INFORMATION TO USERS

This manuscript has been reproduced from the microfilm master. UMI films the text directly from the original or copy submitted. Thus, some thesis and dissertation copies are in typewriter face, while others may be from any type of computer printer.

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleedthrough, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send UMI a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps. Each original is also photographed in one exposure and is included in reduced form at the back of the book.

Photographs included in the original manuscript have been reproduced xerographically in this copy. Higher quality 6" x 9" black and white photographic prints are available for any photographs or illustrations appearing in this copy for an additional charge. Contact UMI directly to order.
Extent of use of the problem-solving approach by first-year teachers of vocational agriculture

McKee, Steven Ray, Ph.D.
The Ohio State University, 1991
Extent of Use of the Problem-Solving Approach by
First-Year Teachers of Vocational Agriculture

Dissertation Committee:

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

By

Steven McKee, BS, MS

The Ohio State University
1991

Dissertation Committee:
Dr. J. Robert Warmbrom
Dr. L.H. Newcomb
Dr. Lowell Hedges

Approved by:

Dr. J. Robert Warmbrom
Adviser
Department of Agricultural Education
DEDICATION

It is the writer's firm belief that major achievements such as this are not simply the work of an individual. Instead, it is only through the work of many that accomplishing the degree of Doctor of Philosophy is possible. The effort per individual may vary, but only through the accumulation of those efforts can success be obtained.

I would like to express my sincere conviction that without the Lord's blessing and inspiration I would have failed at this task just completed. The power of the Lord was a continual source of hope and strength. First and foremost, I dedicate what I have accomplished to the Lord because without Him, I would not have been able to succeed.

Secondly, to the person who helped me with countless hours of assistance and encouragement, I would like to express heartfelt gratitude and thanks. Seeing how those words fall short of my true feelings, I would like to dedicate this work to Cleah McKee. My loving wife, best friend, and mother of my children, you made this possible. Thank you for being my partner in this accomplishment and in life.
ACKNOWLEDGEMENTS

An achievement of the magnitude of obtaining the degree of Doctor of Philosophy cannot be accomplished alone. A great deal of time, effort, and guidance is contributed by many individuals to reach this goal. The writer would like to express a heartfelt thanks and sincere appreciation to those individuals who have made this dream a reality.

A very special thanks and sincere appreciation to Dr. J. Robert Warmbrod for his guidance, encouragement, and wisdom in helping to make this doctoral program a rich and fulfilling experience.

To Dr. R. Kirby Barrick a special thanks for helping me through the times of indecision and giving me the inspiration to continue on with the work at hand.

A sincere thanks to Dr. L. H. Newcomb, Dr. James W. Altschuld, and Dr. Lowell Hedges for their support during the General Examinations and dissertation defense.

A very special thanks to a fellow comrade and a great friend for the many hours of assistance and encouragement: Dr. Oren Christmas.

To Ms. Connie Rice, thanks to a very special friend for the countless times that she has helped me over the years.

A very special thanks to a dear friend who has been a true assistance in this work: Mrs. Vickie Chambers.

To the greatest friend a person could ever have, a special thanks that words cannot express adequately. Thanks Cleah for standing by me through all these years and making this accomplishment possible.
VITA

March 17, 1952 ................................................................. Born - Maysville, Kentucky

1970 ................................................................. Graduated Manchester High School, Manchester, Ohio

1974 ................................................................. Bachelor of Science, The Ohio State University, Columbus, Ohio

1974 ................................................................. Vocational Agricultural Instructor, Ashland High School, Ashland, Ohio

1975 ................................................................. Vocational Agricultural Instructor, Big Walnut High School, Sunbury, Ohio

1976 ................................................................. Master of Science, The Ohio State University, Columbus, Ohio

1980 - present ......................................................... Assistant Director of Support Services, Veterinary Hospital, The Ohio State University, Columbus, Ohio

Fields of Study

Major Field: Agricultural Education
Agricultural Education
Teacher Education
Research and Statistics
Evaluation

Dr. J. Robert Warmbrod
Dr. L.H. Newcomb
Dr. R. Kirby Barrick
Dr. James W. Altschuld
TABLE OF CONTENTS

DEDICATION ........................................................................................................... ii

ACKNOWLEDGMENTS .............................................................................................. iii

VITA ............................................................................................................................... iv

LIST OF TABLES .......................................................................................................... viii

LIST OF FIGURES ........................................................................................................ x

CHAPTER

I. INTRODUCTION ........................................................................................................ 1
   Problem Statement ................................................................................................. 3
   Description of Independent Variables .................................................................. 5
   Description of Dependent Variables .................................................................... 8
   Significance of the Study ..................................................................................... 8
   Limitations of the Study ....................................................................................... 9

II. REVIEW OF LITERATURE .................................................................................... 10
   Acquisition of Problem-Solving Strategies: Non-Agricultural Setting .............. 10
   Problem Solving in Vocational/Agricultural Education ....................................... 21
   Research Concerning Problem-Solving Approach in Agricultural Education ... 27
   Factors Associated with the Type of Teaching Techniques that Teachers Use ... 33
   Teaching Assessment Techniques ..................................................................... 40
   Chapter Summary ............................................................................................... 44

III. METHODOLOGY ................................................................................................... 47
   Population and Sample ....................................................................................... 47
   Design ................................................................................................................. 48
   Instrumentation and Data Collection .................................................................. 48

IV. ANALYSIS AND INTERPRETATION OF DATA .................................................... 61
   Description of Participants .................................................................................. 62
   Extent of Use of the Problem-Solving Approach by First-Year Vocational Agriculture Teachers ................................................................. 65
   Extent of Use of the Problem-Solving Approach in the Methods Course ........ 74
**LIST OF TABLES**

<table>
<thead>
<tr>
<th>TABLE</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Correlations of Analysis and Reanalysis</td>
<td>57</td>
</tr>
<tr>
<td>2.</td>
<td>Microteaching Videotape Reanalysis</td>
<td>58</td>
</tr>
<tr>
<td>3.</td>
<td>Student Teaching Audiotape Reanalysis</td>
<td>59</td>
</tr>
<tr>
<td>4.</td>
<td>First-Year Teaching Audiotape Reanalysis</td>
<td>60</td>
</tr>
<tr>
<td>5.</td>
<td>Description of Students Participating in the Study</td>
<td>63</td>
</tr>
<tr>
<td>6.</td>
<td>Descriptions of Problem-Solving Teaching Behavior during Student Teaching</td>
<td>64</td>
</tr>
<tr>
<td>7.</td>
<td>Extent of Use of the Problem-Solving Approach by First-Year Teachers</td>
<td>66</td>
</tr>
<tr>
<td>8.</td>
<td>First-Year Teachers Audiotape Analysis</td>
<td>68</td>
</tr>
<tr>
<td>9.</td>
<td>Spearman Rank-Order Correlations among Four Measures of the Extent to Which First-Year Teachers Use the Problem-Solving Approach</td>
<td>69</td>
</tr>
<tr>
<td>10.</td>
<td>Methods Microteaching Tape Analysis</td>
<td>76</td>
</tr>
<tr>
<td>11.</td>
<td>Spearman Rank-Order Correlations Indicating Relationships between Extent to Which Problem Solving Was Used in the Methods Course and Extent to Which Problem Solving Was Used during the First Year of Teaching</td>
<td>79</td>
</tr>
<tr>
<td>12.</td>
<td>Scores on Critical Thinking Test</td>
<td>81</td>
</tr>
<tr>
<td>13.</td>
<td>Spearman Rank-Order Correlations of Critical Thinking Test and First-Year Teachers' Extent of Use of the Problem-Solving Approach</td>
<td>83</td>
</tr>
<tr>
<td>14.</td>
<td>Student Teachers’ Extent of Use of the Problem-Solving Approach as Determined by the Student Teachers, Cooperating Teachers, and Supervising Professors</td>
<td>85</td>
</tr>
<tr>
<td>15.</td>
<td>Student Teachers’ Class Session Tape Analysis</td>
<td>87</td>
</tr>
<tr>
<td>16.</td>
<td>Pearson Product Moment Correlations between Five Measures of the Extent of Use of the Problem-Solving Approach by Student Teachers during Student Teaching</td>
<td>92</td>
</tr>
</tbody>
</table>
17. Spearman Rank-Order Correlations: Extent of Use of Problem-Solving during First Year of Teaching and Measurements during Student Teaching .......................... 95

18. Cooperating Teachers' Extent of Use of the Problem-Solving Approach as Determined by the Cooperating Teachers and Student Teachers .......................... 98

19. Spearman Rank-Order Correlations between Extent of Use of the Problem-Solving Approach by Cooperating Teachers and the Extent of Use of the Problem-Solving Approach by First-Year Teachers .......................... 100
LIST OF FIGURES

FIGURE

1. A Comparison of Problem-Solving Models ........................................... 17
2. Summary of Data Collection Methods and Time of Data Collection ........... 54
3. Reanalysis of Micro Teaching Tapes ...................................................... 116
4. Reanalysis of Student Teaching Tapes .................................................. 118
5. Reanalysis of First-Year Teaching Tapes ............................................... 120
6. Combination of All Tape Reanalysis ................................................... 122
CHAPTER I
INTRODUCTION

The problem-solving approach has long been advocated as the instructional method to use in teaching vocational agriculture at the secondary level. Preservice teachers in vocational agriculture are instructed in the use of this approach to teaching. This instruction occurs primarily in a course on "Methods of Teaching," through micro-laboratory exercises, and during student teaching. An enormous amount of effort and time is spent instructing potential teachers in the step-by-step utilization of this approach. This instruction is further enhanced by practice in laboratory and real settings. The agricultural education profession has strongly advocated the use of this instructional approach.

Since the beginning of vocational agriculture, the problem-solving approach has been utilized by the vocational agriculture profession. W. W. Charters is credited with being the first to use the problem-solving approach in teaching, about 1909 (Stimson and Lathrop, 1954). Charters was a student of John Dewey who was an advocate of the problem-solving approach, which he referred to as reflective thinking.

The instructional approach is well suited to the teaching of vocational agriculture. With the availability of many naturally occurring problems that students have in regard to their supervised occupational experience projects, land laboratories, and job placement, the problem-solving approach is an excellent teaching approach. Numerous basic principles of learning are incorporated into the instructional approach. Warmbrod (1969) outlined some of these principles in an Agricultural Education Magazine editorial. These "concepts are basic to a problem-solving approach to teaching:
- Instruction is student-centered rather than subject-centered.
- Instruction aims at the development of and change in behavior of individuals rather than 'covering' subject matter.
- Content is organized such that it is psychologically meaningful to students rather than in a manner that is logical to an expert.
- Teaching and learning is a cooperative venture between the teacher and student rather than a completely teacher-dominated process.
- Students are capable of and will share in planning, conducting, and evaluating what is taught and how it is taught.
- Learning is an active rather than a passive process.
- Learning is improved when students 'inquire into' (discovery or inductive approach to learning) rather than being 'instructed in' subject matter" (Wambrood, 1969).

Dickerson (1984) proclaimed a need for the vocational agriculture profession to get back to the basics that had made the program so successful. He expressed the need for curriculum design to emphasize the problem-solving approach and rational thinking. Crunkilton (1982) explained that, for the profession to stay as a vocational program, the problem-solving approach had to be utilized in the classroom as the way to teach.

The problem-solving approach has been one of the cornerstones of the profession since its inception. "Our greatest ultimate goal in problem teaching is to make our students able to solve new problems without help. In the degree in which we make our young people able to do this, we shall have truly educated them" (Lancelot, 1929, p. 134). It is the responsibility of the vocational agriculture teacher to guide the learning process of students so as to develop within them the "reasoning and problem solving ability to transfer knowledge to real life situations beyond the school" (Crunkilton, 1984, p. 12). Crunkilton further stated that the art and science of teaching can be truly incorporated in the learning environment through the use of the problem-solving approach.

However, a concern exists surrounding the use of the problem-solving approach in the classroom by teachers. Moore and Moore (1984) stated that the problem-solving approach has outlived its usefulness.
Several reasons were cited. First, the adoption of the problem-solving approach by vocational agriculture would appear to have been an "historical accident" (p. 5). Vocational agriculture came into existence at the time that Dewey's professional career was peaking and consequently his problem-solving approach to learning was readily adopted. Second, there exists virtually no research that supports the problem-solving approach to teaching. Third, many students in vocational agriculture do not intend to enter the farming profession and also do not have supervised occupational experience projects. The use of the problem-solving approach in teaching vocational agriculture was, at its conception, based heavily on the two assumptions stated in the third point, which are not so applicable today.

Some in the profession have expressed concern regarding the rejection of the problem-solving approach by teachers at the secondary level. Auville (1982) cited some reasons for the rejection:

- changes in agricultural industry
- changes in the vocational agriculture curriculum
- changes in the type of students enrolled in vocational agriculture courses.

Are the teachers of vocational agriculture using the problem-solving approach in classroom teaching? Each year students graduate from The Ohio State University with Bachelor of Science degrees and enter teaching as vocational agriculture teachers. These beginning teachers have received extensive training and instruction in the use of the problem-solving approach. Do these first-year teachers use this knowledge in classroom teaching? What factors seem to influence the use or nonuse of this instructional approach? To what degree do these factors explain the extent to which the teachers use the problem-solving approach?

Problem Statement

During preservice preparation, teachers receive extensive practice and instruction in the use of the problem-solving approach to teaching. Methods courses, microteaching laboratories, and student teaching have equipped prospective teachers with the knowledge and skills necessary to use the instructional approach. The concern lies in determining the extent to which the problem-solving approach is actually implemented in the classroom. Is the instruction that is received in the preservice program implemented in teaching? To what degree is it implemented?
To describe the extent to which first-year teachers of vocational agriculture use the problem-solving approach, data were collected from a group of first-year agriculture teachers. The population of students chosen for the study was followed through their methods course and microteaching laboratories, through student teaching, and into the first year of teaching. These three time periods were searched for variables that could influence the extent of use of the instructional approach during the first year of teaching. Relationships were investigated. It was expected that these variables, either independently or in combination, were correlated with the dependent variable—the extent to which the problem-solving approach is utilized by first-year teachers who have graduated from The Ohio State University.

The specific objectives of the study were:

1. To determine the extent to which first-year vocational agricultural teachers use the problem-solving approach to teaching.

2. To determine the relationship between the extent to which the problem-solving approach to teaching was utilized by agricultural education undergraduates in the microteaching portion of their methods course and the extent to which they use the problem-solving approach in their first year of teaching vocational agriculture.

3. To determine the relationship between agricultural education undergraduates' general problem-solving abilities and the extent to which they use the problem-solving approach to teaching in their first year of teaching vocational agriculture.

4. To determine the relationship between the extent to which student teachers use the problem-solving approach during student teaching and the extent to which students utilize the problem-solving approach during the first year of teaching vocational agriculture.

5. To determine the relationship between the extent that the cooperating teachers of the first-year teachers had utilized the problem-solving approach to teaching during the student teaching experience and the extent to which these first-year teachers used the problem-solving approach to teaching.
Description of Independent Variables

The first area of consideration will be the on-campus classroom methods course and accompanying microteaching laboratory. Will the future use of the problem-solving approach by agricultural education undergraduates be influenced by their experiences in Agricultural Education 530, "Methods of Teaching in Vocational Agriculture and Extension Education" at The Ohio State University? To determine if a relationship does exist, data were collected from two sources. The two sources of data were the third micro-teaching lesson and an interview conducted at the end of the course.

These agricultural education undergraduates were also given a general problem-solving test to determine their problem-solving abilities. The reason for the test was to determine if a person's general problem-solving ability has any relationship with the future extent of use of the problem-solving approach during the first year of teaching.

Three microteaching sessions are recorded per student during the quarter. The third session is designed to be a mini-lesson that incorporates the six problem-solving approach steps. These six steps are as follows:

1. Interest approach;
2. Group objectives;
3. Questions to be answered;
4. Problem solutions;
5. Testing solutions through application; and

These steps were outlined by Newcomb, McCracken, and Warmbrod (1986, p. 67). The third session videotape was reviewed by the researcher to determine the extent to which the students used the problem-solving approach in their teaching presentations. The problem-solving approach instrument developed by Boone (1988) to determine the extent to which the problem-solving approach was utilized by high school vocational agriculture teachers was used to analyze the microteaching tapes.

Qualitative data, in the form of an interview, were collected at the completion of the quarter. The interview was directed at collecting students' perceptions of the problem-solving approach to teaching.
Questions concerning level of knowledge obtained, viability of the problem-solving approach in the classroom, restrictions on using the approach, and their opinions of the problem-solving approach were addressed. These data, providing a description of the perceptions of the students, supplemented the quantitative data collected.

At the completion of the quarter a test measuring general problem-solving skills was administered. The test selected for this purpose was the Cornell Critical Thinking Test, Level Z (Ennis, Millman, and Tomki, 1985). This test provides the student the opportunity to demonstrate problem-solving skills through a variety of sensors that require no particular subject knowledge.

The second period of data collection was at the completion of the student teaching experience. Student teaching normally follows the quarter in which the methods course has been completed. One area of concern was the perceptions of the student teachers regarding the extent to which they used the problem-solving approach in their classroom teaching. A problem-solving instrument was administered to the student teachers to arrive at a measurement of this variable.

Each student teacher also made two audiotapes of their classroom teaching. These tapes were analyzed by using the problem-solving approach instrument developed by Boone (1988) to determine the extent to which the student teachers had utilized the problem-solving approach during the student teaching period. This supplemented the problem-solving instrument in determining whether the student teachers' perceptions matched their actual actions.

To obtain a more complete assessment of the extent to which student teachers utilized the problem-solving approach, a problem-solving instrument was administered to each of the cooperating teachers. The cooperating teachers were asked to give their perceptions of the extent to which the student teachers had utilized the problem-solving approach.

A fourth measure was collected regarding this variable. The supervising professors for the student teachers were asked to complete a problem-solving instrument. The supervising professors were asked to give their perceptions of the extent to which the student teacher had utilized the problem-solving approach. By collecting information from these sources, a more complete assessment of this variable was possible.
The extent to which cooperating teachers use the problem-solving approach in their teaching was also quantified. Cooperating teachers have a great deal of influence in the way student teachers perform. The literature review (Chapter II) includes various studies that verify this statement. Student teachers will often copy what they see the cooperating teacher doing. The cooperating teacher could have a major influence in the decision of the student teacher to use or not use the problem-solving approach. If the cooperating teacher is a believer in and user of the problem-solving approach, then this positive attitude could be transferred to the student teacher. However, if the cooperating teacher does not support the problem-solving approach, an adverse effect could result.

To determine the extent to which the problem-solving approach is used by the cooperating teacher, two measurements were utilized. Cooperating teachers indicated their perceptions of the extent to which they use problem solving and student teachers gave their perceptions of the extent to which their cooperating teachers used the problem-solving approach. These data were collected by using the problem-solving instrument.

Each student teacher was interviewed by the researcher at the completion of the student teaching experience. The purpose of the interview was to collect information concerning changes in their perceptions of the problem-solving approach, factors that influenced their use of the problem-solving approach, and opinions about their future plans in using the problem-solving approach in their teaching careers. The interview added insights that might not be readily obtainable from the sole use of a questionnaire.

In summary, the independent variables considered in the data collection process are as follows:

1. The extent to which the Agricultural Education 530 course influences the first-year teacher of vocational agriculture in using the problem-solving approach to teaching. This was measured by using the third microteaching tape of a lesson and an interview of each student in the case.

2. The extent to which general problem-solving ability influences the first-year vocational agriculture teachers' extent of use of the problem-solving approach. The Cornell Critical Thinking Test, Level Z was utilized to measure general problem-solving skills.
3. The extent to which the student teaching experience influences the first-year teacher of vocational agriculture in using the problem-solving approach to teaching. This was determined by using analyses of audiotapes of two lessons; problem-solving instruments administered to the student teacher, cooperating teacher, and supervising professor; and an interview of each student teacher.

4. The extent to which the utilization of the problem-solving approach to teaching by the cooperating teacher influences the extent of use of the problem-solving approach by first-year vocational agriculture teachers. The influence occurred during the student teaching experience of each of the first-year teachers. A problem-solving instrument was administered to the student teachers and the cooperating teachers to determine the extent of use of the problem-solving approach by the cooperating teachers.

By considering these independent variables, relationships between them and the dependent variable, extent of use of the problem-solving approach to teaching by first-year vocational agriculture teachers, were investigated.

Description of Dependent Variable

During the first year of teaching of vocational agricultural data were collected to measure the extent to which teachers used the problem-solving approach to teaching. The researcher made two visits to each first-year teacher. One visit was in late November or early December and the second visit was conducted in May of the 1988-89 school year. During each visit, a lesson was audio-recorded and notes taken to supplement the tape. Each first-year teacher was asked to complete a problem-solving instrument regarding their perceptions of the extent to which they utilized the problem-solving approach during their first year of teaching. An interview was conducted at the conclusion of each visit.

Significance of the Study

The agricultural education profession has strongly advocated the use of the problem-solving approach to teaching at the secondary level. It is firmly believed that the problem-solving approach is the instructional approach that is most effective for teaching students about agriculture. The Department of Agricultural Education at The Ohio State University spends a considerable amount of time, effort, and
resources in equipping undergraduates with the knowledge and skills to use the approach. It is the primary instructional approach that is taught in the methods course and stressed during student teaching.

A concern lies in the area of use of the problem-solving approach in the classroom. It is not fully known how extensive the problem-solving approach is utilized in the classrooms of high school vocational agriculture programs. This study will begin to shed light on this matter. By determining the extent to which first-year teachers of vocational agriculture use the problem-solving approach, one could then better evaluate the teacher preparation program.

If first-year teachers do use the problem-solving approach, then what factors seem to correlate positively with its use and what variables do not have any bearing or even have a negative influence? What if first-year teachers do not use the problem-solving approach or use it only marginally? Are these teachers being adequately prepared in the knowledge of the problem-solving approach? Could it be that the problem-solving approach is not suited for today's vocational agriculture classroom?

Many questions readily come to mind concerning the preparation of vocational agriculture teachers. We could begin to see if an adequate job of preparing preservice teachers is being done. Areas that need to be changed could be identified, as well as strengths. The profession would have a better feel for what is occurring in the classroom of the vocational agriculture teacher.

It is hoped that the study will give some insights into how well teachers are being prepared in terms of the problem-solving approach. Also, an evaluation of the problem-solving approach as the preferred instructional approach could and should be done. What areas are strengths and weaknesses in the teacher preparation program? The study could begin to illuminate these areas so that they can be better considered.

Limitations of the Study

A specific population will be studied extensively; however, it will be a small number of first-year vocational agriculture teachers. These first-year vocational agriculture teachers will be restricted to those who have graduated from The Ohio State University who started teaching in the fall of 1988. Thus, the generalizability of the study will be limited by these restrictions.
CHAPTER II
REVIEW OF LITERATURE

Problem solving covers a wide and varied field of knowledge. There has been a considerable amount of research concerning the actual solving of problems, especially in the fields of mathematics, science, and medicine. Research that deals with problem solving as an instructional approach is more limited, especially in agricultural education.

The literature indicates that problem-solving skills can be taught and acquired. Certain factors have a bearing upon how well a person acquires problem-solving skills. The research identifies some of the elements that influence how well problem-solving abilities are learned.

The key point is that problem-solving skills can be taught and learned. Thus, future teachers should be able to learn the problem-solving techniques and strategies associated with the problem-solving approach. After having acquired these skills, these future teachers should in turn be able to teach problem-solving skills to their students. If this was not the case, then the instruction concerning the problem-solving approach would be of little importance.

Acquisition of Problem-Solving Strategies: Non-Agricultural Setting

An easy-to-use problem-solving model that is readily adaptable to a variety of situations was presented by Manera, Rogers, and Wright (1980). The six-step procedure is as follows:

1. State the problem
2. Brainstorm alternative solutions
3. List advantages and disadvantages for each solution
4. Prioritize solutions--ideal to practical
5. Implement solution
6. Evaluate solution.
Most decisions that are encountered can be arrived at by following this outline. This would hold true from making mathematical decisions to using this procedure as an instructional method. Many of the problem-solving models are very similar to this six-step procedure.

**Experience level of learner.**

Ross and Maynes (1983) looked at an instructional program based on expert-novice differences in experimental problem-solving performances in the field of science teaching. They were working with randomly assigned classes of sixth-grade students. The purpose of the study was to contrast the performance of mature problem solvers with those of novice problem solvers. Novice problem solvers in the experiment obtained a level of performance that was not necessarily incorrect but merely inadequate. The novice problem solvers began with operations that were part of higher level performance, but they would come to premature closure. The purpose of the instruction was to accelerate and extend the natural development that occurs as one becomes more adept at problem solving. A comparison of the groups showed that the group receiving problem-solving instruction consistently outperformed the control group that had received none. This achievement did not decline after one month when a group of tests was administered. Ross and Maynes also found that the amount of practice is of key importance in having the training implemented with a high degree of automaticity.

Stern and Keislar (1967) studied the acquisition of problem-solving strategies by young children. They wanted to determine whether young children could be taught strategies used in problem solving within a limited context. "It was predicted that children taught to use maximum knowledge of results through a strategy of multiple hypothesis testing would be better able to solve such problems than children taught a simple hypothesis strategy" (p. 3). They found that problem-solving strategies could be taught to young children and this group was significantly superior to the control group. The children were unable to maintain this superiority where strategy clues were not provided. Stern and Keislar concluded that the three-day training period was insufficient for children of that age.

Stern (1967) conducted a similar study concerning acquisition of problem-solving strategies by young children. The results provided evidence that young children can be taught problem-solving strategies. The children were better able to solve problems after receiving training.
Cognitive styles, as they relate to developmental stages, need to be considered. Kagan, Moss, and Siegel (1963) stated that a child's initial conceptualizations are global and overgeneralized and will tend to become analytic and differentiated as the child matures. Glanzer et al. (1963) related strategies or styles of problem solving to important variables in the problem itself. These are "type of exemplars (positive or negative), ratio of relevant to irrelevant instances and to total number of examples, presence of superfluous information, ordering of examples, amount of information required to solve problems, and rate of introduction of new information. Probably the most important effects relate to how the information is structured as well as the memory storage load" (p. 15).

Type of thinking: abstractness vs. concreteness.

Differences in group problem-solving behavior and effectiveness as a function of abstractness were investigated by Hendrick (1979). "One line of cognitive style personality research suggests that degree of cognitive complexity of concreteness-abstractness may be an important higher order personality determinant of teamwork problem solving effectiveness" (p. 518). It has been reported that concreteness-abstractness has two major structural dimensions--differentiation and integration (Barriff and Lusk, 1977; Harvey, 1966; Harvey, Hunt, and Schroder, 1961; Schroder, 1971). Barriff and Lusk (1977) defined differentiation operationally as the number of dimensions extracted from a set of data. Integration was defined as the number of interconnections between rules for combining structured data.

