning, and assessing. Science and Children, 34(5), 12-17, 46-47.
- Shymansky, J.A. (1980). Rating your individualized program. Science and Children, 17(5), 32 - 33.
- Sigda, R.B. (1983). The crisis in science education and the realities of science teaching in the classroom. Phi Delta Kappan, (May), 624-627.
- Silberman, C. (1971). A critical view of individualization, individualized instruction in schools. Education U.S.A. Washington, DC : National School Public Relations Association.
- Stepans, J.I., McClurg, P.A., & Beiswenger, R.E. (1995). A teacher education program in elementary science that connects content, methods, practicum, and student teaching. Journal of Science Teacher Education, 6(3), 158-163.
- Stronck, D.R. (1980). The educational implications of human individuality. American Biology Teacher, 42(3), 146-151.
- Stronck, D.R. (1985). Recommendations of British Columbia Science Teachers for Revising Teacher Education Programs. Science Education, 69(2), 247 - 257.
- Tennessee Department of Education (1984). Tennessee Science Curriculum Framework K-6. Nashville: Tennessee Department of Education.

- Tennessee Department of Education (1995). Tennessee Science Curriculum Framework K-12. Nashville: Tennessee Department of Education.
- Tennessee Higher Education Commission. (1987). The future of Tennessee: Higher education 1987-1993. (ERIC Document Reproduction Service No. ED 318 356).
- Tennessee Higher Education Commission. (1994). The status of higher education in Tennessee, including the fourth annual report on progress toward the goals of Tennessee Challenge 2000 for the state's public higher education institutions and the first annual report on contributions of the state's independent, regionally accredited higher education institutions. (ERIC Document Reproduction Service No. ED 375 747).
- Tennessee State Board of Education. (1993). Tennessee's education policy: A mid-course assessment. (ERIC Document Reproduction Service No. ED 369 731).
- Tolman, M.N., & Campbell, M.K. (1991). Science preparation requirements of elementary school teachers in the United States. Journal of Science Teacher Education, 2(3), 72-76.
- Victor, E. (1980). Science for the elementary school. (4th ed.). New York: MacMillan Publishing Company.
- Weiss, I.R. (1994). A profile of science and mathematics education in the United States: 1993. (ERIC Document Reproduction Service No. ED 382 461).
- Weiss, I.R. (1995). Mathematics teachers' response to the reform agenda: Results of the 1993 national survey of science and mathematics education. (ERIC Document Reproduction Service No. ED 387 346).
- Welker, J.D. (1985). Individualized instruction in science for students in elementary education at the University of Alabama. (ERIC Document Reproduction Service No. ED 274 337).
- Whybrew, E. (1982). Scientific illiterates? Tennessee Teacher, 49(7), 15-16.
- Willett, J.B., Yamashita, J.J.M., & Anderson, R.D. (1983). A meta-analysis of instructional systems applied in science teaching. Journal of Research in Science Teaching, 20(5), 405 - 417.
- Wise, K.C., & Okey, J.R. (1983). Meta-analysis of the effects of various science teaching strategies on achievement. Journal of Research in Science Teaching, 20, 419-435.

- Woodbury, J.M. (1995). Science teaching methods and strategies of exemplary fifth-grade teachers. Unpublished doctoral dissertation, University of Tennessee, Knoxville.
- Worthy, W. (1982). Improving science education for children. Chemical and Engineering News, 60, 39-41.
- Yager, R.E. (1988). Toward a model science teacher education program. (ERIC Document Reproduction Service No. ED 294 722).
- Yager, R.E., & Penick, J.E. (1983). School science in crisis. Curriculum Review, 22, 67-70.
- Yager, R.E., & Penick, J.E. (1984). What students say about science teaching and science teachers. Science Education, 68, 143-152.
- Zeitler, W. (1975). Individualized science. Science and Children, 12(5), 32-33.

APPENDICES

APPENDIX A

UTK Individualized Instruction Program: Program Description and the 31 Frameworks

PORTFOLIO ASSESSMENT/EVALUATION IN TEACHER EDUCATION

INDIVIDUALIZED INSTRUCTION MODEL FOR THE PREPARATION OF ELEMENTARY SCHOOL EDUCATORS

KNOX COUNTY SCHOOLS AND THE COLLEGE OF EDUCATION, UNIVERSITY OF TENNESSEE KNOXVILLE, TENNESSEE

SEMESTERS: FALL, SPRING - SENIOR YEAR
FALL, SPRING - FIFTH YEAR

For additional information about this program or the implementation of it, contact Dr. C. Glennon Rowell or Ms. Laura Hopfer via Ms. Karen Spitzer, 212 Claxton, University of Tennessee, Knoxville, TN 37996-3400, Tel. (423) 974-4120; Dr. Margie LeCoultré, Principal of Ridgedale Elementary School, 4600 Ridgedale Road, Knoxville, TN 37921, Tel. (423) 909-9060; Mr. Bill Crosland, Principal of Brickey Elementary School, 1810 Dry Gap Pike, Knoxville, TN 37918, Tel. (423) 689-1499; Dr. Sharon Roberts, Principal of Belle Morris Elementary School, 2308 Washington Pike, Knoxville, TN 37918, Tel. (423) 594-1277; or Ms. Rebecca Sharpe, Principal of Dogwood Elementary School, 705 Tipton Avenue, Knoxville, TN 37920, Tel. (423) 579-5677.

Purpose of the Program

The purpose of this program is to prepare prospective elementary school teachers on how to effectively individualize instruction in the elementary schools, K-8. The program's intent, in part, is to help prospective teachers avoid an overly routinized model of providing the exact instructional program for each student in a classroom, hour-after-hour, for each day of the week.

Purpose of the Portfolio

The purpose of the portfolio is to provide for participants in the Individualized Instruction Program a vehicle for documenting that they have mastered the goals and objectives of the program and to have a record of their teacher preparation program to present to potential employers. Thus, the portfolio will be an ongoing (over a two-year period) collection of samples of each college student's involvement in the program. All content in the portfolio will serve as a validation of that phase of the program in which the content was collected.

Objectives of the Program

There are four basic and specific objectives for the program. These include the following:

1. To provide participants with specific techniques for learning about the children they will teach, including the identification of interests and special skills/talents, home backgrounds, and community conditions.
2. To provide participants with specific techniques on how to determine differences among learners.
3. To provide participants with specific planning strategies that lead to individualized instruction in the elementary school classroom.
4. To broaden participants' knowledge of teaching strategies and grouping practices that help attend to individual differences.

Each of these objectives has sets of strategies which will be pivotal in the development of the portfolio. These will be explained in detail later in this document.

Program Overview

This program has been developed to provide the participants with intensive training on how to individualize instruction in the elementary school. Thus, from the beginning semester (Fall Semester of first year) to the last semester of the program for each group of college students (Spring Semester of second year), **the basic theme of the program will be individualization of instruction.** To more effectively carry out this theme, most of the college courses will be taught in the participating schools (Ridgedale, Brickey, Belle Morris, and Dogwood Elementary Schools), with **many opportunities** for the participants in the program to work with children in the four schools involved.

The program is a **cohort** program in that the participants will be moving through the program together. The program is a **professional block** in that the four semesters of the program will be considered as a unified program, with coursework taken one semester highly related to coursework in other semesters. The program is an **on-site program** in that almost all of the college courses will be taught in the elementary schools where students are, at the same time that they are taking coursework, doing their practica and internship. The four specific semesters and what is to be achieved in each are as follows:

1. Semester 1 (Fall Semester of First Year)

In this semester, students will be taking their first educational courses (unless some unrestricted courses were taken prior to the participants' acceptance into the program). The purpose of the coursework/practica in this semester is to better understand children and how they learn and develop, basic concepts/skills for teaching health in the schools, basic concepts/skills for teaching art in the schools, and an effective children's literature program for elementary school students. A vital part of the first semester will be for the participants to become acquainted with their assigned school and the community in which it is situated as well as to begin to learn how parents play a significant role in the education of their children. **Participants should begin (and/or continue) formulating their beliefs about sound principles of education for children, built on basic principles of individualization of instruction.**

2. Semester 2 (Spring Semester of First Year)

In the second semester, the participants will continue taking education courses, including the continuation of a study of children and how they learn, the purpose of schools, the effect of environment on education, and how parents can be involved in the learning process of their children. Methodology in the content fields will continue, with students learning how to individualize instruction in reading, language arts, mathematics, science, and social studies. Special attention will also be given to how one uses the computer to teach these subject areas and how the areas can be integrated. **Participants should increasingly become more reflective in their teaching and make hard choices between one approach/strategy for teaching and another approach/strategy.** At this point, each participant should be able to outline his/her philosophy of education.

3. Semester 3 (Fall Semester of Second Year)

During the third semester of the program, participants in the Individualized Instruction Program will begin their year-long internship. It is during this semester that students will be assigned more to one classroom than during the previous two semesters of the program. The internship at UTK is a significant year in that all aspects of what students have been learning about teaching will be brought together. Participants will be in one of the two schools where they have participated during their senior year as an undergraduate. Students will spend some time in a school or schools other than the two they worked in during their first two semesters of work.

During the third semester, students will be taking Educ. 574 (Analysis of Teaching) and HTL 505 (Elementary Methods), along with four hours of 575 (Internship). Most of the school day, every day will be involved with the internship and taking coursework (again, on site). The course, Educ. 574 will be taken to help interns continue their reflection on what techniques they use in teaching, why they are using these techniques, and what alternative ways of teaching might have been selected. During this course, much attention will be given to how individualization of instruction, the theme for the Individualized Instruction Program, can and should be implemented throughout the school day. Students will continue to work toward mastery of the gamut of strategies that will be periodically introduced and subsequently applied in the classroom.

4. Semester 4 (Spring Semester of Second Year)

The fourth semester of the program will be in many ways the culminating experience in each participant's teacher-preparatory experiences. It is the second semester of the internship year. Participants, in addition to receiving credit for eight hours of internship (Educ. 575) will take Educ. 591, Clinical Studies (4 hrs.). During this class, students will be involved in seminar-type discussions aimed at analysis of their basic competencies in core education courses and finalizing their portfolio.

This semester of internship is more comprehensive, and participants are expected to do more full-day teaching. It is during this semester that each student will (1) finalize his/her portfolio for presentation to a committee of teachers/professors and to peers and (2) present to his/her peers a summary (oral presentation) of the **capstone experience**. The primary goal of the **capstone experience** is to provide for each participant an opportunity to demonstrate that he/she is a reflective practitioner, meaning that the participant, as a future teacher is very discriminating in setting up learning experiences for children. In other words, the participants select only the most effective teaching strategies and work to continuously improve those strategies. The **capstone experience** highlights an earlier-identified teaching problem or approach that each participant has selected to explore and/or experiment with in detail. One example might be a unique approach a participant developed for integrating mathematics and science with a particular grade level. How the approach evolved, the theory/research behind the approach, how the approach was "tried out" with the intern's students, the success and/or

failure with the "try out," and adjustments the participant will make with the approach are basic elements that would be included in a report on the **capstone experience**. Another example is the setting up of a special program for using the computer to teach writing to a selected group of students. It is hoped that whatever the approach, the theme of individualizing instruction will be prominent.

Participants in the program are responsible for selecting a meaningful theme/problem/approach to teaching as early in their coursework as possible. The identification of the project will be discussed not only in a seminar aimed at helping participants integrate their experiences, but in other classes taken. The earlier the topic of the **capstone experience** is selected, the more meaningful the experience will be and the easier it will be for students to effectively carry out this assignment.

Outline of Content for the Portfolio

Part I. Objectives and Strategies for Individualized Instruction in the Elementary School

Objective 1: To provide participants with specific techniques for learning about the children they will teach, including the identification of interests and special skills/talents, home backgrounds, and community conditions.

College students participating in the program will specifically be involved in learning how to learn more about students' backgrounds, hobbies, and interests through the following strategies:

- a. Gathering and using demographic data on students (from multiple sources)
- b. Acquiring information about services available for students
- c. Using interest inventories to learn about students' reading habits, hobbies, television-viewing habits, and so on
- d. Involving parents in the instructional program (including the use of parents as resources for instruction)
- e. Using a computer-tracking system to keep student profiles

Objective 2: To provide participants with specific techniques on how to determine differences among learners

- a. Using journals, logs, and progress-charting activities
- b. Implementing portfolio assessment

- c. Using video and audio tapes for assessment
- d. Observing children at work and determining academic and other needs
- e. Implementing self-assessment procedures
- f. Conferencing with students effectively
- g. Developing and using teacher-made tests
- h. Using commercial tests to determine student placement and to use as diagnostic instruments

Objective 3: To provide participants with specific planning strategies that lead to individualized instruction in the elementary school classroom

College students participating in the program will be involved in establishing appropriate instructional plans and related objectives that maximize individualization of instruction, including the following:

- a. Planning for and maintaining an interactive classroom
- b. Planning daily lessons for large groups, small groups, and where necessary, individual students
- c. Using the Tennessee Instructional Model (TIM)
- d. Establishing long-range instructional goals and short-term objectives
- e. Developing units and mini-units
- f. Developing instructional objectives that vary in focus, including those built around interests of students, special needs that students have, objectives calling for students to analyze what is to be learned, synthesize materials, and evaluate what has been learned
- g. Developing independent tasks and assignments for individual children

Objective 4: To broaden participants' knowledge of teaching strategies and grouping practices that help attend to individual differences

College students participating in the program specifically will be specifically involved in observing and planning instructional strategies and grouping practices that include the following:

- a. Implementing Cooperative Learning groups

- b. Using peer teaching
- c. Providing academic and skill coaching
- d. Setting up learning stations or centers
- e. Using computers with individuals and small groups
- f. Grouping students according to interests
- g. Using ability grouping appropriately
- h. Employing thematic and project teaching
- i. Setting up various kinds of small groups, including dyads and triads
- j. Using graphic organizers, story frames, webbing, and mapping strategies
- k. Using manipulatives and games

The strategies above should be documented in the portfolio according to how each individual participant chooses to document them. However, it is suggested that each strategy's **framework** (which will be presented as appropriate in the coursework participants will take) be thoroughly reviewed. An example of a **framework** for **3a-Planning for/Maintaining an Interactive Classroom** is shown on the following page. Three levels of competencies for this strategy (and for the others in the four objectives) will be examined, using the **rubrics** that follow the **framework**. It is important that participants understand why three levels of competencies for the same framework are expected. Simply performing at one level (for example, Level 1) is somewhat like teaching a skill such as paragraph writing to students in a classroom. The mechanics of paragraph writing (topic sentence, supporting sentences that are related, etc.) can be introduced, but writing good paragraphs takes more effort on the part of students over time. Given more efforts at writing paragraphs over time, leads to a better mastery of the mechanics initially introduced but also the development of more polished, complex paragraphs.

