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THE EFFECT OF THE TYPE OF INSTRUCTIONAL MATERIALS USED IN TEACHING TREE IDENTIFICATION ON THE ACHIEVEMENT OF HIGH SCHOOL VOCATIONAL AGRICULTURE STUDENTS

DISSERTATION

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

By

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PUBLICATIONS


VITA--Continued

PUBLICATIONS


# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ACKNOWLEDGEMENTS</strong></td>
<td>ii</td>
</tr>
<tr>
<td><strong>VITA</strong></td>
<td>iv</td>
</tr>
<tr>
<td><strong>LIST OF TABLES</strong></td>
<td>viii</td>
</tr>
<tr>
<td><strong>Chapter</strong></td>
<td></td>
</tr>
<tr>
<td>I. INTRODUCTION TO THE PROBLEM</td>
<td>1</td>
</tr>
<tr>
<td>Background and Setting</td>
<td>1</td>
</tr>
<tr>
<td>Statement of the Problem</td>
<td>7</td>
</tr>
<tr>
<td>Specific Objectives</td>
<td>8</td>
</tr>
<tr>
<td>Significance of the Study</td>
<td>11</td>
</tr>
<tr>
<td>II. REVIEW OF RELATED LITERATURE</td>
<td>17</td>
</tr>
<tr>
<td>Research In Instructional Materials</td>
<td>20</td>
</tr>
<tr>
<td>Summary of the Review of Related Literature</td>
<td>35</td>
</tr>
<tr>
<td>Hypotheses to be Tested</td>
<td>38</td>
</tr>
<tr>
<td>III. PROCEDURE</td>
<td>42</td>
</tr>
<tr>
<td>Design of the Study</td>
<td>44</td>
</tr>
<tr>
<td>Data and Instrumentation</td>
<td>52</td>
</tr>
<tr>
<td>Monitoring Assigned Variables</td>
<td>57</td>
</tr>
<tr>
<td>Development of the Student Reference</td>
<td>60</td>
</tr>
<tr>
<td>Data Collection</td>
<td>62</td>
</tr>
<tr>
<td>Analysis</td>
<td>64</td>
</tr>
<tr>
<td>IV. FINDINGS OF THE STUDY</td>
<td>66</td>
</tr>
<tr>
<td>Comparison of the Treatment Groups</td>
<td>66</td>
</tr>
<tr>
<td>Hypothesis One</td>
<td>67</td>
</tr>
<tr>
<td>Hypothesis Two</td>
<td>77</td>
</tr>
<tr>
<td>Hypothesis Three</td>
<td>83</td>
</tr>
<tr>
<td>Hypothesis Four</td>
<td>87</td>
</tr>
<tr>
<td>Hypothesis Five</td>
<td>88</td>
</tr>
</tbody>
</table>
TABLE OF CONTENTS--Continued

V. SUMMARY, CONCLUSIONS, AND
RECOMMENDATIONS .......................... 94

The Problem and Hypotheses .................. 94
Procedure .................................. 97
Summary of the Findings ...................... 100
Conclusions .................................. 103
Recommendations ................................ 105
Recommendations For Further Study .......... 106

APPENDIX A. Correspondence .................. 109
APPENDIX B. Pretesting Instructions To The
Teacher ..................................... 114
APPENDIX C. Pretesting Instructions To The
Student ...................................... 127
APPENDIX D. Correspondence During Pretesting.. 130
APPENDIX E. Test Form Sheet .................. 135
APPENDIX F. A Partial Check List of Forest
Trees Growing In Ohio ...................... 139
APPENDIX G. Student Behavioral Objectives .... 141
APPENDIX H. Postesting Instructions To The
Teacher ..................................... 143
APPENDIX I. Posttesting Instructions To The
Student ...................................... 147
APPENDIX J. Tree Identification Test Items
As Referenced To Student
Behavioral Objectives ...................... 150
APPENDIX K. Tree Identification Test ........ 152

vi
<table>
<thead>
<tr>
<th>Appendix</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>Non-relevant Pretest</td>
<td>169</td>
</tr>
<tr>
<td>M</td>
<td>Students' Questionnaire</td>
<td>181</td>
</tr>
<tr>
<td>N</td>
<td>Teacher's Questionnaire</td>
<td>184</td>
</tr>
<tr>
<td>O</td>
<td>Map of Ohio Showing Districts Four, Thirteen, and Fourteen</td>
<td>192</td>
</tr>
<tr>
<td></td>
<td>BIBLIOGRAPHY</td>
<td>194</td>
</tr>
</tbody>
</table>
## LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Two-Way Analysis of Variance Design Level of Treatment by Level of</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>Testing</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Means and Standard Deviations of Subgroups Receiving The Tree Identification Pretest By Levels of Treatment</td>
<td>68</td>
</tr>
<tr>
<td>3.</td>
<td>Analysis of Variance: Pretest Scores Comparing Subgroups Receiving The Tree Identification Pretest By Levels of Treatment</td>
<td>68</td>
</tr>
<tr>
<td>4.</td>
<td>Posttest Means of Subgroups By Type of Instructional Materials</td>
<td>70</td>
</tr>
<tr>
<td>5.</td>
<td>Two-Way Analysis of Variance: Posttest Scores Comparing Groups</td>
<td>71</td>
</tr>
<tr>
<td></td>
<td>Assigned to Levels of Treatment and Levels of Pretesting</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Distribution of Scores by Level of Treatment and Teacher</td>
<td>73</td>
</tr>
<tr>
<td>7.</td>
<td>Correlation Matrix: Relationships For Student Posttest Score and Variables Associated With Student Use of References</td>
<td>79</td>
</tr>
<tr>
<td>8.</td>
<td>Correlation Matrix: Posttest Score and Variables Associated With Teachers Background</td>
<td>85</td>
</tr>
<tr>
<td>9.</td>
<td>Relationships For Number of Teaching Techniques Used and Variables</td>
<td>90</td>
</tr>
<tr>
<td>10.</td>
<td>Correlation Table: Relationship For Extent of Use and Perceived Value of Teaching Techniques With Students' Posttest Scores</td>
<td>93</td>
</tr>
</tbody>
</table>
CHAPTER I

INTRODUCTION TO THE PROBLEM

Background and Setting

The need for practical instruction in forestry in vocational agriculture has increased with the recent focus of public interest on the environment. Trees once cut and burned by our founding fathers to gain open farm land are now being "rustled" from woodlots and forest areas by "timber pirates." The science of growing wood will greatly increase in importance as the non-renewable resources of the United States are depleted.