Relatively little differentiation is used in structuring concepts by someone whose cognitive style would be described as being concrete. Experiential data are categorized within relatively few conceptual dimensions, and within concepts there exists for the person relatively few "pigeon holes" or categories. People who are described as being abstract will tend to demonstrate high differentiation and effective integration in their conceptualizing (Harvey, 1966; Harvey et al., 1961).

"Several important behavioral dimensions that consistently have been found related to abstractness level are authoritarianism, dogmatism, locus of control, conformity, and creativity. When compared to more abstract persons, concrete conceptualizers tend to be authoritarian, closed-minded, absolutist, conforming, and uncreative, and tend to rely on external fate control" (Hendrick, 1979, p. 519).
In summarizing several studies by himself and his colleagues, Harvey (1966) determined that abstract persons have a greater sensitivity to minimal clues and a greater ability to use them appropriately and completely in problem solving. A similar study suggested that when compared with more concrete leaders, abstract designated leaders were better users of feedback clues (Nydegger, 1975).

Abstract conceptualizers are also significantly more effective in their ability to demonstrate a great flexibility in changing their set in problem solving. In a summary of seven studies, Harvey (1966) determined that concrete conceptualizers were consistently poorer performers than abstract persons in their problem-solving skills.

"Miller and Harvey (1973), in studying ego-involving task performance, found abstractness level to be an important moderator under varying levels of stress. Abstract subjects performed relatively better than concrete subjects under both high and low stress conditions in terms of number of approaches utilized, openness to negative evaluation, and display of less ethnocentrism and absolutism. In addition the abstract group performed significantly better under the high stress condition than under low stress on these same performance measures and on intelligence measures of vocabulary and arithmetic reasoning" (Hendrick, 1979, p. 584).

"Abstract persons have a greater sensitivity to minimal cues and a greater ability to use them appropriately and completely in solving problems" (Harvey, 1966, p. 47). Abstract designated people made better use of feedback clues and process information more completely. They also are more flexible in changing their approach when solving a problem.

In Hendrick's (1979) study, undergraduates and graduate students studying management were given the O'Connor Abstractness Orientation Scale. The students with the five highest and five lowest scores in each of 20 course sections were assigned to abstract and concrete problem-solving groups. The abstract groups were more successful in completing the problem-solving tasks. The concrete groups required twice the amount of time to solve the problems. The abstract groups worked at a faster pace and demonstrated better clue utilization.
Individual differences.

Research of a somewhat similar nature was conducted by Ronning, McCurdy, and Ballinger (1984). They believed that the research concerning problem-solving instruction models was lacking in that only knowledge of subject matter and problem-solving methods were being investigated. They felt that individual differences needed to be included as a factor. Gagne (1980) proposed that successful problem solving required three capabilities: intellectual skills, verbal knowledge, and cognitive strategies. He proposed that all (or nearly all) of these capabilities are learned; therefore, variation in problem solving ability in the population is bound to exist. Clearly, it is imperative that these individual difference dimensions be identified. Ronning et al. (1984) attempted to verify that the characteristics of the learner should be included in the development of models concerning problem solving in subject matter domains such as science.

Ronning et al. selected a "single individual difference variable, Witkin (1977) well-known field-dependence-independence (F.D.I.) construct and analyzed it, in the context of other variables, for its value in providing a clearer understanding of the problem-solving process" (p. 73). The field-dependent-independent construct was utilized because of its value in differentiating between successful and unsuccessful problem solvers in science.

The field dependent students did not perform the assigned problem-solving tasks as well as the field independent students. The researchers suspected that the field dependent students' ability to analyze the tasks that were given to them interacted with their inability to bring past experience (knowledge) to bear on these tasks. The findings verified the need for characteristics of the problem solvers to be included as a dimension in the theory of problem solving.

Robert Ennis (1962) has done extensive research into testing critical thinking. He first defined critical thinking as the appraising of propositions. Ennis (1985a) later broadened the definition to be reasonable and reflective thinking that is focused on deciding what to believe or do. A very extensive outline of what critical thinking is appears in a paper by Ennis (1985a). This outline includes what is viewed as problem solving; thus, although problem-solving and critical thinking are not exactly the same, they are very similar.
With the assistance of other researchers, Ennis developed numerous tests that attempt to measure critical thinking. The particular test selected for this study was the Cornell Critical Thinking Test, Level Z by Ennis, Millman, and Tomko (1985). The rationale for choosing this test was that it was designed to be administered to the age group that composed this study. One concern of this study was to determine if the general problem-solving ability of a preservice vocational agricultural first-year teacher was correlated with that individual's use of the problem-solving approach to teaching. By determining the general problem-solving ability of each subject in the study, it would be possible to assess if individual differences in the ability to solve problems had any relationship with the future extent of use of the problem-solving approach.

Method of instruction.

A very important premise of this study is that problem-solving abilities and skills can be taught and learned. If this is not the case, then the use of the problem-solving approach as an instructional approach would have little value in the classroom. The use of problem solving as an instructional tool has long been advocated by educators as being a meaningful way for students to learn. Advocates have also contended that problem solving is more meaningful if students are confronted with real problems related to their immediate experience, rather than contrived problems (Glenn and Ellis, 1982). A key question is What does the body of literature regarding this area of concern indicate? To investigate the effectiveness of the use of problem solving as an instructional approach, a model of how to teach students to be better problem solvers is necessary.

Ways to help students become more systematic, effective problem solvers were stated by Biehler and Snowman (1982). The ten points that they outlined were:

1. Present problems yourself or encourage students to state problems of their own.
2. Encourage and help students find information relating to the problem
3. Allow for an incubation period.
4. When the illumination occurs, urge students to state solutions in the form of hypotheses.
5. Test the hypotheses.
6. Help students recognize and define the problem.
7. Help students ask the right questions.
8. Encourage the generation of many ideas.
9. The generation of ideas should be free and intuitive.
10. Develop persistence by starting out with quick solutions.

For problem solving to occur, certain conditions must exist. Woods (1987) outlined these conditions as follows:

1. Students must possess knowledge or information to solve problems, but how they learn information affects how they solve problems.
2. Students must possess tacit knowledge or experience in the problem area.
3. Students must possess a domain of knowledge or experience that is called problem solving.

A chart comparing several problem-solving models was developed by Eberle (1973). (See Figure 1). This chart can be used as a guide to aid teachers in using the problem-solving approach to teaching. Eberle (1973) developed a Problem-Solving Model of Classroom Instruction, which was included in the chart under the heading Instructional Model (1972). All of these models have roots in John Dewey's (1910) ideas on reflective thinking.

Although creative problem solving is advocated by many, there exists a concern about its use as a teaching method. Eberle (1973) reported that a panel of experts (Bish, Charles E.; Clark, Bill M.; Cole, Henry P.; Edwards, M. O.; Gowen, John C.; Guilford, J.P.; Stanish, Robert; Torrance, E. Paul; Williams, Frank E.) agree: "There is little evidence to suggest that many teachers are aware of problem-solving methods, let alone the use of these techniques as a method of instruction" (p. 724).

Problem solving is a complex operation that involves a number of steps and various factors. Glenn and Ellis (1982) suggested that the best approach to teaching students a problem-solving model is for that instruction to be direct and explicit. The steps, as they saw them, are to state clearly what is to be learned, teach the knowledge that will be needed, provide practice using the skills, and provide appropriate feedback.
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficulty felt</td>
<td>Problem presented to student</td>
<td></td>
<td>Attention aroused</td>
<td>Task orientation</td>
</tr>
<tr>
<td></td>
<td>Restructuring of the problem</td>
<td></td>
<td></td>
<td>Preliminary investigation</td>
</tr>
<tr>
<td>Difficulty defined</td>
<td>Classification of the problem</td>
<td></td>
<td>Problem finding</td>
<td>Problem defined</td>
</tr>
<tr>
<td></td>
<td>Selection of method suitable to problem type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solutions suggested</td>
<td>Use of abstractions to solve problems</td>
<td></td>
<td>Idea finding</td>
<td>Answers generated</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Inquiry Ideation Hypothesizing</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>New information obtained</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Exploration Investigation</td>
</tr>
<tr>
<td>Consequences considered</td>
<td>Solutions to problems</td>
<td>Solution finding</td>
<td></td>
<td>Solutions examined</td>
</tr>
<tr>
<td>Solution accepted</td>
<td>Acceptance finding</td>
<td>New answers generated</td>
<td></td>
<td>Inference Synthesis</td>
</tr>
</tbody>
</table>
The teaching of direct and indirect methods of problem solving to elementary children was the concern of a study by Glenn and Ellis (1982). A previous study by Ellis and Glenn (1977) demonstrated the efficacy of problem solving in the learning of economic concepts by fifth-grade students. The authors also felt that the complex process of problem solving involved a number of other factors such as divergent thinking, creativity, and judgment. These factors had been identified in other studies concerning problem solving (Feldhusen and Guthrie, 1979; Guilford and Hoepfner, 1972; and Houtz and Speedie, 1978). One question that emerged from Ellis and Glenn (1977) previous study was whether or not one method of teaching problem solving was more effective than another for students with different ways of thinking about issues.

The Glenn and Ellis (1982) study identified students as being either stimulus-bound or stimulus-free thinkers. "A stimulus-bound student's response was limited to only the data presented in the picture or problem. S(he) was limited in the responses given. Stimulus-free student responses went beyond the data presented in the picture or the problem. These were more creative as judged by the researcher” (p. 134). Glenn and Ellis' question was Will students who have been identified as either being stimulus-free or stimulus-bound thinkers learn to follow a problem-solving model more effectively if they have been taught by an indirect method of instruction or by a direct method? The type of learner thinking response to problems was not significant in the study. The factor that did have a significant impact was the method of instruction. The direct, explicit method of instruction was the more effective instructional strategy with both groups of students. Effectiveness was determined by analyzing the responses given by each student in the group to a real-life problem that needed to be solved. The analysis was based on how closely each student followed the steps in the problem model.

Lundsteen (1970) felt that instruction aiding abstract thinking ability may facilitate learning behaviors related to problem solving. "It may be that creative problem-solving is the last link in a long chain of hierarchically related skills; unless the component skills are mastered, instruction is difficult if not futile" (p. 376). The researcher wanted to determine if creative problem solving is enhanced by training students in the subskills of abstract quality in thinking. The findings showed the group that had been trained performing better than the control group. The performance of the abstract emphasis group was
consistently higher on the reading and problem-solving variables. Lundsteen also felt that extra practice was valuable.

The use of problem-solving modes of instruction, similar to those outlined in Eberle's chart, have been utilized in other educational fields besides agricultural education. Becker et al. (1979) investigated the use of problem solving in the training of nursery school teachers. A key goal of developing problem-solving skills is to train the person to be able to solve new problems based on what has been learned in solving the present problem. The development of general strategies for solving problems is very important.

Becker and associates (1979) worked with nursery school teachers in the application of problem-solving strategies for one year. The training produced very positive results. The teachers were better able to see their potential power for behavior change. By applying the problem-solving paradigm the teachers were more readily able to relate their educational goals to the social events in the everyday life of the nursery school. They felt that the training was more effective "if the teacher can refer to a written instruction manual which combines theoretical and practical information about the particular steps of the problem-solving process" (p. 512).

Norman (1985) did a study of the use of problem solving by clinicians in the medical field. A key to successful problem solving was experience. Expert problem solvers are better at solving problems, to a larger degree, due to their accumulated experience. Experienced problem solvers were able to arrive at more correct possible answers and to do so very rapidly. The inexperienced problem solvers were hindered due to a lack of knowledge rather than their inability to solve problems.

Three major differences were found to exist when comparing physicists who were novice and expert problem solvers (Chi, 1981). The differences were:

1. Time to solution of the problem.
2. Pause time between retrieving successive equations or chunks of equations.
3. Novice made more errors.

Chi determined that experts will make more complete knowledge statements than novices.
Increasing instructional effectiveness through the use of a problem-solving approach was investigated by Moore and Schaut (1978). They found that teachers who had received training in solving problems of individual students increased their overall effectiveness. The two areas measured were the reduction in the number of students exhibiting inattentive behavior and the amount of group inattention. These two areas were significantly reduced in the teacher group that had received the problem-solving training.

Olmo (1978) believed that three keys to effective teaching were student involvement, problem solving, and transfer. Problem solving is a very acceptable teaching approach in that it ties student involvement and transfer together. It utilizes the principle of transfer because its goal is that the learner will be able to solve future problems based on the strategies learned in solved present problems. The approach also requires a lot of student involvement. A problem-solving instructional approach was used in teaching a group of sixth graders resulted in increased achievement and skill acquisition and the children feeling better about themselves and their accomplishments.

Brauner (1962) said, "The first object of any act of learning, over and beyond the pleasures it may give, is that it should serve us in the future" (p. 12). Problem-solving strategies that are learned can meet this expectation.

Cameron (1985) stated that problem-solving skills can be enhanced. This is possible through the learning of the principles of decision making and practice in utilizing the techniques. It is better to teach how to arrive at the solution than to teach the solution.

Summary of research.

Problem solving can be taught to individuals. Individuals who are taught the problem-solving model will be better able to solve problems. Stern and Keislar (1967), Moore and Schaut (1978), Becker et al. (1979), and Ross and Maynes (1983) all indicate that problem-solving skills can be learned. Practice in the actual use of the problem-solving technique models will further increase problem-solving ability (Cameron, 1985). Norman (1985) indicated that experience is a factor in the ability of a person to be a problem solver. The more experienced the person, the better able the person is at solving problems.
Based on these findings first-year vocational agriculture teachers should be able to utilize the problem-solving approach to teaching. The first-year teachers in this study received instruction in the Agricultural Education 530 course concerning the problem-solving approach. This instruction was supplemented with practice and instruction received during the student teaching experience. These first-year teachers should have developed some skills in the use of the problem-solving approach.

The review of literature further indicates that individual differences can affect the problem-solving capability of a person. Based on this, will a person's ability to solve problems affect the extent to which that person will use the problem-solving approach to teaching? It would appear that the extent of use of the problem-solving approach during the first year of teaching could be influenced by individual differences in general problem solving.

Problem Solving in Vocational/Agricultural Education

The purpose of this study was to determine the extent to which the problem-solving approach was utilized by first-year teachers of vocational agriculture. To be able to assess the extent of use of the problem-solving approach, a clear definition of the problem-solving approach as utilized in vocational/agricultural education must be determined. The principles that are the basis for this definition must be determined.

Definition of problem solving.

John Dewey (1910), in How We Think, wrote of five stages that a person follows in the problem-solving process. He referred to problem solving as reflective thinking. Dewey recognized these stages as being:

1. Recognize that a problem exists.
2. Identify the nature of the problem.
3. Search for possible solutions.
4. Analyze the adequacy of the tentative solutions.
5. Test the most promising of the tentative solutions.
A sixth is sometimes added: evaluating the results. Newcomb, McCracken, and Warmbrod (1986) have adapted these six steps into the problem-solving approach to teaching vocational agriculture. These steps are taught in the teacher preparation program. The steps are:

1. Interest approach.
2. Group objectives.
3. Questions to be answered.
4. Problem solutions.
5. Testing solutions through application.

Many other methods textbooks in the vocational agricultural field (Binkley and Tullock, 1981; Crunkilton and Krebs, 1982; Drawbaugh and Hull, 1971; Hammonds, 1950; Lancelot, 1944; and Phipps, 1980) advocate the use of problem solving as the central approach to teaching. Rosenfeld (1984) stated that this characteristic approach to teaching, together with the supervised occupational experience program and Future Farmers of America components, makes vocational agriculture stand out from other vocational education programs.

The development of general thinking ability in students was one concern of Lancelot. In his book, *Permanent Learning: A Study in Educational Techniques* (1944), he outlined procedures concerning this development. The six procedures he outlined were:

1. Make constant use of problems and questions which require superior thinking, yet which are suited to the ability of the majority of the pupils.
2. Make assignments in such a manner that study by the pupils will be a problem-solving process, or if topics are used, a process of organizing and interpreting facts, as distinguished from one of memorization.
3. Endeavor to guide the study of the pupils so they will form the habit of using the modern scientific thinking process.
4. Lead class discussions in such a manner that they will follow the steps of the modified scientific thinking process.
5. Test occasionally with special care conclusions or opinions expressed casually by members of the class using the standards given in the fourth step of the process.

6. Exert constant, quiet pressure against poor reasons and against loose or careless thinking; and endeavor to teach essential knowledge so that it will be retained and used in the future thinking of the pupils (pp. 95-96).

"Training to think well in any given field or subject is one of the desired results of instruction in it. If a person is taught to think in a field, he must think while he is being taught. One learns to think in a field or subject by thinking in it" (Hammond, 1950, p. 23). A person learns to think by utilizing the thinking process while being instructed. The problem-solving approach addresses this concern very well. This instructional approach encourages the student to be an active participant in the class, requiring the student to be constantly thinking.

Numerous characteristics of the problem-solving approach can be credited to Stewart (1950). In his *Methods of Good Teaching*, he listed characteristics that are central to the problem-solving approach. For problem solving to occur, the problem must be clearly and definitely stated. The problem need not be too easy or too difficult but appropriate for the persons receiving the instruction. Thinking of quality and quantity should be required in solving the problem, and it must be true-to-life. Finally, the problem should make use of other interest techniques, meaning other than true-to-life.

"Problem-solving procedure is recognized as being an effective means of developing and securing desirable learning. It stimulates interest, develops thinking ability, and helps students to evaluate, draw inferences, and make decisions essential to the solution of a problem. (The memorization of facts does not lead to action, whereas problem solving leads to thinking which leads to action. The ability to solve problems will be invaluable in the future when decisions will have to be made.)" (Phipps, 1952, p. 121).

Binkley and Tullock (1981) stated that problem solving was a chain of thoughts aimed at a conclusion or solution. They gave a systematic plan to use in dealing with problems that gave increased understanding and enhanced studying. The process of problem solving is a thinking process, an action process. Reasons for using the problem-solving approach in the classroom are numerous. Binkley and Tulloch stated 10 of these reasons:
1. The problem acts as a selective agency in gathering pertinent facts and organizing them into a connected viewpoint.

2. In problem solving, significant and appropriate facts are taught in useful association and thus will be more likely to be used again when the need arises.

3. Problem solving places emphasis on use of material rather than on memorization of it.

4. The solving of a problem by the learners calls for the use of old things in new ways.

5. Problem solving in teaching contributes to the development in the learners of a habit of evaluation and using data intelligently in a new situation.

6. Since problem solving calls for pausing and weighing the possibilities and alternatives, it contributes to the development of open-mindedness.

7. Proper use of problem solving should contribute to teaching the learners to discover problems.

8. When problems are used in teaching, the learner always has an idea of what is to be done in solving the problem.

9. Problem solving lends itself to learner participation in all its steps or phases.

10. The many variations in kinds of problems and methods of solving them give rich opportunity for flexibility in teaching procedures.

   The National Commission on Secondary Vocational Education (1985) recommended that instruction in problem-solving skills be provided. Problem-solving skills make use of higher level thinking through the application to new experiences of knowledge and experiences previously learned.

   Warmbrod (1970) stated that the problem-solving skills help students to learn how to learn and also how to transfer knowledge.

   **Principles of learning.**

   A reason why the problem-solving approach is so capable of being such an effective educational tool is that it utilizes many principles of learning. Principles that are a part of this instructional approach include the following:

   1. Students must be motivated to learn. Learning activities should be provided which take into account the wants, needs, interests, and aspirations of the students.
2. Motivation (interest) is strongest when students perceive that learning can be useful.

3. Students are motivated through their involvement in setting goals and planning learning activities.

4. To maximize learning, students should "inquire into" rather than "be instructed in" the subject matter.

5. Subject matter that processes meaning, organization, and structure that is clear to the students, will be learned more rapidly and is retained longer.

6. Subject matter and learning experiences must be provided that begin where the learner is.

7. Success is a strong motivating force to students.

8. Students are motivated when they face a task that is a challenge but obtainable.

9. Students will perform better if they are kept informed of their progress.

10. Behaviors that are reinforced are more likely to be learned. Rewards need to follow closely the desired behavior to be most effective.

11. Directed learning is more effective than undirected learning.

12. Students learn what they practice.

13. Supervised practice that is most effective occurs in a functional educational experience (Newcomb, McCracken, Warnbrood, 1986).

Another reason so much support is given to this instructional approach is that many techniques can be utilized by the teacher. Discussion, demonstrations, role playing, supervised study, lecture, and field trips can all be incorporated into the technique. Most of the subject matter covered in class is easily adapted to using problem solving.

**Problem-solving approach: advocates and non-supporters.**

The support for the use of the problem-solving approach in teaching has been and still remains very strong. *The Agricultural Education Magazine* has published numerous articles supporting the use of this instructional approach. Liggett (1981) advocated it as an effective approach to use in the classroom. Clover (1953) discussed the 11-step process that he used in classroom teaching. His process centered around the use of problems.
Many educators have argued strongly for the use of the problem-solving approach to teaching in the classroom. Schumann (1979) felt that the problem-solving approach had to be the central instructional approach utilized.

Dickerson (1984) believed that the profession had to reconfirm its support of the problem-solving approach. The utilization of the instructional approach in the classroom was necessary to keep the word "vocational" in vocational agriculture. Without the problem-solving approach as the central teaching approach, the program was moving toward a nonvocational approach.

A debate was printed in the *Journal of the American Association of Teacher Educators in Agriculture* concerning the use of problem solving. Moore and Moore (1984) argued that there existed no sound empirical base of support for problem solving. They further stated that "our profession appears to have bought problem solving because of historical coincidence and philosophical leanings without questioning the true efficacy of problem-solving" (p. 6). Another concern was that many teachers are incapable of using the very sophisticated, complex approach. The method requires teachers to relinquish their role as the dominant figure in the classroom. Many teachers are more comfortable being behind the podium lecturing (Yeaw, 1979).

Crunkilton (1984) presented the other side of the debate concerning problem solving. He felt that the total teaching/learning process must be considered in examining the problem-solving approach of teaching. Teaching agricultural knowledge simply for the sake of knowledge is not enough and not what education should be. Student thinking must be challenged; a transfer of knowledge is necessary. "The art of teaching and the science of teaching can truly be incorporated in the learning environment through the problem-solving approach" (p. 14).

Summary: definition and principles of problem-solving approach in vocational/agricultural education.

The problem-solving approach to teaching is strongly advocated by the agricultural education profession. The support for the problem-solving approach as the instructional approach to use in the vocational agriculture classroom is very substantial. A definition of the problem-solving approach was presented to enable the researcher to assess the extent of use of the instructional approach. Before any
measurements can be obtained, it must be clear what it is that is being assessed. Models of what the problem-solving approach is as viewed by the vocational profession provided this necessary information.

Principles of learning upon which the problem-solving approach are based provided the means by which the assessment could be made. These basic principles were incorporated into the instruments and interviews utilized to measure the extent of use of the problem-solving approach in this study. If these principles were not clear, it would be difficult to discriminate between the problem-solving approach and other instructional approaches.

The support of the profession for the continued use of the problem-solving approach indicates the importance of this instructional approach. If the support did not exist, there would be little need to continue to emphasize the exclusive use of the problem-solving approach in the teacher preparation program.

Research Concerning Problem-Solving Approach in Agricultural Education

Research concerning the use of the problem solving in agricultural education is limited and inconclusive. It has been argued that there is little or no research support on which to base the use of the problem-solving approach. Is there evidence that supports the use of the problem-solving approach as an effective instructional approach in the vocational agricultural classroom? Will those students who receive problem-solving instruction learn more and perform better than students who receive other forms of instruction? Are there any differences in the area of student learning when the problem-solving approach is compared to other instructional approaches? The research findings that follow will address these questions and concerns.

Comparison of problem solving and conventional instruction.

Dawson (1952) conducted a study comparing lecture and problem-solving approaches in an Agronomy course at Cornell University. The subjects in the study were college students. He found both methods to be equally satisfactory.

Thompson and Tom (1957) conducted an experimental study in which the problem-solving approach (pupil-centered approach) was compared with a teacher-centered approach. They defined a pattern of
teaching "a series of broad areas of activities which a teacher systematically follows as he guides his pupils through a complete unit of instruction" (Thompson and Tom, 1957, p. 668). Twenty-two high school vocational agriculture teachers were involved in the study, with 11 in each group. The pupil-centered group was superior in terms of gain in content but it was not a significant difference. In the areas of solving farm problems and attitudes toward farming no significant difference was found between the two methods. The problem-solving approach was better at teaching facts.

Miller (1955) used three criteria to compare the problem-solving method with the conventional form of teaching to high school vocational agriculture students. The criteria were score on an achievement test, score on a problem-solving test, and quality of student farm plan. The only significant difference occurred in the area of quality of farm plan in favor of the problem-solving method.

Peterson (1969) conducted a quasi-experimental study in which he compared the problem solving and the principle approaches to teaching. The principle approach was based on underlying principles of science and economics. The learning activities were based upon a discovery of these basic principles and the solving of practical agricultural problems affected by these principles. His findings were mixed. The principle approach was significantly better in terms of student achievement for the ninth-grade animal science course and the 11th-grade agricultural mechanics class. For the 10th-grade class in animal, plant, and soil science and the 12th-grade marketing and management class there was no difference. Student attitude was significantly different in one of the four classes in favor of the principle approach.

Problem-solving approach and its effect on questioning strategies.

Kirts and Stewart (1983) conducted a study to determine the effect that classroom experience in using the problem-solving approach had on the questioning strategies of student teachers of vocational agriculture. Nineteen student teachers enrolled in the fall quarter of 1980 made up the sample population used in the study. One instrument used was the Questioning Strategies Observation System (Morse and Davis, 1970), which measured seven dependent variables:

1. Question quantity
2. Cognitive quantity
3. Cognitive quality
4. Tactical versatility
5. Question success
6. Reaction quality
7. Cognitive versatility

A second instrument, the Observation Guide for Student Teachers, was used to measure the proficiency of the student teachers in using the problem-solving approach. A videotaped mini-lesson of the student teachers was made which represented no experience in using the problem-solving approach. Audiotaped lessons were made, at one week of experience and four weeks of experience using the problem-solving approach. Audiotapes for 14 of the student teachers were used in the final analysis. Five of the student teachers had incomplete data sets, which were discarded.

The questioning strategies of the student teachers remained relatively stable except those concerning the variables cognitive quantity and reaction quality. The questioning strategies that were demonstrated in the mini-lesson (no experience) were also used in the student experience. Experience did not have any effect regarding the questioning strategies of the student teachers.

The student teachers who used the problem-solving approach did ask more higher level questions, more lower level questions, and fewer procedural questions than those student teachers who did not use the problem-solving approach. The expected relationship between questioning strategies and the use of the problem-solving approach was not found to exist. Kirts and Stewart recommended that the problem-solving approach should continue to be used in teaching vocational agriculture.