An Example of a Framework for Individualizing Instruction

Planning for/Maintaining an Interactive Classroom (3a) (Specific Topic)

Definition: Classroom where students are free to interact with each other and the teacher on topics being studied in class (as opposed to traditional lecture-oriented, teacher-dominated classroom with passive learners).

Value of: Students more interested in what is to be learned, feel more free to explore what is being studied, are more involved, and go further in studying topic. Active learning replaces passive learning.

Basic Procedures for:

- Have classroom where group work can take place, rather than all seats in straight rows with the teacher's desk in front.
- Plan centers of learning that invite students to participate in a variety of activities.
- Encourage extensive oral-language activities, including small-group work, pairs of students working together, and oral presentations.
- Learn to serve as a facilitator rather than as a teacher who authoritatively dispenses with knowledge about topic to be learned.
- Assess learning environment periodically to determine extent to which students are involved in learning.
- Plan project-theme teaching activities.

Subject Areas Accommodated: All curricular areas should be taught in an interactive classroom. This includes language arts, social studies, math, science, art, and health.

Introductory Implementation: Set up a simplified set of activities where students are working in a limited number of centers in the room. Have specific procedures established to make the centers function well.

Expanded Implementation: Extend the number of centers beyond one subject area and beyond the number started above. Try to implement three or more of the basic strategies given above.

Application Across the Curriculum: Use all strategies identified above, but extend it to the total school day. Integrate two or more subject areas where it is possible to do so.

Rubrics for Determining Competencies of Each Strategy

(Level 1)

- 1. Has studied the topic and reflected on the significance of the basic concepts involved**
- 2. Knows basic strategies (or procedures) for implementation and made initial attempts to implement**
- 3. Has self-analyzed* initial attempts and made plans for adjusting problems encountered**

***Can be done after someone else has observed attempts at implementation**

(Level 2)

- 1. Has continued to study the topic and has reflected on the basic concepts/procedures involved**
- 2. Has experimented with the basic procedures and expanded attempts at implementing to include several different subject areas of the elementary-school curriculum**
- 3. Has shown growth from self-analysis**

(Level 3)

- 1. Has become an expert on the topic and can thoroughly explain merits of the topic**
- 2. Has become highly skilled in implementing the procedures involved**
- 3. Has fine tuned the procedures after several attempts at implementing the overall strategy across several curricular areas, including integration of some subjects**

Part II. Selecting a Problem for the Capstone Experience

A. The purpose of the **capstone experience**, as previously discussed, is to provide an opportunity for each participant to demonstrate that he/she is a reflective practitioner.

1. Each participant will select a problem or approach to teaching that will become a focal point for ongoing exploration and experimentation
2. The problem or approach will be selected early in the internship year, but may be identified during the first year of the program
3. A brief summary of the problem or approach to teaching will be approved by an advisory group serving as coordinator of the program

B. Outline for Presenting the Capstone Experience

1. Discussion of how the teaching problem or approach was selected, including the rationale for selecting it
2. Discussion of the background of the teaching problem or approach selected, including information about other attempts to implement the approach
3. Description of students in the classroom where approach was tried out
4. Description of the success (failure) of the approach
5. Explanation of adjustments to be made before approach will be tried again

C. Format for documenting the **capstone experience** in the portfolio

1. The format of how the **capstone experience** will be presented in the portfolio is left to the individual, but some possible modes for the presentation follow:
 - a. A three-four page paper following the outline in B above
 - b. Copies of students' work presented as evidence of the success (or lack thereof) of the **capstone experience**
 - c. Photographs of ongoing work around the topic of the problem or approach
 - d. Descriptive episodes of events that happened during the carrying out of the **capstone experience** that tell the complete story of the experience
 - e. Combinations of a-d

Part III. Documentation of Course Requirements for the Portfolio

- A. In the various courses taught (Art Education, Health Education, Language Arts, Reading, and so on) the strategies outlined in Part I and the capstone experience presented in Part II will be, to a degree, woven into the content of the respective course. Each professor and/or teacher involved in teaching in the program is committed to advancing the theme of individualized instruction in the elementary school. Thus, the professor teaching the language arts portion of HTL 422 and perhaps HTL 505, might well ask students to develop a system for tracking spelling errors of children with whom the college student is working. This task easily fits under Objective 2a (Using journals, logs, and progress-charting activities). Samples from children's papers could be submitted in the portfolio as documentation under this objective.
- B. Some content-specific documentation might be required in situations where the content being taught (in health, art, and so on) does not easily fit the strategies found under the four basic objectives of the individualized instruction focus. These will be explained as appropriate in the courses taken.

Developing a Timeline for Completing the Portfolio

It is imperative that each participant in the program develop a personal timeline for completing the portfolio. Since the portfolio will be developed throughout the coursework (and often in conjunction with it), it is important that the sequence of coursework (and accompanying practica) be used as a base for developing the timeline. While reference has been made to the courses to be taught, the following diagram should be helpful in understanding the total program's courses:

Four Semesters of Coursework/Practica

Semester 1	Semester 2
PES 210 Human Development - 3 hrs. IS 330 Children's Literature - 3 hrs. AE 301 Art Educ - 3 hrs. HE 306 Health/Elem. Grades - 3 hrs. EdSMRT 486 Intro to Inst. Computing - 3 hrs.	ED 400 Prof. Studies: Teachers, School, & Society - 2 hrs. ED 401 Prof. Studies, The Learner - 3 hrs. HTL 422 Rdg./Lang. Arts; Soc. Studies; Math/Science Methods - Part I - 6 hrs. HTL 351 & 356 Field/Lab. Exp. - 1 hr. each
Semester 3	Semester 4
ED 575 Internship - 4 hrs. ED 574 Analysis of Teaching - 2 hrs. HTL 505 Rdg./Lang. Arts; Soc. Studies; Math/Science Methods - Part II - 6 hrs.	ED 575 Internship - 8 hrs. ED 591 Clinical Studies - 4 hrs. Completion of portfolio & analysis of teaching project - Capstone Experience

The timeline for completing the portfolio roughly should follow the pattern below:

1. All frameworks should be introduced during the first year, and participants should make an effort to move through Level 1 in each. This may not be possible, but it is a reasonable goal to set.
2. For some of the frameworks, Level 2 competency can be met by the end of the first year (end of second semester). In a rare few cases, a participant might meet all levels of competencies in some of the frameworks during the first year of the program.
3. Beginning in the internship year, the opportunities for meeting competencies in all strategies (frameworks) will begin to increase. Participants should be alert to these opportunities.
4. By the end of the halfway point through the internship year, many competencies should be met through the third level. **This means that the portfolio will be developing more rapidly than during the previous year.**
5. Participants should hold periodic conferences with a designated mentor and/or mentors about the progress of their portfolios.

The following forms will be used in making an assessment/evaluation of the portfolio:

Interns Exit Interview - Portfolio Evaluation Form

The portfolio should reflect that the participant has become a **reflective practitioner** during the two years of the Ridgedale/Brickey/Belle Morris Individualized Instruction Program. Since the program's theme has been on individualizing instruction in the elementary school, the portfolio should reflect this theme, with attention given in the collection to the strategies that are found under the four major objectives.

Portfolio Contents:

The portfolio reflects that the participant has been consistent in developing all aspects of the portfolio, has a collection that exemplifies professional growth, and is well-arranged. * Check indicates appropriate completion of the requirement.

- _____ Cover letter which describes the content of the portfolio
- _____ Statement of philosophy which reflects an understanding of individualized instruction for elementary-school children and how the candidate's beliefs about teaching have changed-- (Reflection statement)
- _____ Brief summary of the Capstone Experience
- _____ Program copy of the Capstone Experience
- _____ Statement from the intern supervisor (school level, mentoring teacher)
- _____ Comments from others who have worked with this participant (principal, administrative intern, graduate student(s) from UTK, professors from UTK, other teachers in the school with whom the participant has worked closely)

(signature of Participant)
site)

Date _____

(signature of Principal at assigned school

Date _____

(signature of UTK representative)

Date _____

(signature of UTK liaison)

Date _____

Date: _____

I _____, do hereby affirm that the contents of this portfolio are my own work. I also give permission for the following evaluation team members to view my portfolio for assessment.

Signed: _____

Date: _____

Team members:	Dean Rowell	_____
	Principal	_____
	Program Coordinator	_____

Intern Name: _____
Exit Interview Grade Pt. Average: _____

University of Tennessee - College of Education
Intern Exit Interview

Grading: Total Number of Points per / Number of Evaluators
A= 22 pts + B= 20 pts.+ C= 18.5 pts.

Objective 1: To provide participants with specific techniques for learning about the children they will teach.

- a. gathering and using demographic data on students
- b. acquiring information about available services
- c. use of interest inventories
- d. parental involvement in instructional programs
- e. use of computer tracking systems

_____ evidence of awareness (1pt)

_____ evidence of implementation (2 pt)

_____ evidence of self-analysis (3 pt)

Area(s) of strength: May list by framework

Area(s) of need: May list by framework

Comments:

Objective 2: To provide participants with specific techniques to determine differences among learners.

- a. Use of journals, logs and progress charts
- b. Use of portfolio assessment
- c. Use of video and audio tape assessment
- d. Assessment of students by observation
- e. Self-assessment (student and teacher)
- f. effective student conferencing
- g. developing teacher made tests
- h. use of commercial tests for diagnostic purposes

_____ evidence of awareness (1pt)

_____ evidence of implementation (2 pt)

_____ evidence of self-analysis (3 pt)

Area(s) of strength: May list by framework

Area(s) of need: May list by framework

Comments:

Objective 3: Specific planning strategies that lead to individualized instruction

- a. planning/maintaining an interactive classroom
- b. daily lesson plans for various size groups
- c. using the TIM
- d. establishing long-range goals and short-term objectives
- e. development of units and mini-units
- f. development of instructional objectives that vary in focus
- g. development of individualized tasks and assignments

_____ evidence of awareness (1pt)

_____ evidence of implementation (2 pt)

_____ evidence of self-analysis (3 pt)

Area(s) of strength: May list by framework

Area(s) of need: May list by framework

Comments:

Objective 4: To broaden knowledge of teaching strategies and grouping practices.

- a. implementing cooperative learning
- b. use of peer teaching
- c. provides academic and skills coaching
- d. constructs and implements learning stations and centers
- e. use of computers with individuals and small groups
- f. facilitated interest based groups
- g. appropriate use of ability grouping
- h. use of thematic and project teaching
- i. setting up various small groups
- j. use of graphic organizers, story frames, webbing and mapping strategies
- k. use of manipulatives and games

_____ evidence of awareness (1pt)

_____ evidence of implementation (2 pt)

_____ evidence of self-analysis (3 pt)

Area(s) of strength: May list by framework

Area(s) of need: May list by framework

Comments:

Self-Assessment:

Overall area of strength:

Overall area of need:

Pre-Intern Name: _____
Exit Interview Grade Pt. Average: _____

University of Tennessee - College of Education
Pre-Intern Exit Interview

Grading: Total Number of Points per / Number of Evaluators
A= 19.5 pts + B= 17.5 pts.+ C= 15.5 pts.

Objective 1: To provide participants with specific techniques for learning about the children they will teach.

- | | |
|---|---|
| a. gathering and using demographic data on students | d. parental involvement in instructional programs |
| b. acquiring information about available services | e. use of computer tracking systems |
| c. use of interest inventories | |

_____ evidence of awareness (1pt)

_____ evidence of implementation (2 pt)

_____ evidence of self-analysis (3 pt)

Area(s) of strength: May list by framework

Area(s) of need: May list by framework

Comments:

Objective 2: To provide participants with specific techniques to determine differences among learners.

- | | |
|--|--|
| a. Use of journals, logs and progress charts | e. Self-assessment (student and teacher) |
| b. Use of portfolio assessment | f. effective student conferencing |
| c. Use of video and audio tape assessment | g. developing teacher made tests |
| d. Assessment of students by observation | h. use of commercial tests for diagnostic purposes |

_____ evidence of awareness (1pt)

_____ evidence of implementation (2 pt)

_____ evidence of self-analysis (3 pt)

Area(s) of strength: May list by framework

Area(s) of need: May list by framework

Comments:

Objective 3: Specific planning strategies that lead to individualized instruction

- a. planning/maintaining an interactive classroom
- b. daily lesson plans for various size groups
- c. using the TIM
- d. establishing long-range goals and short-term objectives
- e. development of units and mini-units
- f. development of instructional objectives that vary in focus
- g. development of individualized tasks and assignments

_____ evidence of awareness (1pt)

_____ evidence of implementation (2 pt)

_____ evidence of self-analysis (3 pt)

Area(s) of strength: May list by framework

Area(s) of need: May list by framework

Comments:

Objective 4: To broaden knowledge of teaching strategies and grouping practices.

- a. implementing cooperative learning
- b. use of peer teaching
- c. provides academic and skills coaching
- d. constructs and implements learning stations and centers
- e. use of computers with individuals and small groups
- f. facilitated interest based groups
- g. appropriate use of ability grouping
- h. use of thematic and project teaching
- i. setting up various small groups
- j. use of graphic organizers, story frames, webbing and mapping strategies
- k. use of manipulatives and games

_____ evidence of awareness (1pt)

_____ evidence of implementation (2 pt)

_____ evidence of self-analysis (3 pt)

Area(s) of strength: May list by framework

Area(s) of need: May list by framework

Comments:

Self-Assessment:

Overall area of strength:

Overall area of need:

FRAMEWORKS

TO

GUIDE

PRE-INTERNS

AND

INTERNS

Theory/Practicum Framework

Gathering and Using Demographic Data on Students (From Multiple Sources) (1a) (Specific Topic)

Definition: Demographic data refer to information about students' backgrounds, including socioeconomic status, language skills/development, family stability, neighborhood conditions, previous success/failure in school, extent students have moved, learning styles, and so on.

Value of: Knowing demographic data helps in planning for each student, including the most appropriate curricula/activities for each student and how to reach each one.