The need for practical forestry education which includes the basic principles of woodland management has never been greater than it is at the present. Our nation, within the last two hundred years, has changed from a pioneer society dependent on virgin forests to a technological society which must rely on a continuous supply of forest crops provided by scientific management techniques.

Ohio, once largely covered by forests, has also had most of its forested land converted to cropland, urban areas and highways. The urbanization of Ohio has divided large forested land holdings into many small properties. Kingsley (1970), after conducting a survey of Ohio's
timber resources, estimated that:

Ninety-two percent of Ohio's commercial forest land is owned by farmers or by a variety of private owners, school teachers, businessmen and the like. (p. 40)

...fifty two percent is owned by farmers; and much of it is in relatively small tracts. (p. 39)

Debald (1969), writing about the concern for Ohio's timber, warned:

Unless forest management activities are stepped up in the region, the future timber supplies may well fall short of the potential demand. (p. 15)

To insure the species composition and quality and quantity of raw materials needed by future wood using firms, more of the forest land will have to be put under specific management practices. This will involve educating the landowner to the economics and ecology of forest management. In reference to the timber resources of Ohio, Kingsley (1970) stated:

The theoretical potential of private forest land for timber management production nearly staggers the imagination. (p. 40)

Although the principles of forestry have been known and practised since the early 1900's in the United States, it is just being understood by the public that the field of forestry related occupations bears the varying and sometimes contradictory pressures of wood production, watershed management, recreation and aesthetics.
With the increase in the federal activities in the forest resource management field after the passage of the Land and Water Conservation Act of 1963, it is apparent that the population pressures for forest resources have produced and will continue to produce a need for more and better trained personnel.

The teaching of forestry related courses is not new. Berry (1920), a county vocational supervisor in Pennsylvania, suggested the need for environmental awareness in the public schools:

The subject of tree identification may be introduced into our public school curriculum at any time after the fourth grade and surely every high school graduate should be able to recognize all the important trees which occur locally. In connection with the study of birds and other phases of nature study, the identification of trees should be encouraged and made part of every field trip. (preface)

Harlow (1968) emphasized that:

...students of forestry should first know well the commercial species...of the locality where they may find themselves practicing forestry. The latter must usually be done by the student himself with the aid of a local tree manual. (preface)

Harlow (1968) in his discussion of dendrology makes two statements concerning the importance of tree identification:

A knowledge of the names of trees, their habits, and principal botanical features is basic to...studies in forestry. (p. 1)
A knowledge of the fundamentals of classification, nomenclature, and identification is requisite to all work in dendrology. (p. 2)

Trees are found in every state of the Union and the same principles of identification apply to the many different species. The ability of a student to identify trees is essential to forestry related educational programs. The curriculum guide, "Career Preparation in Forestry," U.S. Department of Health, Education and Welfare (1974), developed by a research grant at The Ohio State University, included the following statement as a unit concept:

If the forestry student is able to accurately identify the common tree species in his area, he will have a basis for performing many of the operations in forestry occupations. (p. 50)

The Occupational Outlook Handbook, U.S. Department of Labor (1974-75) presents an optimistic projection for future employment in forestry related jobs:

Employment opportunities for forestry aides are expected to increase very rapidly through the mid-1980's. Job opportunities will be especially good for those with specialized post-high school technical training in forestry. (p. 335)

Forestry, natural resources, parks and recreation, watershed management and wildlife management courses have been introduced into the vocational agriculture programs to meet the educational needs of the community. The Ohio State Department of Agricultural Education recognized the
educational needs in the environmental occupations area. Resource conservation, environmental protection, agricultural resources and forestry courses were initiated as part of the vocational agriculture programs. All of these courses include a tree identification unit as part of the curriculum.

Tullock (1975), in his discussion of natural resources education, pointed out the recent emphasis on environmental education. He said that teachers of agriculture are somewhat familiar with the basic principles of conservation and natural resources management, because of the related earth sciences courses on which both occupational areas are based. However, many educators responsible for natural resources programs in agriculture do not have a comprehensive background in natural resources and lack sufficient personal knowledge or experience to effectively use instructional equipment and materials.

The emphasis on natural resources, environmental education, and forestry has created a need for instructional materials. Paulus (1963), in justifying an effort to create a high school forestry manual, stated that:

One of the problems faced by alert teachers of agriculture has been the lack of accurate up-to-date organized materials to teach what was needed in managing the farm woodland. (preface)

In a survey of eleven North Atlantic states pertaining to the production and dissemination of instructional
resources in agricultural education, Drawbaugh (1971) indicated that the projected needs for the immediate future showed:

Occupational areas in agricultural education in need of instructional resources ...(indicated) seventy five percent of the priorities listed were in the occupational areas of agricultural resources.... (p. 66)

In discussing the need for instructional materials in the forestry related areas with Dr. Harlan Ridenour, Director of the Ohio Agricultural Education Curriculum Materials Service, and Mr. Welch Barnett, Area Supervisor of Vocational Agriculture, it was the consensus of opinion that a forest tree identification manual should be developed to be used in vocational agricultural high school classes.

After an intensive search of existing tree identification instructional materials and communication with state and federal forest service offices, the investigator found no satisfactory composite units presently available for use at the high school level for students living within the central hardwood forest ecosystem. A tree identification manual was conceptualized and a prototype presented in October 1974 to the Teaching Aids Committee of the Ohio Vocational Agricultural Teacher's Association for approval. The Teaching Aids Committee recommended that the tree identification instructional materials be developed. A student manual, Tree Identification (1975) and a
teacher's guide, *Teaching Tree Identification* (1975), were developed and published.

**Statement of the Problem**

Because the tree identification materials are unique in format and approach in presenting the basic principles of tree identification to the student, the investigator decided to field test the student manual and teacher's guide before sale and distribution. It was decided to evaluate the effectiveness of instruction that included the use of either the student manual only or both the student manual and the teacher's guide.

The problem investigated was: what is the effect, in terms of students' scores on a criterion-referenced test, of the type of instructional materials used in teaching tree identification to high school students enrolled in vocational agriculture? The treatment, type of instructional materials, included three levels which are as follows:


2. a student manual, *Tree Identification* (1975), used without the teacher's guide.