Student learning and the problem-solving approach.

A paper presented by Flowers and Osborne (1986) at the Thirteenth Annual National Agricultural Education Research Meeting studied the problem-solving approach and its effect on achievement, retention of subject matter, retention of knowledge, and attitudes of vocational agriculture students toward the method of teaching as compared to the subject matter approach. High school vocational agriculture students who were enrolled in programs where the teacher taught two or more introductory agriculture classes were selected for the study. The teachers taught one class using the problem-solving approach and a second class using the subject matter approach. Sixty-six students were in the problem-solving treatment group and 60
students were in the subject matter group. Three instruments were used to collect data. These instruments consisted of an instrument to measure the student's attitude toward the teaching methods, a problem achievement test, and a parallel problem area retention test. Teachers who were to be in the study received inservice training on the proper use of the two teaching approaches.

In the area of student achievement, there was no difference between the two teaching approaches. The problem-solving approach was no different than a subject matter approach in producing higher scores on the retention test. Those students who received instruction in problem-solving approach did retain more acquired knowledge than the subject matter group of students. The retention test was administered one week after the achievement test. Also, the attitude of the students was slightly more in favor of the problem-solving approach but the difference was not significant.

Factors associated with the problem-solving ability of high school students enrolled in vocational horticulture were the concern of Chuatong's (1986) dissertation. The relationship between the problem-solving ability of students and academic aptitude, the extent to which teachers use problem-solving teaching behaviors, degree of students' involvement in supervised occupational experience, degree of students' participation in FFA, grade level of students, and subject matter emphasis of the vocational horticulture program in which students are enrolled were investigated. High school students enrolled in the horticulture programs in Ohio secondary schools during the 1986 school year made up the population. The students enrolled in seven joint vocational schools were selected to be the sample for the study. Fourteen teachers and 14 vocational horticulture classes made up the final sample.

Measurement of the variables in the study was accomplished by using five instruments. The problem-solving ability in horticulture, the main dependent variable, was measured by an instrument developed for this study. The Ohio Horticulture Achievement Test 1986 was used to measure the students' achievement in all of the areas of the horticulture program. The California Short Form Test of Academic Aptitude level 5 (1970) was used to measure students' academic aptitude. The fourth instrument was developed by Chuatong to measure the extent to which the teachers used the problem-solving approach. Students were rated by their high school teachers regarding their degree of involvement in supervised occupational experience and degree of FFA participation.
Academic aptitude of students was determined to explain the highest proportion of variance in students' problem-solving ability and achievement in horticulture. "Vocational horticulture students who exhibit higher levels of problem solving ability and process higher levels of achievement in horticulture tend to have higher levels of academic aptitude, are engaged to a greater extent in supervised occupational experience programs, participate to a greater extent in F.F.A. activities, are taught by teachers who report using more problem solving teacher behaviors and are more likely to be enrolled in vocational horticulture programs that emphasize landscape subject matter" (Warmbrod and Chuatong, 1986, p. 10).

Boone (1988) investigated two instructional approaches to determine which was more effective in teaching vocational agriculture at the high school level as measured by achievement test scores. The two approaches were compared based on student achievement, retention of learning, attitude toward instruction, and time required to complete a unit. The approach to teaching and the timing of the instructional unit composed the two independent variables in the study. There were two levels for the variable approach to teaching: the problem solving and the subject matter. The variable timing of the unit also had two levels: first and second unit taught in the instructional series.

Four groups of vocational agriculture teachers and their high school freshman classes composed the sample in the study. Sixteen teachers and their freshman students were identified to be in the study. Each group received the following:

- a pretest
- a unit of instruction
- an immediate posttest
- an attitude toward instruction instrument
- a second posttest 14 days later

Group one taught unit A with a problem-solving approach and unit B with a subject matter approach.
Group two taught unit A with the subject matter approach and unit B with a problem-solving approach.
Group three taught unit B with a problem-solving approach and unit A with a subject matter approach.
Group four taught unit B with a subject matter approach and unit A with a problem-solving approach.
A significant interaction was found between the effect of the two independent variables on the dependent variable - student's attitude toward instruction scores. Through the analysis of audiotapes it was determined that the levels of the independent variable, teaching approach, were not administered properly. Findings indicated that teachers do not fully use all of the essential elements of the problem-solving approach to teaching. Teachers who use the problem-solving approach on a regular basis have a difficult time using the subject matter approach. Students who were taught first using the problem-solving approach had a higher attitude toward the instruction when compared with those students who had been taught with the subject matter approach first. Teachers had a difficult time using an instructional approach with which they were not familiar.

_Agricultural education research: summation._

The problem-solving approach is highly advocated by the profession but the extent to which it is actually used in the classroom is unclear. The concern has been expressed that the profession is moving away from the use of the problem-solving approach at the high school level. "Agricultural educators must return to using problem solving as the way to each or we as a profession must be willing to accept that our program is well on its way to becoming a non-vocational program" (Crunkilton, 1982, p. 4).

Krebs (1982) argued that a critical point in deciding to use the problem-solving approach is that one must believe in the method. If one does not believe, then the teacher's behavior will often result in the method's failure. He further stated that for problem solving to be used effectively in teaching, the teacher must believe that students have the right to direct their own educational development and that the schools have an obligation to teach them how to do so.

When the problem-solving approach was compared to other teaching approaches such as the subject matter approach, the early research found that there was no difference. Later research did find slight differences in certain areas, such as the following:

- The problem-solving approach was better in the area of retaining facts.
- Student teachers who used the problem-solving approach did ask more higher level questions, more lower level questions, and fewer procedural questions.
Students taught with the problem-solving approach did retain subject matter better than those students taught with the subject matter approach.

Horticulture students taught by teachers who used the problem-solving approach exhibited higher levels of problem-solving ability and achieved at higher levels in horticulture.

The problem-solving approach has not been found to be a completely superior teaching approach, but the research is somewhat limited. There are some indications that the problem-solving approach is effective and should be used in teaching vocational agriculture. The extent of use of the problem-solving approach by vocational agriculture teachers is not clear and factors that affect the use of the problem-solving approach are not clear. Thus, the need for information in these areas exists.

Factors Associated with the Type of Teaching Techniques that Teachers Use

The teaching preparation process is a very extensive, time-consuming process. Much energy is expended in an effort to instruct college students in the instructional approaches and principles of learning that will be necessary to be an effective teacher. Two major components of this training are the methods course and student teaching. A major element of the methods course is microteaching. The instruction of future vocational agriculture teachers includes these components. It is assumed that these components are effective in equipping the students with the skills and knowledge necessary to be successful high school teachers. Is there any evidence that supports this assumption? Are those practices taught in the microteaching and student teaching portion of the teacher preparation program adopted and used by these students when they start teaching? Can it be correctly assumed that the instruction concerning the use of the problem-solving approach will be implemented in the real classroom? These are very real concerns and need to be addressed.

Effectiveness of microteaching.

Microteaching has become a very important part of the teacher preservice training experience. The purpose of microteaching is to provide an opportunity for preservice teachers to put into action the theory that has been taught in the classroom. McAleese and Unwin (1971) described it as a scaled-down teaching encounter - - scaled down in terms of class size, lesson length, and teaching complexity. "Frequently one
microteaching episode includes a lesson and immediate feedback on the teacher's effectiveness. This feedback may come from videotape or audiotape recordings, supervisors, pupils, colleagues, or from the teacher's self-perceptions" (Cooper and Allen, 1971, p. 6).

Teaching is very complex and requires many skills. Microteaching permits preservice teachers the opportunity to experiment and practice these skills. These students also receive feedback that equips them with the ability to improve their teaching. This dimension is crucial in terms of changing the trainee's behavior. A key question is How effective is microteaching at improving the teaching skills of these future teachers?

Legge and Asper (1972) conducted a study to investigate this question. Junior college students, who were studying to be elementary teachers, were divided into two groups. One group experienced videotaped microteaching lessons and feedback, and the control did not receive this instruction. The experimental group outperformed the control group significantly in the areas of aims of the lesson, planning the lesson, and presentation of the lesson. The self-appraisal proved to be very meaningful in aiding the improvement of instruction. Microteaching was recommended very strongly to continue being used in teacher training programs.

Esquivel et al. (1978) considered the effect of feedback on questioning of preservice teachers in microteaching. Findings concerning this question had been mixed. A study by Harrington and Doty (1972) had investigated whether the source of feedback to preservice teachers had any effect on behavior and attitude and had found none. Another study (Illingworth, 1971) found that feedback expressed by a supervisor produced significant change in the preservice teacher when compared with peer feedback, no feedback, and a combination of supervisor and peer feedback. Esquivel's study compared self-feedback, supervisor feedback, peer feedback, and no feedback. The source of feedback made no difference in the teachers' demonstration of certain behaviors. The findings did not consider whether the teachers performed acceptably or not.

Peterson (1973) investigated the effectiveness of microteaching in developing the classroom use of 12 questioning skills when conducted immediately prior to student teaching. Two groups were compared based on one having received microteaching and the other not having received the microteaching. No significant differences in the frequency of occurrence on any of the 12 variables existed between the two
groups. The microteaching group was more aware of how to use the 12 questioning skills and was better able to implement them in small groups.

The effects of microteaching with videotape playback and strategy analysis on the teaching strategies selected by preservice secondary science teachers were investigated by Yeany (1978). Three intact groups received varying amounts of feedback in the analysis of their microteaching tapes. One group viewed their individual teaching tapes privately with no guidelines on what they should be evaluating. A second group had teaching strategies observation instrument to aid them in their self-evaluation. The third group received the same instrument as group two but also had input from the class instructor during the viewings. A cumulative review of tapes by each student had an impact that was significantly greater than that in the group that was simply on their own. The addition of the instructor's input caused an even greater shift in the same direction. These results indicate "that most teachers require others to help them focus beyond the superficialities of a lesson" (p. 207) and support the results of a study by McNeil and Popham (1973).

A major assumption with microteaching is that it increases the probability that target skills will be acquired by the preservice teachers with a high degree of efficiency. Some of the research already discussed as well as other studies (Borg et al., 1969; Davis and Smoot, 1970; Fortune et al., 1967; McDonald and Allen, 1967; Morse and Davis, 1970; Reed et al., 1970) give support to that assumption. A second assumption is that these skills will then be carried into the classroom and utilized in the student teaching part of the teacher training program. Evidence to support this assumption is much less conclusive.

Boeck (1972) reported that there was a significant difference between groups of microteaching and non-microteaching student teachers measured one year later. The study was limited in that the sample (N=2) was very small. Copeland and Doyle (1973) reported no significant difference between microteaching and nonmicroteaching groups at the completion of the training and before student teaching started.

To investigate this question further, Copeland (1975) did a study to determine if those teaching skills that had been learned during microteaching would be displayed during student teaching. Thirty-two elementary student teachers composed the sample being investigated. The student teachers were divided into two groups - - one group received training on specific teaching skills by way of a microteaching experience
and the control group received no microteaching. Samples of the student teachers' classroom performance were recorded and coded. Coding and scoring was done through the use of an instrument that produced scores indicating rates of occurrence of the target teaching skills per minute of teacher talk. A two-way analysis of variance was utilized to compare statistically the experimental group and the control group. No significant difference was found between the two groups in their ability to demonstrate the desired target teaching skills.

**Student teaching: influence on students.**

Student teaching receives a great deal of attention in the teacher preparation process. Many independent and interactive relationships exist in the instructional process. It is difficult to have the student teaching portion of the teacher preparation process stand alone when assessing the effectiveness of the training.

Student teaching interacts with what occurred during the microteaching portion of the training. The cooperating teacher can exert an influence on the outcome of the student teaching process. Other factors could affect the student teaching experience.

The assumption that microteaching is significantly related to student teaching in producing desired teaching skills was not supported by the Copeland (1975) study. Other factors that could be affecting classroom performance of student teachers need to be considered. Prokop (1971) suggested that the perceptions of the role of teaching by the student teacher are related to those of their supervisors. Numerous studies (Flint, 1967; Mitchell, 1969; Roberts and Blankenship, 1970; and Seperson and Joyce, 1971) identified the behavior pattern of the cooperating teacher as another factor that needs consideration. The behavior patterns of the cooperating teacher significantly affected the classroom performance of the student teachers whom they supervised. The students who comprise the classes that the student teachers instruct can have a critical role in influencing the behavior of the student teachers (Haller, 1966).

To investigate this question further, Copeland (1977) did a study to determine the relationship between the intervention behaviors of cooperating teachers and the classroom exhibition by student teachers of skills acquired in the microteaching experience. Sixty-one student teachers in the study were randomly assigned to either the positive or negative level of three variables. The variables were microteaching
training, training in supervision received by each of the subjects' cooperating teachers, and the tendency of the subjects' cooperating teacher to exhibit the target teaching skill. Those student teachers who received microteaching training in teaching techniques demonstrated a significantly higher rate of exhibition of those teaching techniques when the student teachers had received either direct or indirect intervention by the cooperating teacher concerning the teaching techniques.

There was no relationship between microteaching alone and the classroom performance of student teachers. Nor was there any main effect by either of the other two variables, cooperating teachers' training and the cooperating teachers' skill in using the target teaching skills, on the classroom performance of the student teachers.

Those student teachers who received directed, effective supervision from their individual cooperating teacher used the target teaching skills in the classroom. Also, the student teacher's observation of the demonstration of the desired teaching skills by the cooperating teacher reinforced the use of these teaching skills in the student teachers' teaching. If the student teacher did not receive this reinforcement, the use of the desired teaching skills diminished to the level of those student teachers who had received no microtraining. Little difference existed between direct or indirect intervention by the cooperating teacher.

Student teaching is a major component of teacher education programs. A key person in the student teaching experience is the cooperating teacher. "The focal point of a successful student teaching experience is the cooperating teacher in whose classroom the student teacher is assigned" (Bennie, 1966, p. 51). The cooperating teacher must have the ability to:

1. demonstrate effective teaching;
2. analyze teaching;
3. guide teaching;
4. evaluate teaching (Hayes, 1966).

With the cooperating teacher playing such a major role in the student teaching experience, how much influence does the cooperating teacher have in regard to those student teachers who are supervised? Will student teachers who have cooperating teachers who use the problem-solving approach in their classroom instruction be more inclined to use the problem-solving approach in their first year of teaching?
Opinions differ regarding the influence that the cooperating teachers have in regard to their student teachers in general.

The influence of the cooperating teacher on student teachers' behavior can be substantial. Milner (1959) and Sleeves (1952) reported that the most relevant variable that influences the student teacher behavior was the cooperating teacher. This influence can be sufficiently strong to surpass the effect of all methods courses.

Yee (1969) investigated the influence that cooperating teachers had in regard to student teachers' attitudes toward young people. The study included 124 student teachers and 124 cooperating teachers. A pretest-posttest analysis of each group's attitude toward young people was conducted. Yee found that the attitudes of student teachers toward young people generally reflected the attitude of their cooperating teacher.

Price (1961) found similar results. Student teachers' attitudes were altered in the direction of those held by cooperating teachers. He also concluded that the student teachers acquired many of the teaching practices of their cooperating teacher. Similar results have been reported by Glassberg and Sprinthal (1980), McAulay (1960), Zeichner (1980), and Zeichner and Tabachnick (1981).

Some findings disagree with the studies that have been mentioned. Brown (1967) found no relationship between the principles of the cooperating teachers being adopted by their student teachers; if anything, the relationship was negative. Bochee et al. (1978) found that "no student teacher's educational philosophy was related to his or her cooperating teacher's educational philosophy" (p. 60). McIntyre et al. (1979) reported that there was no relationship between the verbal behavior of the student teacher and cooperating teacher. The correlations that did exist were negative but not significant.

Zimpher et al. (1980) found that cooperating teachers, in general, do not review student teachers' work critically. The cooperating teacher did not want to observe the student teacher teaching. Critical evaluations and negative remarks were also avoided by the cooperating teacher. The relationship between the two parties can become void of substance and the interactions will become brief and impersonal (Tabachnick et al., 1979).
Summary concerning microteaching and student teaching research.

The research concerning microteaching and its value to the teacher preparation program is mixed. Microteaching does appear to help preservice teachers to acquire desired teaching skills. The benefits of microteaching do not carry over into student teaching experience very well. Studies mentioned in this section indicated that the teaching skills learned in microteaching do not always transfer to the student teachers' classroom instruction. Other factors play a role in the demonstration of desired teaching skills by student teachers.

The cooperating teacher can have a major impact on the teaching skills that are put into practice by student teachers in their classroom teaching. Student teachers are very likely to adopt the attitudes and ways of their cooperating teacher. If student teachers receive reinforcement from the cooperating teachers concerning the desired teaching skills that were learned in microteaching, then those skills are likely to be adopted and used by the student teacher. If reinforcement is not received, then the teaching skills are not utilized by the student teacher.

Because the influence of the cooperating teacher is very strong in regard to the behaviors and attitudes that student teachers adopt, the finding of Zimphler et al. (1980) causes some concern. They (1980) reported that cooperating teachers do not review student teachers' work very critically and cooperating teachers do not want to observe student teachers. These two findings could have a major impact on how successful the student teaching experience is for the student teacher. If the cooperating teacher is not reviewing the work of the student teacher and not observing the student teacher, then how can a positive influence be exerted by the cooperating teacher?

The pupils in the classes that are being taught by the student teacher can play a role in the adoption and utilization of desired teaching skills by student teachers. The perceptions of the student teachers concerning the role of teaching influence the student teachers' decision to incorporate into their teaching the learned desired teaching skills.

These implications are very important to this researcher's study. The extent to which the problem-solving approach is used by first-year teachers can be influenced by a number of variables. The microteaching and student teaching experiences, the attitude of the cooperating teacher regarding the problem-
solving approach, and even the students in the student teachers' classrooms can all have an influence on the future use of the problem-solving approach. These variables were investigated to determine the extent of influence that each variable had concerning the future use of the problem-solving approach to teaching during the first year of teaching.

Teaching Assessment Techniques

This study of the extent to which first-year teachers of vocational agriculture use the problem-solving approach required various forms of assessment. Student teachers were asked to describe their individual cooperating teachers' extent of use of the problem-solving approach as well as their own extent of use. The cooperating teachers were asked to give their perceptions of the extent to which they use the problem-solving approach as well as their perceptions of the extent to which their student teachers utilized the problem-solving approach. Supervising professors assessed the student teachers' extent to which the problem-solving approach was utilized by student teachers.

How reliable and valid are these various measures? Are student teachers capable of describing their teaching? Are they capable of giving a description of their cooperating teachers that truly indicates what is happening in the classroom in terms of extent to which the problem-solving approach is utilized? These same questions hold true for the cooperating teachers' description of their own teaching as well as their assessment of the student teacher for whom they were responsible.

A review of the literature in the areas of self-evaluation, student-teacher evaluations, and supervisor evaluation produced some evidence to support their use in this study.

Self-assessment research.

Irvine (1983) wrote the following in regard to self-assessment: "Agostino and Barrett's (1978) call for increased emphasis on teacher self-evaluation is based on Festinger's theory of cognitive dissonance: that is, a belief that people's pattern of action reflect a need to bring perception of their behavior into congruence with their conceptions of their ideal behavior. They describe this process as an internal one in which individuals assess themselves. For classroom teaching, this task involves helping teachers develop clear,
firm convictions concerning teaching processes and means of objectively assessing and evaluating themselves in relation to these goals.

"Others (Hartman, 1978; Anderson, 1972; Combs, 1979; and Rogers, 1961) have written on the value of participating in the assessment of one's own behavior by emphasizing that: a) the best way to change a person's behavior is to change a person's perception of his/her behavior, b) behavior is not permanently changed by fiat, c) learning which influences behavior is self directed and self-discovered and d) independence, creativity, and self-reliance are facilitated when self-criticism is basic and evaluation by others of secondary importance" (Irvine, 1983, p. 25).

Other assessment research.

Webb and Nolan (1955) found a high relationship between the way a student views a teacher as a teacher and the way a teacher views himself/herself. Another positive correlation of moderate strength was between the instructor's enthusiasm for teaching and the student's rating of his/her teaching ability.

Guthrie (1954) found high correlations between students ranking the quality of their teachers from one year to the next. Touq and Feldhusen (1974) found that student ratings of instructors are a valid method to evaluate teaching.

French (1957) found 10 items that contributed most to students' overall judgment of teachers: (1) interprets abstract ideas and theories clearly, (2) gets student interested in subject, (3) has increased my skills in thinking, (4) has helped broaden my interests, (5) stresses important material, (6) makes good use of examples and illustrations, (7) motivated me to do my best work, (8) inspires class confidence in his (teacher) knowledge of the subject, (9) has given me new viewpoints or applications, and (10) is clear and understandable in his (teacher) explanations. Other studies (Guthrie, 1949; and Coffman, 1954) found very similar teacher characteristics. Many of these characteristics would be evident when a teacher uses the problem-solving approach to teaching.

Another way to validate student ratings is to compare them with other teacher ratings that have been made by supervisors or colleagues. When comparison of that nature was performed by Costin (1966), a significant correlation was found between the scores from the two groups. Maslow and Zimmerman (1956) found very similar results when student and colleague ratings were compared.
Pease (1975) analyzed four sets of ratings given to college students during their teacher preparation training, which included methods course work and the student teaching experience. Ratings of the preservice students were made by (1) public and college school supervisors, (2) college classroom instructors, (3) student-peer groups, and (4) student self-rating. The study involved 62 preservice teachers over a two-year period of data collection. All rating patterns correlated at high levels of significance concerning the teaching effectiveness of the preservice teachers. The ratings of the peer group agreed most significantly with the ratings that were given by the supervisors, instructors, and preservice teachers themselves. The rating of a student by the instructor was a particularly good indicator of teaching performance.

Two studies by Marsh et al. (1975) and Marsh (1977) produced results that supported the validity of student evaluation of instruction. High quality instruction can be recognized and assessed by students.

Doyle and Crichton (1978) compared the ratings of students and peers and self-evaluation of college instructors. The ratings by all three groups were fairly similar and seem deficient in that what is measured does not always bear directly on student learning.

The accuracy of preservice teacher's assessment of their classroom behaviors was the concern of a study by Irvine (1983). It was found that the preservice teacher's self-ratings of their classroom performance moderately agreed with the rating of their supervising teachers. Chiu (1975) found that student teachers' perceptions of their teaching effectiveness agreed with that of their cooperating teacher.

Hook and Rosenshine (1979) expressed that caution should be taken when considering teachers' reports about classroom behavior as being accurate. They felt that teachers were not capable of estimating correctly what they actually did in the classroom.

Centra (1973) found a discrepancy between the student rating of college instructors and those instructors' self-ratings. The two groups ranked teaching characteristics very similarly but the evaluation of those traits was quite different. The instructors rated themselves higher in general than the students' evaluation. Clark and Blackburn (1973) found similar results in that professors overrated their teaching performance. It was concluded that professors are not good judges of their role performance.
Because teaching is so complex, analysis is difficult. To address this problem, the analysis of notes of class visitation, audiotapes, and videotapes is necessary. Boone (1988) developed an instrument to be utilized in the analysis of video and audiotapes to determine the extent to which the problem-solving approach to teaching had been utilized in the classroom by vocational agriculture teachers. Ten essential elements of the problem-solving approach were used to form the instrument. A seven-point scale was incorporated as the rating scale. These scores were weighted so as to arrive at a weighted score between one and seven. It was determined that a weighted score of greater than four was necessary for the instruction to be considered as problem-solving teaching. Reliability for the teaching approach instrument was established at a Cronbach's Alpha level of .96. The content validity of the instrument was established by a panel of experts.

Boone utilized the instruments in listening to audiotapes of teaching. This study will use the instruments in a similar fashion. Characteristics of the problem-solving method of teaching will be utilized to determine if the first-year teachers are using the instructional approach. These characteristics were derived from the book *Methods of Teaching Agriculture* (Newcomb et al., 1986). The following characteristics were used:

1. The wants, needs, and aspirations of the students were taken into account by the teacher in determining classroom activities and subject matter.
2. The involvement of students in the class goal setting process and the planning of learning activities was present in the classroom.
3. Students were encouraged to "inquire into" the subject matter instead of being "instructed in" the subject matter.
4. Student learning successes were utilized as a motivating tool in the classroom instruction.
5. The learning process was directed by the teacher.
6. Practice was provided for the student to enhance his/her learning.
7. More than one solution to a problem is considered in the solving of a problem.
8. SOE projects, school laboratory experiences, and field trips were utilized to determine classroom instructional topics.
9. The application of the material learned in the classroom was encouraged of the students in real life situations.

10. The subject matter being taught is perceived as being obtainable, organized, and meaningful to the students.

**Teaching assessment techniques summary.**

The research indicates that self-assessment is an appropriate and valid form of teaching assessment. Individuals are capable of assessing what they are doing in the classroom. This is critical because of the extent of use of self-assessment in this study. Teachers must be able to recognize what it is that they are doing in the classroom and then must be able to give an assessment of their actions. The subjects in this study were asked to give multiple self-assessments at various points in time. Having evidence that supports the validity of these self-assessments lends support to the findings of the study.

Other forms of assessment were utilized in this study. The research indicated that other groups are capable of assessing the teachers' performance in the classroom. Cooperating teachers and supervising professors are all capable of providing relevant teaching assessment. The agreement between the assessments of the various groups was also supported. Assessments of the student teachers' instruction by cooperating teachers and supervising professors were utilized in this study. Having research findings that support this type of assessment provides evidence of the validity of the use of these techniques in the research.

**Chapter Summary**

A key premise that was supported by the findings reported is that problem-solving skills and techniques can be taught and learned. If teachers are going to be expected to use the problem-solving approach as their primary instructional approach, then they must be capable of learning the principles of problem solving. These principles must in turn also be transferable to their students. The evidence provided substantiates these premises.

Individual differences affect a person's ability to solve problems. These individual differences, such as intellectual skills, verbal knowledge, and type of thinker, can play a part in how well a person is able to learn and utilize problem-solving skills. The Cornell Critical Thinking Test, Level Z, measures the general
problem skills of individuals. One concern of this research was to determine if individual differences in
general problem-solving skills would have any bearing on the extent of use of the problem-solving
approach in the classroom. Will the general problem-solving skills of these first-year teachers be a factor in
determining the extent to which they use the problem-solving approach in their classroom instruction? The
administration of the Cornell Critical Thinking Test, Level Z, provides the means to address the question.

Before the extent of use of the problem-solving approach could be determined, a clear definition of
what the problem-solving approach is was necessary. The information provided by the literature review
provides a clear step-by-step process of the problem-solving approach. Also, the principles of learning that
provide the basis for the problem-solving approach were outlined. These principles were critical in the
development of the instruments and interview questions used in the study. The extensive information on
the problem-solving approach provided the means by which the assessment of the extent of use of the
problem-solving approach was possible.