Basic Sources for Gathering Demographic Data:

- Past school records, including cumulative folders
- Conferences with students' former teachers
- Learning style inventories
- Visits to students' neighborhoods and their homes
- Conferences with social workers and other agents who serve students being taught
- Health records, including what the home might furnish
- Students' reactions to surveys (Examples: how they feel about school, certain school activities, projected/possible careers, and so on)
- Sociograms
- Language assessment (including bilingual facilities)

How to Use Demographic Data:

- Treat each student as an individual, using group data (Examples: immigrant children, children from same socioeconomic status, children from one-parent families) only as a general guide.
- Be alert to discrepancies between materials/activities to be used and knowledge/skills students possess (Example: Picture of stepladder to teach st blend may not be appropriate for students who only know concept and vocabulary for ladder).
- Be aware that for some children, the school culture is quite different from their previous school's culture (Example: for some immigrant children listening to the teacher, not interacting in groups, was dominant mode for learning).
- Always use varied types of activities, such as manipulative activities, use of visuals, use of audio materials, movement activities, and so on.

Implementation of: Use demographic data to develop a profile for three or four students. Learn how to develop activities for them, then expand to other students.

Theory/Practicum Framework

Acquiring Information About Services Available for Students (Specific Topic) (1b)

Definition/Explanation of: The school is just one organization that works to improve the lives of children. Health agencies, human services agencies, social workers, family counseling agencies, public librarians, and many others must be fully involved, where needed, in helping meet the total needs of the students in a classroom. All agencies working with the school help accomplish this.

Value of: The school's primary focus is to educate each student, but this is done best when services of all agents in the community come together to help students.

Basic Procedures for Enlisting Help from Other Agencies:

- Learn what agencies are available to help students in the school's area and specifically what services they provide.
- Learn, where possible, the specific names of personnel in each agency who are "school oriented" and willing to work closely with the school.
- Hold conferences with identified personnel (those above) to plan strategies for working together (but be sure to do this with others in the school asked to help work with community agencies).
- With others in the school, plan sessions with parents to fully acquaint them with services available through agencies in the community (Note: Sessions might be held in the school, but in some cases, better attendance comes from parents gathering in homes to learn about these services.).
- Help set up a volunteer travel pool to transport parents and their children to service agencies such as the County Health Clinic.

Initial Implementation: Work with the principal of the school or a designated faculty member to determine what Community/County Agencies are available to help students. Visit the agencies, if possible. Ask teachers in the school to let you observe a conference with two or three sets of parents where plans are being made with the parents to have their children get a hearing test, get immunizations, visit the public library, and so on. Ask teachers in your school to let you review correspondence to parents about services available in the community.

Expanded Implementation: In consultation with your principal/supervising teacher, plan (and if possible take the lead in implementing) conferences with two or three sets of parents about services for their children.

Knowledge/Practicum Framework

Using Interest Inventories, etc. (1c)

(Specific Topic)

Definition: Surveys completed by children to determine their interests in a wide-range of areas, including what they like to do with their free time, what they like to read, what they like to collect, and so on.

Value of: Gives teachers a wide array of areas around which curriculum can be organized, around which reading lists can be developed for individual students, and areas in which teachers can communicate with students.

When to Give: Can be given several times during year, but should be given early in year as one time. A complete survey can be given at one time, or portions of a survey can be given at appropriate intervals.

Use of Information From Inventories: Can be used to develop activities in all subject areas, including activities for individuals or small groups of students with common interests. Students with similar interests work together to write a story, collect pictures/words on their common interests, write word problems in math using their common interests, plan and build a health bulletin board, and any variety of activities centered around the identified interests. Any of these activities can be similarly done by an individual student.

Involvement of Parents With Their Children's Interests: Hold parental conferences to set up program for parental involvement around specific interests of their children. Some activities: finding books on interests, planning television viewing around interests, going to city library, writing for information (on children's specific interests), visiting museums or other centers to help feed children's interests, and collecting pictures or photographs on children's interests.

Introductory Implementation: Set up a simple system for determining children's interests, such as giving a segment of an interest inventory (e.g., What I like to read about), check out books to match interests, and so on.

Extended Application: Fine tune introductory activities and expand to several curricular areas and to a larger number of students. Eventually, weave interests of all students into total-school curriculum.

Theory/Practicum Framework

Involving Parents in the Instructional Program, Including
the Use of Parents as Resources for Instruction (1d)
(Specific Topic)

Definition/Explanation of: Parents are a child's first teacher. Parents should be involved as much as possible in the instructional program (or support thereof) via serving as resources (Example: Explaining their career when careers are being studied, showing artifacts from a country they have visited, taking their children to a museum, helping with a field trip, and so on), helping make the learning/study environment in the home as effective as possible, and helping motivate their children to learn and love learning.

Value of: As the child's first teacher and as a "continuous teacher," this valuable resource provides unlimited potential for the instruction that goes on in schools. Parents can be the best possible partners in helping children "learn how to learn."

Basic Plan for Soliciting Parental Help:

- In an early meeting with or communicate to all parents who have children in the same class, survey how parents can help that year with the instructional program. The survey should include questions related to what will be studied that year (Example: the basic units being planned) and questions about resources the parents might provide.
- When instructional plans change or when a unit/mini-unit is being introduced, communicate again with parents via memo/newsletter about the topics to be covered in the unit.
- Invite selected parents to make presentations to the class, but be sure to be thorough in planning (how long the presentation will be, facilities, needed, etc.).
- Ask parents to help their own children when they are gathering resources, asked to watch a certain television program, or doing homework for a class assignment.
- Communicate with parents about overall conditions that children need for the most effective learning environment at home. In individual cases, communicate with parents about progress their children are making, some specific points that parents could follow in helping their children, and so on.

Implementation: Talk with teachers about the different ways they involve parents in the instructional program. Make notes of these ways. If possible, follow through with actual participation in the process of involving parents (Example: Conferencing with parents about providing resources for an upcoming topic of study).

Theory/Practicum Framework

Using a Computer-Tracking System to Keep Student Profiles
(Specific Topic) (1e)

Definition/Explanation of: Computer systems are available for tracking students' progress in skill development areas. Teachers can also develop systems, such as having students record and keep up with spelling errors that are made each week. These errors are then corrected on an individual basis.

Value of: Recording students' work on a computer saves much valuable time and helps in the identification of clusters of students who have common needs. It is also a valuable procedure for getting students to see how well they have improved in their work.

Basic Procedures for Setting up Computer-Tracking

- Learn what commercial systems are currently on the market. Review as many as you can, and make notes on how you would use each system.
- Identify specific areas (such as weekly spelling errors or solving word problems in mathematics) where systems can be developed for tracking student progress/problems.
- Develop as simple recording system as possible, keeping in mind that several systems might eventually be used.
- Try out the system with a small group of students, and make adjustments as needed.
- Develop follow-up activities for using the information discovered from use of the tracking system (Example: Note types of spelling errors students make, and plan corrective activities.).
- Eventually, select those systems that are the most helpful, and provide students with their own disks which they systematically use to track their progress.

Introductory Implementation: After becoming familiar with one or two commercial computer-tracking programs, try them out with three or four students. Teach students to apply the systems to their daily work (in areas for which the systems have been designed).

Expanded Application: Work with your supervising teacher to set up a system that you have developed, and use it with your total class. Learn how to use the system across two or more subject areas (Example: Recording of spelling errors not only in spelling classes but in content fields as well). Evaluate the system(s) you develop in terms of how well it helps students see their progress in selected areas of the curriculum, how well it helps you identify problems that students have in common, and how efficient it is compared to other techniques such as students keeping folders to record progress/problems.

Knowledge/Practicum Framework (Specific Topic)
Using Journals, Logs, and Progress-Charting Activities (2a)

Definition/Explanation of: Journals are accounts of what activities a student is involved in, but usually with some type of reflective statement. Journals (including dialogue journals where the teacher writes back to the student) help extend a student's thinking about a topic of study, a book the student has read, and so on. Logs are similar to journals but are more like notes to oneself, including ideas for writing or for a project on which a student is working. Logs are kept in a small book that is handy at all times. Progress-charting activities refer to any kind of activities that call for a student to record how well he/she is moving toward an objective (Example: A student graphs his/her weekly scores in mathematics, showing/stating progress made.).

Value of: Journals, logs, and progress-charting activities are useful because they help make instructional tasks more meaningful than they might otherwise be. When students have to reflect on what they have learned or what task they have performed, there is a greater chance students will see the significance in learning. In addition, journals offer a medium for the teacher to communicate with each individual student, and logs help systematize (but in a fun way) "idea collection." Progress-charting activities help a student see his/her progress in an area, thus establishing a "competition-against-self" condition for setting goals and doing better.

Basic Procedures for Implementation of:

- Journals and logs are private, being shared only when students wish to share them with other students. The teacher usually is a part of the sharing of journal entries, but even then, there may be times not to share. Logs are usually private (shared only with teachers).
- Ideas and reflective moments are encouraged, rather than spelling, punctuation, and other factors calling for "correct form." Don't correct entries.
- Journals can be kept by the very young child, starting out with pictures and gradually moving to words.
- Set some specifics about entries in journals, but not to the point of prescribing how to do entries or even when. Make the information more suggestive than prescriptive, such as, "I wonder if you want to write in your journal about that book you have just read." For progress-charting activities, students are guided to look for more specific "learnings" across time.
- Hold conferences with students periodically to discuss their journals, logs, and progress-charting activities, but make it a time of reflection, not correction. To get started, set up simple, short-term areas and expand.

Knowledge/Practicum Framework

Implementing Portfolio Assessment (2b)

(Specific Topic)

Definition: Assessing children's progress via a comprehensive approach to their performance (not just standardized or teacher-made tests). Includes analysis of their written/oral performances and other naturalistic means.
Value of: Much more reflective of how well children are achieving/growing. Assessment of how well children can do in the real world where they are expected to perform. Fairer way to assess in that variety of modes used.
Where to Use: Can be used in all subject areas, but especially in writing, handwriting, and the other language arts. Can easily be used in math and science also. Used for short-range assessment/long-range evaluation.
How to Set Up: Set up a designated time period such as a six-week period, and plan with students what kinds of work will go in the portfolio and when samples will be collected. Relate samples to specific work being done.
How to Analyze: Keep a checklist in portfolio, relating samples and points to remember/use in analysis. Encourage students to self-analyze work. Checklist can serve as a rubric which clearly points out expectations.
Going Further With Evaluation: Turn assessment into a kind of evaluation "over time." Have a section of the portfolio in a sub-folder where students place earlier samples of their work to compare with current samples.
Introductory Implementation: Start with simple collection of "best work" in designated area, such as stories that students have written. Encourage students to add to the collection when they are happy with a piece of work.
Extended Implementation: Move to a larger and more expansive collection. Coach children on how they can improve in an area and even replace formerly acceptable work. Work to make each student proud of his/her portfolio.
Application Across the Curriculum: Go beyond an area like language arts to writing and oral presentations in other subjects like social studies, mathematics, and science. Health and art can also be included in the portfolio.

Theory/Practicum Framework

Using Video and Audio Tapes for Assessment (2c)

(Specific Topic)

Definition/Explanation of: Video and audio tapes for use in assessment help in the recording of students' behavior (both single episodes and episodes over time) to assess progress and problems with specific learning tasks (For example: Making a video of a presentation such as an oral book report and viewing it with the student to determine how he/she did on factors considered important to the making of a good book report [Example: unique beginning to get attention/build interest in book on which the report is being given]).

Value of: Students can see problems they have in any subject area where they are asked to perform and where there is improvement. Students can also see how well they have improved over time in the same skill area.

Basic Procedures for Implementation:

- Identify a specific skill area (Example: reading orally with expression and fluency) in which students are to perform.
- Make sure that students know the major behavior(s) or factor(s) to be learned (Example: reading smoothly) to be improved, including having heard/seen a model.
- Let students know in advance when taping will be done.
- Where necessary and possible, hold a conference with a student being taped (before and after taping).
- Provide ample "practice time" for a student before a taping session.
- Have student keep a log of points needing improvement and develop a plan for improvement on these points.
- Where several students are working on the same kind of skills, work with them in groups.

Individualization of Instruction With Audio/Video Tapes:

Major improvement in any area (group project work, small group discussions, oral presentation, and so on) can be highly individualized. Students often can spot their own problems when they listen and/or observe a tape in which they participated. Take advantage of this self-analysis. Students can also listen/review others in an attempt to see/hear a model presentation or discussion.

Introductory Implementation: Locate a simplified situation for working with a small group of students or an individual on skill areas where students perform. Follow the steps outlined above (in **Basic Procedures**).

Extended Application: Extend the use of taping to include situations where larger groups participate.

Theory/Practicum Framework

Observing Children at Work and Determining Academic and
Other Needs (2d)

(Specific Topic)

Definition/Explanation of: Observing children as they work means focusing on any number of variables relating to how they learn. Included are how well they get along with others, how much they enjoy an activity, perseverance on an assigned task, response to a visually-oriented (or auditorily-oriented, manipulative, etc.) task, their study habits, and so on.

Value of: Through observing children at work in school, much can be learned to help teachers as they plan instructional programs for each child. Problems observed (as well as strengths) can give teachers direction for maximally helping students in a classroom.

Basic Directions for Making Observations:

- Know specific factors that have an effect on learning a task, such as in written composition where students should pause to reflect on what they have written and plan what they will write next (a procedure that can be observed [to a degree] and encouraged).
- Systematically (as opposed to randomly) observe students at work. Select a few (3-5) students at a time and make notes on a specially-prepared chart [with large cells] of factors being observed.
- Make adjustments in grouping for instruction based on observations (Example: more manipulatives for teaching a math lesson when response to manipulatives revealed that more learning for some children took place).
- Develop appropriate activities for those students who you observed need them, such as corrective activities for improving study habits and/or study skills.
- Use results of observations in coaching (small group or individual sessions).

Initial Implementation of: Select an area in the curriculum and identify specific factors that you want to observe when students are working in the area. For example, in writing as specified above, look for indicators of students stopping to review their compositions, as well as to make revisions, make notes about what they are writing, and so on. Jot down your results on a selected few students. Hold conferences with those students, and provide instruction where necessary.

Expanded Implementation of: Develop charts for observing students on several factors (study habits, study skills, enjoyment of a lesson, etc.). Observe selected students, and use the results in planning instruction.