3. references and instructional materials normally used by the teacher in teaching tree
identification to vocational agriculture high school students. The teacher's guide and student manual were not available to this group of teachers.

Student achievement was measured by a score on a criterion-referenced test on tree identification.

**Specific Objectives**

The specific objectives of the study were as follows:

1. To compare the scores of high school students enrolled in vocational agriculture on a criterion-referenced tree identification posttest who have been taught tree identification by:
   b. using the student manual, without the use of the teacher's guide.
   c. using references and instructional materials normally used by the teacher to teach tree identification. The student manual and teacher's guide were not available for use.
2. To investigate the relationships between student's scores on the tree identification criterion-referenced posttest and the following independent variables:
   a. months of work experience in jobs held by the student that required knowledge of tree identification.
   b. extent to which the tree identification book or manual was used by the student as a reference in completing homework assignments.
   c. extent to which the tree identification book or manual was used by the student as a reference in the classroom.
   d. extent to which the tree identification book or manual was used by the student as a reference while identifying trees in the out-of-doors.
   e. extent to which the tree identification book or manual was interesting to the student.

3. To investigate the relationships between students' scores on the tree identification criterion-referenced posttest and the following independent variables:
a. number of years experience teaching tree identification completed by the teacher.

b. number of courses the teacher has taken beyond the high school level requiring knowledge of tree identification.

c. number of years work experience by the teacher in jobs that required a knowledge of tree identification.

d. number of hours allotted by the teacher to outdoor study and identification of trees.

e. number of hours allotted by the teacher to classroom study and identification of trees.

4. To determine the relationship between students' scores on the tree identification criterion-referenced posttest and the following independent variables:

a. extent to which teachers used certain teaching techniques.

b. teachers' perceptions of the value of certain teaching techniques used in teaching tree identification to vocational agricultural high school students.
c. the number of teaching techniques used by the teacher in teaching tree identification.

Significance of the Study

The Presidents Panel of Consultants in their report entitled, *Education For A Changing World of Work*, stated:

The task of curriculum and course-of-study development, and the accompanying task of providing appropriate instructional materials, is thus a large and complicated one.

Research efforts aimed at the evaluation of instructional materials and assessing their impact on students need to be organized to investigate this important area in-depth. With the diversification of instruction in vocational agriculture in the recent decade, the importance of teacher and student accessibility to high quality, up-to-date instructional materials has taken on a new dimension in this era of rapid technological advancement.

Many teachers develop their own instructional materials using a variety of informational sources. Colliver (1975), a vocational agricultural teacher discussing a new junior and senior natural resources program, "...wrote 85 letters to sources..." concerned with the field of natural resources. He went on to say that he "...received a wealth of reference materials all free." (p. 175) Presently, many teachers teaching units in tree
identification are preparing their own instructional materials drawing from the free materials which are targeted to a wide variety of audiences. Teacher developed instructional materials not only take time to prepare, but also need periodical updating and revision to stay current with technological advances and new teaching media.

Jacks (1971), in an editorial concerning teacher developed instructional materials, stated:

Many educators have subscribed to the concept of teachers developing their own instructional materials, but this has proven inefficient. The vast majority of them have had little training in developing such materials and have an inadequate background in the various subject matter areas involved in their instructional programs. Furthermore they have neither the time nor adequate basic references necessary for preparing such materials. (p. 55)

It is by no means a small task for teachers to produce high quality student-oriented instructional materials. Halcomb (1971), in his support of the use of prepared instructional materials, said: "Teachers of Vo-Ag are busy people-developing instructional materials is time consuming." (p. 70) The teacher must also acquire the right kinds of reference materials for drafting instructional materials to fit the objectives of their lesson plans.

As teaching responsibilities increase, time available for lesson preparation decreases. Teachers are
constrained by the mastery of special education methods and techniques, maintaining current awareness of changing technology within the occupational areas taught, increased record keeping requirements, and nine-month contracts. It is evident that prepared instructional materials will add greatly to the effectiveness of the teacher-learner process.

By comparing classes of students using the student manual only and a combination of the student manual and teacher's guide with classes of students using instructional materials and references normally used by the teacher, the effectiveness of the use of the student manual only was reflected by the students' score on the criterion referenced posttest. Student achievement on the posttest indicated the effectiveness of the student manual in comparison to the instructional materials and references normally used by the teacher to teach tree identification.

Drawbaugh (1971), using findings from a survey pertaining to the production and dissemination of instructional materials in agricultural education in eleven North Atlantic States, noted that the heaviest demand for instructional resources in the immediate future:

...was not for student resources such as job sheets, worksheets, manuals, and workbooks, but rather for teacher's guides. (p. 65)
By comparing classes of students where the teacher is provided with a teacher's guide, with classes of students where the teacher is not provided with a guide, the effectiveness of the teacher's guide was reflected in the students' scores on the criterion-referenced posttest. Student achievement indicated the effectiveness of the use of a teacher's guide in combination with a student manual as compared to use of a student manual without the use of a teacher's guide in the teaching-learning process.

Quality of instructional materials is associated with the effectiveness of instructional materials in the teaching-learning process. Drawbaugh (1971) indicated quality of curriculum materials was one of the four perspectives reviewed in a survey of eleven North Atlantic States. The survey revealed:

The quality of instructional materials was associated with field testing for effectiveness in teaching and learning. Presently, more instructional resources are being disseminated which were not tested than were tested for effectiveness in teaching and learning. (p. 65)

The information gained from this study can be used by curriculum materials service personnel and teacher educators. The curriculum materials service personnel can use the information in the following situations:

1. to make decisions concerning the provision of teacher's guides with student oriented
instructional materials.

2. to assess the effectiveness of a particular student manual in comparison to instructional materials and references normally used by the teacher.

3. to measure the effect of instructional materials on student achievement.

4. to provide an indication of the quality of the instructional materials provided for use by teachers and students.

5. to show the relationship of teaching techniques illustrated in the teacher's guide to student achievement.

6. to show the relationship of the teacher's background to the effectiveness of the use of instructional materials in the teaching-learning process.

Teacher educators can use the information gained from this study in the following situations:

1. to gain insight into the relationship for teacher's success in using instructional materials to teach tree identification and student achievement.