Evidence that supported the extensive use of the problem-solving approach indicated the
importance of the instructional approach. The problem-solving approach is an effective teaching approach
in terms of producing learning by students. If the problem-solving approach was not effective, then there
would be little reason to use the approach so extensively. The research indicated that the problem-solving
approach is comparable, or in some cases superior, to other instructional approaches in terms of student
learning.

Two major components of the teacher preparation program are the microteaching laboratories and
the student teaching experience. Extensive investigation of these two components was done to determine
the extent of use of the problem-solving approach in the vocational agricultural classroom. Evidence that
connects what has happened in the microteaching and student teaching experience with what occurs in actual
teaching is very significant.

The microteaching laboratories provide the student with practice in the basic principles of learning.
This experience can be effective in teaching the student the important principles involved with teaching.
The problem-solving approach can be effectively learned through the processes involved in the
microteaching laboratories. The transfer of these learned principles into use during the student teaching does not always occur.

Numerous factors can affect what a student teacher does in the classroom. The cooperating teacher can have a major influence regarding the teaching skills utilized and developed by the student teacher. The students in the classes that are taught by the student teacher can also have some influence. Thus the extent to which the student teachers utilize the problem-solving approach could also be affected by these factors. To assess the extent of use of the problem-solving approach during the first year of teaching, these factors need to be given consideration.

The research included in this chapter also indicated the validity of particular forms of assessment techniques. The two techniques of most concern were self-assessment techniques and the assessment of an individual by a second party. Both types of techniques are appropriate and valid and thus can provide valuable data. This research study depended extensively on both assessment techniques to arrive at the data gathered. The verification of these assessment techniques as being reliable and valid was necessary to support the use of these techniques in this study. Teachers can accurately assess what they are doing in the classroom. The assessment of teachers by other individuals can also be performed and done accurately. The congruence between these two types of assessments was also substantiated.
Population and Sample

The population was the undergraduate students enrolled at The Ohio State University who completed Agricultural Education 530, "Methods of Teaching in Vocational Agriculture and Extension Education," in the spring quarter of 1987 and autumn quarter of 1987. The students in those two classes who completed student teaching and entered the teaching profession in the autumn of 1988 were the group used to investigate the research question. The research question was the extent to which first-year vocational agriculture teachers use the problem-solving approach to teaching in classroom instruction. There were seven students in the spring class and 15 in the autumn. From this total of 22 students, seven students entered the teaching profession.

Students in the methods course who entered the extension service, foreign students who would be returning to their countries, and students who had no intention of student teaching or entering teaching as a vocational agriculture teacher were excluded from the study. This further limited the size of the population being studied but was necessary due to the longitudinal nature of the study. The intent was to follow students through their teacher preparation and into their first year of teaching to determine if any relationships existed between factors occurring during undergraduate teacher education and their first year of teaching regarding the extent of use of the problem-solving approach to teaching.
Design

The study was correlational. Qualitative information obtained from multiple interviews with each subject was also utilized. Each first-year teacher was interviewed four times. These first-year teachers were also observed during two on-site visits by the researcher. The extent to which they utilized the problem-solving approach to teaching was partially determined from these observations.

The qualitative data added depth to the study by obtaining personal insights of each subject regarding the problem-solving approach to teaching. This should provide a more complete picture of the extent to which the problem-solving approach to teaching is utilized by these first-year teachers.

Instrumentation and Data Collection

Dependent variable.

The dependent variable, extent of use of the problem-solving approach to teaching during the first year of teaching, was measured at two times through various methods. One method was a self-analysis instrument that each first-year teacher completed. The instrument was developed based on a similar instrument that had been developed by Chuatong (1986), which was used to measure the extent to which horticulture teachers used the problem-solving approach. The instrument was composed of 25 randomly ordered items with a five-point Likert scale. The five response options on the Likert scale were:

1. Almost never or never
2. Sometimes
3. About half of the time
4. Frequently
5. Almost always or always

The items were based upon the principles of the problem-solving approach to teaching. This instrument was the same self-assessment instrument completed during student teaching by the student teachers and the cooperating teachers regarding their use of the problem-solving approach. In future, this instrument will be referred to as the problem-solving approach instrument (see Appendix I).
Scoring of the problem-solving approach instrument was accomplished by adding responses for the 25 items. Five was the maximum score for each item that was equal to always or almost always on the scale, and one was the minimum score for each item that was equal to never or almost never. A maximum score of 125 points and a minimum of 25 points were possible. The higher the total score the greater the extent of use of the problem-solving approach.

During the visit to the school during which the instrument was administered, the researcher audio-recorded a class session. Notes of class activities, seating arrangements, and other information were recorded as the class proceeded. The audiotapes were later analyzed by using the Teaching Approach Instrument (Boone, 1988). The notes were used to aid in the analysis of the tapes.

Scoring of the audiotapes was on a seven-point scale. There were 10 questions, with some questions having subparts. A total of 17 different responses was possible. Boone assigned a weight to each question that was to be multiplied by the number (1 through 7) selected as the response (the sum of the weights assigned by Boone equaled 1.00). The resulting weighted values were summed to provide a total score for the tape regarding the extent of use of the problem-solving approach. Boone (1988) indicated that a total adjusted weighted score of 4 or more indicated that the problem-solving approach to teaching was being utilized (see Appendix M).

Additional data were collected during each visit to the high schools. An interview was conducted with each of the seven first-year teachers at the conclusion of the class that was observed. The interviews were intended to gather more information regarding why the problem-solving approach had been used or not used, when the problem-solving approach was used, what restricted the use of the problem-solving approach, and future plans regarding the use of the problem-solving approach in the classroom teaching. The interviews were audio-recorded and later transcribed.

Two visits were made by the researcher to each of the seven first-year teachers. The first visit was in late November or early December 1988, and the second visit was in May 1989. During each visit the problem-solving instrument was administered, a class session was recorded, and an interview was conducted. This gave a total of six pieces of data to consider in determining the extent of use of the problem-solving approach by these first-year teachers of vocational agriculture. The spacing of the two visits was to
determine if any changes in the extent of use of the problem-solving approach occurred during the first year of teaching.

**Independent variables.**

One of the independent variables addressed was the determination of the extent to which the future first-year teachers had utilized the problem-solving approach to teaching during their microteaching laboratory in Agricultural Education 530, "Methods of Teaching in Vocational Agriculture and Extension Education." Students' extent of use of the problem-solving approach to teaching during the methods course was determined through two sources. The videotapes of the third microteaching performance of each student were analyzed. The third microteaching performance is a 20-minute miniature lesson that is to have incorporated into it the following six major parts of the problem-solving approach to teaching: interest approach, group objectives, questions to be answered, problem solutions, testing solutions, and evaluation of solutions.

The microteaching videotapes were collected from all the future first-year teachers. The spring quarter 1987 and fall quarter 1987 videotapes were collected and analyzed together. Each videotape was randomly selected for analysis. Boone's (1988) Teaching Approach Instrument was used to analyze the micro-teaching videotapes (see page 44 for description of Boone's instrument). The determination of the extent to which the problem-solving approach to teaching was incorporated into these mini-lessons was the goal of the instructional analysis. The researcher did the analysis of the tapes.

Each of the students enrolled in the methods course was interviewed to provide a second source of information. The interview guide is in Appendix F. Students were questioned regarding their perceptions of the problem-solving approach as a viable, workable instructional method. They were also asked what restrictions, if any, they perceived for the problem-solving approach. Areas of strengths and weakness were to be stated by each student. The interviews were conducted during the last two weeks of the quarter and done face-to-face. Each interview was audio-recorded and later transcribed.

Another independent variable was the general problem-solving abilities of the future first-year teachers and how that characteristic related to the extent they use the problem-solving approach to teaching. During the last week of the quarter, a general problem-solving test was administered to the students in the
methods course. The test was the Cornell Critical Thinking Test Level Z (Ennis, Millman, and Tomki, 1985). Ennis defined critical thinking as being "the process of reasonably deciding what to believe and do" (1985, p. 1). Critical thinking, as described by Ennis, incorporates many of the principles of the problem-solving approach to teaching into the explanation of critical thinking. The purpose for administering the test was to determine if general problem-solving skills are correlated with the future use of the problem-solving approach to teaching during student teaching and especially during the first year of teaching.

To determine the reliability of the Cornell Critical Thinking Test, Level Z, two analyses were utilized. The Spearman-Brown reliability test produced a coefficient of .75, and the Kuder-Richardson reliability scale produced a range of values of .50 to .77 (Ennis et al., 1985).

The validity of the Cornell Critical Thinking Test Level Z was also addressed by Ennis (1985b). The test developers worked very hard to select those items that call for the employment of critical thinking in significant situations that people understand. Only those items that fitted the definition of critical thinking were selected for the test.

Another independent variable measured was the extent to which students utilized the problem-solving approach to teaching during student teaching and to determine the relationship student teaching has with the extent they used the problem-solving approach during the first year of teaching. The extent of use of the problem-solving approach during student teaching was measured from a triangulation approach. The student teacher, cooperating teacher, and supervising professor all had input. The instrument used was the problem-solving approach instrument (see Appendix I).

During the first two weeks of the quarter that followed the completion of the student teaching experience, the researcher contacted each student teacher. Of the 22 student teachers, the researcher was able to meet face-to-face with 18. The other four were interviewed by phone and the problem-solving approach instrument was mailed to each of the four individuals. During the interview the problem-solving approach instrument was administered and completed by each of the student teachers. The purpose of the interview was to collect more information regarding the extent of use of the problem-solving approach during student teaching. Some of the questions presented during the interview were:
- successes and failures in using the problem-solving approach;
- restrictions and limitations in using the problem-solving approach;
- factors that supported the use of the problem-solving approach;
- influence that the cooperating teacher and supervising professor had concerning the extent of use of the problem-solving approach; and
- future plans to use the problem-solving approach.

The interviews were audio-recorded and later transcribed by the researcher (see Appendix L).

During the interview another instrument was administered. The instrument was to measure the extent of use of the problem-solving approach by the cooperating teacher as perceived by the student teacher. Each student teacher completed the problem-solving approach instrument indicating their perceptions regarding the cooperating teacher with whom they had completed student teaching during the previous quarter. This instrument was mailed to the four individuals that were interviewed by telephone.

To determine more completely the extent of use of the problem-solving approach by the student teacher, additional data were collected. The cooperating teacher was mailed a problem-solving approach instrument concerning the student teacher. The researcher was able to collect an instrument for each student teacher. The instrument was mailed to cooperating teachers at the completion of the student teaching experience.

Supervising professors were asked to complete a problem-solving approach instrument regarding the extent of use of the problem-solving approach by the student teachers they had supervised. Instruments were completed for the 22 student teachers.

The problem-solving approach instrument that was completed by student teachers, cooperating teachers, and supervising professors was the same, except for minor word changes. Some changes were necessary to have the proper wording for the particular group completing the instrument. The order of the questions for each of the forms of the instruments was random. The various forms of the instrument were as follows:

- Student teachers' and the cooperating teachers' self-perceptions instruments were the same.
- Student teachers' perceptions of the cooperating teacher.
Cooperating teachers' and supervising professors' perceptions of the student teacher were the same.

Another source of data concerning the extent of use of the problem-solving approach by student teachers was two audio-recorded class sessions. Each student teacher, as part of their student teaching assignments, was to record two class sessions. These tapes were to be taken at two different times during the quarter around the midpoint and near the completion of student teaching. These tapes were to be delivered at the completion of the quarter. Fifteen student teachers presented tapes for the first class session; seven student teachers submitted tapes for the second class session.

The tapes were analyzed by using the teaching approach instruments (Boone, 1988). The researcher did the analysis of all the tapes.

The final independent variable was the extent of use of the problem-solving approach by the cooperating teacher and the relationship between this variable and the extent of use of the problem-solving approach by the first-year teachers. Cooperating teachers were mailed the problem-solving approach instrument with the request that they complete it indicating their perceptions regarding the extent to which they use the problem-solving approach to teaching. The instrument was mailed four weeks after the instrument regarding the student teacher had been mailed. All 16 cooperating teachers returned the instrument. Six cooperating teachers had more than one student teacher resulting in 16 cooperating teachers for the 22 student teachers.

The student teachers completed a problem-solving approach instrument concerning the extent of use of the problem-solving approach by the cooperating teachers. This was done to determine the extent of use of the problem-solving approach by the cooperating teachers. The two different instruments would provide a more complete understanding of the extent of use of the problem-solving approach by the cooperating teachers.

The extent of use of the problem-solving approach during the first year of teaching was measured by using two self-assessing problem-solving instruments, two analyses of audiorecorded class sessions, and two interviews. By using these three different sources of data which were collected at two points in time, a more complete assessment of the extent of use of the problem-solving approach was possible. The use of
<table>
<thead>
<tr>
<th>Enrollment in Methods Course</th>
<th>Student Teaching</th>
<th>First Year of Teaching</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Understanding of and plans for using the problem-solving approach (interview) (N=22)</td>
<td>2. Cooperating teachers’ perceptions of extent of use of the problem-solving approach by the student teachers (instrument) (N=22)</td>
<td>2. Extent of use of the problem-solving approach by first-year teachers, second visit (instrument) (N=7)</td>
</tr>
<tr>
<td>3. General problem-solving test (Cornell Critical Thinking Test Level Z) (N=22)</td>
<td>3. Supervising professors’ perceptions of extent of use of the problem-solving approach by student teachers (instrument) (N=22)</td>
<td>3. Audiotapes of class sessions analyzed, first visit (N=7)</td>
</tr>
<tr>
<td>4.</td>
<td>4. Student teachers’ perceptions regarding the problem-solving approach (interview) (N=22)</td>
<td>4. Audiotapes of class sessions analyzed, second visit (N=7)</td>
</tr>
<tr>
<td>5.</td>
<td>5. Analysis of first audiotapes of class sessions of student teachers (N=15)</td>
<td>5. First-year teachers’ perceptions regarding the problem-solving approach (interview) (N=6)</td>
</tr>
<tr>
<td>6.</td>
<td>6. Analysis of second audiotapes of class sessions of student teachers (N=7)</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>7. Cooperating teachers’ self-perceptions of their extent of use of the problem-solving approach (instrument) (N=16)</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>8. Student teachers’ perceptions of the cooperating teachers extent of use of the problem-solving approach (instrument) (N=22)</td>
<td></td>
</tr>
</tbody>
</table>

Figure 2: Summary of Data Collection Methods and Time of Data Collection
qualitative data in the form of the interview provided greater insight into why the first-year teacher responded to the problem-solving approach instrument in the fashion that s(he) did.

It was also important to determine the relationship between various independent variables and the extent of use of the problem-solving approach during the first year of teaching. The methods course and student teaching are two very important aspects of the teacher preparation program. Will the extent of use of the problem-solving approach in these two aspects of the teachers’ preparation program have a relationship with the future use of the problem-solving approach during the first year of teaching? This is a question that deserves to be investigated.

The general problem-solving ability of the students was determined. Is this a variable that is related to the extent of use of the problem-solving approach during the first year of teaching? Will the extent of use of the problem-solving approach by the cooperating teachers influence the extent of use of the problem-solving approach of their student teachers as they enter the first year of teaching? Questions concerning these relationships will be addressed in Chapter IV.

The addressing of these relationships will provide a clearer picture concerning the extent of use of the problem-solving approach by first-year teachers.

**Reanalysis of tapes using the problem-solving instrument.**

To determine if the researcher was consistent in the analysis of the video and audiotapes, a reanalysis was conducted on 12 of the tapes. Four microteaching videotapes, four audiotapes from student teaching, and four audio recordings of first-year teachers were randomly selected for reanalysis. A reanalysis was conducted of the 12 tapes four weeks after the initial analysis. The Teaching Approach Instrument (Boone, 1988) was used to do the reanalysis. (The scores for each question were compared for the two analyses to determine how similarly they had been analyzed.)

A correlation coefficient was calculated to compare the two analyses of the tapes. The total adjusted scores from the first analysis and the reanalysis were utilized to calculate the correlation. Table 1 displays results for the three times measurement were made and an overall correlation coefficient.

The overall total correlational coefficient for the 12 tapes was \( r = .88 \). This very strong relationship indicates a high level of consistency between the original analysis and the reanalysis (see tables...
2, 3, and 4). The correlation coefficient for the methods course microtape analysis - reanalysis was $r = .94$; for the student teaching audiotape analysis - reanalysis, the correlation coefficient was $r = .79$; and concerning the first year of teaching audiotape analysis - reanalysis, the correlation coefficient was $r = .90$. All three correlation coefficients were very strong and positive. Figures 3, 4, 5, 6 (see Appendices A, B, C, and D) are the scatter plots for each analysis and reanalysis.
Table 1
Pearson Product Moment Correlations of Analysis and Reanalysis

<table>
<thead>
<tr>
<th>Tapes</th>
<th>Correlation Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microteaching Tapes (N=4)</td>
<td>0.94</td>
</tr>
<tr>
<td>Student Teaching Tapes (N=4)</td>
<td>0.79</td>
</tr>
<tr>
<td>First-Year Teaching Tapes (N=4)</td>
<td>0.90</td>
</tr>
<tr>
<td>Overall (N=12)</td>
<td>0.88</td>
</tr>
</tbody>
</table>
Table 2
Microteaching Videotape Reanalysis

<table>
<thead>
<tr>
<th>Question Number</th>
<th>Weighted Values^a</th>
<th>First Analysis 1</th>
<th>First Analysis 2</th>
<th>First Analysis 3</th>
<th>First Analysis 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.04</td>
<td>5</td>
<td>6</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>1A</td>
<td>0.02</td>
<td>5</td>
<td>6</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>1B</td>
<td>0.02</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>1C</td>
<td>0.02</td>
<td>4</td>
<td>6</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>0.07</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>2A</td>
<td>0.03</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>0.10</td>
<td>5</td>
<td>5</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>0.06</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>4A</td>
<td>0.02</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>4B</td>
<td>0.02</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>0.10</td>
<td>5</td>
<td>6</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>0.05</td>
<td>5</td>
<td>6</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>6A</td>
<td>0.05</td>
<td>5</td>
<td>6</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>0.10</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>0.10</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>0.10</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>0.10</td>
<td>3</td>
<td>5</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

b 1.00 4.45 4.98 5.08 5.38 2.73 2.96 4.60 4.30

^a Weighted value that is multiplied times the score. (Score x weighted value = adjusted score).
Add all of the adjusted scores together to get the total adjusted score for the individual.

b These are the total adjusted scores.
Table 3
Student Teaching Audiotape Reanalysis

<table>
<thead>
<tr>
<th>Question Number</th>
<th>Weighted Values&lt;sup&gt;a&lt;/sup&gt;</th>
<th>First Analysis 1</th>
<th>Reanalysis</th>
<th>First Analysis 2</th>
<th>Reanalysis</th>
<th>First Analysis 3</th>
<th>Reanalysis</th>
<th>First Analysis 4</th>
<th>Reanalysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.04</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>1A</td>
<td>0.02</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>1B</td>
<td>0.02</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>1C</td>
<td>0.02</td>
<td>5</td>
<td>4</td>
<td>6</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>0.07</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2A</td>
<td>0.03</td>
<td>4</td>
<td>3</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>0.10</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>0.06</td>
<td>4</td>
<td>3</td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4A</td>
<td>0.02</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4B</td>
<td>0.02</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>0.10</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>0.05</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6A</td>
<td>0.05</td>
<td>4</td>
<td>4</td>
<td>6</td>
<td>6</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>0.10</td>
<td>4</td>
<td>4</td>
<td>6</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>0.10</td>
<td>3</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>9</td>
<td>0.10</td>
<td>4</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>10</td>
<td>0.10</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>b</td>
<td>1.00</td>
<td>3.23</td>
<td>3.16</td>
<td>5.13</td>
<td>4.39</td>
<td>3.31</td>
<td>3.40</td>
<td>3.66</td>
<td>4.26</td>
</tr>
</tbody>
</table>

<sup>a</sup>Weighted value that is multiplied times the score. (Score x weighted value = adjusted score).

<sup>b</sup>Add all of the adjusted scores together to get the total adjusted score for the individual.

<sup>b</sup>These are the total adjusted scores.
Table 4
First-Year Teaching Audiotape Reanalysis

<table>
<thead>
<tr>
<th>Question Number</th>
<th>Weighted Values(^a)</th>
<th>First Analysis 1</th>
<th>First Analysis 2</th>
<th>First Analysis 3</th>
<th>First Analysis 4</th>
<th>Reanalysis</th>
<th>Reanalysis</th>
<th>Reanalysis</th>
<th>Reanalysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.04</td>
<td>6</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>1A</td>
<td>0.02</td>
<td>6</td>
<td>6</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>1B</td>
<td>0.02</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>1C</td>
<td>0.02</td>
<td>5</td>
<td>6</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>0.07</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>2A</td>
<td>0.03</td>
<td>6</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>0.10</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>0.06</td>
<td>7</td>
<td>5</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>4A</td>
<td>0.02</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>4B</td>
<td>0.02</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>0.10</td>
<td>5</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>0.05</td>
<td>5</td>
<td>6</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6A</td>
<td>0.05</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>0.10</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>0.10</td>
<td>5</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>0.10</td>
<td>6</td>
<td>6</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>0.10</td>
<td>5</td>
<td>6</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>b</td>
<td>1.00</td>
<td>5.60</td>
<td>5.49</td>
<td>4.61</td>
<td>4.43</td>
<td>3.56</td>
<td>4.01</td>
<td>3.73</td>
<td>3.15</td>
</tr>
</tbody>
</table>

\(^a\) Weighted value that is multiplied times the score. (Score x weighted value = adjusted score).

Add all of the adjusted scores together to get the total adjusted score for the individual.

\(^b\) These are the total adjusted scores.
CHAPTER IV
ANALYSIS AND INTERPRETATION OF DATA

The determination of the extent to which first-year teachers of vocational agriculture used the problem-solving approach to teaching was the purpose of this study. Data and information were collected by audio-recorded class sessions, instruments, and interviews. The collection of the data and information occurred at two times during the first year of teaching the better to determine the extent of use of the problem-solving approach.

Also of concern was the investigation of variables that are related to the extent of use of the problem-solving approach during the first year of teaching. All of the first-year vocational agriculture teachers in the study had participated in the same teaching preparation activities. Variables investigated included the classroom and laboratory instruction in Agricultural Education 530, "Methods of Teaching in Vocational Agriculture and Extension Education," the general problem-solving ability of the teachers, and selected parts of the student teaching experience.

The initial part of this chapter pertains to the 22 students in the study. An overview will be presented for the 22 students. A description of how the seven first-year teachers for whom complete data are available compared with the entire group and the other 15 students will follow.

The extent to which the first-year teachers used the problem-solving approach will then be presented. Information collected through interviews will be incorporated throughout.

The presentation of the independent variables and their relationships with the dependent variable will follow. The independent variables will be presented as they occurred in time sequence. Relationships between the independent and dependent variables will be described. Interview information will also be presented. Summary statements concerning each objective of the study will conclude the chapter.
Description of Participants

Twenty-two students enrolled in two sections of Agricultural Education 530, “Methods of Teaching in Vocational Agriculture and Extension Education,” were the participants in the study. The data collected for the 22 students are recorded in Table 5. In Table 5 and the tables that follow, the first seven students listed are the students who entered the first year of teaching.

The first variable is score received on the Cornell Critical Thinking Test. The seven first-year teachers appear to be atypical. Their mean score was 13.1, which compares to a mean score of 16.9 for the entire group of 22 students and a mean score of 18.7 for the 15 who did not enter teaching. The seven first-year teachers had the four lowest scores plus two of the highest scores with one score near the mean score.

The second variable is score on the microteaching tape analysis. The overall mean score for the 22 students was 4.31 on a scale ranging from 2.49 to 5.64 where high scores indicate greater extent of use of the problem-solving approach. The seven first-year teachers’ mean score was 4.06 and the mean score for the other 15 students was 4.40. The seven first-year teachers did not differ substantially on this variable from the other participants in the study.

Five pieces of data were collected during the student teaching period. These data are recorded in Table 6.

The student teachers’ assessment of their extent of use of the problem-solving approach produced the only major difference in mean scores. The seven first-year teachers’ self-assessment of the extent of use of the problem-solving approach during student teaching indicates that the mean score was 82.0, which compared to a group mean score of 76.9 and a mean score of 74.5 for the other 15 student teachers. The second tape analysis produced differences in the mean scores but the small number of student teachers with data available renders this information less useful.