Theory/Practicum Framework

Implementing Self-Assessment Procedures (2e)

(Specific Topic)

Definition/Explanation of: Self-assessment procedures are systems/techniques for getting students to self-check their own work, including preventive procedures such as proofreading.

Value of: Students who are taught to examine their own work become more adept at preventing errors and/or improving assignments given (e.g., expanding description of characters in a story written). The act of self-assessment and competition against self (i.e., working to improve on a specific skill from the last effort on the same skill) help students keep more focused on the task at hand and give meaning to the work being done. (See Framework 3c for additional information.)

Basic Procedures Involved:

- Specific skill areas and standards must be identified for the students (e.g., correct formation of straight stick letters [i l +] in manuscript writing).
- Set up a step-by-step procedure for self-assessment of the target skill. Make sure students know the steps.
- Using the steps established, have students assess their papers or oral language assignments, using specific "what to look for" factors (e.g., in giving an oral report, having a creative opening, making eye contact with the audience, and summarizing at the end are three important factors to be considered).
- Use the most effective materials/equipment for helping students be successful with self-assessment strategies (e.g., in oral reporting, videoing students and letting them see themselves give the report or using check lists and/or computer disks in having students track their spelling error types).
- Set up conferences with students to discuss their progress with self-assessment procedures established.

Individualization of Instruction Involved: As each student makes his/her own analyses of problems and progress, individualized assignments should follow. This leads to differentiated instruction based on needs.

Getting Started: Select a subject area where it is easy to implement the procedures outlined in "Basic Procedures" above. Spelling and handwriting, both given as examples, are easy starter areas. So is mathematics.

Expanded Use of: As students become skilled in self-assessment in a limited area of the curriculum, expand the strategies to other areas of the curriculum.

Theory/Practicum Framework

Conferencing With Children Effectively (2f)

(Specific Topic)

Definition/Explanation of: One-on-one conferencing with children refers to working with them to review their work, pointing out both progress and needs. It should be a regular part of the instructional program, done systematically and for specific purposes. The goal of conferencing should be to bring about growth, and students should be encouraged to take the conference time seriously.

Value of: Regular conferences with children in any classroom are valuable in that they are excellent for showing children that you care for them. The personal interest in each child's progress can be demonstrated in one-on-one conferences, with undivided attention given to specific points where each child has done well, where improvement has been made, where improvement is needed, and plans for correcting problems. Conferencing is a chief mechanism for coaching (See Framework 4c).

Strategies for Implementing:

- Plan systematic conferences with each student, and hold each one for a purpose.
- Let students know what their responsibilities are for each conference, such as bringing designated classwork to a conference, to be ready to talk about what they have been reading on a topic (or library books), etc.
- Do not permit other students to interfere when you are holding conferences with a student.
- When a conference ends, make sure that each student understands what he/she is to do as follow up to what has been discussed.
- Make notes in a conference log, and refer to these notes when follow-up conferences are held.

Getting Started:

Start out by discussing with students the first set of conferences you will be having (e.g., conferences on the science project each student is doing, conferences to discuss the book each student is reading, or conferences to review progress in writing that has been taking place). Develop a schedule of conferences (Each conference should last from 5-10 minutes.). Make sure that the conference is held in a semi-private place, such as a corner of the room away from the major arena for instruction. Work hard to make each student feel comfortable in the conference setting, to see the purpose of the conference, and to recognize his/her progress from one conference to the next.

Theory/Practicum Framework

Developing and Using Teacher-Made Tests (2g)

(Specific Topic)

Definition/Explanation of: Teacher-made tests are informal tests that usually are developed to determine progress in a subject or phase of study in a subject, although teacher-made tests can be for diagnostic purposes.

Value of: Teacher-made tests are of value because they can be developed more frequently than standardized tests can be used. Also, teacher-made tests can more closely reflect what has been studied over a period of time, whether it is a weekly quiz, a six-weeks test, a unit test, or a test over a semester or the whole year. Such tests can also be developed to reflect process of learning as well as content covered. Skilled teachers can also develop tests to determine problems students are having, such as the kind of punctuation problems that students might be having, key processes in mathematics, and so on.

Basic Procedures for Developing:

- Determine specifically the objectives for learning a segment of content or a process being taught (e.g., how the United States became involved in World War II; the basics needed for outlining or how to use a dictionary). If the test is to be diagnostic in nature, determine specifically what is to be assessed (such as a test to determine the kind of spelling errors students might be making such as a reversal error [iorn instead of iron], or a word-ending error [somethin for something]).
- Determine the kind of test question that is best for the content or process to be tested (such as essay, short answer, identification, multiple choice, true-false, recall).
- Use the best practices for making test items, regardless of the kind of test question being used. There are correct and incorrect ways to write test questions.

Procedures for Using:

- In using teacher-made tests, it usually is better to have a mixture of test questions (some multiple choice, some short answers, some identification, and so on). Remember, teacher-made tests should be supplemented by portfolio assessment (See Framework 2b) and commercial tests (See Framework 2h).
- Make sure that the students taking a test know the extent of the content and processes to be covered on a test (If the test is for diagnostic purposes, students should also know that it is a diagnostic test.).
- Make sure that results of tests are appropriately used (Let students see instructional value of tests used.).

Theory/Practicum Framework (Specific Topic)
**Using Commercial Tests to Determine Student Placement and to
 Use as Diagnostic Instruments (2h)**

Definition/Explanation of: Commercial tests are those given school-wide, at system-level, and/or nation-wide and are primarily used for comparison of students' achievement/abilities, for purposes of determining progress in an area, or for determining difficulties a student is having in a subject or subset of that subject.

Value of: Commercial tests are of value because they provide some indication of how well students are achieving in an area or, as in the case of diagnostic tests, what problems need correcting. While commercial tests are of value, some school systems are moving to a more comprehensive (including naturalistic) form of assessment.

Basic Uses of Commercial Tests: Such tests can provide:

- one measure of where a student should be placed for instruction in a subject area (Example: reading level).
- some indication of problems a student is having in a subject, such as matching symbols with the sound they stand for in initial position of words.
- one view of how a class measures up to similar students who took the same test under similar conditions.
- a view of differences among students in a classroom, helping lead to differentiated instruction.
- an indication of progress (for a group of students) from one testing period to another, such as over a twelve-week period or over a total school year.

Major Features of Commercial Tests:

- usually standardized, meaning they are norm-referenced and can be used to compare an individual's score with similar students did on the same test
- more formal than teacher-made tests
- have been treated for validity (extent to which a test actually measures what it is designed to measure) and reliability (consistency of measurement from one administration to another)
- have specific measurement factors, such as raw score (the actual score a student obtains); grade equivalent score (Example: 4.3-fourth year, third month); percentile (how many students [in percentages] score the same or lower than a student scores on same test); stanine (score converted to a distribution on nine intervals, with 9 being highest stanine and stanine 1 the lowest).

Implementation of: Ask teachers with whom you work to let you review different kinds of tests on file. Observe such tests being given, and review/discuss use of results. If possible, train to and help administer tests.

Knowledge/Practicum Framework

Planning for/Maintaining an Interactive Classroom (3a)
(Specific Topic)

Definition: Classroom where students are free to interact with each other and the teacher on topics being studied in class (as opposed to traditional lecture-oriented, teacher-dominated classroom with passive learners).

Value of: Students more interested in what is to be learned, feel more free to explore what is being studied, are more involved, and go further in studying topic. Active learning replaces passive learning.

Basic Procedures for:

- Have classroom where group work can take place, rather than all seats in straight rows with the teacher's desk in front.
- Plan centers of learning that invite students to participate in a variety of activities.
- Encourage extensive oral-language activities, including small-group work, pairs of students working together, and oral presentations.
- Learn to serve as a facilitator rather than as a teacher who authoritatively dispenses with knowledge about topic to be learned.
- Assess learning environment periodically to determine extent to which students are involved in learning.
- Plan project-theme teaching activities.

Subject Areas Accommodated: All curricular areas should be taught in an interactive classroom. This includes language arts, social studies, math, science, art, and health.

Introductory Implementation: Set up a simplified set of activities where students are working in a limited number of centers in the room. Have specific procedures established to make the centers function well.

Expanded Implementation: Extend the number of centers beyond one subject area and beyond the number started above. Try to implement three or more of the basic strategies given above.

Application Across the Curriculum: Use all strategies identified above, but extend it to the total school day. Integrate two or more subject areas where it is possible to do so.

Theory/Practicum Framework

Planning Daily Lessons for Large Groups, Small Groups, and Where Necessary, Individual Students (3b) (Specific Topic)

Definition/Explanation of: Plans for daily lessons should not only include lessons in which all of the class will participate, but lessons for small groups of students and also lessons for individual students. A teacher must be flexible and know how to carry out lessons for these different kinds of groups.

Value of: Individualization of instruction takes place when a teacher can manage lessons for groups of different numbers of students and for individual students. If only lessons are planned for the total class, many, many students will be lost because the lessons may be either too difficult (or too easy) or uninteresting to them.

How to Implement Lessons for Groups of Different Sizes:

- First, know the many variations in group sizes that can be organized in a given classroom (See Framework 4i on different kinds of groups).
- Second, look for special needs of students, as in the case of students having trouble learning multiplication by three's or students having trouble with the writing of a paragraph.
- Third, look for common interests that some students have as is the case where students are quite interested in horses (See Framework 4f on grouping students according to interests.).
- Fourth, develop a lesson or series of lessons for one or more small groups. Plan activities that can be independent of constant teacher guidance, since others will also be taught during the same time the small group(s) will be taught.
- Fifth, explain to total class what different groups will be doing during a certain period of time (such as a 30-minute block of time). Sometimes it helps to have a student in each group repeat what has been said, but the time to explain the several groups' activities must be streamlined. In some cases, skeletal explanations are given, with the promise that more detailed explanations will be given on a sheet of directions when each group gathers in its corner, table, etc. to begin work.
- Sixth, try out the "multiple groups" approach to teaching. Be sure to circulate among the different groups to make sure that they are on task and to help where help is needed. In cases where direct attention is being given to one group, be sure to find or make brief times when the group can be left while others are given attention. Note: This takes practice.

Knowledge/Practicum Framework

Using the Tennessee Instructional Model (TIM), (3c) (Specific Topic)

Definition: An instructional strategy or model developed by the Tennessee State Department of Education. The model encompasses five specific instructional steps that begin with development of objectives and ends with the implementation of options for further instruction.

Value of: Provides teachers with a logical, well-designed model for instructing groups of students, implementing some of the basic tenets of sound instruction (such as getting each student mentally ready for learning the lesson to be taught, interacting with each student as appropriate, monitoring progress of each student on the learning task at hand, and following up as appropriate).

Basic Steps Involved:-Establish objectives for a specific "learning." Identify this "learning" and the "behavior" desired and expected.

- Establish set (meaning set foundation) by linking or bridging past experiences to new learning desired. The intent of set is to arouse interest in learning and to create a receptive frame of mind for learning the specific new "learning" being planned.
- Move into the instruction component. Interact with students, check for understanding, observe student performance, and adjust instruction as needed.
- Bring closure to the lesson, using summarizing techniques to do so. Observe during closure to see what else about the lesson each student needs.
- Implement options as needed, with some students doing independent practice, some students being retaught, and some students receiving enrichment-type experiences.

Individualized Nature of: During instruction, teacher observes each student and adjusts instruction as needed. Also, during options, students provided different help.

Introductory Implementation: Outline several points for each step as a lesson is planned for a small group of students. Implement and adjust as needed.

Extended Implementation: Use TIM with a larger group, such as the whole class. Expand the number of subjects for the next lesson, such as integrating a lesson in science and health, art and language arts, and so on.

Resource: Tennessee Department of Education, Planning Document, 1984.

Theory/Practicum Framework

Establishing Long-Range Instructional Goals and Short-Term Objectives (3d)

(Specific Topic)

Definition/Explanation of: Short-term objectives are the day-to-day objectives that guide lessons taught to individuals, small groups, and/or the total class. However, these objectives are under the umbrella of long-range goals. For example, a teacher might plan a lesson on using the dictionary to determine meanings of words, but this skill, along with a number of others, would be a part of the study skills needed to make students independent learners (a long-range goal).

Value of: Short-term objectives and long-range goals are valuable in that they are maps which guide teachers as they develop and implement a meaningful instructional program. Instruction, to have a purpose, must have goals and objectives. Often these goals and objectives are spelled out by a school or central school system, and they are done so to give meaning to the curriculum.

Planning and Implementation:

- Look for goals and objectives in the school's curriculum guide for subjects being taught, or examine the guides provided by the school system. In some cases, schools and school systems rely on the state guide in a subject area. Regardless, the school has expectations of what is to be taught in an area. Sometimes, goals and objectives are detailed in textbooks used.
- Develop or adopt a system for stating the objective to be taught (See Framework 3c on the Tennessee Instructional model or TIM.). In most instances, the system will include a behavior that should be expected of those who are being taught.
- Write out both the short-term instructional objective and the long-range goal as lessons are planned.

Getting Started: Start with a subject that you feel you know best, and ask to develop a series of lessons to be taught in your classroom. Work on writing objectives and goals. Teach the lesson and evaluate how well the objective is taught. Develop objectives and goals for individual students and small groups that are different from what the class as a whole might be learning.

Going Further: Expand lesson planning in which attention is focused on long-range goals and short-term objectives to subjects you do not know as well. Practice finding/writing objectives in this area. Learn how to combine objectives in the same lesson and across different areas.

Theory/Practicum Framework
Developing Units and Mini-units (3e)
(Specific Topic)

Definition: A unit refers to a plan for teaching a theme or a broad area of study (Example: Seeds and Plants). A unit has subtopics such as evergreen, deciduous, conifers, and photosynthesis) under example given above. A unit usually lasts from three to five weeks and encompasses content from several disciplines and a variety of activities. A mini-unit is shorter than a unit, is on a more narrow topic, and lasts a much shorter period of time (three to six days). A topic for a mini-unit might be very specific, such as Learning to Love Poetry.

Value of: Units and mini-units help bring together information and activities that might otherwise be randomly taught, thus helping students and teachers see the big picture. Units/mini-units bring focus to what is taught.