2. to gain insight into the relationship between certain teaching techniques and the effectiveness of instructional materials used to teach
tree identification.

3. to gain insight into the relationship between student achievement and the extent to which certain teaching techniques are used and their associated value as perceived by teachers.

4. to gain insight into the need for teacher education in the classroom, outdoor, and laboratory environments.

This study will indicate the effectiveness of instruction when instructional materials prepared by the Ohio Agricultural Education Curriculum Materials Service are used to teach vocational agricultural high school students tree identification. The result of the study will assist the Curriculum Materials Service in revision of the original tree identification instructional materials. The information gained from the study will help in planning and preparing additional instructional materials in a new forestry series of instructional materials.
CHAPTER II

REVIEW OF RELATED LITERATURE

Evaluation of instructional materials has been neglected in the past. The authors of the publication, Review and Synthesis of Research in Agricultural Education (1966) showed that:

Experimental studies designed specifically to evaluate the effectiveness of instructional materials have not been common in agricultural education. (p. 57)

Considerable effort and expense goes into the development and production of instructional materials, but their impact on the effectiveness of instruction is often neglected. Testing of instructional materials should be pursued to determine learning specific to the instructional materials used with a specific unit of a curriculum. Available materials have been conceptualized, developed, and revised mainly from suggestions gleaned from supervisors, teachers, and professional employers in the field. The impact of new instructional materials on the teaching-learning process should be quantified by classroom testing.

Ridenour (1966) in concern for evaluation of the effectiveness of instructional materials said:
The effectiveness of educational materials in the teaching-learning process will be unknown until the materials have been tried in the classroom and evaluated in terms of whether or not they have brought about the behavioral changes in students that were specified in the educational objectives. (p. 132)

Not all education research studies have concluded with significant findings. Dr. Leslie Briggs (1967) in summarizing conclusions reached from his review of more than 2,000 reports on media research observed:

...those who have worked with real-life problems rarely have used research procedures which permit unambiguous answers to research questions they posed. Others have simplified the problems so as to gain control of the variables and have given relatively precise answers to artificially simple problems.

Dr. Briggs goes on to give two reasons for the lack of significant differences between instructional materials:

First, most things to be learned in school lessons as presently prescribed involve more than one kind of learning. The net difference between two methods applied to a variety of learning tasks tends to be zero, even when one method is superior for one of the kinds of learning tasks included. Secondly, the differences between methods are obscured by such practical difficulties as having only an excellently written program to compare with a poorly prepared film. The difficulties encountered in the method A vs. B studies illustrates the need for more research precision for investigating real-life problems. (p. 26)

Dr. Briggs' statements would suggest that the researcher so structure the research methodology to gain precise answers to problems that currently exist in the field of curriculum materials development. He also suggests
that instructional materials be tested in consideration of possible differences between methods of teaching and the extent of use of various instructional materials available to the different teachers.

Merrill (1973) suggested that three premises underlie the basic instructional research model containing the following components: behavioral objectives, pretest, instructional activities, and posttest. The following sequence of activities is suggested:

1. Objectives must be specified by observable student behavior.

2. Testing instruments should measure the students ability to perform specified behavior (criterion-referenced) rather than how well he performs in comparison with other students (norm referenced).

3. Instructional products must be verified by empirical procedures. (p. 95)

Merrill (1973) also stated:

Most instructional development efforts can be characterized by "raw empiricism." Instructional materials are prepared on the basis of intuition, folklore, or experience and administered to members of the target population....Progress cannot be made toward an empirically based instructional development methodology until propositions that relate objectives to learning activities are specified and tested. (p. 96)

Merrill's premises underlying basic instructional research have applicability in measuring the effectiveness of instruction when instructional resources are used in the teaching-learning process.
Research of instructional materials and classroom aids used in teaching students enrolled in vocational agriculture has been limited in amount and scope. In some studies, the instructional materials were found to be effective in teaching students and developing positive attitudes towards the occupational field.

Barker (1967) developed an instructional unit for use in vocational agricultural high school classes in Ohio. The unit was designed to enhance student understanding of basic economic profit maximizing principles as applied to farm business management. Twenty-two high schools offering vocational agriculture were included in the study. Six high schools were selected as controls; teachers in seven high schools were assigned to teach from the instructional units in an uninterrupted sequence; and teachers in nine high schools integrated the instructional units with other subject matter during a six week trial period. A posttest (45 multiple choice questions) was used to evaluate the students' understanding of the content of the unit. Further information was gained from a subjective appraisal of the units by the pilot teachers. Thirteen assigned independent variables were monitored and tested to determine their association with students' knowledge of the material used in the study. Findings showed that the test group of seven schools using only the instructional
units developed by Barker (1967) obtained the highest score on the posttest. In order of statistical significance, the nine schools using the units integrated with other subject matter had the second highest score on the posttest and the six schools in the control group were third. Control schools taught farm management in the traditional manner without the aid or use of the developed unit, "Instructional Units On Profit Maximizing Principles." Comparison of the mean posttest scores of the individual test groups were significantly different at the .05 level. Analysis of data allowed Barker (1967) to conclude:

...that the developed instructional units did enhance understanding...beyond the traditional manner of teaching farm management to students of vocational agriculture. (p. 125)

Four of the thirteen variables in Barker's (1967) study were not significantly related to student posttest scores. They are as follows:

1. Student year in high school.
2. Number of economics courses taken by students in high school.
3. Teachers having received Farm Business Planning and Analysis instruction.
4. Teachers having coordinated a Farm Business Planning and Analysis program. (p. 156)

Three of the thirteen variables showed a very minor degree of positive relationship to the students'
scores. In each case only one group of students of the three levels within the study was significant at the .05 level. These variables would not be reliable in predicting posttest scores, but do indicate direction. They are as follows:

1. College quarter hours of economics instruction received by the teachers.

2. Hours of instructional time used.

3. Local Grades. (Grades achieved by students on exams designed and administered by the teachers pursuant to the subject taught during the instructional unit trial period. (p. 156)

Six remaining variables showed only a low degree of relationship to students' posttest scores. The first four variables had a positive relationship and the last two had an inverse relationship with the posttest scores. They are as follows:

1. Student's year in vocational agriculture.

2. Student's years of farm experience.

3. Student's I.Q.

4. Number of teachers in the vocational agriculture department.

5. Teacher's years of teaching experience.

6. Teacher's attainment of an advanced degree. (p. 157)

In summary it was found that students with the greatest experience in vocational agriculture scored higher on the posttest; students with more farm experience
scored higher on the posttest; I.Q. was as closely related to student understanding of profit-maximizing principles as any of the thirteen independent variables; students enrolled in a two-teacher department obtained a higher level of understanding than did those students in a single teacher department; and the number of years of teaching experience and having an advanced degree were inversely related to the student's posttest score.