Overall, the seven first-year teachers did not differ greatly from the other 15 students in the study. The seven students were typical of the entire group of 22 students.
Table 5
Description of Students Participating in the Study

<table>
<thead>
<tr>
<th>Score</th>
<th>Analysis</th>
<th>Problem-Solving</th>
<th>Problem-Solving</th>
<th>Analysis of</th>
<th>Analysis of</th>
<th>Analysis of</th>
<th>Analysis of</th>
<th>Problem-Solving</th>
<th>Problem-Solving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical Thinking</td>
<td>Microteaching Instrument</td>
<td>Student Cooperating</td>
<td>Supervising Professor</td>
<td>Student Teaching</td>
<td>Student Teaching</td>
<td>First-Year Teacher Tape</td>
<td>First-Year Teacher Tape</td>
<td>First-Year Teacher</td>
<td>First-Year Teacher</td>
</tr>
<tr>
<td>Students</td>
<td>Test</td>
<td>Analysis</td>
<td>of</td>
<td>Instrument</td>
<td>Instrument</td>
<td></td>
<td></td>
<td>Instrument</td>
<td>Instrument</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1d</td>
<td>24</td>
<td>4.64</td>
<td>90</td>
<td>82</td>
<td>88</td>
<td>3.23</td>
<td>3.79</td>
<td>5.6</td>
<td>5</td>
</tr>
<tr>
<td>2d</td>
<td>6</td>
<td>-</td>
<td>86</td>
<td>67</td>
<td>87</td>
<td>-</td>
<td>-</td>
<td>3.4</td>
<td>5.1</td>
</tr>
<tr>
<td>3d</td>
<td>4</td>
<td>3.05</td>
<td>80</td>
<td>73</td>
<td>75</td>
<td>-</td>
<td>-</td>
<td>2.4</td>
<td>3.7</td>
</tr>
<tr>
<td>4d</td>
<td>6</td>
<td>4.15</td>
<td>88</td>
<td>77</td>
<td>87</td>
<td>5.35</td>
<td>5.51</td>
<td>3.8</td>
<td>3.6</td>
</tr>
<tr>
<td>5d</td>
<td>6</td>
<td>5.17</td>
<td>78</td>
<td>82</td>
<td>82</td>
<td>2.9</td>
<td>1.48</td>
<td>5.3</td>
<td>5</td>
</tr>
<tr>
<td>6d</td>
<td>28</td>
<td>3.26</td>
<td>85</td>
<td>60</td>
<td>69</td>
<td>2.72</td>
<td>2.49</td>
<td>4.2</td>
<td>-</td>
</tr>
<tr>
<td>7d</td>
<td>18</td>
<td>4.06</td>
<td>67</td>
<td>80</td>
<td>90</td>
<td>5.56</td>
<td>-</td>
<td>4.6</td>
<td>4.6</td>
</tr>
<tr>
<td>8</td>
<td>19</td>
<td>5.64</td>
<td>78</td>
<td>68</td>
<td>78</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>19</td>
<td>5.26</td>
<td>73</td>
<td>64</td>
<td>90</td>
<td>3.31</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>26</td>
<td>5.33</td>
<td>76</td>
<td>79</td>
<td>90</td>
<td>5.08</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>11</td>
<td>20</td>
<td>3.09</td>
<td>76</td>
<td>78</td>
<td>84</td>
<td>5.13</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>12</td>
<td>11</td>
<td>4.89</td>
<td>84</td>
<td>80</td>
<td>96</td>
<td>3.92</td>
<td>2.44</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>13</td>
<td>18</td>
<td>4.59</td>
<td>62</td>
<td>58</td>
<td>64</td>
<td>1.76</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>14</td>
<td>20</td>
<td>5.38</td>
<td>85</td>
<td>90</td>
<td>92</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>15</td>
<td>28</td>
<td>3.89</td>
<td>62</td>
<td>82</td>
<td>91</td>
<td>3.66</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>16</td>
<td>19</td>
<td>4.65</td>
<td>88</td>
<td>74</td>
<td>91</td>
<td>3.9</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>17</td>
<td>19</td>
<td>4.81</td>
<td>70</td>
<td>67</td>
<td>82</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>18</td>
<td>8</td>
<td>-</td>
<td>67</td>
<td>79</td>
<td>83</td>
<td>-</td>
<td>2.1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>19</td>
<td>19</td>
<td>4.60</td>
<td>71</td>
<td>80</td>
<td>98</td>
<td>3.04</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>20</td>
<td>23</td>
<td>2.49</td>
<td>85</td>
<td>73</td>
<td>75</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>21</td>
<td>20</td>
<td>5.20</td>
<td>67</td>
<td>57</td>
<td>58</td>
<td>4.37</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>22</td>
<td>11</td>
<td>4.75</td>
<td>70</td>
<td>75</td>
<td>75</td>
<td>3.15</td>
<td>2.75</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

MEAN 16.9 4.31 74.9 74.2 83.1 3.83 2.94 4.19 4.53 81.3 80.3
SD 7.4 0.88 8.7 8.3 10.3 1.12 1.33 1.11 0.72 10.2 7.2

a Cornell Critical Thinking Test Level 2 was administered. Scores ranged from 0 to 52. The higher the score, the greater the problem-solving skills an individual possesses.

b See p. 82 for comparable group scores of college students on the Cornell Critical Thinking Test, Level 2.

c Boone's (1968) instrument was utilized to analyse tapes. Scores ranged from 1 to 7 on a weighted scale. The higher the score, the greater the extent of use of the problem-solving approach to teaching.

d The problem-solving instrument had a range of scores from 25 to 125. The higher the score, the greater was the extent of use of the problem-solving approach to teaching.

e These seven students were the first-year teachers in the study.
Table 6
Descriptions of Problem-Solving Teaching Behavior during Student Teaching

<table>
<thead>
<tr>
<th>Groupings</th>
<th>Problem-Solving Instrument Student Teacher a</th>
<th>Problem-Solving Instrument Cooperating Teacher a</th>
<th>Problem-Solving Instrument Supervising Professor a</th>
<th>Analysis of Audiotape 1 Student Teaching b</th>
<th>Analysis of Audiotape 2 Student Teaching b</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Student Teachers (22)</td>
<td>mean = 76.9</td>
<td>mean = 74.2</td>
<td>mean = 83.1</td>
<td>mean = 3.8</td>
<td>mean = 2.9</td>
</tr>
<tr>
<td></td>
<td>SD = 8.7</td>
<td>SD = 8.3</td>
<td>SD = 10.3</td>
<td>SD = 1.1</td>
<td>SD = 1.3</td>
</tr>
<tr>
<td></td>
<td>(N = 15)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First-Year Teachers (7)</td>
<td>mean = 82.0</td>
<td>mean = 75.6</td>
<td>mean = 82.6</td>
<td>mean = 3.9</td>
<td>mean = 3.2</td>
</tr>
<tr>
<td></td>
<td>SD = 7.9</td>
<td>SD = 6.3</td>
<td>SD = 7.8</td>
<td>SD = 1.4</td>
<td>SD = 2.1</td>
</tr>
<tr>
<td></td>
<td>(N = 5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Student Teachers (15)</td>
<td>mean = 74.5</td>
<td>mean = 73.6</td>
<td>mean = 83.3</td>
<td>mean = 3.8</td>
<td>mean = 2.4</td>
</tr>
<tr>
<td></td>
<td>SD = 8.3</td>
<td>SD = 9.2</td>
<td>SD = 10.3</td>
<td>SD = 1.1</td>
<td>SD = .4</td>
</tr>
<tr>
<td></td>
<td>(N = 10)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a The problem-solving instrument range of scores was from 25 to 125. Higher scores on the instrument indicate a greater extent of use of the problem-solving approach to teaching.

b The Boone (1988) instrument was utilized to analyze the audiotape. The range of scores for the instrument was a weighted value of 1 to 7. The higher the rating, the greater the extent of use of the problem-solving approach to teaching.
Extent of Use of the Problem-Solving Approach by First-Year Vocational Agriculture Teachers

The extent to which the first-year vocational agriculture teachers used the problem-solving approach to teaching was determined by using six measurements. Two self-assessment instruments, two audio-recorded class sessions, and two interviews comprised these data. Two visits were made to each first-year teacher, the first in the fall of 1988 and the second in the spring of 1989.

The problem-solving instrument contained 25 items and was administered during each visit to the first-year teacher. The instrument measured the perception of the first-year teachers regarding their extent of use of the problem-solving approach. A Likert scale with five response options was utilized. A possible score of 125 points was the maximum and a score of 25, the minimum. The mean score for the self-assessing problem-solving approach instrument for the first visit to the first-year teachers was 81.3 with a standard deviation of 10.2. The range was from a low of 62 to a high of 96. The mean score for the self-assessing problem-solving approach instrument for the second visit was 80.3 with a standard deviation of 7.2. The range was from a low of 71 to a high of 92. Table 7 contains the scores for both visits.

The scores for each first-year teacher were very similar for both measurements. Four first-year teachers rated their extent of use of the problem-solving approach slightly lower on the second measurement whereas two first-year teachers rated themselves higher on the second measurement. The midpoint of possible range of scores for the problem-solving approach instrument was 75 points. On the first administration of the instrument, six of the seven first-year teachers were above the midpoint of possible range of scores for the instrument. Five of the seven rated themselves above the midpoint of possible range of scores on the second instrument. The problem-solving approach to teaching was being incorporated in the first-year teachers' classrooms. Of the 14 scores from both visits, 11 scores were above the midpoint of 75 points. Five of the seven first-year teachers rated themselves above the midpoint of possible range of scores of 75 points on both administrations of the instrument. Only one teacher rated himself or herself below the midpoint of possible range of scores on the instrument both times the instrument was administered. The other first-year teacher was above the midpoint of possible range of scores on the first administration of the instrument and below on the second administration of the instrument.
Table 7
Extent of Use of the Problem-Solving Approach by First-Year Teachers

<table>
<thead>
<tr>
<th>First-Year Teacher</th>
<th>Problem-Solving Instrument(^a)</th>
<th>First Visit</th>
<th>Second Visit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>87 (2)(^b)</td>
<td>85 (2)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>62 (7)</td>
<td>71 (7)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>82 (3)</td>
<td>78 (5)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>81 (4)</td>
<td>81 (4)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>96 (1)</td>
<td>92 (1)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>81 (4)</td>
<td>82 (3)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>80 (6)</td>
<td>73 (6)</td>
<td></td>
</tr>
</tbody>
</table>

mean = 81.3  mean = 80.3
SD = 10.2   SD = 7.2

\(^a\)The problem-solving approach instrument has a possible range from 25 points to 125 points. The higher the score, the greater the extent of use of the problem-solving approach to teaching.

\(^b\)Numbers in parentheses are the rank order for each visit based on the scores listed.
A second data source was the audio-recorded class sessions. During each visit one class was audio-recorded and notes were taken by the researcher regarding the events of the classroom. These tapes were analyzed by using the Teaching Approach Instrument (Boone, 1988). The Teaching Approach Instrument is a weighted 17-item analysis instrument that uses a seven-point rating scale for each item. The higher the weighted total score, the greater the extent to which the problem-solving approach was used in the instruction. The midpoint of possible range of scores for the Teaching Approach Instrument was four.

The seven tapes from the first visit produced a mean score of 4.2 with a standard deviation of 1.1. Scores ranged from a low of 2.4 to a high of 5.6. The analysis produced a weighted score of less than 4.0 for three of the seven first-year teachers.

The analysis of the second visit tapes produced a mean score of 4.5 with a standard deviation of 0.7. The range of scores ran from a low of 3.6 to a high of 5. Two of the first-year teachers' weighted scores were below 4.0 and four scores were above 4.0. One tape was not analyzed because the class time was spent cleaning the shop. Table 8 includes the data from the two analyses.

To determine how much agreement existed between the two analyses in terms of rank order, a Spearman rank-order coefficient was calculated. The Spearman rank-order coefficient for the first-year teachers based on the two audiotape analyses was .54. The most noticeable change in rank order was with teacher number two who had the sixth rank score on the first analysis and the highest score on the second analysis. The rank-order for the other five scores was relatively the same.

Two of the first-year teachers were below the midpoint of possible range of scores of four on both of the analyses of the teaching tape sessions. Three first-year teachers were above the midpoint of possible range of scores for both analyses. One teacher was split, with the sixth lowest rating on the first teaching tape session analysis and the highest rating on the second tape session analysis. One teacher had only one rating, which was 4.2. Two of the first-year teachers had a higher rating on the second session analysis, three had higher ratings on the first session, and one first-year teacher had identical ratings.

To determine how the two problem-solving instruments and the two audiotape analyses were related to each other in their measurement of the extent of use of the problem-solving approach, Spearman rank-order correlations were calculated. Table 9 contains the results.
Table 8  
First-Year Teachers Audiotape Analysis

<table>
<thead>
<tr>
<th>First-Year Teachers</th>
<th>Audiotape Analysis</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First Visit</td>
<td>Second Visit</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>5.6 (1)b</td>
<td>5.2 (2)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>3.4 (6)</td>
<td>5.9 (1)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>2.4 (7)</td>
<td>3.7 (5)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>3.8 (5)</td>
<td>3.6 (6)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>5.3 (2)</td>
<td>4.9 (3)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>4.2 (4)</td>
<td>discarded</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>4.6 (3)</td>
<td>4.6 (4)</td>
<td></td>
</tr>
</tbody>
</table>

mean = 4.2
SD = 1.1

mean = 4.5
SD = 0.7

\(^a\)The Teaching Approach Instrument (Boone, 1988) was utilized to analyze the audiotapes. There is a possible range of 1 to 7 for the instrument with the higher the score, the greater the extent of use of the problem-solving approach to teaching.

\(^b\)Numbers in parentheses are the rank order for each tape analysis based on the weighted scores produced with the Teaching Approach Instrument.
Table 9
Spearman Rank-Order Correlations among Four Measures of the Extent to Which First-Year Teachers Use the Problem-Solving Approach

<table>
<thead>
<tr>
<th>Measurements of First-Year Teachers</th>
<th>Problem-Solving Instrument (Time One)</th>
<th>Problem-Solving Instrument (Time Two)</th>
<th>Analysis of Audiotape First-Year Teacher (Time One)</th>
<th>Analysis of Audiotape First-Year Teacher (Time Two)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem-Solving Instrument (Time One)</td>
<td>-</td>
<td>.88 (N = 7)</td>
<td>.49 (N = 7)</td>
<td>-.14 (N = 6)</td>
</tr>
<tr>
<td>Problem-Solving Instrument (Time Two)</td>
<td>1.00</td>
<td>.68 (N = 7)</td>
<td>.09 (N = 6)</td>
<td></td>
</tr>
<tr>
<td>Analysis of Audiotape First-Year Teacher (Time One)</td>
<td>1.00</td>
<td>.54 (N = 6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analysis of Audiotape First-Year Teacher (Time Two)</td>
<td></td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Some strong relationships existed between the various variables. The highest correlation ($r = .88$) was between the analysis of the two problem-solving approach instruments that were administered during the first year of teaching. The analysis of audiotape first-year teacher (time one) when correlated with the two problem-solving approach instruments from the first year of teaching resulted in values that were moderate ($r = .49$) and substantial ($r = .68$) and positive respectively. Those three sources of data were fairly consistent in measuring the dependent variable. The analysis of audiotape first-year teacher (time two) did not correlate with the two problem-solving approach instruments. However, the relationship between the analysis of audiotape first year of teaching (time one) and the analysis of audiotape first year of teaching (time two) was a substantially strong and positive association ($r = .54$).

During each of the two visits to the first-year teachers, interviews were conducted. Responses from the first visit produced these results. When asked to give a percentage regarding the extent of use of the problem-solving approach, two said 75% of the time, three said 50% of the time, and two said 25% of the time. All seven stated that they used the lecture/subject matter teaching approach when not using the problem-solving approach.

"Were you successful in using the problem-solving approach when you did incorporate it into the classroom?" was another question asked. All of the first-year teachers indicated that they had had success in using the problem-solving approach. It was not always 100% effective, but generally did produce favorable results. When the problem-solving approach was used, success was normal for the first-year teachers.

"How difficult was the problem-solving approach to use in the classroom?" All indicated that it was not so difficult that it could not be used. The problem-solving approach was easier to use with the younger students, especially the freshmen. The freshmen learned it more readily and cooperated more when the problem-solving approach was used. Upper classmen did not respond in a positive fashion generally. This was even more of a problem when the previous agricultural teacher had not used the problem-solving approach and the upper classmen thus had no previous experience with the teaching approach.

Restrictions in using the teaching approach did exist. Time was a major concern for four of the first-year teachers. The time to prepare and implement the problem-solving approach in the classroom was
a considerable problem. The lack of problems to use to direct the problem-solving approach was another concern. Five first-year teachers indicated that supervised occupational experience (SOE) projects can be an excellent help in using the problem-solving approach. Having good SOE projects was a difficulty. A concern over the quantity and quality of SOE projects was expressed by five first-year teachers. These interviews were conducted in late November and early December so the time that the first-year teachers had had to work on SOE projects had been limited.

Six of the seven teachers indicated that subject matter plays a definite factor in their use of the problem-solving approach. Certain subjects do not lend themselves to the problem-solving approach. Those subjects or topics that are of interest or concern to most of the students work well with the problem-solving approach. When the students have no knowledge of a subject area and/or no interest in the subject area, then difficulties with using the problem-solving approach occurred. When the teacher felt inadequate in his or her knowledge of the subject matter being taught, the use of the problem-solving approach was more difficult. The combination of lack of technical knowledge on the part of the students and on the part of the first-year teacher caused difficulty in using the problem-solving approach.

"Do you view the problem-solving approach as being a viable and workable approach to teaching?"

"Do you plan on using the problem-solving approach next year and to what extent?" These two additional questions were asked of these first-year teachers during the first visit. All seven agreed that the problem-solving approach was a viable approach to teaching and that it does have a place in the vocational agriculture classroom. All seven stated that they planned to use it more in the future. Experience in using the instructional approach and time to prepare for class were the two factors most often mentioned as needing improvement. Four first-year teachers said that the problem-solving approach was not the only teaching approach to use in the classroom. They felt that the problem-solving approach did not fit every situation so as to be used 100% of the time. All seven expressed more confidence in using the problem-solving approach in the classroom compared to when they had graduated from college.
The second visit produced another set of interview data. When asked to what extent the problem-solving approach had been utilized in the classroom, the answers were:

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>80%</td>
<td>1</td>
</tr>
<tr>
<td>70%</td>
<td>1</td>
</tr>
<tr>
<td>60%</td>
<td>1</td>
</tr>
<tr>
<td>50%</td>
<td>3</td>
</tr>
<tr>
<td>20%</td>
<td>1</td>
</tr>
</tbody>
</table>

From the first interview to the second interview, three of the first-year teachers’ self assessments did not change, three expressed a higher use of the problem-solving approach during the second interview, and one stated a lower percentage of use during the second interview.

"Have you been successful in your use of the problem-solving approach during your first year of teaching?” All seven felt that they had been successful in using the problem-solving approach when it was instituted in the classroom; however, not one first-year teacher used it all the time. A first-year teacher who had not used the problem-solving approach very often experienced much success when it was incorporated into the classroom instruction.

"What restricted the use of the problem-solving approach in the classroom?” Subject matter as contained in particular units of instruction caused a great deal of concern among the first-year teachers. Five first-year teachers mentioned subject matter as being a restriction. Some of the subjects named as causing difficulty in using the problem-solving approach were record keeping, shopwork, international agriculture, breed identification, meat identification, and FFA activities such as the creed. This is not a complete list in that the first-year teachers had difficulty in naming every particular unit that did not work well with the problem-solving approach.

Time was a very restrictive problem and a concern to all seven first-year teachers. The extensive time required to prepare for using the problem-solving approach plus the other activities that agricultural teachers are faced with resulted in a shortage of time. Compounding this problem is the inexperience of first-year teachers. The problem-solving approach is more time consuming to use in the classroom than the
traditional lecture method of instruction. They all felt confident that experience would help with the time factor to some degree.

A third area of restriction was regarding the background and characteristics of students enrolled in the vocational agriculture courses. Most students do not have an agricultural background and lack knowledge regarding agriculture. So there existed very few personal agricultural problems to use in the classroom.

The lack of confidence in a particular subject area and/or technical knowledge caused the first-year teachers not to use the problem-solving approach. Four of the seven expressed such concerns as the notion that it is hard to teach subjects that are not as familiar and the additional pressure of trying to incorporate the problem-solving approach could make it more difficult. The problems of preparation time, getting the lesson started, and getting objectives stated would deter the teacher from using the problem-solving approach.

A related question concerned the use of the problem-solving approach and how students' abilities and level of achievement influenced the use of the approach. Five first-year teachers indicated that freshmen were much more receptive to the approach than the juniors and seniors. The freshmen were more accommodating and responsive to the problem-solving approach. Juniors and seniors, especially if the former agriculture teacher had not used the problem-solving approach, were very uncooperative and unresponsive. One teacher saw no difference and one teacher did not have juniors and seniors. Part of the problem with the juniors and seniors relates to discipline concerns. A lack of classroom management and student control was a problem for all seven first-year teachers to some degree, especially with the juniors and seniors.

A final question concerned the first-year teachers' undergraduate training and any changes that they would recommend based on what they now know. Four of the first-year teachers mentioned the need for more technical knowledge. Each felt inadequate in some area(s) and felt that they needed more technical courses in their undergraduate programs. Another response was the need to see the problem-solving approach in action. They had not seen the approach used enough in a correct fashion so as to develop a
better understanding of how it works. More opportunities to witness the problem-solving approach in action during the student teaching experience are needed.

Three first-year teachers stated that the methods course needed to incorporate knowledge of how to use a shorter, quicker version of the problem-solving approach. All lesson plans do not have to have all the details and every step so clearly spelled out that it becomes impossible to write. A more practical version is needed.

Extent of Use of the Problem-Solving Approach in the Methods Course

The methods course is the first exposure that the future vocational agriculture teachers have to the problem-solving approach, at least from the point of view of being taught how to use it in the classroom. The extent that these future first-year vocational agriculture teachers used the problem-solving approach to teaching in their third microteaching session was determined by the analysis of a videotaped recording of that session. The third and final session was a mini-lesson that incorporated each step of the problem-solving approach. The tapes were analyzed by the researcher using the Teaching Approach Instrument (Boone, 1988).

There were 22 undergraduate students in the two groups studied. However, only seven of these individuals actually started teaching in the fall of 1988. The entire population of 22 individuals will be discussed initially, followed by a discussion of the seven individuals who did eventually start to teach in the fall of 1988. All 22 individuals completed the student teaching experience. Correlations concerning the extent of use of the problem-solving approach in the student teaching experience will also be determined and discussed.

The analysis of the microteaching videotapes was done by utilizing Boone's (1988) Teaching Approach Instrument. The Teaching Approach Instrument uses a seven-point rating scale; the higher the number, the greater the extent of use of the problem-solving approach. Each rating was weighted and then the ratings were summed to produce a total weighted score for each individual. The range of scores is from 1 to 7 with a midpoint of possible range of scores of 4 for the instrument. One tape was inexplicably blank and one tape was missing, resulting in only 20 microteaching videotapes being analyzed.
The mean score for the 20 individuals whose tapes were analyzed was 4.31 with a standard deviation of .88. The range was from a low of 2.49 to a high of 5.64 (see Table 10).

Fifteen of the 20 individuals scored above the possible midpoint of possible range of scores of 4.0 on the Teaching Approach Instrument. This would indicate that those 15 individuals used the problem-solving approach. The problem-solving approach was also utilized by the other five individuals but to a lesser extent. A rank ordering of the 20 individuals was done to determine where the seven first-year teachers were in regard to the overall group. The microteaching tape that was blank was for one of the seven first-year teachers. As Table 10 indicates, the six were dispersed throughout the 20 individuals. Four individuals were in the bottom 10, however, and one was in the top five.

The 22 students enrolled in the teaching methods course were interviewed during the last two weeks of the quarter to provide additional data. All interviews were audio-recorded and transcribed by the researcher. Each individual was asked to assess his/her understanding of the problem-solving approach to teaching on a seven-point scale. One was considered to indicate no understanding and seven indicated complete understanding of the problem-solving approach. The mean score for the students was 5.3 with a range of 4 to 6. All of the students expressed strong confidence in their understanding of the problem-solving approach.

Another question asked was if they had the knowledge and skills necessary to put the problem-solving approach to teaching into practice. Each student expressed confidence in being able to use the problem-solving approach in the classroom.

When asked to give an overall opinion of the problem-solving approach as a teaching approach, the responses were very positive. A few of their comments were:

"I see it as a good tool for all teachers in all areas. It gives good interaction . . ."

"I just think that if more teachers in the school would use it, a lot more learning would probably take place. It takes into account the principles of interest, and the principles of learning when you use it."
Table 10
Methods Microteaching Tape Analysis

<table>
<thead>
<tr>
<th>Students</th>
<th>Analysis of Microteaching Tape</th>
<th>Rank Order</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4.64</td>
<td>9</td>
</tr>
<tr>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>3.05</td>
<td>19</td>
</tr>
<tr>
<td>4</td>
<td>4.15</td>
<td>13</td>
</tr>
<tr>
<td>5</td>
<td>5.17</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>3.26</td>
<td>16</td>
</tr>
<tr>
<td>7</td>
<td>4.06</td>
<td>14</td>
</tr>
<tr>
<td>8</td>
<td>5.64</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>4.26</td>
<td>12</td>
</tr>
<tr>
<td>10</td>
<td>5.33</td>
<td>3</td>
</tr>
<tr>
<td>11</td>
<td>3.09</td>
<td>18</td>
</tr>
<tr>
<td>12</td>
<td>4.89</td>
<td>5</td>
</tr>
<tr>
<td>13</td>
<td>4.59</td>
<td>11</td>
</tr>
<tr>
<td>14</td>
<td>5.38</td>
<td>2</td>
</tr>
<tr>
<td>15</td>
<td>3.89</td>
<td>15</td>
</tr>
<tr>
<td>16</td>
<td>4.65</td>
<td>8</td>
</tr>
<tr>
<td>17</td>
<td>4.81</td>
<td>6</td>
</tr>
<tr>
<td>18</td>
<td>missing</td>
<td>-</td>
</tr>
<tr>
<td>19</td>
<td>4.60</td>
<td>10</td>
</tr>
<tr>
<td>20</td>
<td>2.49</td>
<td>20</td>
</tr>
<tr>
<td>21</td>
<td>3.20</td>
<td>17</td>
</tr>
<tr>
<td>22</td>
<td>4.75</td>
<td>7</td>
</tr>
</tbody>
</table>

Mean 4.31
SD 0.88

*a* The first seven students are the first-year teachers.

*b* The range of scores on the Boone (1988) instrument is from 1 to 7 with a higher score indicating a greater extent of use of the problem-solving approach to teaching.
"Instead of someone handing them (the high school student) the answer, they can go out and find the answer themselves."

"Like I said before, it gives the student the chance to find out the answer themselves or actually do the process themselves, or actually solve the problems."

Another question asked was if they viewed the problem-solving approach as a viable, workable approach to teaching. The 22 students agreed that the problem-solving approach is a very viable teaching approach that will work in the classroom. Three students expressed concerns regarding the use of the problem-solving approach exclusively. They felt that there could be times when the problem-solving approach might not necessarily be the best or only teaching method.

When asked to point out difficulties that had occurred while using the problem-solving approach in the methods course, 12 of the group mentioned the time factor. The problem-solving approach requires a lot more preparation time. More preplanning for each class is required. Another reply concerned subject matter. Nine individuals stated that certain subjects might be harder to adapt to the problem-solving approach.

The overall analysis of the interviews resulted in very positive attitudes concerning the problem-solving approach. All 22 students stated that they planned on using the problem-solving approach and believed it to be the best way to teach. A concern about time to prepare for class was the biggest hindrance to using the problem-solving approach.

The following data apply to the seven individuals enrolled in the methods course who entered teaching in the fall of 1988. The mean score for the six microteaching tapes (one was blank) analyzed was 4.06 with a standard deviation of .81. This compares to a mean score of 4.31 for the group of 20. Very little difference existed between the two groups. The range was from a low of 3.05 to a high of 5.17. Four of the six did rank in the bottom 10 of the 20 based on a rank ordering of the microteaching videotape analysis (see Table 10). Four of the six individuals scored above the midpoint of possible range of scores of four on the Teaching Approach Instrument (Boone, 1988), indicating that those four individuals used the problem-solving approach.
The interviews of these seven produced the same positive opinions of the problem-solving approach as those of the entire group. When asked to rate their understanding of the problem-solving approach on a scale of one to seven, with seven indicating complete understanding, the mean score for the seven was 5.5. This compares to a mean score of 5.3 for the group. The range ran from 4 to 6 on the seven-point scale.

The seven individuals who entered teaching appear to be no different than the entire group. Their comments during the interviews were identical to those of the entire group. The seven individuals understood the problem-solving approach, had confidence in their ability to use the problem-solving approach, and planned on utilizing the teaching approach. The seven individuals demonstrated that they had the ability to use the problem-solving approach.