Basic Components of: The structure of a unit or mini-unit varies, but usually the following components in one form or another exist:

- Objectives of the unit that define the focus and purpose of the unit (what is to be achieved)
 - Outline of content which includes the breadth and depth of what is to be taught (not everything about a topic can be taught). The outline includes the sequence of skills, facts, generalizations, and concepts/vocabulary to be taught.
 - Activities for teaching the unit, usually divided into introductory or initiating activities, developmental activities, and culminating activities
 - Resources needed for teaching the unit
 - Timeline which projects sequence of all activities
- Note: A mini-unit can contain any or all of these components, but greatly abbreviated.

Individualization of Instruction Through Unit Teaching: Activities for teaching a unit provide many opportunities for differentiating instruction. Students who draw/paint well might be asked to develop a mural about some aspect of the unit, others might be asked to write script for a dialogue between characters being studied in the unit, and others might be asked to collect pictures and/or artifacts about subtopics in the unit. In addition, students who need help on skills needed for some aspect of the unit (outlining, as an example) can be grouped for a lesson .

Implementation of: Read how to construct/implement a unit, examine examples of units, and observe units being taught. Develop/teach units in the program as required.

Theory/Practicum Framework

Developing Instructional Objectives That Vary in Focus,
Including Those Built Around Interests of Students, Special
Needs That Students Have, Objectives Calling for Students to
Analyze What is to be Learned, Synthesize Materials, and
Evaluate What has Been Learned (3f)

(Specific Topic)

Definition/Explanation of: Objectives must vary according to differences in learners, although many learners need the same objectives. Differences that must be accounted for include not only differences in academic capacities (See Framework 4g on ability grouping), but deficiencies that some students have in common (regardless of abilities), interests, and other special needs, such as social needs. Objectives that call for students to do different tasks within a content area, such as analyze data; evaluate data, classify factors, and so on must be accounted for in the instructional program (See Framework 3b on planning daily lessons for groups and individuals.).

Value of: The teacher who takes care of the many different needs of students is not content to plan single lessons for each content area taught during a school day. Such lessons may be the starting point, but within each of these kinds of lessons are sub-objectives that push some students further than a lesson for a larger group will push those students. Planning for a large number of individual differences has value in that maximum growth of all students in a classroom will occur.

Getting Started:

- Make sure that all systems established to know each individual in a classroom are working (Thus, Frameworks 1a, 1c, 1e, 2a, 2b, 2c, 2d, 2e, 2f, 2g, and 2h should be operative, for these Frameworks deal with knowing individuals, their needs, interests, progress in school and so on.).
- In planning a group lesson (small group or total class) make sure that some activities have "going further or challenge" factors for students who need to be more challenged, but also make sure that there are "switch-off" activities for students who might need to have some more basic prerequisites for the lesson being taught. The "switch-off" activities may be follow-up lessons, although they often can be implemented during the ongoing lesson (a feat that calls for excellent organization and management on the part of the teacher).

Going Further: After learning how to provide different objectives within the context of a lesson for a group of students, move to planning for simultaneous lessons to take place during a given hour. Plan for each, as needed.

Theory/Practicum Framework

Developing Independent Tasks and Assignments for Individual Students (3g)

(Specific Topic)

Definition/Explanation of: Some students need special assignments that no other students may need. Thus, independent tasks/assignments are needed for these students for purposes of correcting a specific problem that no one else might have at that time or because the student has a special interest in a topic.

Value of: When students have special interests or a particular problem, an independent assignment can provide what the students need. In the case of a problem, such as needing help in writing better paragraphs, a separate plan of instruction for the student needing it should be developed, and time found in the day for that student to work independently. Likewise, if a student has shown a special interest in a topic that no other student has shown an interest in, feeding that interest via an independent task/assignment helps individualize instruction for that student. Such a task/assignment could very well be the best instruction possible at the time provided.

Procedures for Setting up Independent Tasks/Assignments:

- The starting point for independent tasks/assignments is knowing what each individual student's interests/needs are. Thus, having a system for setting up individual profiles of students' needs as diagnosed and interests surveyed is critical.
- The second critical element for giving independent tasks or assignments is to have a file of interesting activities that tie in with as many curricular areas as is possible. Such a file should be kept up-to-date.
- Plan a strategy for providing independent activities for each student in a classroom at least once every two weeks. A good starting point might be the identified interests of each student (See Framework 1c). From the interests, plan for each student such activities as reading a book on an identified interest, calling a parent about a community event that is an interest of that parent's child, doing a game or puzzle about an interest that one particular child has, and/or helping a student begin a magazine picture collection on the student's interests. Increase frequency of such tasks.

Going Further: Expand the giving of independent tasks and assignments beyond activities around students' interests (but keep doing interests) to diagnosed problems that individual children have. Do more than one subject.

Knowledge/Practicum Framework

Implementing Cooperative Learning Groups (4a) (Specific Topic)

Definition: Structured, mixed-ability groups where students have well-defined responsibilities and usually work toward team goals aimed at maximizing learning and getting along with others.
Value of: Promotes interdependence, interaction, individual accountability, personal responsibility, small-group skills, group processing, and learning of specific content.
Group Composition: Diverse in nature, being made up of boys and girls, fast and slow learners, and different racial and ethnic groups. Group composition is always heterogeneous, with common interests sometimes a factor.
Atmosphere Sought: Cooperation and group unity instead of all-encompassing and pervasive competition found among students in more traditional schools.
Subject Areas Accommodated: Any subject area, but social studies especially adaptable. Can be used in science, mathematics, reading, language arts, art, health, and other areas.
Basic Strategies: Well-known cooperative learning strategies are Jigsaw, Teams Games Tournaments (TGT), Small Group Teaching (SGT), & Student Teams Achievement Division (STAD), all with specific operational procedures.
Introductory Implementation: A good understanding of how initial groups are formed, the teacher's role in facilitating each strategy employed, and appropriate follow-up to each group's activity must be operationalized.
Extended Implementation: A second or perhaps third try for each strategy should result in fine-tuning of the strategies employed. Assessment of how one implements each strategy should result in improved operations.
Application Across the Curriculum: Cooperative learning, as mentioned above, can be applied to any subject area. Be able to apply the basic strategies identified above to various areas of the curriculum.

Theory/Practicum Framework

Using Peer Teaching (4b)

(Specific Topic)

Definition: Peer teaching refers to students teaching each other. At one time, peer teaching was reserved for such activities as giving out spelling words to each other (as part of drill), but today peer teaching goes beyond drill to encompass some introductory teaching.

Value of: Students often can show other students how to solve a problem, how to write a certain kind of sentence, or how to read a map much better than the students can learn in a large group setting. Such teaching under careful supervision by the teacher should be encouraged.

Basic Strategies:

- Specify clearly what is to be learned when students are to provide instruction/coaching for one another. (e.g., in some cooperative learning groups, students teaching a segment of a topic on George Washington would have to know exactly what segment it is (early years, schooling, years as President, and so on).
- Work with students on what they are to teach or if it is a matter of reacting to another student's work, what is the mode of reaction, the area to review (e.g., looking at a short story another student has written and telling him/her how the setting might be improved), and so on.
- Pair or group students who can work together and who can help each other. Make sure that all students get some opportunities to instruct and be instructed.
- Let parents know (via discussions during visit-the-room night or a letter home) that the bulk of the teaching will be done by you but that there are times when your students can learn from each other. Give good and varied examples and leave no doubt as to each's value.
- Circulate among students when they are peer teaching. Note some examples of positive teaching going on and in a group session, mention some of the types of good instruction going on (with the idea in mind that these are activities to emulate).

Introductory Implementation: Select a limited number of areas where students can teach simple facts or skills to others. Have the students who are going to teach others (perhaps eight or nine students who will each work with a couple of others) meet with you to go over what they will teach and how. Make sure all understand.

Extended Application: Gradually move to a more complex skill or set of facts for students to teach each other. Move to more than one curricular area.

Knowledge/Practicum Framework

Providing Academic and Skill Coaching (4c)
(Specific Topic)

Definition: Supervising performance in any skill area to help students reach a desired level of achievement with that skill. Includes helping students learn facts, concepts, and vocabulary related to skill development.

Value of: Helps students keep focused on task at hand, is motivational, and helps student persevere toward learning objective. Also, helps student learn value of what is being learned. Shows student that you care.

Basic Procedures Involved: -Usually is one-on-one (teacher-student) but can be done in small groups or in large-group where teacher circulates to help students.
-Know previous achievements of individual student that relates to what is being learned (Example: "Multiplying by 4 is no harder than multiplying by 3 which you did well when we studied that last week.")
-Work to help student clearly see what is to be learned. Have student say in own words what is to be achieved.
-Show student a model of what is to be achieved. (Example: Making straight-stick letters [i l t] in manuscript is best learned if model is examined together.)
-Break skill to be learned down into simplified and sequential steps.
-Help student assess progress.
-Help student chart/record progress.

Introductory Implementation: Work with a single student on a specific skill to be learned. Use strategies outlined above with this one student. Upon succeeding in this area, move to another skill in same subject area.

Extended Implementation: Find several ways to fine tune each strategy used in introductory implementation stage. Move on to skill development in another area where coaching is to be done. Follow strategies outlined above.

Application Across the Curriculum: Apply strategies outlined above to all curricular areas found in the elementary school. Try some of the strategies with small groups of students, but use the strategies primarily in conferences with individual students.

Theory/Practicum Framework

Setting up Learning Stations or Centers (4d)

(Specific Topic)

Definition/Explanation of: Learning stations or centers are places in the room for specific instructional purposes, often for independent, individual use. A center may be to promote writing, for independent reading, for special help in mathematics, for listening, or a science center where students might do independent experiments. The many kinds of learning centers are limited only by the number of curricular areas taught, but they should be well-designed and functional.

Value of: Learning centers or stations are valuable in helping with independent and small-group teaching and for providing enrichment activities for students. Students need special help that the teacher cannot always break away and give on a one-on-one basis (although this kind of help must be provided when needed). Learning centers, if appropriately designed and upgraded, can greatly enrich the instructional program by providing that special kind of help, including enrichment. For example, a good learning center for writing not only would have writing ideas (topics on which to write), but would have some self-help activities (e.g., a list of specific words—gallop, trot, ambles) for over-used generic words (run, walk) that one might use in writing about horses.

Steps for Setting up/Maintaining Learning Centers:

- Make an assessment of what part of the curriculum a learning center would provide most help (One might start with a broad field like reading, science, mathematics, but later move into a sub-field that cuts across all of the subjects taught.). Vocabulary development might be such a sub-field, as is listening and/or writing.
- Develop topics within the area chosen that will be highlighted, since a learning center cannot possibly cover all areas within a chosen subject or sub-field.
- Develop a series of activities for each topic chosen to be in a learning center or station. The activities should be those that are relatively easy to do and can be independent of direct guidance by the teacher.
- Make sure that both audio and visual aids/activities are found in the learning center(s) set up.
- Introduce the learning center(s) to small groups of students at a time, making sure they know each phase of a center, the purpose of the center, and how to use it. Independent use is critical in a learning center.
- Talk to students about their work in a learning center, focusing on how well the center is being used. Note how well the center is being integrated with the total area of the curriculum that parallels the center's focus.

Theory/Practicum Framework
Using Computers With Individuals and Small Groups (4e)
(Specific Topic)

Definition/Explanation of: Computers can be used with individuals in a classroom when computers are available (even on a rotating basis) or in some situations, where small groups (two or more) can work at the same terminal. For example, two students might compose a story together, read a passage from the same terminal, play a computer game together, record their errors in spelling on a disk they share together, and so on.

Value of: Computers (technically micro-computers) are extremely valuable in teaching and in helping keep records of students' progress (See Framework 1e). James L. Hoot, in Computers in Early Childhood Education: Issues and Practices, (Prentice-Hall, 1986) pp. 2-3, says that computers can be used in the instructional program for drill and practice, tutorial exercises, simulations, and tools for a particular use such as writing a story. Computers are highly motivating, and some students are more receptive to correction via a computer than correction via the teacher or other students.

Basic Policies/Strategies for Using*:

- Clearly know and state the instructional objective for each computer lesson (or any other use).
- Use the computer for activities that can be done better with the computer than with traditional procedures/materials.
- Prompts used should be simple and direct.
- Screen instructions must be on appropriate grade level, be clear and unambiguous, with print, margin, spacing on the screen being quite legible.
- Activities should call for effective involvement/participation by the learner.
- Hardware should be durable, have sufficient memory, be capable of producing high quality displays, and have a functional keyboard.

Introductory Implementation: Select an easy-to-use software computer package for first experiences with an individual student or small group. Begin slowly unless the students have had previous experiences with the computer. As students begin feeling comfortable with the computer, move to more complex uses, such as composing a story on the computer or recording errors made in a subject.

Expanded Application: Begin developing games and/or creative drill and practice activities that you believe to be effective for students to be taught. Try out the activities and revise as appropriate.

*Adapted from "Guidelines for Educators on Using Computers in the Schools," The Reading Teacher 38 (1984), pp. 80-81.

Theory/Practicum Framework

Grouping Students According to Interests (4f)

(Specific Topic)

Definition: Grouping students according to interests refers to the placement of students who are interested in the same topic or area (e.g., those who like animals) and then providing meaningful activities such as writing or reading about this common interest.

Value of: When interests of students are known and students with the same interests are grouped for instruction, motivation to learn is considerably higher than otherwise might be the case. A purpose for learning is easily established and maintained in such situations.

Group Composition: When surveys of children's interests are systematically and regularly done (See Framework 1c), it is easy to see which students like to read about the same topic, which ones like to travel, to write, to watch movies (and what kinds), which ones have older (or younger) siblings, what activities they like to do with their parents, and so on. These become automatic topics for grouping students for various activities that are more personal and meaningful than generic activities.

Basic Strategies:

- After giving the survey, make a chart that has categories of interests, with students under each who indicated that they liked the same topic(s).
- Start out with a generic type of assignment that permits students to zero in on their favorite interests. One example is writing. If students were asked to indicate what they like to write about, permit students to write about their first (or second) choice in this area.
- Move into another activity area, such as reading. Work with the media specialist (librarian) to have books available on five, six, or seven (even more if possible) of the interests indicated on the inventory.
- Gradually move to other curricular areas (science, social studies, etc.), and find ways of getting students to weave their interests into work in these areas.
- Using the chart (a ready-reference chart) of interests mentioned in the first strategy above, learn to ask questions in classroom discussions that permit students to weave in their interests (e.g., Chuck, you said that you like horses. If you had been growing up during frontier days, what kinds of jobs working with horses could a boy like you have gotten then that you might not be able to get today?)
- After several weeks have elapsed, do an up-date on the interest survey given earlier (either adding to the one given earlier or doing another one).