Urbanic (1971) measured the effectiveness of the use of a student reference, *The Nursery Worker* (1970), in teaching ornamental horticulture to high school students. Sixteen vocational agricultural teachers in Ohio were asked to teach selected portions of the vocational horticulture curriculum using behavioral objectives and objective tests developed by Urbanic. The sixteen teachers were randomly assigned to two groups. A group of eight teachers were furnished with copies of a section of the student reference which they used as the primary reference in teaching the horticulture unit. This group of teachers constituted the experimental group. The second group of eight teachers was designated as the control group and were not told about the student reference. This group of teachers used references other than *The Nursery Worker* (1970).

The design for this study was the posttest-only control group design, Campbell and Stanley's (1963)
design 6. Intact classes of vocational horticulture students were randomly assigned to the treatment and control groups. The results of the study showed no significant difference in test scores between those students using the student reference and the control group. In this study, the student reference made no difference in student success in learning.

Pearson product-moment correlations were calculated for eight independent variables and the dependent variable, student score, to determine degree of relationship. Six of the eight variables in the Urbanic (1971) study were not significantly related to student posttest scores. They are as follows:

1. Degree holding status of the teachers.
2. Years teaching experience.
3. Average lesson preparation time.
4. Years of vocational agriculture completed for the students.
5. Previous horticulture employment for the students. (Reported in the form of: no experience, parttime employment, and full time employment)
6. Present horticulture employment for the students. (Reported in the form of: no experience, parttime employment, and full time employment)

Two of the eight variables showed a significant relationship to student posttest scores. They are as follows:
1. Number of professional education courses completed by the teacher. (negative direction)

2. Number of periods a student spends per day in horticulture class. (positive direction)

Urbanic (1971) reported that an interesting trend appears when the direction of relationship between degree holding status, number of years teaching experience and number of professional education courses taken was considered. Each of these variables was negatively related to the scores of the posttest. He also noted that these three independent variables were related to each other.

A negative relationship also existed when lesson preparation time is compared with degree holding status of teachers. Although the correlation coefficient was not significant it appeared, for Urbanic's group of teachers, that those with higher degrees spent less time preparing lessons and their students did poorer on the posttests.

Although not significant there was a positive relationship between posttest scores and:

1. Previous horticulture employment (students).
2. Present horticulture employment (students).

The results of the study indicate that horticulture related work experience may help improve a student's performance in subject matter relating to the type of job in which the person is employed.
Zurbrick (1971) conducted a study to evaluate the effectiveness of instruction based on materials and suggestions contained in the teacher reference, *Instructional Units On Agricultural Marketing Principles* (1969). Selected vocational agriculture teachers in the western half of the state of Ohio were asked to participate in the study. Sixteen teachers representing fifteen high schools were randomly assigned to a control group and an experimental group. Campbell and Stanley's (1963) design 4, pretest-posttest control group design, was used in the study. Classes served as intact experimental units in this design. Teachers in the experimental group were supplied with *Instructional Units On Agricultural Marketing Principles* (1969). Teachers in the control group were given the same student objectives as the experimental group, but used their own references and instructional materials normally used in teaching marketing principles. The manipulated independent variable was whether or not the teacher reference was used in teaching marketing principles.

The dependent variable was the score on a fifty-five item multiple choice posttest. Students in both groups were given the same pretest and posttest. Zurbrick (1971) used instructional time and preparation time as other dependent variables.
Analysis of covariance was used to determine statistical significance of the effectiveness of instruction when a teacher's reference was used in teaching marketing principles. The pretest scores were used as the only covariate in an analysis of covariance. Zurbrick (1971) concluded:

...those students taught from the teacher reference did have posttest scores statistically higher at the .05 level when the pretest scores were used as a covariate in the analysis of covariance. (p. 99)

Eight additional variables relating to the characteristics of the students and teachers participating in the study were studied. The eight assigned variables are as follows:

1. Years of teaching experience.
2. Years of teaching experience using a teaching reference.
3. Teacher's previous experience in teaching using an inductive mode of instruction.
4. Teacher's educational preparation in marketing.
5. Student's grade level.
6. Student's academic ability.
7. Student's previous work experience.
8. Student's previous instruction in vocational agriculture.

The Pearson product-moment correlation coefficient was used to determine relationships between the independent
and dependent variables. Analysis of the data revealed the following:

1. There was no statistically significant relationship between instruction time and the adjusted class mean posttest score.

2. There was no statistically significant relationship between teacher's number of courses taken in marketing and the adjusted class mean posttest score.

3. There was no statistically significant relationship between teacher's years of experience teaching and the adjusted class mean posttest score.

4. There was a statistically significant relationship between teacher's previous experience in teaching marketing principles and the adjusted class mean posttest score. A negative relationship significant at the .05 level was found for the experimental group. There was no significant relationship found for the control group.

5. There was no statistically significant relationship between teacher's previous teaching experience using a prepared reference and the adjusted class mean posttest score. It was noted that a high positive correlation was found, but not significant. Even though the relationship was not statistically significant, classes instructed by teachers who had previously used a teacher reference tended to score higher on the posttest.

6. There was no statistically significant relationship between student characteristics such as, grade level, previous agricultural experience, number of years of instruction in vocational agriculture, and academic aptitude and the adjusted class mean posttest score.

In this study, the teacher reference on marketing principles enhanced student understanding of marketing principles to a significant degree when compared to the
traditional technique of teaching marketing principles employed by teachers in the control group.