Relationship between the Extent to which the Problem-Solving Approach Occurred in the Methods Course and the Extent of Use of Problem-Solving during the First Year of Teaching

To address the research question regarding the relationship between the extent to which the problem-solving approach was utilized in the methods course and the extent to which it was utilized in the first year of teaching, the correlations reported in Table 11 were calculated. The Spearman rank-order correlations were consistent and strongly positive between the two problem-solving instruments and two audiotape analyses that measured the extent of use of the problem-solving approach by first-year teachers and the extent of use of the problem-solving approach in the methods course (see Table 11).

To compare the rank order of the seven individuals between the extent of use of the problem-solving approach during the first year of teaching as determined by the two problem-solving instruments and the two audiotape analyses and extent of use of the problem-solving approach during microteaching, the Spearman rank correlation coefficient was utilized. The rank order of the seven individuals during the microteaching lab remained relatively constant during their first year of teaching (see Table 11). The correlation between the extent of use of the problem-solving approach as determined by the analysis of the microteaching videotape and the two problem-solving instruments (first year of teaching) were substantial
Table 11

Spearman Rank-Order Correlations Indicating Relationships between Extent to Which Problem Solving Was Used in the Methods Course and Extent to Which Problem Solving Was Used during the First Year of Teaching.

<table>
<thead>
<tr>
<th>Methods Microteaching</th>
<th>First-Year Teaching Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Problem-Solving Instrument First-Year Teacher (First Visit)</td>
</tr>
<tr>
<td>Methods Microteaching</td>
<td>.55 (N = 6)</td>
</tr>
</tbody>
</table>
(r_s = .55) and strong (r_s = .71) and positive. The correlation between the analysis of the microteaching videotape and the two analyses of the audiotapes first year of teaching were strong (r_s = .77) and substantial (r_s = .60) and positive.

These findings indicate a relatively substantial relationship between the extent to which students used the problem-solving approach during the third microteaching lab and the extent to which the problem-solving approach was used during the first year of teaching. The knowledge and experience gained during the methods course is a major factor in influencing the extent to which future teachers use the problem-solving approach to teaching.

Relationship between General Problem-Solving Skills and the Extent to Which First-Year Teachers Used the Problem-Solving Approach

Another piece of data was collected during the ninth week of the quarter from both groups of methods course students involved in this study. The information collected was the general problem-solving ability of the 22 students in the study. The research question was to determine if a relationship existed between agricultural education undergraduates' general problem-solving ability and the extent to which these individuals used the problem-solving approach to teaching during their first year of teaching.

To measure the general problem-solving ability of the individuals in the method courses, the Cornell Critical Thinking Test Level Z was administered. The test was administered during the ninth week of a 10-week quarter. The scores for the 22 individuals are recorded in Table 12.

The mean score for the seven first-year teachers was 13.1 which was lower than the 16.9 mean score for all 22 individuals and the 18.7 mean score for the 15 who were not first-year teachers. There are 52 questions on the Cornell Critical Thinking Test Level Z for a possible total score of 52 points. The higher the score, the greater the individual's general problem-solving skills and abilities. Some comparable groups of subjects' scores (Ennis, Millman, and Tomko, 1985) are:
Table 12
Scores on Critical Thinking Test

<table>
<thead>
<tr>
<th>Students</th>
<th>Score Critical Thinking Test a</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>24</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>28</td>
</tr>
<tr>
<td>7</td>
<td>18</td>
</tr>
<tr>
<td>8</td>
<td>19</td>
</tr>
<tr>
<td>9</td>
<td>19</td>
</tr>
<tr>
<td>10</td>
<td>26</td>
</tr>
<tr>
<td>11</td>
<td>20</td>
</tr>
<tr>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>13</td>
<td>18</td>
</tr>
<tr>
<td>14</td>
<td>20</td>
</tr>
<tr>
<td>15</td>
<td>28</td>
</tr>
<tr>
<td>16</td>
<td>19</td>
</tr>
<tr>
<td>17</td>
<td>19</td>
</tr>
<tr>
<td>18</td>
<td>8</td>
</tr>
<tr>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>20</td>
<td>23</td>
</tr>
<tr>
<td>21</td>
<td>20</td>
</tr>
<tr>
<td>22</td>
<td>11</td>
</tr>
<tr>
<td>Mean</td>
<td>16.9</td>
</tr>
<tr>
<td>SD</td>
<td>7.4</td>
</tr>
</tbody>
</table>

aThe Cornell Critical Thinking Test Level Z was used. There was a high score of 52 possible for the test. The higher the score, the greater the general problem-solving ability of the individual.
The problem-solving scores from the Cornell Critical Thinking Test of the seven first-year teachers were correlated with the extent of use of the problem-solving approach in the first year of teaching as determined by the two problem-solving instruments and two audiotape analyses. The results are reported in Table 13. The two correlations between the general problem-solving ability of the students and the extent of use of the problem-solving approach during the first year of teaching as measured by the audiotape analysis were substantial and positive at $r_s = .64$ and $r_s = .60$. A third correlation between the general problem-solving ability of students and the extent of use of the problem-solving approach by first-year teachers as determined by the problem-solving instrument (time two) was moderate and positive at $r_s = .32$. There was no relationship between the general problem-solving ability and the extent of use of the problem-solving approach during the first year of teaching as determined by the problem-solving instrument (time one). Three of the four measures of first-year teachers' extent of use of the problem-solving approach related moderately to substantially and positively with the general problem-solving ability of these students. These findings would indicate that the general problem-solving ability of students is a good indicator of extent of use of the problem-solving approach during the first year of teaching.

Extent that Student Teachers Used the Problem-Solving Approach during Student Teaching

The next step in the preparation of teachers was student teaching. The measurement of the extent of use of the problem-solving approach during the student teaching experience was determined by collecting six different pieces of data.
Table 13
Spearman Rank-Order Correlations of Critical Thinking Test and First-Year Teachers' Extent of Use of the Problem-Solving Approach

<table>
<thead>
<tr>
<th>First-Year Teaching Data</th>
<th>Correlation (r = )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem Solving Instrument</td>
<td>-.03</td>
</tr>
<tr>
<td>First-Year Teacher (Time 1) (N = 7)</td>
<td></td>
</tr>
<tr>
<td>Problem Solving Instrument</td>
<td>.32</td>
</tr>
<tr>
<td>First-Year Teacher (Time 2) (N = 7)</td>
<td></td>
</tr>
<tr>
<td>Analysis of First-Year Teacher Tape (Time 1) (N = 7)</td>
<td>.64</td>
</tr>
<tr>
<td>Analysis of First-Year Teacher Tape (Time 2) (N = 6)</td>
<td>.60</td>
</tr>
</tbody>
</table>
Problem-solving approach instrument.

The problem-solving approach instrument was used to measure the extent to which the student teachers had implemented the problem-solving approach during student teaching. The instrument contains 25 statements with a five-point scale on which one indicates “never or almost never using the problem-solving approach” and five indicates “always or almost always using the problem-solving approach.” A total maximum score of 125 points was possible with a minimum score of 25 points.

One measurement was student teachers’ self-assessments of the extent of use of the problem-solving approach, which were obtained by completing the problem-solving approach instrument. The mean score for all 22 student teachers was 76.9 with a standard deviation of 8.7. The range was from 62 to 90. Fourteen student teachers scored above the midpoint of possible range of scores of 75. Table 14 contains the scores of the 22 student teachers. The mean score for the seven student teachers who eventually became the first-year teachers was 82.0, whereas the mean score for the other 15 student teachers was 74.5.

The cooperating teachers completed the problem-solving instrument regarding the extent of use of the problem-solving approach by the student teachers they supervised. The mean score for the total group was 74.2 with a standard deviation of 8.3. The range was from a low of 58 to a high of 90. There were 12 student teachers whose ratings by cooperating teachers were above the midpoint of possible range of scores of 75. Table 14 includes the scores regarding the student teachers’ extent of use of the problem-solving approach as rated by the cooperating teachers.

The cooperating teachers’ assessments of the seven student teachers who would eventually become first-year teachers produced a mean score of 75.6. The mean score for the other 15 student teachers was 73.6, which would indicate that the two groups were similar.

The supervising professors did an assessment of each of the student teachers they had personally supervised during the quarter. The problem-solving approach instrument was completed to quantify this assessment. The mean for the entire group was 83.1 with a standard deviation of 10.3. The range was from a low of 58 to a high of 98. Nineteen of the 22 student teachers received a score at or above the midpoint of possible range of scores.
Table 14
Student Teachers' Extent of Use of the Problem-Solving Approach as Determined by the Student Teachers, Cooperating Teachers, and Supervising Professors

<table>
<thead>
<tr>
<th>Student Teacher</th>
<th>Problem-Solving Instrument</th>
<th>Problem-Solving Instrument</th>
<th>Problem-Solving Instrument</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>90</td>
<td>82</td>
<td>88</td>
</tr>
<tr>
<td>2</td>
<td>86</td>
<td>67</td>
<td>87</td>
</tr>
<tr>
<td>3</td>
<td>80</td>
<td>73</td>
<td>75</td>
</tr>
<tr>
<td>4</td>
<td>88</td>
<td>77</td>
<td>87</td>
</tr>
<tr>
<td>5</td>
<td>78</td>
<td>82</td>
<td>82</td>
</tr>
<tr>
<td>6</td>
<td>85</td>
<td>68</td>
<td>69</td>
</tr>
<tr>
<td>7</td>
<td>67</td>
<td>80</td>
<td>90</td>
</tr>
<tr>
<td>8</td>
<td>76</td>
<td>68</td>
<td>78</td>
</tr>
<tr>
<td>9</td>
<td>73</td>
<td>64</td>
<td>90</td>
</tr>
<tr>
<td>10</td>
<td>76</td>
<td>79</td>
<td>90</td>
</tr>
<tr>
<td>11</td>
<td>76</td>
<td>78</td>
<td>84</td>
</tr>
<tr>
<td>12</td>
<td>84</td>
<td>80</td>
<td>96</td>
</tr>
<tr>
<td>13</td>
<td>62</td>
<td>58</td>
<td>64</td>
</tr>
<tr>
<td>14</td>
<td>85</td>
<td>90</td>
<td>92</td>
</tr>
<tr>
<td>15</td>
<td>62</td>
<td>82</td>
<td>91</td>
</tr>
<tr>
<td>16</td>
<td>88</td>
<td>74</td>
<td>91</td>
</tr>
<tr>
<td>17</td>
<td>70</td>
<td>67</td>
<td>82</td>
</tr>
<tr>
<td>18</td>
<td>67</td>
<td>79</td>
<td>85</td>
</tr>
<tr>
<td>19</td>
<td>71</td>
<td>80</td>
<td>98</td>
</tr>
<tr>
<td>20</td>
<td>85</td>
<td>73</td>
<td>75</td>
</tr>
<tr>
<td>21</td>
<td>67</td>
<td>57</td>
<td>58</td>
</tr>
<tr>
<td>22</td>
<td>75</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>Mean</td>
<td>76.9</td>
<td>74.2</td>
<td>83.1</td>
</tr>
<tr>
<td>SD</td>
<td>8.7</td>
<td>8.3</td>
<td>10.3</td>
</tr>
</tbody>
</table>

^a First seven student teachers are the future teachers.

^b The problem-solving instrument was utilized for these three assessments. The range for the instrument was from 25 to 125 with the higher the score indicating the greater the extent of use of the problem-solving approach.
The mean score for the seven future teachers was 82.6 and the mean score for the 15 student teachers who did not enter teaching was 83.3. The seven future teachers' mean score was similar to the mean score of the 15 student teachers who did not enter teaching.

**Audiotape analysis.**

One of the class assignments for the student teaching experience was to audio-record two different class sessions that were to be turned in at the end of the quarter. These tapes were collected and analyzed by the researcher using the Teaching Approach Instrument (Boone, 1988). The researcher was able to collect 15 audio-recorded tapes for the first class session. Tapes of the second recorded class session were available for seven student teachers. Boone's instrument uses a seven-point rating scale with the higher the rating indicating the greater the extent of use of the problem-solving approach. The mean score for the 15 first class session audiotapes was 3.83 with a standard deviation of 1.12. Scores ranged from a low of 1.8 to a high of 5.7. Five student teachers were given an appraisal above the midpoint of possible range of scores of 4.0.

The seven second class session tapes were analyzed and the resulting mean score was 2.94 with a standard deviation of 1.52. The low score was 1.5 and the high score was 5.5. One of the student teachers received a rating of above the midpoint of possible range of scores. Table 15 contains the results for both class session analyses.

The low number of tapes, especially for the second class session, was a problem. The student teachers were required to make two audio-recorded tapes of class sessions that they had taught. Although the researcher had expected that the assignment would be completed, but many tapes were not produced.

The midpoint of possible range of scores of 4.0 for the Teaching Approach Instrument is the point designated to indicate the use of the problem-solving approach. The results show that the problem-solving approach was being utilized but to a limited extent. Analyses of both of the tapes produced mean scores (3.83 and 2.94) below the midpoint of possible range of scores of 4.0.

Evident in the tapes was a lot of class noise. Chatter, talking, horseplay, and smart answers were prevalent. In listening to the tapes, it was often hard to hear the student teacher over the class noise. A
Table 15
Student Teachers' Class Session Tape Analysis

<table>
<thead>
<tr>
<th>Student Teachers</th>
<th>Points in Time&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Analysis of</th>
<th>Analysis of</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Audiotape 1</td>
<td>Audiotape 2</td>
</tr>
<tr>
<td></td>
<td>Student Teaching</td>
<td>Student Teaching</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>3.23</td>
<td>3.79</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>5.35</td>
<td>5.51</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>2.90</td>
<td>1.48</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>2.72</td>
<td>2.49</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>5.36</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>3.31</td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>5.68</td>
<td>-</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>5.13</td>
<td>-</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>3.92</td>
<td>2.44</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>1.76</td>
<td>-</td>
</tr>
<tr>
<td>14</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>3.66</td>
<td>-</td>
</tr>
<tr>
<td>16</td>
<td></td>
<td>3.90</td>
<td>-</td>
</tr>
<tr>
<td>17</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>18</td>
<td></td>
<td>-</td>
<td>2.10</td>
</tr>
<tr>
<td>19</td>
<td></td>
<td>3.04</td>
<td>-</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>21</td>
<td></td>
<td>4.37</td>
<td>-</td>
</tr>
<tr>
<td>22</td>
<td></td>
<td>3.15</td>
<td>2.75</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td>3.83</td>
<td>2.94</td>
</tr>
<tr>
<td>SD</td>
<td></td>
<td>1.12</td>
<td>1.33</td>
</tr>
</tbody>
</table>

<sup>a</sup> First seven student teachers are the future teachers
<sup>b</sup> The Teaching Approach Instrument (Boone, 1988) was utilized to analyze the audiotapes. Scores can range from 1 to 7 with the higher the score indicating the greater the extent of use of the problem-solving approach.
lack of respect for the student teachers was very evident in what was said by the students in the classes. Student teachers demonstrated a lack of knowledge in knowing how to handle the situations.

**Interviews.**

At the beginning of the quarter that directly followed the student teaching experience, interviews with every student teacher were conducted by the researcher. All of the interviews were audio-recorded. A variety of questions were used to determine the extent to which each student teacher had used the problem-solving approach during student teaching.

Student teachers were asked to assess the extent to which they had used the problem-solving approach to teaching. A five-point scale was used with the following headings:

1. Almost never or never
2. Sometimes
3. About half the time
4. Frequently
5. Almost always or always

One student teacher selected the number 5 response, 10 chose the number 4 response, six chose the number 3 response, three selected the number 2 response, and two student teachers selected 1. The mean score for the entire group was 3.23. Seventeen student teachers' self-assessments of the extent to which they had used the problem-solving approach were at the level 3 or above, indicating that the problem-solving approach was being utilized at least 50% or more of the time.

The student teachers were asked to assess the extent to which they understood the problem-solving approach. A seven-point scale was used for this self-assessment where 1 on the scale equaled no understanding of the problem-solving approach and 7 indicated complete understanding. A rating of 3 was chosen by one student teacher, four student teachers indicated a rating of 4, 10 student teachers selected a rating of 5, six student teachers selected a rating of 6, and one student teacher selected a rating of 7. The mean score for the group was 5.09.

As part of this question, the student teachers were asked how their understanding had changed since the completion of the methods course. Nine student teachers indicated that they had developed a better understanding of the problem-solving approach due to their student teaching experience. Eleven student
teachers indicated that there was no change in their understanding of the problem-solving approach. Two student teachers indicated that their understanding had decreased.

A similar seven-point scale was used to determine if the student teachers had the skills necessary to implement the problem-solving approach into their teaching. One was used to indicate no skills and 7 indicated complete skill in being able to use the problem-solving approach. The mean score for the group was 4.57.

The student teachers were asked if they felt that the problem-solving approach was a difficult teaching approach to use in the classroom. Seventeen students answered that they felt the problem-solving approach was difficult to use. Five students felt that the problem-solving approach fit teaching vocational agriculture very well and was not difficult to use. Some of the reasons given for it being difficult to use were as follows:

- Student either lacked good supervised occupational experience (SOE) or had no SOE projects.
- The beginning of the lesson was very difficult. Starting the lesson, getting objectives, and setting up the problem were the most difficult parts.
- The problem-solving approach required a lot of planning to prepare.
- Students did not respond very well due to lack of knowledge concerning the problem-solving approach and due to lack of knowledge about agricultural topics.

The five students who felt that the problem-solving approach was not difficult stated that it fit very naturally into teaching vocational agriculture. After the initial problems of starting the lesson and getting the objectives stated, the problem-solving approach was much easier to use and the student teachers were successful in using the teaching approach.

A related question concerned restrictions that the student teachers had encountered in using the problem-solving approach. Eight student teachers indicated that subject matter was a problem. Seven student teachers indicated that the time factor was another major concern, in the areas of class preparation and getting the unit started. Another restriction was that certain subjects are not adaptable for use with the problem-solving approach. The subject matter areas were restrictive because no problem or felt need to know could be generated within the high school students in the classroom. A general lack of knowledge of
agricultural subjects by the high school students caused difficulties. Another area that restricted the use of the problem-solving approach was a lack of technical knowledge on the part of the student teachers. Four student teachers expressed a lack of competency in the subject matter area that they had taught. One student teacher made the following statement regarding the area of subject matter: "If the curriculum fits the needs of the area, then the problem-solving approach was not a problem. The subject matter needs to fit the needs of the area." The extent to which students had Supervised Occupational Experience (SOE) projects was also a major problem. The generation of problems based on SOE projects was very difficult due to the general lack of student SOE projects. Also, the knowledge of agriculture was hindered because of lack of exposure of the high school students to problems in their SOE projects. The SOE problem is in part due to the types of students in the classroom. More and more nonagricultural students are entering vocational agriculture programs with very limited, if any, knowledge of agriculture.

When student teachers were asked if the problem-solving approach was a viable, workable approach to teaching vocational agriculture, unanimous "yes" was the reply. All felt that the problem-solving approach did fit into the vocational agriculture program. Half of the student teachers felt that they could use it all the time or nearly 100% of the time, whereas the other half felt that there were limits to when the problem-solving approach could be utilized.

The student teachers were asked how the cooperating teachers had either helped and/or hindered them in their use of the problem-solving approach. The consensus was that the cooperating teachers helped very little in this particular area. The following concerns of the student teachers were expressed:

- "He didn't help us at all. They only time he observed us was when the supervising professor would visit."

- "He didn't! He looked at what we had planned and then he said if you want to try anything - then try it."

- "Help - not at all. He didn't use the problem-solving approach."

- "I can't really say that he did (help me). When we went over things, he would just ask how is it going."

- "He never watched me teach and I never got the chance to watch him teach."

- "He let me teach any way I felt that I could succeed."
The most positive comment was regarding the help that was given in the area of questioning. Some cooperating teachers did advise the student teachers on how to improve their questioning techniques. Some of the cooperating teachers looked at the lesson plans and gave some guidance in classroom teaching techniques.

Student teachers are visited three times during the quarter by a university professor who is to assist and give guidance to the student teachers. The student teachers were asked if the supervising professor aided and/or hindered the extent to which they had utilized the problem-solving approach. Every student teacher indicated that the supervising professor did nothing to hinder the use of the problem-solving approach. Six student teachers indicated that they had, to a limited extent, received help and guidance from the supervising professor regarding the use of the problem-solving approach. Fourteen student teachers stated that the supervising professors helped with organizing lessons and questioning techniques. Two student teachers stated that they received very little help at all from the cooperating professors.

**Instruments and tape analysis correlations.**

To determine the relationship between the data from the three problem-solving instruments and two audiotape analyses, Pearson Product Moment correlations were calculated. The purpose was to determine if the various groups, assessment of the extent of the use of the problem-solving approach were in agreement with each other. Table 16 reports the correlations for these comparisons.

The correlation between the assessment of the student teachers' extent of use of the problem-solving approach by the cooperating teacher and the self-assessment by the student teachers was low \((r = .28)\) and positive. The similar correlation between the supervising professors' appraisal and the student teachers' self-assessment resulted in a low and positive correlation value of \(r = .22\). The extent of use of the problem-solving approach by the student teachers as assessed by the cooperating teachers and the supervising professors did not agree with the self-assessment of the student teachers. There was agreement between the cooperating teachers and the professors regarding their perceptions of the student teachers' extent of use of the problem-solving approach. The correlation was \(r = .71\), indicating a strong, positive relationship. This correlation indicates that the cooperating teachers and supervising professors were in
Table 16
Pearson Product Moment Correlations between Five Measures Assessment of the Extent of Use of the Problem-Solving Approach by Student Teachers during Student Teaching

<table>
<thead>
<tr>
<th></th>
<th>Problem-Solving Instrument (Student Teachers)</th>
<th>Problem-Solving Instrument (Cooperating Teachers)</th>
<th>Problem-Solving Instrument (Supervising Professors)</th>
<th>Analysis of Audiotape 1 (Student Teaching)</th>
<th>Analysis of Audiotape 2 (Student Teaching)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem-Solving</td>
<td>1.00</td>
<td>.28 (N = 22)</td>
<td>.22 (N = 22)</td>
<td>.20 (N = 15)</td>
<td>.57 (N = 7)</td>
</tr>
<tr>
<td>Instrument</td>
<td>Student Teachers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooperating</td>
<td>1.00</td>
<td>.71 (N = 22)</td>
<td>.48 (N = 15)</td>
<td>-.11 (N = 7)</td>
<td></td>
</tr>
<tr>
<td>Teachers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supervising</td>
<td>1.00</td>
<td>.54 (N = 15)</td>
<td>.13 (N = 7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Professors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analysis of</td>
<td>1.00</td>
<td></td>
<td></td>
<td>.76 (N = 7)</td>
<td></td>
</tr>
<tr>
<td>Audiotape 1</td>
<td>(Student Teaching)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Student Teaching)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
agreement in terms of their assessment of the extent of use of the problem-solving approach as used by the student teachers.

The correlation between the supervising professors' assessment of the extent of use of the problem-solving approach by the student teachers and the first audiotape class session analysis was substantial ($r = .54$) and positive. The correlation between the supervising professors' appraisal and the second audiotape class session analysis resulted in a low and positive correlation value of $r = .13$. There was a low $N$ of only seven subjects.

The correlation between the cooperating teachers' appraisal of the student teachers and the first class session tape analysis of the student teachers resulted in a positive correlation value of $r = .48$, indicating that a moderate relationship did exist. When the cooperating teachers' appraisal of the student teachers was correlated with the second class session tape analysis of the student teachers, no relationship was found.

The correlation that resulted when the first and second tape class session analyses were compared was strongly positive ($r = .76$). The researcher did the analysis of the audiotapes using the Boone instrument. These two measures of the extent of use of the problem-solving approach by the student teachers were in very strong agreement.

The correlation between the student teachers' self-assessment and the two audiotape analyses were low ($r = .20$) and substantial ($r = .57$) and positive. It should be noted that for the first class session analysis, $N=15$, for the second analysis, $N=7$.

As can be seen, the results are mixed. The student teachers', cooperating teachers', and supervising professors' assessments of the extent of use of the problem-solving approach by student teachers and the researcher's class tape analysis are not in very close agreement in their assessment of the extent of use of the problem-solving approach by the student teachers. The supervising professors and cooperating teachers were the most similar in their assessments of the student teachers' extent of use of the problem-solving approach. These two measures also had moderately strong relationship with the analysis of audiotape one ($r = .48$ and $r = .54$), respectively. This would seem to indicate that the supervising professors and cooperating teachers are moderately similar in their assessment of the extent of use of the problem-solving approach by student teachers.
The fourth research question concerned the relationship between the extent to which student teachers had used the problem-solving approach and the extent to which these student teachers used the problem-solving approach during their first year of teaching. Does the student teaching experience concerning the use of the problem-solving approach have any relationship to future use of the problem-solving approach during the first year of teaching? Is there a relationship and if so, to what extent?

To arrive at an answer to this research question, the data that had been collected regarding the extent of use of the problem-solving approach in student teaching were correlated with the data that had been gathered to determine the extent of use of the problem-solving approach in the first year of teaching. These Spearman rank-order correlations were calculated and Table 17 reports the results.

There was no relationship between the student teachers' self-appraisals of the extent of use of problem-solving during student teaching and the four measurements used to determine the extent of use of the problem-solving approach during the first year of teaching.

The two analyses of audiotape student teaching class sessions were correlated with the two problem-solving instruments and two audiotape analyses that determined the extent of use of the problem-solving approach during the first year of teaching. The eight resulting correlations (see Table 17) were all negative. A small N did exist for each correlation, which reduces the reliability of these data. It is unclear why these data were in such contrast to the rest of the data in Table 17. It could be that the extent of use of the problem-solving approach that was reported and what actually was occurring in the classroom were opposite of each other. The variable that did have a substantial relationship with the extent to which the problem-solving approach was utilized during the first year of teaching was the cooperating teachers' appraisal of the extent student teachers used the problem-solving approach. The two correlations that resulted when the cooperating teachers' appraisals were correlated with the two problem-solving instruments concerning the extent of use of the problem-solving approach during the first year of teaching were strong (r = .75) and substantial (r = .67) and positive. The relationship between the cooperating teachers' assessment of the
Table 17
Spearman Rank-Order Correlations: Extent of Use of Problem-Solving during First Year of Teaching and Measurements during Student Teaching

<table>
<thead>
<tr>
<th>Student Teaching Data Sources</th>
<th>Problem-Solving Instrument First-Year Teacher</th>
<th>Problem-Solving Instrument Cooperating Teacher</th>
<th>Problem-Solving Instrument Supervising Professor</th>
<th>Analysis of Audiotape 1 Student Teaching</th>
<th>Analysis of Audiotape 2 Student Teaching</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem-Solving Instrument First-Year Teacher (Time 1)</td>
<td>.04 (N = 7)</td>
<td>.71 (N = 7)</td>
<td>-.24 (N = 7)</td>
<td>-.43 (N = 5)</td>
<td>-.55 (N = 4)</td>
</tr>
<tr>
<td>Problem-Solving Instrument First-Year Teacher (Time 2)</td>
<td>.14 (N = 7)</td>
<td>.67 (N = 7)</td>
<td>-.26 (N = 7)</td>
<td>-.63 (N = 5)</td>
<td>-.8 (N = 4)</td>
</tr>
<tr>
<td>Analysis of Audiotape First-Year Teacher (Time 1)</td>
<td>.04 (N = 7)</td>
<td>.81 (N = 7)</td>
<td>.42 (N = 7)</td>
<td>-.18 (N = 5)</td>
<td>-.4 (N = 4)</td>
</tr>
<tr>
<td>Analysis of Audiotape First-Year Teacher (Time 2)</td>
<td>.26 (N = 6)</td>
<td>.33 (N = 6)</td>
<td>.33 (N = 6)</td>
<td>-.65 (N = 4)</td>
<td>-.5 (N = 3)</td>
</tr>
</tbody>
</table>
student teachers' extent of use of the problem-solving approach and the two first year of teaching audiotape analyses were strong ($r_s = .81$) and moderate ($r_s = .33$) and positive. Substantial positive relationship existed for three of the four variables. These findings indicate that the cooperating teachers' assessments of the extent of use of the problem-solving approach by the student teachers are a good indicator of the future extent of use of the problem-solving approach by first-year teachers.