Theory/Practicum Framework

Using Ability Grouping Appropriately (4g)

(Specific Topic)

Definition: In a traditional sense, ability grouping referred to placing students of about the same abilities (the brighter one-fourth, the middle ability levels, and so on) in the same classroom for instruction. However, such a practice became too rigid and overlooked other schemes that might have been used, such as occasionally regrouping students according to abilities on a short term basis. Another name for ability grouping found in the literature is homogeneous (as opposed to heterogeneous) grouping.

Value of: If flexible schemes are followed, some grouping according to ability levels can be meaningful. Students who are the very brightest might work on a short-term project in literature, in mathematics, or in science. If however, these students can then be called on to add to a discussion for the entire class, make a presentation, or in some way contribute to the overall topic on which they did some special small-group work, the value of ability grouping (in this situation, at least) increases.

Basic Strategies:

- Follow the policy/procedures of the school in which you are assigned or work when using ability grouping.
- As you learn more about different abilities of the group you teach, learn how to cross ability levels when small group work is to be done. In other words, note what the individual strengths are regardless of ability levels, and use those strengths where appropriate. A low-ability-level student (in math, reading, etc.) might have unique art skills and can help do a mural for a unit better than any other student. Give this student the opportunity to use this talent.
- When working with small groups of students that are on the same level (again, hopefully on a short-term basis), find ways to keep students from getting a "halo effect" (if they are top-level students) or "defeatist attitude" (if they are in the low group). One way, in addition to the short-term grouping mentioned above, is to put students of different ability levels together for a variety of activities (See Framework 4a).
- Employ "coaching techniques" (See Framework 4c) often.

Getting Started: Since this is a controversial area, it is best to know as much as possible about the pro's and con's of ability grouping. Learn the school's and/or system's policies/procedures. Gradually work in ways to group and regroup students with similar (different) abilities in various activities within the same classroom.

Theory/Practicum Framework

Employing Thematic and Project Teaching (4h)

(Specific Topic)

Definition/Explanation of: Thematic and project teaching involves the selection of a theme and/or project to serve as the focal point for a unit or segment of teaching that usually lasts several days, or in some cases, several weeks. Sometimes when a theme is selected (e.g., "Contributions Immigrants Make to our Culture"), the theme might cut across several sections of the same grade, be schoolwide, or limited to one section of a grade. An example of project teaching is the selection of a real or imaginary situation for teaching a segment of content, as in planning a school trip where costs for travel, room and food, and incidental costs are all calculated, thus learning mathematics content/processes being studied via this planned activity instead of through textbook activities (See Framework 3e on unit teaching.).

Value of: The value of thematic and project teaching is primarily in the motivational factors involved, although learning is often more meaningful via this approach to teaching. Teaching with themes and projects also helps in bringing together resources that might otherwise not be used if a straight textbook activities approach is followed.

Basic Components of:

- Select a theme and/or project that most, if not all students would find of interest.
- Establish objectives for the theme/projects, including skills, vocabulary, and content to be taught to students at this level.
- Divide the theme/project into logical segments, letting students be involved in planning.
- Develop a timeline for the development of the entire theme/project, making sure that each segment mentioned above is accounted for.
- Plan activities for each segment of the teaching to be done, again including students in the planning. Make sure to plan projects that can include the talents of all students.
- Develop lists of resources needed for teaching the selected theme/project, making sure to include parents (See Framework 1d on parental involvement.).
- Periodically review objectives planned to see if they are being met.

Individualization of Instruction Via Theme Teaching:

Again, see Framework 3e on unit teaching. Basically, a theme or project allows for diversity of activities in teaching. Thus, it provides more ways to reach students.

Theory/Practicum Framework

Setting up Various Kinds of Small Groups, Including Dyads and Triads (4i)

(Specific Topic)

Definition: Small-group work refers to a number of different kinds of small groups, including cooperative learning groups (Framework 4a), skills groups where several students are placed together for a short term to shore up deficiencies in a skill area, and dyads and triads. Dyads are groups of two students working together for purposes of review, teaching each other, summarizing key points, reading to each other, and so on. In some cases, it is more appropriate for three students to work together, and thus the group becomes a triad.

Value of: A variety of small-group activities should be used in every classroom and on every day. Small groups (compared to total-class instruction where the same topic is explored by all students, day-after-day) help in a number of ways, including the provision of a vehicle to reach each individual, greater provision for interaction among students, and greater motivation for students to learn.

Basic Strategies for Implementing:

- Learn the specifics of as many different kinds of small groups as possible, including five or six major cooperative-learning groups, skills groups, dyads, triads, a variety of small-group discussions (brainstorming, buzz groups, and so on). Learn how these groups are different from each other, when they should be used, and how to implement them.
- Develop a timeline for trying out each kind of small group as you learn it (in your college classes).
- When you learn one kind of small-group activity, try it out and ask a peer (another pre-intern or intern) to observe you teach the small-group activity. Your teacher might also observe you.
- Ask your "observer" to critique your implementation of the small-group activity, with reference to the points you have been taught that make the small-group activity unique.
- Try the same small-group activity with another topic, keeping in mind that students in your classroom may need training on how to work in the small-group activity that you are trying to implement. For learning some small-group activities, students may need to have several experiences, depending on how much the teacher of the class you are assigned to has used the kind of small-group activity that you are implementing.
- Try small-group activities you have learned in several different subject areas.

Theory/Practicum Framework

Using Graphic Organizers, Story Frames, Webbing, and Mapping Strategies (4j)

(Specific Topic)

Definition/Explanation of: Graphic organizers, story frames, webbing, and mapping strategies are structures for helping students comprehend reading and/or writing text. Essentially, they help in the comprehension process by providing a framework for students to see how parts or factors of text come together to provide meaning. In some cases, as in webbing, themes and subthemes are better understood with a graphic display.

Value of: These structures help simplify text by taking what could be for some students a complex idea and breaking it down for understanding. While many students can understand sequence, details, and other skills to be taught and necessary for meaning in reading and writing, some students need graphic support. They need to "see" how parts go together to make meaning. Thus, graphic organizers, story frames, webbing, and mapping strategies help these students "see" what they might otherwise not see. The graphic structures provide scaffolding.

How to Use:

- First, determine what skill in reading and writing is to be taught and if a graphic support system is needed. The latter decision might be a the result of trying out a more conventional approach (i.e., having students read and answer appropriate questions raised) and determining that students need more graphics to comprehend.
- Next, locate at least two graphic structures that appear to be appropriate for the skill being taught. There are numerous kinds of graphic organizers, story frames, and mapping strategies. Even webbing can be used in several ways. Be sure to select the ones that best fit what is being taught.
- Try out the selected structure, and assess the outcome of its use.
- Use the selected structure, where possible, in reading and writing. For example, story pattern,* intended for use in understanding stories written for children, can effectively be used in helping students organize stories that they write.
- Follow up the use of graphic structures by discussing with the students how the structure was used. Make adjustments in the use of the structure, and try it again.
- Make a note on an index card about the use of the structure, including how to use it and who it was used with.

*Marilyn Smith and Thomas W. Bean. "Four Strategies That Develop Children's Story Comprehension," The Reading Teacher 37 (1983): 296-297.

Knowledge/Practicum Framework

Using Manipulatives and Games (4k)

(Specific Topic)

Definition: Manipulatives and games are "hands-on" materials for use in the classroom or home. Included among wide variety of materials in this category are puzzle-type games and special math/reading devices.
Value of: Helps keep students engaged and active (as opposed to passive). Also, manipulatives and games appeal to the student who learns best through haptics or hand learning.
Background Requirements for Construction and Use: Such materials should be built/used around a selected, specific objective (Example: a multiplication fact such as $2 \times 3 = 6$).
Where to Use: Any phase of the curriculum, but especially in math, language arts, and science. Important to know which part of teaching cycle (introduction, reinforcement, application) materials will be used.
How to Use: Let students of near-equal ability play educational games, but develop materials that an individual can use alone. Practice for upcoming use of games is important, as is letting students take materials home.
How to Package/Store: Should be packaged in durable but ready-to-use containers, such as strong manilla envelopes or small cardboard boxes. Important to teach students how to put up materials after use, ready for next student.
How to Use for Individualized Instruction: Match students to different levels (of difficulty), thus making achievement in materials possible. Use different materials at same time via small groups and/or independent usage.
Assessment/Evaluation of: Should be made on each game/manipulative as tied to the objective for which the game/manipulative is being used. Simple question of, "Does this help teach the objective?" should be answered.
Further Use of: Manipulatives and games should be continued if they are useful, not if the students had fun with them (although fun should not be ignored). Most useful materials should be expanded in quantity and use.

APPENDIX B

Five-Year Semester-by- Semester Schedule

of Prospective UTK Elementary Education Teachers

with Focus on Individualized Instruction

**Table B.1: Five-Year Semester-by-Semester Schedule
of Prospective UTK Elementary Education Teachers
with Focus on Individualized Instruction**

<u>Semester 1</u> Arts & Sciences Discipline	<u>Semester 2</u> Art & Sciences Discipline
<u>Semester 3</u> Arts & Sciences Discipline	<u>Semester 4</u> Arts & Sciences Discipline
<u>Semester 5</u> Arts & Sciences Discipline Minor in Education Semester generally admitted to Teacher Education	<u>Semester 6</u> Arts & Sciences Discipline Minor in Education
<u>Semester 7</u> Arts & Sciences Discipline Minor in Education PES ¹ 210 - Human Development - 3 hrs. IS ² 330 - Children's Lit. - 3 hrs. EdSMRT ³ 486 - Introd. to Instructional Computing - 3 hrs. AE 301 - Art Educ.- 3 hrs. HE 306 - Health Educ.- 3 hrs.	<u>Semester 8</u> Arts & Sciences Discipline Minor in Education ED 400 & 401 - Study of Learner, School, and Society - 5 hrs. HTL ⁴ 351 & 356 - 1 hr. each (Field & Lab. Exp.) HTL 422 - Rdg./Lang. Arts; Soc. Studies; Math/Science Methods PART I - 6 hrs. Receive Arts & Sciences Degree
<u>Semester 9</u> First Semester of Internship ED 574 - Analysis of Tchg. - 2 hrs. ED 575 - Internship - 4 hrs. HTL 505 - Rdg./Lang. Arts; Soc. Studies; Math/Science Methods - PART II - 6 hrs.	<u>Semester 10</u> Second Semester of Internship ED 591 - Clinical Studies - 4 hrs. ED 575 - Internship - 8 hrs. Receive Licensure

¹PES = Psychoeducational Studies; ²IS = Information Sciences; ³EdSMRT = Education in the Sciences, Math, Research and Technology; ⁴HTL = Holistic Teaching/Learning

APPENDIX C

The Pilot Survey



College of Education
Education in the Sciences, Mathematics, Research and Technology
422 Claxton Addition
Knoxville, Tennessee 37996-3400
(423) 974-5037 - Fax (423) 974-8103

March 25, 1997

Elementary Science Educator
Address

Dear Sir / Madam,

I am a doctoral student in science education at the University of Tennessee. My research interest is the individualization of science in K - 8 preservice programs in the state of Tennessee. My research advisor is Dr. Phyllis Huff (423-974-3435 or e-mail: huff@utkux.utcc.utk.edu).

I am surveying science educators in the Southeast (Tennessee excluded) to determine their views on the importance and need to integrate strategies (frameworks) for individualized science instruction into the preservice teacher education curriculum. The frameworks in this survey were developed by the Individualized Instruction Program in the College of Education at the University of Tennessee, Knoxville.

This study is important because science teachers today have the task of accommodating a much broader range of student abilities, interests, and needs than ever before. Unfortunately, individualized instruction is rarely a part of the preservice teacher's training, preparation and experience. Furthermore, there is no instrument available to measure the extent of individualization of science in such programs. Your response to the enclosed pretest will contribute to the development of such a measure.

Please complete and return the survey in the enclosed postage-paid envelope by April 18, 1997. I do thank you for your willingness to participate in this research. Your assistance will contribute to the validity and the utility of the findings.

Please direct any questions to me at 423-974-1065 or e-mail : ahazari@utk.edu.

Sincerely yours,

Al Hazari

Enclosures

The Pilot Survey: Southeastern Universities
(listed alphabetically by state)

Auburn University
Auburn, AL 36849

University of Alabama
Tuscaloosa, AL 35487

University of North Alabama
Florence, AL 35632

University of South Alabama
Mobile, AL 36688

Arkansas State University
State University, AR 72467

University of Arkansas
Fayetteville, AR 72701

Florida State University
Tallahassee, FL 32306

University of Central Florida
Orlando, FL 32816

University of Florida
Gainesville, FL 32611

University of Miami
Coral Gables, FL 33124

Emory University
Atlanta, GA 30322

Georgia State University
Atlanta, GA 30303

University of Georgia
Athens, GA 30602

Murray State University
Murray, KY 42071

University of Kentucky
Lexington, KY 40506

University of Louisville
Louisville, KY 40292

Louisiana State University
Baton Rouge, LA 70803

Loyola University
New Orleans, LA 70118

Tulane University
New Orleans, LA 70118

University of New Orleans
New Orleans, LA 70148

University of Missouri
Columbia, MO 65211

University of Missouri
St. Louis, MO 63121

Mississippi State University
Mississippi State, MS 39762

University of Mississippi
University, MS 38677

Univ. of Southern Mississippi
Hattiesburg, MS 39406

North Carolina St. University
Raleigh, NC 27695

Univ. of North Carolina
Chapel Hill, NC 27599

Univ. of North Carolina
Charlotte, NC 28223

Wake Forest University
Winston-Salem, NC 27109

Univ. of South Carolina
Columbia, SC 29208

INDIVIDUALIZATION OF SCIENCE IN K-8 PRESERVICE PROGRAMS

P R E T E S T

Please rate each of the following 30 strategies (frameworks) for individualized instruction in the elementary school as to the degree of importance in science teaching / learning. *Use this 5-point scale to respond as to:*

No	Limited	Moderate	Considerable	Very Great
Importance	Importance	Importance	Importance	Importance
1	2	3	4	5

	Rating
1. Gathering and using demographic data on students	-----
2. Acquiring information about services available for students	-----
3. Using interest inventories to learn about students	-----
4. Involving parents in the instructional program	-----
5. Using a computer-tracking system to keep student profiles	-----
6. Using journals, logs, and progress-charting activities	-----
7. Implementing portfolio assessment	-----
8. Using video and audio tapes for assessment	-----
9. Observing children at work and determining academic and other needs	-----
10. Implementing self-assessment procedures	-----
11. Conferencing with students effectively	-----
12. Developing and using teacher-made tests	-----
13. Using commercial tests to determine student placement	-----
14. Planning for and maintaining an interactive classroom	-----
15. Planning daily lessons for large groups and for individuals	-----

No	Limited	Moderate	Considerable	Very Great
Importance	Importance	Importance	Importance	Importance
1	2	3	4	5

Rating

- | | |
|--|-------|
| 16. Establishing long-range instructional goals and short-term objectives | ----- |
| 17. Developing units and mini-units | ----- |
| 18. Developing instructional objectives that vary in focus | ----- |
| 19. Developing independent tasks and assignments for individual children | ----- |
| 20. Implementing cooperative learning groups | ----- |
| 21. Using peer teaching | ----- |
| 22. Providing academic and skill coaching | ----- |
| 23. Setting up learning stations or centers | ----- |
| 24. Using computers with individuals and small groups | ----- |
| 25. Grouping students according to interest | ----- |
| 26. Using ability grouping appropriately | ----- |
| 27. Employing thematic and project teaching | ----- |
| 28. Setting up various kinds of small groups, including dyads and triads | ----- |
| 29. Using graphic organizers, story frames, webbing and mapping strategies | ----- |
| 30. Using manipulatives and games | ----- |

Comments : On a separate sheet of paper, please comment on any of the 30 frameworks. Also, indicate whether any of the survey items deserve to be omitted as well as any others need to be added to the list.