Mortensen (1973) in a study to determine the effects of a forestry instructional resource unit, *Products From Our Forest-Their Management and Their Use*, used a multivariate experiment. Design 10, Campbell and Stanley's (1963) nonequivalent control group design, was used in combination with factorial analysis to test differences in student learning among four different instructional resource units. Type of instructional materials used was crossed with a forestry unit taught previous to the study or a forestry unit not taught previously to the study. One experimental group of fifteen high schools was randomly selected from a stratified population of those schools who had taught forestry using the resource unit, *Management of Forest Resources for Multiple Use*, the year previous to the study. The second group of fifteen high schools was randomly selected from those schools who had not taught forestry using the resource unit, *Management of Forest Resources for Multiple Use*, the year previous to the study. All thirty schools were selected from the Central Vocational Administrative Region of Pennsylvania. Three schools from each of the two groups of fifteen schools were randomly assigned as a control group. The remaining twelve schools in both groups were instructed to teach forestry using the unit, *Products From Our Forest-Their Manufacture and Use*. 
for a period of eighteen clock hours. A thirty-one page teacher's guide was prepared to accompany the student instructional unit, *Products From Our Forest-Their Manufacture and Use*, used in teaching forestry by both experimental groups. Six schools, in each of the two experimental groups, were randomly assigned behavioral objectives to use in the instructional process. The other six schools, in each of the two experimental groups, were assigned traditional instructional objectives. Three schools from each of the groups of six schools assigned either behavioral objectives or traditional instructional objectives were assigned realia to use along with the other instructional materials. Three schools in each group did not receive realia.

The manipulated independent variables were:

1. Whether or not the unit, *Products From Our Forest-Their Manufacture and Use*, was used in teaching forestry.

2. Whether behavioral objectives or traditional instructional objectives were used in teaching forestry.

3. Whether or not realia was used in teaching forestry.

The assigned independent variable was whether or not forestry had been taught using the student instructional unit, *Management of Forest Resources for Multiple Use*, the year previous to the study.
A fifty-question multiple choice achievement test was used as both the pretest and posttest in determining the effectiveness of the forest instructional resource units. There was a four-week period between the administration of the pretest and the posttest. Score on the posttest was the dependent variable.

Mortensen (1973) found that student achievement test scores were significantly affected by use of the instructional resource units in teaching forestry. Analysis of covariance was used to equate the differences which may have existed among students. Student differences were controlled by using pretest scores as the covariate. The analysis of covariance showed a significant difference among treatments. Students taught forestry using the unit combination, *Products From Our Forest-Their Manufacture and Use*, and *Management of Forest Resources for Multiple Use* achieved a significantly greater mean achievement test score, at the .01 level, than the students taught forestry using the forest product unit and forest management unit separately. This would indicate an instructional advantage in using complementary resource units of instruction. Although the use of complementary instructional resource units showed the greatest effectiveness on test scores, separate use of the forest product unit also showed a significantly greater effectiveness when compared to a conventional method of instruction.
Mortensen (1973) concluded:

...that instructional resource units were effective in building the cognitive structure of high school students. (p. 78)

Kowalka (1974) tested the instructional utility of a chapter of the student manual, *Circuit Anatomy* (1974) as compared to competencies possessed by students not using the instructional manual. The ninth-grade classes of twelve central Ohio high schools offering vocational agriculture were used in the study. Intact classes were randomly assigned to levels of the treatment. One level of the treatment used a chapter of the student manual, *Circuit Anatomy*, to teach basic electrical wiring skills and the second level of the treatment did not use the manual. Kowalka (1974) used the individual student mean posttest scores as the dependent variable. A quasi-experimental adaptation of the Solomon four-group design as explained by Campbell and Stanley (1963) was used in the study.

Kowalka (1974) found that:

The use of the student manual was effective in aiding the learning of basic electric skills by the students involved in the study. (p. 113)

In analysis of the posttest scores, he found:

The analysis of variance revealed the mean posttest score of the treatment group was significantly higher than that of the control group....There is support for the hypothesis that those students using the student manual performed significantly better than those not using the manual. (p. 71)
The manual developed by Kowalka (1974) and used as an instructional resource in teaching basic electrical wiring increased the effectiveness of the teacher-learner process.

McCreight (1969) developed instructional materials to be used in teaching a basic course for vocational agriculture high school students on quality control in the processing of meat. Two student instructional resource units and a teacher's guide were developed to be used in teaching quality control and occupations in the meat industry. Classes of students within twenty-four high schools were randomly assigned to four levels of the experimental treatment. The four levels of the treatment were:

1. teacher's guide, teacher taught class of occupations and quality control.
2. teacher's guide, student self-instruction of occupations, teacher taught class of quality control.
3. no teacher's guide, teacher taught class of occupations and quality control.
4. no teacher's guide, student self-instruction of occupations, teacher taught class of quality control.

A set of slides and accompanying script were developed by McCreight and used in the study by all twenty-four
schools. Teachers were asked to spend twelve hours teaching the units in order to serve as a control for the experiment. A pretest and posttest were administered to the students to determine the effect of the treatments. Students' score on the posttest was the dependent variable. There was a three week period between the pretest and the posttest.

Analysis of covariance was used in the analysis of data. High school fifth and total pretest achievement scores were used as covariates. The high school fifth is an estimate by the teachers of agriculture dividing the class of students into five groups based on achievement. A specific objective was to measure the effects of the use the teacher's guide in teaching quality control and occupations on student achievement. The analysis of data showed that the adjusted mean posttest score on the occupations unit and the quality control unit for students who received teacher taught classes in combination with the teacher's guide was:

...significantly higher than the adjusted mean posttest score...for the students who received instruction without the use of a teacher's guide. The difference was significant at the .01 level by analysis of covariance. (p.28)

The twelve schools using the teacher's guide scored significantly higher at the .01 level for both units of instruction using the teacher's guide. It was also noted
that the teachers using the teacher's guide showed an increased use of instructional resources as compared to teachers who were not furnished a teacher's guide.

Summary of the Review of Literature

The need for evaluation of instructional materials becomes more important as the technological discoveries of the twentieth century continue to rapidly expand in advance of field application. Classroom evaluation of new instructional materials should reveal the areas within the content that need clarified, deleted, or expanded. The primary concern of research focused on instructional resources has been to detect a significant difference in student achievement as a result of the teacher and student using the instructional materials. Only a few of the studies concerning the use of instructional materials have shown a significant difference.