The results were mixed when a comparison was made of the correlations between the supervising professors' assessments of the student teachers' extent of use of the problem-solving approach during student teaching and the four measures of the extent of use of the problem-solving approach during the first year. The correlations between the supervising professors' assessments of the student teachers' extent of use of the problem-solving approach and the two analyses of the first year of teaching audiotapes were moderate ($r_s = .42$ and $r_s = .33$) and positive. There was no relationship between the supervising professors' assessment of the student teachers' extent of use of the problem-solving approach and the two first-year teachers' problem-solving instruments. These findings indicate that the supervising professors' assessments of the extent student teachers' use of the problem-solving approach are not good indicators of future extent of use of the problem-solving approach during the first year of teaching.

The Extent to which the Cooperating Teacher Used the Problem-Solving Approach During Student Teaching

The measurement of the extent to which cooperating teachers used the problem-solving approach during the student teaching period was accomplished by using two instruments. First, the cooperating teachers were asked to assess their extent of use of the problem-solving approach. The second instrument was administered to the student teacher. The student teachers were asked to assess each of their cooperating teachers' extent of use of the problem-solving approach during their student teaching experience. The problem-solving approach instrument was used in both cases.

The 25 question instrument was the same instrument that had been administered to obtain the information concerning the student teachers' extent of use of the problem-solving approach. A score of 75 points was the midpoint of the possible range of scores for the instrument. The cooperating teachers' self-
assessments produced 13 scores out of a possible 16 cooperating teachers' scores that fell at or above 75 points. There were only 16 cooperating teachers because two student teachers were placed in the same school in six cases. The range of scores was from a high of 98 to a low of 58. The mean score was 82.4 with a standard deviation of 10.3 (see Table 18). The rank ordering of the cooperating teachers had the seven cooperating teachers of the first-year teachers dispersed throughout the group.

The student teachers did an assessment of the cooperating teachers' extent of use of the problem-solving approach. Eleven of the 22 cooperating teachers received a score of 75 points or higher. The range of scores was from a high of 93 to a low of 48. The mean score was 76.2 with a standard deviation of 11.9 (see Table 18). The distribution of the seven cooperating teachers of the first-year teachers was even throughout the group.

The cooperating teachers appraised themselves higher than the student teachers had assessed the cooperating teachers. The cooperating teachers' assessment had 81% of the cooperating teachers receiving a score of 75 points or above. The student teachers' assessment resulted in 50% of the cooperating teachers receiving a score at or above the midpoint of the possible range of scores (75) for the instrument.

A Pearson Product Moment correlation coefficient was calculated to determine the relationship between the student teachers' assessment of the cooperating teachers and the cooperating teachers' self-assessment regarding the extent of use of the problem-solving approach. The correlation was $r = .40$ ($N = 22$) indicating moderate agreement between the two measures of the extent to which cooperating teachers used the problem-solving approach during the student teaching period.

Relationship between the Extent to which Cooperating Teachers Used the Problem-Solving Approach and the Extent to which First-Year Teachers Used the Problem-Solving Approach

Spearman rank-order correlation coefficients were calculated to determine if the extent of use of the problem-solving approach by cooperating teachers had any relationship with the future use of the problem-solving approach by their student teachers during the first year of teaching. Were first-year teachers influenced in their use of the problem-solving approach by the extent of use of the problem-solving approach by their cooperating teacher? The two measures of the extent of use of the problem-solving approach by the cooperating teachers were correlated with the two problem-solving instruments and the two
Table 18
Cooperating Teachers' Extent of Use of the Problem-Solving Approach as Determined by the Cooperating Teachers and Student Teachers

<table>
<thead>
<tr>
<th>Cooperating Teachers</th>
<th>Problem-Solving Instrument</th>
<th></th>
<th>Problem-Solving Instrument</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cooperating Teachers</td>
<td>Rank</td>
<td>Student Teachers</td>
<td>Rank</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Order</td>
<td></td>
<td>Order</td>
</tr>
<tr>
<td>1</td>
<td>88</td>
<td>9</td>
<td>87</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>87</td>
<td>10</td>
<td>48</td>
<td>22</td>
</tr>
<tr>
<td>3</td>
<td>75</td>
<td>17</td>
<td>71</td>
<td>16</td>
</tr>
<tr>
<td>4</td>
<td>87</td>
<td>10</td>
<td>88</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>82</td>
<td>14</td>
<td>88</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>69</td>
<td>20</td>
<td>65</td>
<td>20</td>
</tr>
<tr>
<td>7</td>
<td>90</td>
<td>6</td>
<td>68</td>
<td>18</td>
</tr>
<tr>
<td>8</td>
<td>78</td>
<td>16</td>
<td>74</td>
<td>12</td>
</tr>
<tr>
<td>9</td>
<td>90</td>
<td>6</td>
<td>70</td>
<td>17</td>
</tr>
<tr>
<td>10</td>
<td>90</td>
<td>6</td>
<td>78</td>
<td>10</td>
</tr>
<tr>
<td>11</td>
<td>84</td>
<td>13</td>
<td>93</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>96</td>
<td>2</td>
<td>90</td>
<td>2</td>
</tr>
<tr>
<td>13</td>
<td>64</td>
<td>21</td>
<td>71</td>
<td>15</td>
</tr>
<tr>
<td>14</td>
<td>92</td>
<td>3</td>
<td>74</td>
<td>12</td>
</tr>
<tr>
<td>15</td>
<td>91</td>
<td>4</td>
<td>86</td>
<td>7</td>
</tr>
<tr>
<td>16</td>
<td>91</td>
<td>5</td>
<td>75</td>
<td>11</td>
</tr>
<tr>
<td>17</td>
<td>82</td>
<td>14</td>
<td>72</td>
<td>14</td>
</tr>
<tr>
<td>18</td>
<td>85</td>
<td>12</td>
<td>85</td>
<td>8</td>
</tr>
<tr>
<td>19</td>
<td>98</td>
<td>1</td>
<td>89</td>
<td>3</td>
</tr>
<tr>
<td>20</td>
<td>75</td>
<td>17</td>
<td>80</td>
<td>9</td>
</tr>
<tr>
<td>21</td>
<td>58</td>
<td>22</td>
<td>68</td>
<td>18</td>
</tr>
<tr>
<td>22</td>
<td>75</td>
<td>17</td>
<td>55</td>
<td>21</td>
</tr>
</tbody>
</table>

Mean 82.4 76.2
SD 10.3 11.9

---

aFirst seven cooperating teachers were the cooperating teachers of the first-year teachers.
bThe range of scores on the problem-solving instrument was from 25 to 125. The higher the number, the greater the extent of use of the problem-solving approach.
audiotape analyses that were used to determine the extent of use of the problem-solving approach by first-year teachers. Table 19 contains these results.

The correlations between the cooperating teachers' self-assessment and assessments of first-year teachers' extent of use of the problem-solving approach resulted in mixed evidence. When the cooperating teachers' self-assessment was correlated with the four measurements of the extent of use of the problem-solving approach by the first-year teachers, two types of relationships resulted. There was no relationship between the cooperating teachers' self-assessment of their use of problem solving during student teaching and the problem-solving instrument as completed by the first-year teachers indicating their extent of use of the approach. The correlations between the cooperating teachers' extent of use of the problem-solving approach and the analyses of the first-year teachers' audiotapes were moderate ($r_a = .42$ and $r_a = .33$) and positive. These two coefficients indicate that there is some relationship between the extent to which cooperating teachers utilized the problem-solving approach during student teaching and the extent to which their student teachers used the problem-solving approach during their first year of teaching. When all four correlations are considered, it is difficult to get a clear picture of the extent of influence that the cooperating teachers had concerning the first-year teachers' extent of use of the problem-solving approach. Some influence is possible but the degree of influence is quite variable. The cooperating teachers' self-assessment would not be a good indicator of the future extent of use of the problem-solving approach by first-year teachers.

The second group of correlations presented a slightly different picture. The correlations between the student teachers' assessment of the cooperating teachers and the two problem-solving instruments used to measure the extent of use of the problem-solving approach by the first-year teachers were very strong and positive ($r_a = .74$) and substantial and positive ($r_a = .67$). The correlations between the student teachers' assessment of the cooperating teachers' extent of use of the problem-solving approach and the two audiotape analyses of the first-year teachers' extent of use of the problem-solving approach were moderate and positive ($r_a = .38$) for the first analysis and no relationship for the second analysis. With three of the four correlations being positive, the student teachers' assessment of the cooperating teachers' extent of use of the
Table 19
Spearman Rank-Order Correlations between Extent of Use of the Problem-Solving Approach by Cooperating Teachers and the Extent of Use of the Problem-Solving Approach by First-Year Teachers

<table>
<thead>
<tr>
<th></th>
<th>Assessment of Cooperating Teacher</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First-Year Teacher Data Collection</td>
</tr>
<tr>
<td>Problem-Solving Instrument</td>
<td>First-Year Teacher (Time one)</td>
</tr>
<tr>
<td>Problem-Solving Instrument</td>
<td>First-Year Teacher (Time two)</td>
</tr>
<tr>
<td>Analysis of Audiotape</td>
<td>First-Year Teacher (Time one)</td>
</tr>
<tr>
<td>Analysis of Audiotape</td>
<td>First-Year Teacher (Time two)</td>
</tr>
</tbody>
</table>
problem-solving approach would be a fair indicator of the future extent of use of the problem-solving approach by these student teachers in their first year of teaching. With there being no relationship in the one correlation, the results are not as supportive of the relationship between the cooperating teachers' extent of use of the problem-solving approach, as assessed by the student teachers, and the extent of use of the problem-solving approach by first-year teachers.

Chapter Summary

The extent of use of the problem-solving approach by the seven first-year teachers was measured by the administration of two problem-solving instruments that indicated the teachers' perceptions of the extent to which they used teaching behaviors and practices that describe a problem-solving approach to teaching. The problem-solving instruments were administered in the autumn of 1988 and the spring of 1989. Class sessions were also audio-recorded during these two visits to the first-year teachers and later analyzed to determine the extent that problem-solving teaching behaviors and practices were demonstrated.

The seven first-year teachers' responses to the problem-solving instrument indicated that the teachers perceived they were using teaching behaviors and practices that describe a problem-solving approach to teaching. Scores on both administrations of the problem-solving instrument were consistently higher than the midpoint of the possible range of scores for the instrument. The Spearman rank-order correlation between the two administrations of the problem-solving instrument was strong and positive ($r_s = .88$). The analysis of the two audiotape class sessions of the first-year teachers indicated that the teachers were using problem-solving behaviors and practices in their teaching. The scores yielded by the analysis of the audiotapes were consistently above the midpoint of the range of possible scores for the analysis. The Spearman rank-order correlation between the scores resulting from the analyses of the two audiotapes was moderate and positive ($r_s = .54$). The relationship between the two measures of the teachers' perceptions of the extent of use of the problem-solving approach as determined by the problem-solving instrument and the scores from the analysis of the first audiotape was moderate ($r_s = .49$) to substantial ($r_s = .68$) and positive. There was no relationship between the two measures of the teachers' perceptions of the extent of use of the
problem-solving approach (problem-solving instrument) and the scores from the analyses of the second audiotapes. The first-year teachers expressed during interviews that they believed in the problem-solving approach as an instructional approach and that they planned to use it more extensively in the future. Difficulties in using the problem-solving approach were also expressed by the first-year teachers. The time required to prepare lessons and to get the lessons started was a concern. The teachers expressed that it was difficult to use the problem-solving approach in teaching certain subject matter. Further, they stated that the problem-solving approach could not be used 100 percent of the time; that at times other instructional approaches seemed more appropriate.

The extent of use of the problem-solving approach in the methods course by the future seven first-year teachers correlated substantially and positively with the extent of use of the problem-solving approach in the first year of teaching by those seven teachers. In interviews, the students expressed confidence in the problem-solving approach as a viable, workable instructional approach. They also stated that they planned to use the problem-solving approach during their student teaching. One concern expressed was regarding the amount of time required to prepare lesson plans that incorporated the problem-solving approach. The data indicate that the extent of use of the problem-solving approach in the methods course is one indicator of the extent of use of the problem-solving approach during the first year of teaching.

The general problem-solving ability of the seven students was related positively to the extent of use of the problem-solving approach during the first year of teaching. The Spearman rank-order correlations between general problem-solving ability and the extent of use of the problem-solving approach as measured by the two problem-solving instruments were substantial ($r_s = .64$, $r_s = .60$) and positive. The relationship between general problem-solving ability and the analysis of the first audiotape was moderate ($r_s = .32$) and positive. There was no relationship between general problem-solving ability and the analysis of the second audiotape.

The extent of use of the problem-solving approach during student teaching by the seven future teachers had a low association with the extent of use of the problem-solving approach during the first year of teaching. The correlations between the two analyses of student teaching audiotapes with the two problem-solving instruments (first-year teachers) and the two analyses of audiotape (first-year teachers) were
negative. The extent of use of the problem-solving approach as determined by the student teachers’ perceptions on the problem-solving instrument correlated lowly with the four measures of the dependent variable. The four measures being the two problem-solving instruments and the two analyses of the first-year teachers’ audiotapes.

The cooperating teachers’ assessment of the student teachers’ extent of use of the problem-solving approach as determined by the problem-solving instrument correlated strongly positive \((r_s = .71)\) and substantially positive \((r_s = .67)\) with the extent of use of the problem-solving approach of first-year teachers as determined by the two problem-solving instruments. The relationships between the cooperating teachers assessment of the student teachers’ extent of use of the problem-solving approach as determined by the problem-solving instrument and the two analyses of the first-year teachers’ audiotapes were strong \((r_s = .81)\) and moderate \((r_s = .33)\) and positive. The relationship between the extent of use of the problem-solving approach by student teachers as assessed by the supervising professors and the extent of use of the problem-solving approach by first-year teachers was low.

The student teachers reported in interviews that cooperating teachers did not provide enough assistance and support during student teaching concerning the use of the problem-solving approach. Difficulties in using the problem-solving approach were also identified. The amount of time required in lesson preparation, getting the lesson started and objectives stated, and problems with utilizing the problem-solving approach with certain subject matter were some of the difficulties mentioned. The student teachers did state that they believed that the problem-solving approach was a viable, workable, instructional approach and that they planned on using it in the future. The data indicate that the extent of use of the problem-solving approach during student teaching is not an indicator of the future use of the problem-solving approach during the first year of teaching.

The relationship between the extent of use of the problem-solving approach by the cooperating teacher and the extent of use of the problem-solving approach by first-year teachers was unclear. The responses of the cooperating teachers to the problem-solving instrument indicated that the cooperating teachers perceived that they were using the problem-solving approach in their teaching. No relationship
existed between this instrument and the two first-year teachers' problem-solving instruments. The correlations between the cooperating teachers' perceptions on the problem-solving instrument and the analyses of the two first-year teacher audiotapes were moderate ($r_s = .42$ and $r_s = .33$) and positive. The student teachers' perception of the cooperating teachers' extent of use of the problem-solving approach as indicated by responses on the problem-solving instrument was that the cooperating teachers were using the problem-solving approach to a limited degree. The correlation between the measures of the extent of use of the problem-solving approach by the cooperating teachers as indicated by responses on the problem-solving instrument by the cooperating teachers and the student teachers was moderate ($r_s = .42$) and positive. The relationship between the student teachers' perceptions of the cooperating teachers as indicated by responses on the problem-solving instrument and the extent of use of the problem-solving approach by first-year teachers as determined by responses on the problem-solving instrument were strong ($r_s = .74$) and substantial ($r_s = .67$) and positive. The relationship between the student teachers' perceptions of the cooperating teachers' extent of use of the problem-solving approach as indicated on the problem-solving instrument and the analysis of the two first-year teachers' audiotapes were moderate and positive ($r_s = .38$) and no relationship. The student teachers' assessments of the cooperating teachers' extent of use of the problem-solving approach correlated in a slightly more positive direction with the extent of use of the problem-solving approach by the first-year teachers.
CHAPTER V
SUMMARY, CONCLUSIONS, DISCUSSION, AND RECOMMENDATIONS

Purpose of the Study.
The purpose of this study was to determine the extent to which first-year teachers of vocational agriculture use the problem-solving approach in their teaching. The use of the problem-solving approach to teaching by the teachers in the study was observed during microteaching in the methods course, while they were student teaching and during their first year of teaching.

The objectives of the study were the following:
1. To determine the extent to which first-year vocational agriculture teachers used the problem-solving approach to teaching.
2. To determine the relationship between the extent to which the problem-solving approach to teaching was utilized by agricultural education undergraduates in the microteaching portion of their methods course and the extent to which they use the problem-solving approach in their first year of teaching vocational agriculture.
3. To determine the relationship between agricultural education undergraduates' general problem-solving ability and the extent to which they used the problem-solving approach to teaching in their first year of teaching vocational agriculture.
4. To determine the relationship between the extent to which student teachers used the problem-solving approach during student teaching and the extent to which they utilized the problem-solving approach during the first year of teaching vocational agriculture.
5. To determine the relationship between the extent to which the cooperating teachers of the first-year teachers utilized the problem-solving approach to teaching during the student teaching experience and the extent to which these first-year teachers used the problem-solving approach to teaching.

Procedure

There were a total of 22 students in the study when data collection began with the methods courses in spring quarter of 1987 and autumn quarter of 1987. Seven of these students entered the vocational agriculture teaching profession in the autumn of 1988. These seven first-year teachers composed the group utilized to determine the extent of use of the problem-solving approach during the first year of teaching.

During the methods course and student teaching, data were collected from all 22 students. A comparison of mean scores for the seven first-year teachers and the other 15 students who did not enter teaching concerning the extent of use of the problem-solving approach during the methods course and student teaching was performed. This comparison included the microteaching videotape analyses; the perceptions of the student teachers, cooperating teachers, and supervising professors as recorded on problem-solving instruments regarding the extent of use of the problem-solving approach by student teachers; and the analyses of two audiotapes of student teachers’ extent of use of the problem-solving approach. The comparison of mean scores indicated that the seven students who entered teaching were similar to the 15 students who did not enter teaching in the autumn of 1988.

The 22 students entering the methods course in spring quarter of 1987 and autumn quarter of 1987 were observed through the methods courses including the collection of data regarding the extent of use of the problem-solving approach. The data were gathered by analyzing the third microteaching lab videotape. The analyses of the tapes were done by utilizing the Teaching Approach Instrument (Boone, 1988), which provides a measurement of the extent of use of the problem-solving approach. The students were interviewed at the end of the quarter concerning their perceptions and attitudes regarding the problem-solving approach. A general problem test, the Cornell Critical Thinking Test-Level Z, was also administered at the conclusion of the quarter of enrollment in the methods course.
Data concerning the student teaching experience were collected in the autumn quarter of 1987 and the winter quarter of 1988. Data were collected from the 22 student teachers, their cooperating teachers, and the supervising professors by using a problem-solving instrument. The instrument measured the perceptions of these three groups concerning the extent of use of the problem-solving approach of the student teachers.

Audiotapes made at two points during the quarter of student teaching provided additional data. These audiotapes were analyzed using the Teaching Approach Instrument (Boone, 1988) to determine the extent of use of the problem-solving approach by the student teachers. These student teachers were also interviewed during the beginning of the quarter that immediately preceded the student teaching experience.

The seven students who entered teaching in the autumn of 1988 constituted the group of first-year teachers. Data were gathered at two points, the end of November and the beginning of December 1988 and in May 1989, during the first year of teaching. During each visit the first-year teachers gave their perceptions of the extent of use of the problem-solving approach by completing a problem-solving instrument. A class session was audio-recorded and later analyzed by using the Teaching Approach Instrument (Boone, 1988). An interview was conducted during each data-gathering visit.

Correlations were calculated for the various relationships investigated in the study.

**Summary of Findings**

**The extent of use of the problem-solving approach by first-year teachers**

The extent of use of the problem-solving approach by the seven first-year teachers was measured by two administrations of the problem-solving instrument indicating the teachers’ perceptions of the extent to which they used teaching behaviors and practices that describe a problem-solving approach to teaching. Class sessions of the first-year teachers were audiotaped at two times during the year to provide additional data the better to measure the extent to which problem-solving teaching behaviors and practices were demonstrated.

Teaching behaviors and practices that describe a problem-solving approach to teaching were being utilized by the seven first-year teachers as indicated by their perceptions on the problem-solving instrument.
Scores on the problem-solving instrument, for both administrations of the instrument, consistently were higher than the midpoint of the possible range of scores for the instrument. The Spearman rank-order correlation between the scores from the two administrations of the problem-solving instrument was strong and positive ($r_s = .88$). A further indication that the teachers were using problem-solving behaviors and practices in their teaching was provided by the analyses of two audiotape recordings of the first-year teachers. The scores yielded by the analyses of the audiotapes were consistently above the midpoint of the range of possible scores for the analysis. The relationship between the scores resulting from the analyses of the two audiotapes was moderate and positive ($r_s = .54$). The relationships between the two measures of the teachers' perceptions of the extent of use of the problem-solving approach as determined by the problem-solving instrument and the scores from the analysis of the first audiotape were moderately ($r_s = .49$) to substantially ($r_s = .68$) positive. There were no relationships between the two measures of teachers' perceptions (problem-solving instrument) and the scores from the analysis of the second audiotape.

Interviews were conducted during the two visits to the first-year teachers. The seven first-year teachers all stated that the problem-solving approach was a viable instructional approach and that they planned to use it more in the future. They all believed that the problem-solving approach was well suited for use in the vocational agriculture classroom. Some difficulties in using the problem-solving approach were identified: the problem-solving approach is very time consuming in the preparation of lessons, getting lessons started and objectives clarified requires a lot of time, and certain subject areas are difficult to teach using the problem-solving approach.

**Relationships between methods course experience and extent of use of the problem-solving approach during first year of teaching**

The analysis of the videotapes of the third microteaching performance of students during the methods course produced data indicating the extent students demonstrated the problem-solving approach during the methods course. The videotapes were analyzed using the Teaching Approach Instrument (Boone, 1988). Scores on the Teaching Approach Instrument exceeded the midpoint of possible range of scores for the instrument indicating that the students were demonstrating problem-solving teaching behaviors and
practices. During interviews following the completion of the methods course, students expressed strong belief in the problem-solving approach as a viable, workable instructional approach. The students stated that they planned to use the problem-solving approach and believed it to be the best instructional approach to use. Difficulties in using problem solving were identified by some students. They reported that the time required in preparing to use the problem-solving approach is substantial. Another concern was that certain subject areas are difficult to adapt to the problem-solving approach. For the seven first-year teachers a substantial, positive relationship was found between the extent that the problem-solving approach was utilized in the third microteaching session during the methods course and the extent to which the problem-solving approach was utilized in the first year of teaching. The Spearman rank-order correlations between the extent of use of the problem-solving approach during the third microteaching session during the methods course and the extent of use of the problem-solving approach during the first year of teaching as determined by the two self-assessing problem-solving instruments were substantial ($r_s = .55$ and $r_s = .71$) and positive. The Spearman rank-order correlations between the extent of use of the problem-solving approach during the third microteaching session during the methods course and the extent of use of the problem-solving approach during the first year of teaching as assessed by the analysis of the two audiotapes were also substantial ($r_s = .77$ and $r_s = .60$) and positive.

During the quarter that students were enrolled in the methods course, the general problem-solving ability of the students was measured on the Cornell Critical Thinking Test, Level Z. Spearman rank-order correlations between the seven first-year teachers' general problem-solving ability and the extent of use of the problem-solving approach during the first year of teaching as determined by the self-assessing problem-solving instrument were weak ($r_s = -.03$) and moderate ($r_s = .32$) and positive. The Spearman rank-order correlations between the general problem-solving ability of the seven first-year teachers and the extent of use of the problem-solving approach as determined by the audiotape analyses were moderately positive ($r_s = .64$ and $r_s = .60$). The results indicate that the general problem-solving ability is at best a moderately good indicator of extent of use of the problem-solving approach by the seven first-year teachers.
Extent of use of the problem-solving approach by student teachers and its relationship to the use of the problem-solving approach during the first year of teaching

The problem-solving instrument was administered to three groups involved in the student teaching experience: the student teachers, cooperating teachers, and supervising professors. The purpose of the administration of the instruments was to determine the extent of use of the problem-solving approach by student teachers during student teaching. The student teachers' self-assessment, using the problem-solving instrument, indicated that they were using the problem-solving approach to a limited degree. Scores on the problem-solving instrument, for student teachers' self-assessment were slightly higher than the midpoint of the range of possible scores for the instrument. The cooperating teachers' assessments of the student teachers' extent of use of the problem-solving approach, using the problem-solving instrument, indicated a limited use of the problem-solving approach by student teachers. Scores on the problem-solving instrument, for cooperating teachers' assessment of student teachers were slightly higher than the midpoint of the range of possible scores for the instrument. The supervising professors' assessments of the student teachers, using the problem-solving instrument, indicated that student teachers were using the problem-solving approach. Scores on the problem-solving instrument, for supervising professors' assessment of student teachers were consistently higher than the midpoint of the range of possible scores for the instrument. Audio-recorded class sessions of student teachers obtained at two times during student teaching were analyzed by the Teaching Approach Instrument (Boone, 1988). The analyses indicated that the extent of use of the problem-solving approach by the student teachers was limited. Scores yielded by the analyses of the audiotapes were consistently below the midpoint of the range of possible scores for the analyses.