Thank you for taking the time to complete this survey. Please return the survey in the enclosed postage-paid envelope by April 18, 1997.

Al Hazari, 533 Buehler Hall, University of Tennessee, Knoxville, TN 37996-1600

Table C.1: The Pilot Survey: Results
(n = 19 educators)

No	Limited	Moderate	Considerable	Very Great
Importance	Importance	Importance	Importance	Importance
1	2	3	4	5

Survey Item	Average Mean	SD
1. Gathering and using demographic data on students	3.11	0.85
2. Acquiring information about services available for students	3.63	0.93
3. Using interest inventories to learn about students	3.74	0.96
4. Involving parents in the instructional program	3.79	0.83
5. Using a computer-tracking system to keep student profiles	3.11	0.91
6. Using journals, logs, and progress-charting activities	4.00	0.86
7. Implementing portfolio assessment	4.11	0.79
8. Using video and audio tapes for assessment	2.95	0.69
9. Observing children at work and determining academic and other needs	4.42	0.59
10. Implementing self-assessment procedures	3.95	0.69
11. Conferencing with students effectively	4.26	0.71
12. Developing and using teacher-made tests	3.79	1.00
13. Using commercial tests to determine student placement	2.50	1.01
14. Planning for and maintaining an interactive classroom	4.58	0.67
15. Planning daily lessons of large groups and individuals	4.47	0.82
16. Establishing long-range instructional goals and short-term objectives	4.21	0.89
17. Developing units and mini-units	4.42	0.59
18. Developing instructional objectives that vary in focus	4.26	0.71
19. Developing independent tasks and assignments for individual children	4.05	0.83

Table C.1: (continued)
(n = 19 educators)

	No Importance 1	Limited Importance 2	Moderate Importance 3	Considerable Importance 4	Very Great Importance 5
Survey Item	Average Mean				SD
20. Implementing cooperative learning groups	4.37				0.67
21. Using peer teaching	4.00				1.03
22. Providing academic and skill coaching	3.92				0.83
23. Setting up learning stations or centers	4.11				0.79
24. Using computers with individuals and small groups	3.63				0.98
25. Grouping students according to interest	3.16				0.81
26. Using ability grouping appropriately	3.16				1.09
27. Employing thematic and project teaching	4.24				0.47
28. Setting up various kinds of small groups, including dyads and triads	3.92				1.05
29. Using graphic organizers, story frames, webbing and mapping strategies	4.00				0.86
30. Using manipulatives and games	4.42				0.67
All items	3.88				0.51

APPENDIX D

The Tennessee Instructional Model (TIM): A Modified Version

Used by the UTK Individualized Instruction Program

The Tennessee Instructional Model (TIM): Modified Version Used by the UTK Individualized Instruction Program

1. Subject Area/Grade Level:

(Subject and what grade it is prepared for)

2. Unit Title and Unit Objective:

What unit of study is this lesson a part?

Unit objective can be long-range and non-specific

3. Instructional Objective

Learning: What the student will know when the lesson is over; SPECIFIC

Behavior: What the students will do to show that learning has taken place

Format: The student will-----(behavior)-----(learning)-----

4. Content:

Include all information that must be known in order to teach the lesson; this the background for the lesson. Should include the vocabulary for the lesson here.

5. Materials/Media:

What do you need/use to teach this lesson?

Materials must be appropriate for the lesson and the age of the student

6. Instructional Procedure/Activities:

A. Set:

(Introduction and Motivating Activity)

Involve all students; Label the learning; Build on previous learning (if not an introductory lesson); Relate to the student's life. No instructions should be given during the set.

B. Key Questions:

(Used to develop the lesson, reinforce and monitor/adjust)

C. Classroom Activities:

(List sequentially what you will be doing in order to actually teach the lesson; Incorporate a variety of strategies)

What will the teacher be doing? What will the student be doing?

Sequence the activities in a logical order; Demonstrate the skill they are to be learning; Explain how the materials and media will be used.

D. Practice and Review:

The teacher establishes practice patterns and routines which result in increased learning. Indicate the purpose; Feedback from students/independent practice/grading. Provide practice time for the skill; Sequence the practice in a logical order.

**Monitor and adjust
Supervised practice**

E. Closure:

(Tie everything together)

**Summarize
Do one more
Active participation**

F. Alternative and/or Supplemental Activities:

Provide(s) "extra" or "enriched" practice; Gives other choices
Be sure to include: For whom is this activity intended? For what purpose: enrichment? individual practice? homework?

7. Method of Evaluation:

Provides for assessment of understanding and gives a purpose for the practice — feedback, grading, independent study, etc.

Informal: (How will you check each student each time?)

Formal: (Quiz, test, skill demonstration---Be sure to include a copy)

Your indicated form of evaluation should answer the following questions:

Did they respond appropriately/how do you determine?

Does your evaluation fit your objectives?

8. Method of Reteaching:

(Should be an example, procedure or explanation different from the one used to teach the lesson)

A different approach or activity for those who did not "get it"

APPENDIX E

The Tennessee Survey

THE UNIVERSITY OF TENNESSEE
KNOXVILLE



College of Education
Education in the Sciences, Mathematics, Research and Technology
422 Claxton Addition
Knoxville, Tennessee 37996-3400
(423) 974-5037 - Fax (423) 974-8103

June 24, 1997

Name
Address

Dear (Administrator):

As one of the approved teacher education programs in the state of Tennessee, your institution is requested to respond to the enclosed survey on science education and teacher preparation. The purpose of the survey is to assess the status of K-8 teacher preparation for individualizing science instruction. The selection of strategies on the survey was developed by the Individualized Instruction Program in the College of Education at the University of Tennessee, Knoxville.

Please give this survey to the K-8 science teacher educator(s) in your institution and ask the person(s) to return the completed survey in the postage-paid envelope by July 20, 1997. Please fill out and return the attached postcard should I wish to have further correspondence with your institution regarding this survey.

If you have any questions about the survey or research program, please contact me (423-974-1065; e-mail: ahazari@utk.edu) or Dr. Phyllis Huff (423-974-3435 ; e-mail: huff@utkux.utcc.utk.edu).

Thank you for your time and consideration.

Sincerely yours,

Al Hazari
Doctoral Candidate

Enclosures

Return Postcard

Front

(stamp)

Al Hazari
533 Buehler Hall
University of Tennessee
Knoxville, TN 37996-1600

Back

Name(s) and address(es) of the person(s) completing the
"Status of Individualized Science Instruction" survey.

1. _____

2. _____

Tennessee Teacher Education Institutions

(41 state-approved programs)

Aquinas College Nashville, TN 37205	Johnson Bible College Knoxville, TN 37998	Tennessee State Univ. Nashville, TN 37209
Austin Peay State Univ. Clarksville, TN 37044	King College Bristol, TN 37620	TN Technological Univ. Cookeville, TN 38505
Belmont University Nashville, TN 37212	Knoxville College Knoxville, TN 37921	TN Temple University Chattanooga, TN 37404
Bethel College McKenzie, TN 38201	Lambuth College Jackson, TN 38301	TN Wesleyan College Athens, TN 37303
Bryan College Dayton, TN 37321	Lane College Jackson, TN 38301	The Univ. of the South Sewanee, TN 37383
Carson-Newman College Jefferson City, TN 37760	Lee College Cleveland, TN 37311	Trevecca Nazarene Univ. Nashville, TN 37210
Christian Brothers Univ. Memphis, TN 38104	LeMoyne-Owen College Memphis, TN 38126	Tusculum College Greeneville, TN 37743
Crichton College Memphis, TN 38175	Lincoln Memorial Univ. Harrogate, TN 37752	Union University Jackson, TN 38305
Cumberland University Lebanon, TN 37087	Martin Methodist Coll. Pulaski, TN 38478	University of Memphis Memphis, TN 38152
David Lipscomb University Nashville, TN 37204	Maryville College Maryville, TN 37804	University of Tennessee Chattanooga, TN 37403
East TN State University Johnson City, TN 37614	Middle TN State Univ. Murfreesboro, TN 37132	University of Tennessee Knoxville, TN 37996
Fisk University Nashville, TN 37208	Milligan College Milligan Coll., TN 37682	University of Tennessee Martin, TN 38238
Free Will Bap. Bible Coll. Nashville, TN 37205	Rhodes College Memphis, TN 38112	Vanderbilt University Nashville, TN 37240
Freed-Hardeman Univ. Henderson, TN 38340	Southern Adventist Univ. Collegedale, TN 37315	



College of Education
Education in the Sciences, Mathematics, Research and Technology
422 Claxton Addition
Knoxville, Tennessee 37996-3400
(423) 974-5037 - Fax (423) 974-8103

June 24, 1997

Dear K-8 Science Teacher Educator,

Greetings. I am a doctoral candidate in science education at the University of Tennessee. I am requesting your assistance with an assessment of K-8 teacher preparation in the state of Tennessee for individualizing science instruction. This study is important because science teachers today have the task of accommodating a much broader range of student abilities, interests, and needs than ever before.

With the enclosed survey I hope to identify the individualizing strategies currently being introduced in science teacher preparation. I ask you specifically to identify the strategies you include in your elementary science teaching methods course. The selection of strategies on the survey was developed by the Individualized Instruction Program in the College of Education at the University of Tennessee, Knoxville.

Please reflect on your science methods course, and then respond to each of the survey items as they apply in your class. Your responses will be kept confidential. The data you provide us will be compiled, the responses will be reported in aggregate form and will not include any specific information about your institution. Please return the completed survey in the enclosed postage-paid envelope by July 20, 1997.

If you have any questions about the survey or research program, please contact me (423-974-1065; e-mail : ahazari@utk.edu) or Dr. Phyllis Huff (423-974-3435 ; e-mail : huff@utkux.utcc.utk.edu).

Thank you for your time and consideration.

Sincerely yours,

Al Hazari
Doctoral Candidate

Enclosures

Status of Individualized Science Instruction in Tennessee Teacher Education Institutions

The purpose of this survey is to assess the status of teacher preparation for individualizing science instruction in grades K - 8 classrooms.

The survey has four sections, where we would like to learn about ***your science teaching methods course*** as you prepare elementary teachers in specific strategies...

Section I ... for learning about the children they will teach.

Section II ... on how to determine differences among learners.

Section III ... for planning that leads to individualized instruction in the elementary school classroom.

Section IV ... that help attend to individual student differences.

More specific explanations and instructions for each section are provided within the survey. If you have any questions, please contact Al Hazari (423-974-1065, fax 423-974-3454, e-mail : ahazari@utk.edu) at the University of Tennessee, Knoxville.

***Your reflective consideration and honest responses
will be greatly appreciated.***

Section I : Learning about the children

The following strategies can be used by teachers to acquire more information about the children they will teach, including the identification of interests and special skills/talents, home backgrounds, and community conditions.

For each item below, circle the number which best describes the degree to which you teach about and/or use the strategy in your elementary science methods class.
Use this 5-point scale to respond as to :

1 = None 2 = Some 3 = A fair amount 4 = Quite a bit 5 = A great deal

- | | |
|---|------------------|
| 1. Gathering and using demographic data on students | 1 2 3 4 5 |
| information about students' backgrounds helps individualize planning for each student, including appropriate curricula/activities. | |
| 2. Acquiring information about services available for students | 1 2 3 4 5 |
| information from health agencies, human services agencies, public librarians, and many others who are involved in helping meet the total needs of each student. | |
| 3. Using interest inventories to learn about students | 1 2 3 4 5 |
| surveys completed by children can give teachers a wide array of areas around which curriculum can be organized and reading lists can be developed for individual students, and areas in which teachers can communicate with students. | |
| 4. Involving parents in the instructional program | 1 2 3 4 5 |
| parental involvement can deepen the teacher's understanding of the students and their cultural settings. | |
| 5. Using a computer-tracking system to keep student profiles | 1 2 3 4 5 |
| using available or teacher-developed computer systems to track student progress in skill development areas. | |

Section II : Determining differences among learners

The following strategies can be used by teachers to determine differences among learners.