Two possible factors have been suggested for the lack of significance in the studies:

1. More than one kind of learning is involved in the teacher-learner process.

2. Studies have not compared the instructional materials tested with other instructional materials of reputable value in teaching a given subject.
Research has pointed out that the instructional materials should be evaluated in terms of students behavior change and defined in terms for which the materials are intended. Three underlying premises have been suggested for the basic research model containing behavioral objectives, pretest, instructional activities and post-test components. The three premises suggested are:

1. Objectives specified by observable student behavior.
2. Criterion referenced instruments.
3. Instructional products verified by empirical procedures.

The case for evaluation of instructional materials has been strongly recommended in the literature reviewed. Evaluation of the instructional materials by field testing in actual classroom situations is the recommended setting for a study to be generalizable to other similar teaching situations.

The studies cited in the review of literature described the relationship of purposefully chosen assigned independent variables to the posttest scores of the students or classes involved in the study. Although relationships between some assigned variables and student posttest scores were not significant, direction of relationship was indicated. This information in some cases may point to an explanation concerning significant differences between use and
non-use of instructional materials.

All but one of the studies cited in the review of literature indicated that instructional materials used for specific teaching-learning purposes did make a significant difference when compared to instructional materials and methods normally used by the teacher. The instructional materials used in the various studies cited were quite dissimilar. The technical content information was different and different formats were used in presenting the technical information. Some researchers provided additional teaching materials supportive of the manuals used by the teacher and student. Slides and scripts, overhead transparencies, realia, tools and equipment, and behavioral objectives may have had an effect on the outcome of the studies. This suggests that variables other than instructional materials alone had a part in producing a significant difference between treatment groups.

In most studies, assigned variables for teachers and students were monitored and analyzed for possible relationship to student achievement. A significant positive relationship to student achievement was found for the following variables:

1. Hours of instructional time used to teach the subject.

2. Number of periods a student spends per day in class.
3. Student years of farm work experience. A significant negative relationship to student achievement was found for the following variables:

1. Teacher's attainment of an advanced degree.
2. Teacher's years of teaching experience.
3. Number of professional education courses completed by the teacher.
4. Teacher's previous experience in teaching the specific subject in which the instructional materials were tested.

As was revealed in previous studies cited, independent variables descriptive of student and teacher characteristics may possibly be related to student achievement. It appears to be the consensus among the researchers conducting studies on instructional materials that independent variables other than use and non-use of instructional materials must be incorporated into the study to help clarify the results. The relationship of these variables to the dependent variable and possibly to each other will provide future researchers clues to explanations of non-significant and significant findings.

Hypotheses to be Tested

In consideration of the purpose of the study and the specific objectives, the following hypotheses were developed based on related research and literature. The
The following five hypotheses were used to guide the investigator in the evaluation of the effectiveness of instruction that included the use of tree identification instructional materials.

1. Students taught tree identification using the student manual, *Tree Identification* (1975), and the teacher's guide, *Teaching Tree Identification* (1975), will score significantly higher on the posttest than students taught tree identification using the student manual only. Both groups of students (teacher's guide and student manual and student manual only) will score higher on the posttest than students taught tree identification without the use of the student manual or teacher's guide.

2. There is a positive relationship between students' scores on the criterion-referenced posttest and the following independent variables:

   a. months of work experience in jobs held by the student that required knowledge of tree identification.

   b. extent to which the tree identification book or manual was used by the student as a reference in completing homework assignments.

   c. extent to which the tree identification book or manual was used by the student as a reference in the classroom.
d. extent to which the tree identification book or manual was used by the student as a reference in the outdoors.

e. extent to which the tree identification book or manual was interesting to the student.

3. There is a positive relationship between students' scores on the criterion-referenced posttest and the following independent variables:

a. number of years work experience by the teacher in jobs requiring a knowledge of tree identification.

b. number of hours allotted by the teacher to outdoor study and identification of trees.

c. number of courses the teacher has taken beyond the high school level requiring knowledge of tree identification.

4. There is a negative relationship between students' scores on the criterion-referenced posttest and the following independent variables:

a. number of years experience teaching tree identification completed by the teacher.
b. number of hours allotted by the teacher to classroom study and identification of trees.

5. There is a positive relationship between students' scores on the criterion-referenced posttest and the following independent variables:

   a. the number of teaching techniques used in teaching tree identification.

   b. the extent to which certain teaching techniques are used by the teacher.

   c. teacher's perception of the value of certain teaching techniques used in teaching tree identification.
CHAPTER III

PROCEDURE

Population and Sample

The target population of this study was vocational agriculture teachers in the state of Ohio having responsibility for teaching tree identification within the instructional areas of forestry, agricultural resources, agricultural production and environmental science. The majority of Ohio's commercial timber land is located in the unglaciated "Hill Country." This unglaciated timber area is geographically positioned in the eastern and southern counties of Ohio. The glaciated northern and central counties have been smoothed by the advance and retreat of several glaciers. These counties were cleared of the original timber and converted into farm crop and grazing lands. Vocational agriculture programs within the unglaciated areas of Ohio are more closely associated with forest operations and industry which requires knowledge of tree identification as a requisite for employment. Therefore, schools within the commercial timber area of Ohio were selected to participate in the evaluation of the instructional materials used to teach tree identification.
to high school students.

The State Department of Education, Division of Vocational Education, has divided the state of Ohio into fifteen districts. The accessible population of high school students was obtained from schools within districts four, thirteen, and fourteen. A map of Ohio indicating districts four, thirteen, and fourteen is included in Appendix 0. These districts were selected for their geographical location within the major commercial timber producing areas of Ohio.

During the Ohio Vocational Agriculture Teacher's Association state meeting held July 1975 in Columbus, Ohio, the researcher surveyed teachers in districts four, thirteen, and fourteen during their respective district meetings to identify those teachers who planned to teach tree identification during the fall of 1975 and the spring of 1976. At this time the researcher presented a very brief explanation of the evaluation process involving the use of the instructional materials in teaching tree identification.

During the survey, forty-two teachers in the agricultural resources, agricultural production, forestry, and environmental science instructional areas were identified as offering tree identification units in their curriculum. These teachers were asked if they would participate in the study. Thirty-seven teachers expressed a desire to participate in the study, five teachers declined. The name,
address and name of the school represented by the teacher were obtained from the thirty-seven teachers wishing to participate in the study.