The student teachers were interviewed concerning their perceptions of the problem-solving approach. All of the student teachers expressed the belief that the problem-solving approach was a viable approach to teaching vocational agriculture. Some did feel that the problem-solving approach was difficult to use. Difficulties occurred in the areas of time required for class preparation, certain subject matter areas that were not readily suited to the problem-solving approach, and getting objectives stated. The consensus was that the cooperating teachers had done little to help or to encourage the use of the problem-solving approach by the student teachers.
For the seven first-year teachers, Spearman rank-order correlations were calculated to determine the relationship between the extent of use of the problem-solving approach during student teaching and the extent of use of the problem-solving approach during the first year of teaching. Generally, the extent of use of the problem-solving approach during student teaching was not generally related to the extent of use of the problem-solving approach during the first year of teaching. The correlations between the extent of use of the problem-solving approach during student teaching as determined by the two audiotape analyses and the extent of use of the problem-solving approach during the first year of teaching as determined by the two problem-solving instruments and two audiotape analyses were negative. Generally, the correlations between the extent of use of the problem-solving approach by student teachers as perceived by the student teachers and supervising professors on the problem-solving instrument with the extent of use of the problem-solving approach by first-year teachers were low. The correlations between the extent of use of the problem-solving approach by student teachers as perceived by the cooperating teachers on the problem-solving instrument and the extent of use of the problem-solving approach by first-year teachers as assessed by the problem-solving instrument were strong ($r_s = .71$) and substantial ($r_s = .67$) and positive. The correlations between the extent of use of the problem-solving approach by student teachers as perceived by the cooperating teachers on the problem-solving instrument and the scores resulting from the analyses of the first-year teachers' two audiotape analyses were substantial ($r_s = .81$) and low ($r_s = .33$) and positive.

**Relationship between the cooperating teachers' extent of use of the problem-solving approach and the first-year teachers' extent of use of the problem-solving approach**

The extent of use of the problem-solving approach by cooperating teachers was determined by using the problem-solving instrument. The cooperating teachers did a self-assessment and the student teachers indicated their perceptions of the extent cooperating teachers used the problem-solving approach. When asked the extent to which they used the problem-solving approach during teaching, cooperating teachers responded that they were using the problem-solving approach. This was indicated by scores on the problem-solving instrument that exceeded the midpoint of the range of possible scores for the instrument. The student teachers' perceptions of the cooperating teachers indicated that the cooperating teachers were
using the problem-solving approach to a limited extent. This was indicated by scores on the problem-solving instrument that were below the midpoint of range of possible scores for the instrument.

The cooperating teachers' self-assessments of their extent of use of the problem-solving approach were correlated with the extent of use of the problem-solving approach by first-year teachers as determined by the problem-solving instruments, and no meaningful relationships were found. The cooperating teachers' self-assessments of their extent of use of the problem-solving approach, when correlated with the extent of use of the problem-solving approach by first-year teachers as determined by the two audiotape analyses, indicated a moderate ($r_s = .42$, $r_s = .33$) positive relationship. The student teachers' assessments of the extent cooperating teachers use the problem-solving approach were correlated substantially and positively with the extent of use of the problem-solving approach by first-year teachers as assessed by the problem-solving instrument ($r_s = .74$ and $r_s = .67$). The student teachers' assessments of the extent cooperating teachers used the problem-solving approach were also moderately and positively ($r_s = .38$) correlated with the extent of use of the problem-solving approach by first-year teachers as determined by the analysis of the first audiotape, but there was no relationship for the second audiotape.

Conclusions

First-year teachers of vocational agriculture in this study were using the problem-solving approach. The data and interview responses indicate that the first-year teachers believe in the problem-solving approach and are incorporating it into their classroom teaching. This conclusion is indicated by scores on the problem-solving instrument and analyses of audiotapes. Responses on the interviews indicated that the teachers believed in the problem-solving approach as an instructional approach and planned to use it more extensively in the future. Difficulties in utilizing the problem-solving approach were expressed by the first-year teachers. Some concerns of the first-year teachers were time required for class preparation, getting objectives stated, and the difficulty of using the problem-solving approach in teaching certain subject matter.
The extent of use of the problem-solving approach during the third microteaching lab of the methods course was substantially related to the extent of use of the problem-solving approach by first-year teachers. Students reported in interviews at the completion of the methods course that they believed that the problem-solving approach was a very viable instructional approach and was well suited for teaching vocational agriculture. Difficulties in using the problem-solving approach, such as time required for lesson plan preparation, were also stated. The general problem-solving ability of these students did have a moderate relationship with the future use of the problem-solving approach by first-year teachers.

The extent of use of the problem-solving approach during student teaching had a negligible relationship with the extent of use of the problem-solving approach during the first year of teaching. In interviews at the completion of student teaching, the student teachers expressed a belief in the problem-solving approach as a viable teaching approach but they did experience difficulties in using the instructional approach. Preparation time and getting the class started were two of the expressed concerns.

The extent of use of the problem-solving approach by the cooperating teachers as assessed by the student teachers did have a moderate relationship with the extent of use of the problem-solving approach by first-year teachers.

Recommendations

Based on these conclusions, certain groups need to be made aware of these findings. Agricultural teacher educators need to be aware of the value of the methods course in the preparation of teachers in the use of the problem-solving approach. The student teaching experience, from the standpoint of fostering the use of the problem-solving approach, is in need of review. The results of this study would indicate that the student teaching experience is not developing the abilities of the student teachers to use the problem-solving approach. Changes in the student teaching program could possibly be needed.

Additional research to investigate the relationship between the extent of use of the problem-solving approach in student teaching and the extent of use of the problem-solving approach during the first year of teaching is necessary. The findings of this study would indicate that the student teaching experience is not
enhancing the educational training of the student teachers in the area of using the problem-solving approach. What factors are involved in this finding and what corrective actions are necessary?

University agricultural education teacher preparation programs need to consider if it is practical to teach only the problem-solving approach. Students might be better served if they were taught other instructional approaches.

Cooperating teachers need to be made aware of the influence that they can have concerning future teachers' extent of use of the problem-solving approach. Their involvement in the student teaching experience needs to be greater, especially in the area of instructing and encouraging student teachers in the use of the problem-solving approach. Cooperating teachers need to be selected with more emphasis on their ability to use the problem-solving approach.
Appendix A

Reanalysis of Microteaching Tapes
Figure 3. Reanalysis of Microteaching Tapes
Appendix B

Reanalysis of Student Teaching Tapes
Figure 4. Reanalysis of Student Teaching Tapes
Appendix C

Reanalysis of First-Year Teaching Tapes
Figure 5. Reanalysis of First-Year Teaching Tapes
Appendix D

Combination of All Tape Reanalysis
First Analysis of the 12 Tapes

Figure 6. Combination of All Tape Reanalysis
Appendix E

Interview Explanation for Methods Course Students
Before the interview, state the person's name, date, time, and location of the interview so that it is recorded on the tape.

Hello, (student's name), my name is Steve McKee. I appreciate you taking the time out of your busy schedule for this interview. I am conducting a research project within the department as part of the requirements to complete my dissertation. The study will be to determine the extent to which first year teachers of vocational agriculture utilize the problem-solving approach in their teaching. One factor under consideration is the level of knowledge of the problem-solving approach and how it could relate to actually using the approach. I am trying to determine the level of knowledge of the problem-solving approach that students develop as a result of their being in the methods class.

Your name will not be used in the study and your responses will be kept confidential. Your grade in the methods class will not be affected in any fashion by what you say. I am seeking an honest appraisal of the methods class ability to influence your knowledge of the problem-solving approach.

Do you have any questions about the interview or anything else? I would like to record the interview to facilitate getting your responses accurately. Your responses will be transcribed but your responses will be kept in complete confidence. If you have no questions, then let us begin.
Appendix F

Interview for Methods Course Students
1. Based on your knowledge of the problem-solving approach to teaching, to what extent did you understand the approach before the quarter began? Rate yourself on a scale of 1 to 7 with one meaning on knowledge and seven meaning complete understanding. (Probe to determine what prompted the person to give this rating. If the person had some previous knowledge of the problem-solving approach, what influenced this understanding?)

2. On this same scale, how would you rate your understanding of the problem-solving approach?

3. What contributed to this change or lack of change in knowledge of the problem-solving approach?

4. What part(s) of the classwork was(ware) the most important in influencing the development of the problem-solving approach?

5. What part(s) of the lab work was(ware) the most important in influencing the development of the problem-solving approach?

6. What do you feel has been the least valuable part(s) of the class in aiding your understanding of the problem-solving approach?

7. What part(s) of the lab work was(ware) the least valuable in aiding your knowledge of the problem-solving approach?

8. Was there a particular time or event in the quarter that caused your knowledge of the problem-solving approach to "click" or become clear? What or when was this and why did it affect you in this fashion?

9. Do you view the problem-solving approach as a viable, workable approach to teaching that can be used in your future classroom teaching? Why do you feel this way?

10. Do you think you will use the problem-solving approach in your future teaching? (Ask for some elaboration of their answer.)

11. What personal area(s) do you feel need(s) more development before you will be able to utilize the problem-solving approach effectively in your teaching? How do you plan to achieve this development of knowledge of the problem-solving approach?

12. If you change any part of this quarter's experience, what would it be? Why?

13. What is your overall opinion of the problem-solving approach?
14. Do you have any summary comments?

15. Do you have any suggestions for me to help me improve the interview?

Thank you for your time and responses.
Appendix G

Letter to Cooperating Teachers

Requesting Student Teachers' Assessment
The problem-solving approach to teaching is viewed by The Ohio State University Department of Agricultural Education as being the instructional approach that is best suited for the instruction of vocational agriculture. Students preparing to be teachers of vocational agriculture are given extensive instruction and experience in the utilization of this instructional approach. It is of great interest to the department to determine the extent to which these preservice teachers utilize the problem-solving approach in their actual classroom teaching during their student teaching experience.

I am currently conducting a research project which is concerned with the extent to which the problem-solving approach to teaching is used by preservice teachers during their student teaching experience. This research is being conducted to fulfill the requirements for graduation for a PhD degree in Agricultural Education. The enclosed instrument has been developed to help determine the extent to which the problem-solving approach was utilized by the student teaching during the Autumn Quarter, 1987. Each cooperating teacher is being asked to complete the instrument concerning the student teacher whom they supervised during this quarter.

A very small population has been selected for this study. The population will consist of those preservice teachers who will be student teaching Autumn Quarter, 1987, and Winter Quarter, 1988. It is extremely important that a response is received from all cooperating teachers in this select group.

Your participation will be greatly appreciated. Please complete the instrument and return it in the enclosed envelope. Thank you for your time and valuable information.

Sincerely,

Steven R. McKee, Graduate Student
Department of Agricultural Education
Appendix H

Letter to Cooperating Teachers

Requesting Self-Assessment
First, I would like to express my appreciation to you for your cooperation in returning the instrument(s) regarding your student teacher(s). The information is very valuable to the success of this study.

Your cooperation is needed one more time. Information regarding your personal problem solving skills as determined by a self evaluation is requested. Please fill out and return the enclosed instrument. Your answers will be kept confidential and your input is very valuable. Thank you for your cooperation.

Sincerely,

Steven R. McKee, Graduate Student
Department of Agricultural Education
Appendix I

Problem-Solving Approach Instrument:

Student Teachers' Self-Assessment
Circle the number that most accurately reflects your answer: 1 = Almost Never or Never; 2 = Sometimes; 3 = About Half of the Time; 4 = Frequently; and 5 = Almost Always or Always

1. At the conclusion of a unit of instruction, I required students to develop written plans of practice for their SOE projects.

2. I required students to get information from more than one source before formulating solutions to problems.

3. Students are required to implement the chosen solutions to problems in their SOE projects.

4. I let students decide what reference materials to use to solve problems.

5. At the beginning of each unit of instruction, I give students a list of topics to be studied.

6. When students encounter problems in their SOE projects, I direct students in analyzing possible solutions so that they can determine the best solution for their particular problem.

7. I require that students observe actual situations (e.g., SOE, laboratory, field trips, etc.) to identify problems that need to be studied.

8. I give tests which require students to recall specific information that has been taught.

9. When students encounter problems in their SOE projects, I present the problems in the classroom for study and discussion.

10. At the conclusion of a unit of instructions, I state to students the best solutions to the problems that they have studied.

11. To what extent do you use the problem-solving approach to teaching in your classroom instruction?

12. I let students decide what specific information they should look for in reference materials to find solutions to problems

13. I tell students the information they need to know to arrive at solutions to problems.

14. I require students to analyze their SOE records to find possible solutions to problems that are being studied.

15. I demonstrate to students that more than one solution may be generated for a problem.
16. I require students to conduct experiments to solve problems.

17. I require students to come up with more than one possible solution to a problem before a conclusion is made.

18. I use in my classroom instruction problems that students actually encounter in their SOE program to determine the content for specific instructional units.

19. The students and I jointly determine what is the best solution to a problem that has been raised in a particular instructional unit.

20. I present actual situations from SOE programs, the laboratory, and field trips for students to identify problems that need to be studied.

21. I use in my classroom instruction problems that students actually encounter in the school laboratory to determine the content for specific instructional units.

22. At the conclusion of a unit of instruction, I require students to develop written plans of practice for laboratory exercises.

23. At the conclusion of a unit of instruction, I state to students the reasons underlying the best solutions to the problems they have studied.

24. I give assignments which require students to apply the specific knowledge learned in the classroom.

25. At the beginning of a unit of instruction, I involve students in developing a list of problems that determine what will be taught.
Appendix J

Problem-Solving Approach Instrument:
Assessment of Student Teachers by
Cooperating Teachers and Supervising Professors
Circle the number that most accurately reflects your answer: 1 = Almost Never or Never; 2 = Sometimes; 3 = About Half of the Time; 4 = Frequently; and 5 = Almost Always or Always

1. The student teacher required that students observe actual situations (e.g., from SOE, laboratory, field trips, etc.) to identify problems that need to be studied. 1 2 3 4 5

2. When students encounter problems in their SOE projects, the student teacher directed the students in their analyzing of the possible solutions so that they could determine the best solution for their particular problem. 1 2 3 4 5

3. The student teacher gave tests which require students to recall specific information that has been taught. 1 2 3 4 5

4. When students encounter problems in their SOE projects, the student teacher presented the problems in the classroom for study and discussion. 1 2 3 4 5

5. At the beginning of a unit of instruction, the student teacher involved students in developing a list of problems that determined what will be taught in the unit. 1 2 3 4 5

6. At the conclusion of a unit of instruction, the student teacher stated to the students the best solutions to the problems that they had studied in the instructional unit. 1 2 3 4 5

7. To what extent did the student teacher use the problem-solving approach to teaching in their classroom instruction? 1 2 3 4 5

8. The student teacher told students the information they need to know to arrive at solutions to problems. 1 2 3 4 5

9. The student teacher required students to analyze their SOE experiences to find possible solutions to problems that are being studied. 1 2 3 4 5

10. At the conclusion of a unit of instruction, the student teacher required students to develop written plans of practice for their SOE projects. 1 2 3 4 5

11. The student teacher let the students decide what reference materials to find solutions to problems. 1 2 3 4 5

12. At the beginning of each unit of instruction, the student teacher gave students a list of topics to be studied. 1 2 3 4 5

13. The student teacher required students to get information from more than one source before formulating solutions to problems. 1 2 3 4 5
14. Students are required to implement the chosen solution in their SOE project for evaluation of that solution.

15. The students and the student teacher jointly determined what is their best solution to a problem that has been raised in a particular instructional unit.

16. The student teacher presented actual situations (e.g., from SOE, laboratory, field trips, etc.) for students to identify problems that need to be studied.

17. The student teacher used in his/her classroom instruction problems that students actually encounter in the school laboratory to determine the content for specific instructional units.

18. At the conclusion of a unit of instruction, the student teacher required students to develop written plans of practice for their laboratory.

19. The student teacher required students to come up with more than one possible solution before a conclusion was made.

20. The student teacher used in his/her classroom instruction problems that students actually encounter in their SOE program to determine the content for specific instructional units.

21. At the conclusion of a unit of instruction, the student teacher stated to the students the reasons underlying the best solutions to the problems that have been studied in the instructional unit.

22. The student teacher demonstrated to students that more than one solution may be generated for a problem.

23. The student teacher gave assignments which require students to apply the specific knowledge learned in the classroom.

24. The student teacher let students decide what specific information they should look for in reference materials to find solutions to problems.

25. The student teacher required students to conduct experiments to solve problems.
Appendix K

Problem-Solving Approach Instrument:
Assessment of Cooperating Teachers
by Student Teachers
Circle the number that most accurately reflects your answer: 1 = Almost Never or Never; 2 = Sometimes; 3 = About Half of the Time; 4 = Frequently; and 5 = Almost Always or Always

1. The cooperating teacher required that students observe actual situations (e.g., from SOE, laboratory, field trips, etc.) to identify problems that need to be studied. 1 2 3 4 5

2. The cooperating teacher and the students jointly determined what is their best solution to a problem that has been raised in a particular instructional unit. 1 2 3 4 5

3. When students encounter problems in their SOE projects, the cooperating teacher presented the problems in the classroom for study and discussion. 1 2 3 4 5

4. At the conclusion of a unit of instruction, the cooperating teacher required students to develop written plans of practice for their laboratory. 1 2 3 4 5

5. The cooperating teacher required students to analyze their SOE experiences to find possible solutions to problems that are being studied. 1 2 3 4 5

6. At the beginning of a unit of instruction, the cooperating teacher involved students in developing a list of problems that determine what will be taught in the unit. 1 2 3 4 5

7. The cooperating teacher gave assignments which required students to apply the specific knowledge learned in the classroom. 1 2 3 4 5

8. At the beginning of each unit of instruction, the cooperating teacher gave students a list of topics to be studied. 1 2 3 4 5

9. The cooperating teacher required students to come up with more than one possible solution before a conclusion is made. 1 2 3 4 5

10. The cooperating teacher told students the information they needed to know to arrive at solutions to problems. 1 2 3 4 5

11. To what extent did the cooperating teacher use the problem-solving approach to teaching in their classroom instruction? 1 2 3 4 5

12. Students are required to implement the chosen solution in their SOE project for evaluation of that solution. 1 2 3 4 5

13. The cooperating teacher demonstrated to students that more than one solution may be generated for a problem. 1 2 3 4 5

14. The cooperating teacher gave tests which required students to recall specific information that has been taught. 1 2 3 4 5
<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>15. The cooperating teacher required students to get information from more than one source before formulating solutions to problems.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>16. When students encounter problems in their SOE projects, the cooperating teacher directed the students in their analyzing of the possible solutions so that they could determine the best solution for their particular problem</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>17. At the conclusion of a unit of instruction, the cooperating teacher stated to the students the best solutions to the problems that they have studied in the instructional unit.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>18. The cooperating teacher let the students decide what reference materials to find solutions to problems.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>19. The cooperating teacher let students decide what specific information they should look for in reference materials to find solutions to problems.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>20. At the conclusion of a unit of instruction, the cooperating teacher required students to develop written plans of practice for their SOE projects.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>21. The cooperating teacher presented actual situations (e.g., from SOE, laboratory, field trips, etc.) for students to identify problems that needed to be studied.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>22. The cooperating teacher used in his/her classroom instruction problems that students actually encounter in their SOE program to determine the content for specific instructional units.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>23. The cooperating teacher required students to conduct experiments to solve problems.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>24. The cooperating teacher used in his/her classroom instruction problems that students actually encounter in the school laboratory to determine the content for specific instructional units.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>25. At the conclusion of a unit of instruction, the cooperating teacher stated to the students the reasons underlying the best solutions to the problems that have been studied in the instructional unit.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
Appendix L

Interview Schedule for Student Teachers
Interview Schedule for Student Teachers

1. What are your strengths and weaknesses in using the problem-solving approach to teaching?

2. To what extent did you use the problem-solving approach to teaching in your student teaching experience? On a scale of 1 to 5, with these headings, how would you rate yourself?
   a. Almost never or never
   b. Sometimes
   c. About half of the time
   d. Frequently
   e. Almost always or always

3. What other instructional approaches did you utilize during the student teaching experience? Why did you utilize these approaches in your classroom teaching? You have mentioned that you used these instructional approach (______, ______, ______), rank order these in terms of extent of use. Which one did you use the most, second, etc? What percent of time for each one?

4. What positive experience(s) occurred during your student teaching experience in the use of the problem-solving approach to teaching? Elaborate on your experience.

5. What negative experience(s) occurred (see #4)?

6. How difficult was it to use the problem-solving approach to teaching in the vocational agriculture classroom? What are some of the things, reasons that make it so difficult to use?

7. What restriction(s) were there in using the problem-solving approach in teaching vocational agriculture? How did it restrict the use of the problem-solving approach?

8. How did your cooperating teacher assist you in your use of the problem-solving approach?

9. How did your cooperating teacher hinder you in your use of the problem-solving approach?

10. How did your supervising professor assist you in using the problem-solving approach?

11. How did your supervising professor hinder your use of the problem-solving approach?

12. How did each of the following contribute to or detract from your use of the problem-solving approach to teaching? Explain how each affected the extent of use of the problem-solving approach.
   a. Supervised occupational experience program - Type (Ag, Ag Business, School Lab, etc.)
   b. Extent students had SOE projects
   c. Subject matter being taught
   d. FFA activities
   e. Others

13. Do you view the problem-solving approach to teaching as a viable workable approach to teaching vocational agriculture? Why do you feel this way?
14. On a scale of 1 to 7 with "1" meaning no understanding and "7" meaning complete understanding, at what level would you rate your understanding of the problem-solving approach? How has this changed (if any) from your opinion at the completion of the methods class?

15. On a scale of 1 to 7 with "1" meaning unskilled and "7" meaning very skilled, how would you rate your ability to use the problem-solving approach in your classroom teaching?

16. Closing comments?
Appendix M

Teaching Approach Instrument
Evaluation of Approaches Used to Teach High School Vocational Agriculture Students

This instrument has been prepared to evaluate the approaches used to teach high school vocational agriculture students. Please circle the letter that best represents your evaluation of each of the following items. The numbers in the instrument represent the degree the item is present in the teaching performance with a (1) representing the absence of the item and a (7) representing a strong presence of the item in the teaching performance.

**TO WHAT EXTENT:**

<table>
<thead>
<tr>
<th>Question</th>
<th>Circle Your Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Was the instruction organized around solvable problem statements?</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>1A. Was there an answer to the problem statements?</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>1B. Was there more than one answer to each problem statement?</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>1C. Was the problem statement true-to-life (real)?</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>2. Was the problem statement explored by the students?</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>2A. Were a variety of questions used to explore the content and bring out the problems?</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>3. Did the class develop a clear-cut statement of the problem?</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>4. Did students help discover possible solutions to the problem(s)?</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>4A. Were possible solutions drawn from the class using key words or questions?</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>4B. Was each solution a potential answer to the problem?</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>5. Did the class discover what factors needed to be considered in accepting a possible solution?</td>
<td>1 2 3 4 5 6 7</td>
</tr>
</tbody>
</table>
6. Did students find and interpret information needed to analyze the potential solutions to the problem?  
   1  2  3  4  5  6  7  NA  

   Were the class members helped by the teacher to progress toward a solution to the problem "on their own"?  
   1  2  3  4  5  6  7  NA  

7. Were students helped to weigh and process the information gathered to determine its significance to the situation being considered?  
   1  2  3  4  5  6  7  NA  

8. Did the class discuss and arrive at a tentative (assumed best) conclusion to the problem?  
   1  2  3  4  5  6  7  NA  

9. Was the solution to the problem implemented under the teachers' guidance?  
   1  2  3  4  5  6  7  NA  

10. Were the results of the solution evaluation and success and failure of the solution discussed?  
    1  2  3  4  5  6  7  NA
DATA ANALYSIS:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>WEIGHT SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCORE 1</td>
<td>x .04 =</td>
</tr>
<tr>
<td>SCORE 1A</td>
<td>x .02 =</td>
</tr>
<tr>
<td>SCORE 1B</td>
<td>x .02 =</td>
</tr>
<tr>
<td>SCORE 1C</td>
<td>x .02 =</td>
</tr>
<tr>
<td>SCORE 2</td>
<td>x .07 =</td>
</tr>
<tr>
<td>SCORE 2A</td>
<td>x .03 =</td>
</tr>
<tr>
<td>SCORE 3</td>
<td>x .10 =</td>
</tr>
<tr>
<td>SCORE 4</td>
<td>x .06 =</td>
</tr>
<tr>
<td>SCORE 4A</td>
<td>x .02 =</td>
</tr>
<tr>
<td>SCORE 4B</td>
<td>x .02 =</td>
</tr>
<tr>
<td>SCORE 5</td>
<td>x .10 =</td>
</tr>
<tr>
<td>SCORE 6</td>
<td>x .05 =</td>
</tr>
<tr>
<td>SCORE 6A</td>
<td>x .05 =</td>
</tr>
<tr>
<td>SCORE 7</td>
<td>x .10 =</td>
</tr>
<tr>
<td>SCORE 8</td>
<td>x .10 =</td>
</tr>
<tr>
<td>SCORE 9</td>
<td>x .10 =</td>
</tr>
<tr>
<td>SCORE 10</td>
<td>x .10 =</td>
</tr>
</tbody>
</table>

TOTAL

(TOTAL SCORE / TOTAL WEIGHT) = ADJUSTED SCORE
Appendix N

Interview Schedule for
First-Year Teachers
Interview Schedule for First Year Teachers

1. From the viewpoint of classroom teaching, how has your first year of teaching been?

2. Do you feel that you have been successful as a teacher in using the problem-solving approach in your teaching?

3. To what extent did you utilize the problem-solving approach in your teaching? What ranking on scale and a percent?
   a. Almost never or never
   b. Sometimes
   c. About half of the time
   d. Frequently
   e. Almost always or always

4. How do you feel about using the problem-solving approach to teaching? When utilized, was it successful? When have you used the approach (or not) and why? What restricts (if anything) its use in the classroom? Has the age of your class affected your use of the approach? Such as, did freshmen respond differently than seniors?

5. Do you see the problem-solving approach to teaching as being a teaching method that will work in the vocational agriculture classroom?

6. Do you plan on using the approach next year? To what extent? More or less?

7. Do you feel confident in using the problem-solving approach? Explain your answer.

8. Is there anything that should be changed in your undergraduate training that would better prepare you to use the problem-solving approach?

9. Has your skill level in using the approach changed any this year?

10. What do you see as areas of improvement in using the problem-solving approach?

11. Closing comments.
REFERENCES


Boone HN (1988). Effects of Approach to Teaching on Student Achievement, Retention, and Attitude. dissertation, The Ohio State University.


McDonald FJ and Allen DW (1967). Training effects of feedback and modeling procedures on teacher performance. Stanford University School of Education.


Morse KR and Davis OL (1970). Effectiveness of teaching laboratory instruction on the questioning behaviors of beginning teacher candidates. Austin, TX: Research and Development Center for Teacher Education, University of Texas.


Bibliography