For each item below, circle the number which best describes the degree to which you teach about and/or use the strategy in your elementary science methods class.
Use this 5-point scale to respond as to :

1 = None 2 = Some 3 = A fair amount 4 = Quite a bit 5 = A great deal

- | | |
|---|------------------|
| 6. Implementing portfolio assessment | 1 2 3 4 5 |
| assessing each student's progress via a comprehensive approach to their performance (may include any or all of strategies 7 - 13, below.) | |

- | | |
|---|------------------|
| 7. Using journals, logs, and progress-charting activities | 1 2 3 4 5 |
| journals for accounts of what activities the student is involved in, logs for collection of student's own ideas, progress-charting activities for recording how well the student is moving toward an objective. | |
| 8. Using commercial tests to determine student placement. | 1 2 3 4 5 |
| given school-wide, at system-level, and/or nationwide; primarily used to compare student progress in an area, or determine difficulties a student may be having. | |
| 9. Developing and using teacher-made tests | 1 2 3 4 5 |
| informal tests usually developed to determine progress in a subject or a phase of study in a subject or for diagnostic purposes. | |
| 10. Observing children at work and determining academic and other needs | 1 2 3 4 5 |
| systematic observation records kept to help teachers plan instructional programs for each child. | |
| 11. Implementing self-assessment procedures | 1 2 3 4 5 |
| systems/techniques for getting students to self-check their own work, and to make their own analyses of problems and progress. | |
| 12. Conferencing with students effectively | 1 2 3 4 5 |
| working one-on-one with students to review their work, pointing out both progress and needs. | |
| 13. Using video and audio tapes for assessment | 1 2 3 4 5 |
| recording students' behavior to monitor progress and identify problems with specific learning tasks. | |

Section III : Planning for individualized instruction in the elementary school classroom

The following strategies can be used by teachers to plan for individualized instruction in the elementary school classroom

For each item below, circle the number which best describes the degree to which you teach about and/or use the strategy in your elementary science methods class.
Use this 5-point scale to respond as to :

1 = None 2 = Some 3 = A fair amount 4 = Quite a bit 5 = A great deal

- | | |
|---|------------------|
| 14. Planning for and maintaining an interactive classroom | 1 2 3 4 5 |
| classroom where students are free to interact with each other and with the teacher on topics being studied in class. | |
| 15. Planning daily lessons for large groups and for individuals | 1 2 3 4 5 |
| plans for daily lessons to include a variety of activities for groups of different numbers of students and for individual students. | |
| 16. Using the Tennessee Instructional Model (TIM) | 1 2 3 4 5 |
| in the TIM instruction component, the teacher observes student performance and adjusts instruction as needed. | |

- | | |
|---|------------------|
| 17. Establishing long-range instructional goals and short-term objectives
teacher develops objectives and goals for individual students and small groups that are different from what the class as a whole might be learning. | 1 2 3 4 5 |
| 18. Developing units and mini-units
units can be broken up into tasks where the teacher is able to take advantage of individual student abilities/interests. | 1 2 3 4 5 |
| 19. Developing instructional objectives that vary in focus
objectives built around interests of students, special needs that students have, and objectives calling students to analyze what is to be learned, synthesize materials, and evaluate what has been learned. | 1 2 3 4 5 |
| 20. Developing independent tasks for individual children
independent tasks/assignments for some students for purposes of correcting a problem that no one else might have at that time or because the student has a special interest in a topic. | 1 2 3 4 5 |

Section IV : Attending to individual student differences

The following strategies can be used by teachers to attend to individual student differences.

For each item below, circle the number which best describes the degree to which you teach about and/or use the strategy in your elementary science methods class.
Use this 5-point scale to respond as to :

1 = None 2 = Some 3 = A fair amount 4 = Quite a bit 5 = A great deal

- | | |
|--|------------------|
| 21. Using peer teaching
students teaching other students in both small and large groups. | 1 2 3 4 5 |
| 22. Providing academic and skill coaching
supervising performance in any skill area to help students reach a desired level of achievement with that skill. | 1 2 3 4 5 |
| 23. Setting up learning stations or centers
setting up places in the room for specific instructional purposes for individual or small group enrichment activities. | 1 2 3 4 5 |
| 24. Using computers with individuals and small groups
using computers with individual students, or where small groups can work at the same terminal. | 1 2 3 4 5 |
| 25. Grouping students according to interests
grouping students who are interested in the same topic or area and then providing meaningful activities about this common interest. | 1 2 3 4 5 |
| 26. Employing thematic and project teaching
using a theme or project to serve as the focal point for a unit or segment of teaching lasting many days to several weeks during which students carry out individual tasks - may be multi-grade or schoolwide. | 1 2 3 4 5 |

- | | |
|---|-----------|
| 27. Implementing cooperative learning groups | 1 2 3 4 5 |
| using structured, mixed-ability groups where students have well-defined responsibilities and usually work toward team goals aimed at maximizing learning and getting along with others. | |
| 28. Using ability grouping appropriately | 1 2 3 4 5 |
| using flexible student grouping to enable instruction with mixed-ability groups and others with similar abilities. | |
| 29. Setting up various kinds of small groups, including dyads and triads | 1 2 3 4 5 |
| using small groups such as cooperative learning groups (Strategy 27) or skills groups as a vehicle to reach individual students. | |
| 30. Using graphic organizers, story frames, webbing and mapping strategies | 1 2 3 4 5 |
| using strategies that help students construct personalized meanings and understanding. | |
| 31. Using manipulatives and games | 1 2 3 4 5 |
| using hands-on materials for use in the classroom or home, such as puzzle-type games and special math/reading devices to provide strategies adapted to varied learning styles. | |

ABOUT YOURSELF :

Finally, we would like some information about yourself and your institution to help with statistical analyses.

How many years have you been teaching ? _____

What is your gender? male _____ female _____

Your highest degree is bachelor's _____ master's _____ doctorate _____

Type of institution: Public _____ Private (church) _____ Private non-church) _____

Total enrollment of students in your institution is _____

Enrollment of education students in your institution is _____

Number of science teachers education faculty in your teacher preparation program _____

How many elementary? _____ secondary? _____ elem./sec.? _____

Preservice teachers required to take a science methods course? Yes _____ No _____

Please turn to the back page for comments.

Comments

Thank you for taking the time to complete this survey booklet. Teaching is a very demanding occupation, and your dedication is evident in your willingness to participate in this research. Your assistance will contribute to the validity and utility of the findings. Please use the space below and/or additional paper to comment upon the strategies.

Please return the survey booklet in the postage-paid envelope, and direct any questions to :

Al Hazari
533 Buehler Hall
University of Tennessee
Knoxville, TN 37996-1600
423-974-1065 ; Fax 423-974-3454 ; e-mail : ahazari@utk.edu

THE UNIVERSITY OF TENNESSEE
KNOXVILLE



College of Education
Education in the Sciences, Mathematics, Research and Technology
422 Claxton Addition
Knoxville, Tennessee 37996-3400
(423) 974-5037 - Fax (423) 974-8103

July 30, 1997

Name
Address

Dear (Administrator):

A few weeks ago, I sent you two copies of a survey on science education and teacher preparation. Just in case the papers were lost in transit, I am enclosing another set for your convenience.

I would like very much to include your institution in my study. In order to do so, I need the survey responses from your K-8 science teacher educators as soon as possible.

Thank you for your cooperation.

Sincerely yours,

Al Hazari
Doctoral Candidate

Enclosures

APPENDIX F

Correlation of the Frameworks:

UTK, The Pilot Survey, The Tennessee Survey

Table F.1: Correlation of the Frameworks

Framework	UTK Item	Pilot Survey Item	Tennessee Survey Item
Gathering and using demographic data on students	1a	1	1
Acquiring information about services available for students	1b	2	2
Using interest inventories to learn about students	1c	3	3
Involving parents in the instructional program	1d	4	4
Using a computer-tracking system to keep student profiles	1e	5	5
Using journals, logs, and progress-charting activities	2a	6	7
Implementing portfolio assessment	2b	7	6
Using video and audio tapes for assessment	2c	8	13
Observing children at work and determining academic and other needs	2d	9	10
Implementing self-assessment procedures	2e	10	11
Conferencing with students effectively	2f	11	12
Developing and using teacher-made tests	2g	12	9
Using commercial tests to determine student placement	2h	13	8
Planning for and maintaining an interactive classroom	3a	14	14
Planning daily lessons for large groups, and individuals	3b	15	15
Using the Tennessee Instructional Model (TIM)	3c	n/a	16
Establishing long-range instructional goals and short-term objectives	3d	16	17
Developing units and mini-units	3e	17	18

Table F.1: (continued)

Framework	UTK Item	Pilot Survey Item	Tennessee Survey Item
Developing instructional objectives that vary in focus	3f	18	19
Developing independent tasks for individual students	3g	19	20
Implementing cooperative learning groups	4a	20	27
Using peer teaching	4b	21	21
Providing academic and skill coaching	4c	22	22
Setting up learning stations or centers	4d	23	23
Using computers with individuals and small groups	4e	24	24
Grouping students according to interest	4f	25	25
Using ability grouping appropriately	4g	26	28
Employing thematic and project teaching	4h	27	26
Setting up various kinds of small groups, including dyads and triads	4i	28	29
Using graphic organizers, story frames, webbing mapping strategies	4j	29	30
Using manipulatives and games	4k	30	31

APPENDIX G

The Tennessee Survey:

Demographic Data from Surveys

Table G.1: The Tennessee Survey: Demographic Data From Surveys

"About Yourself" Demographic Data	Frequency	Percent
Number of Years Taught: (n = 32 educators)		
0 - 9	4	12.5
10 - 20	10	31.2
over 20	18	56.3
Gender: (n = 32 educators)		
Female	19	59.4
Male	13	40.6
Highest Degree: (n = 32 educators)		
Bachelor's	2	6.2
Master's	7	21.9
Doctorate	23	71.9
Type of Institution: (n = 26 institutions)		
Public	8	30.8
Private (church-related)	16	61.5
Private (non-church-related)	2	7.7
Total Enrollment* of Students in Institution: (n = 26 institutions)		
0 - 999	7	26.9
1,000 - 2,999	10	38.5
3,000 - 9,999	5	19.2
10,000 - 30,000	4	15.4
Enrollment* of Education Students: (n = 26 institutions)		
0 - 99	7	26.9
100 - 499	10	38.5
500 - 999	5	19.2
1,000 - 4,000	4	15.4

*Approximate numbers

Table G.1: (continued)

“About yourself” Demographic Data”	Frequency	Percent
Number of Science Teacher Education Faculty in Your Teacher Preparation Program: (in the 26 institutions) Elementary Secondary Elementary/Secondary	26.5 12.5 55.5	28.0 13.2 58.7
Preservice Teachers Required to Take a Science Methods Course: (n = 26 institutions) Yes No	25 1	96.1 3.9

APPENDIX H

The Tennessee Survey:

Elementary Science Teacher Educator Comments

Table H.1: The Tennessee Survey: Science Teacher Educator Comments

Survey Number	Comments
7	The Sanders Assessment Model (see Sanders, et al., 1997) for Tennessee public school teachers binds the teacher to a list of specific skills. Often this leads to non-creative teaching techniques.
19	Our science methods course is included in a block with math and social studies. Students must develop an interdisciplinary unit that includes whole class, small group, and individual learning activities. A 20-hour practicum is also required.
25	Organizing a basic educational philosophy...drives the adoption and maintenance of strategy and methodology. Students (teachers) need to know <u>why</u> they are doing, <u>what</u> they are doing and <u>how</u> it will affect the overall community. A personal value...system is often ignored in education thus accountability suffers and so does education.
27	Science methods are included as part of a strategies course and two field experience courses.
29	I did a lot of hands-on instructing, while utilizing students interests, talents and abilities. Not all children are interested in science, so making it exciting and meaningful to them was important. I taught the science/social studies methods class at...College with sophomores and juniors...Many of them did not like the idea of taking science, but were excited about it by the end of the class - They learned what teaching science can be.
41	...I must sadly tell you that our college does not offer a science methods course - we only offer reading and a general methods course. As a science major and educator, this has been a source of disappointment with our current program.
49	I know this is negative but this questionnaire fails to get to the root of the problems in science education in Tennessee (and other states). There are far, far too many science methods courses devoid of practical content. So new teachers <u>may</u> know about material and strategies but they still don't <u>know</u> the science they are to teach. Underlying the questions is a philosophy indicated in (survey strategy) number 31 - <u>games</u> !
69	At...College, we are very much into the Shoebox science. This is very helpful in that it teaches the students organizational skills, discipline, but more importantly it gets the parents involved in their child's education. The Shoebox science provides a systematic approach to presenting the basic concepts in science.

Table H.1:continued

Survey Number	Comments
74	Actually, we have a 1-hour science methods course and a 3-hour science concepts course that focuses on science content for the elementary school. This course combines science content and methods and is consistent with the National Standards respective to teacher preparation.
77	We have no K-8 program in science education.
79	I do little of this (Survey <i>Section I</i> Strategies) because students take a course on Student, Parent and Community in which those topics are addressed in depth.
80	I seek to model many of the strategies included in this survey. Through modeling I hope my prescience teachers will have a greater understanding of how each strategy can enhance their own learning: this understanding would be grounded in their own experiences. The trade-off, of course, is that many of the strategies are not explicitly discussed in isolation--as a result I fear some students leave the course not making the connection between their experiences as learners in my course and their elementary students experiences in their future classrooms.

VITA

Alan "Al" A. Hazari, a native of Lebanon, grew up and did his undergraduate studies in the Middle East. He received his B.S. degree in Chemistry from the American University in Cairo in 1968. In 1970, he immigrated to the U.S. After teaching middle and high school science and mathematics in New Jersey for a year, Al decided to continue his chemistry studies. In 1972, he was awarded the M.S. degree in Chemistry from Youngstown State University in Ohio. His Master's Thesis was entitled "Neutron Activation Analysis of River Water." His research advisor was the late Dr. I. Mahadeviah. Work toward the Ph.D. degree in Chemistry began in 1972 at the University of Kentucky but was not completed. From 1973-76, he was a Chemistry Instructor and Lab Coordinator at Tougaloo College in Jackson, MS, followed by a 15-year stint as Instructor in Chemistry and Director of Labs at the University of Mississippi in Oxford. In 1991, the Hazaris (Al and wife Marcelle and children Jessica, Patrick, and Nicole) moved to Knoxville, TN. He currently holds the position of Director of Undergraduate Chemistry Laboratories at the University of Tennessee.

Al has always been very excited about sharing his scientific knowledge with K-16 students and teachers. He has received many grants from government agencies and industry to support hands-on science and chemistry teacher workshops. He has a strong commitment to K-8 science teacher education based on his belief that elementary teachers are a key influence and that the teachers need to trust in their capability to do science. Teachers are the major factor in student appreciation and enjoyment of science. Al hopes that his doctoral degree will provide new opportunities to impact preservice and inservice science teachers, with an ultimate goal of science for *all*.