During October 1975, a follow-up letter with an enclosed pre-addressed postcard was mailed to the thirty-seven teachers who previously expressed a desire to be included in the study. The letter is included in Appendix A. The letter explained the procedure of the study in more detail. The teachers were asked to use the postcard to confirm their willingness to use the instructional materials to teach tree identification. When the returned postcards were tallied, sixteen teachers indicated that they no longer wished to participate. Twenty-one teachers agreed to use the instructional materials. The classes of the twenty-one teachers who agreed to participate were randomly assigned to one of the three levels of treatment, type of instructional materials.

During the orientation-organizational stage of the study early in March 1976, one teacher indicated that he no longer wished to participate in the study. Another teacher, who previously had not been included in the study, expressed a desire to participate. The new teacher was assigned to take the place of the teacher who dropped out of the study.

**Design of the Study**

A modification of a true experimental design was
used to test the major hypothesis of the study. The design used was a modification of the Solomon four-group design, Design 5 as explained by Campbell and Stanley (1963). Twenty-one intact classes of vocational agricultural students were included in the study. The twenty-one classes were randomly assigned to one of the three levels of the treatment, type of instructional materials. Each intact class of students was randomly divided into two equivalent subgroups for pretesting purposes. One subgroup received a non-relevant test; the other subgroup received the tree identification test. See Appendix E for a detailed explanation of the procedure used to randomly divide the class into two equivalent subgroups. Both subgroups within each intact class received the same posttest. The tree identification test was used as both a pretest and a posttest. See appendices K and L for copies of the non-relevant pretest and the tree identification pretest and posttest.

The design used in this study is shown diagrammatically as follows:

\[
\begin{align*}
R & \quad 0_1 \quad X_1 \quad 0_2 \\
R & \quad X_1 \quad 0_3 \\
R & \quad 0_4 \quad X_2 \quad 0_5 \\
R & \quad X_2 \quad 0_6 \\
R & \quad 0_7 \quad X_3 \quad 0_8 \\
R & \quad X_3 \quad 0_9 \\
\end{align*}
\]

(7 intact classes)

(7 intact classes)

(7 intact classes)
The symbols represent the following:

\[ X_1 \] represents the use of the teacher's guide, *Teaching Tree Identification (1975)*, in combination with the student manual, *Tree Identification (1975)*, used in teaching tree identification.

\[ X_2 \] represents the use of the student manual, *Tree Identification (1975)*, used in teaching tree identification.

\[ X_3 \] represent the materials normally used by the teacher in teaching tree identification.

\[ O_{1,04} \] represents the actual tree identification pretest.

\[ O_{2,03} \] represents the tree identification posttest used to determine student achievement.

\[ O_{5,06} \] \[ O_{8,09} \]

\[ R_1 \] represents the random assignment of intact classes to one of the treatment levels, type of instructional materials.

\[ R \] represents the random assignment of students within intact classes to pretest-posttest and posttest only subgroups.

\[ \ldots \] represents nonequivalence between intact classes.

One of the active independent variables was the type of instructional materials used. There were three levels of this variable:

2. a student manual, *Tree Identification* (1975), used in teaching tree identification to high school students.

3. a control group using instructional materials normally used by the teacher in teaching tree identification to high school students.

The other active independent variable was testing. There were two levels of this variable:

1. pretest (actual tree identification test)
2. no pretest (non-relevant pretest)

In addition to the manipulated independent variables, twelve assigned variables were measured to determine their relationship to student achievement. The assigned independent variables for the students were:

- months of work experience in jobs that required knowledge of tree identification;
- the extent to which a tree identification book or manual was used as a reference in completing homework assignments, as a reference in the classroom, as a reference to identify trees in the outdoors; and
- the extent to which the tree identification book or manual was interesting to the student. The assigned independent variables for teachers were:

- the number of years experience
teaching tree identification; the number of courses taken beyond the high school level requiring knowledge of tree identification; the number of years work experience in jobs that required a knowledge of tree identification; the number of hours allotted to classroom study and identification of trees; the number of hours allotted to outdoor study and identification of trees; the extent to which certain teaching techniques were used by the teacher; and the teacher's perception of the value of certain teaching techniques used in teaching tree identification to vocational agricultural high school students.

A correlational design was used to show relationships between the assigned variables and the dependent variable. The assigned independent variables for teachers were correlated with the mean score of the teacher's students on the posttest. The assigned independent variables for students were correlated with the student's score on the posttest.

The Solomon Four-Group Design controls threats to internal validity. The practice effects of pretesting was controlled by the use of a control group and by building the variable "testing" into the design. The classes were randomly divided into two equivalent subgroups. The teachers administered a non-relevant pretest to one subgroup and the actual tree identification test to the second subgroup within each intact class. Both groups
received the tree identification test for the posttest.

Maturation was controlled by the use of a control group. The effects of maturation should be manifested equally in both the experimental and control groups. History was controlled by the control group. Whatever historical events that might have produced a difference in student achievement in the experimental group would also produce a difference in student achievement in the control group.

Instrumentation was controlled by the students responding to an instrument developed as a paper and pencil test. The same tree identification test was used to test intact classes assigned to all three levels of the treatment. The tests were administered in the classroom by the teacher with control on the test orientation in the form of written instructions.

Regression was controlled by random assignment and the use of a control group. Any regression effects would be represented equally in both experimental and control groups.

Mortality was taken into consideration by using all of the student posttest scores of the selected experimental and control group who completed both pretest and posttest, including those who missed some classes during the treatment period. This will attenuate the apparent effect of
the treatment, but avoids sampling bias.

The Solomon Four-Group Design controls most threats to external validity. Interaction of testing and the treatment, type of instructional materials, was controlled by dividing the intact classes into equivalent subgroups. One subgroup was assigned the non-relevant pretest and the second subgroup was assigned the actual tree identification pretest. Factorial analysis of variance provided evidence indicating if there was interaction between testing and the treatment.

Intact classes of the twenty-one teachers wishing to use the instructional materials in the study were randomly assigned to one of the three levels of the treatment. The twenty-one classes represented schools in districts four, thirteen and fourteen within the commercial timber region of Ohio. Although, interaction of selection and the treatment was not controlled for by random selection of experimental subjects from a common population, the selection-treatment interaction problem was strengthened because of the representation of twenty-one intact classes (7 per group) in contrast with the use of a single class per group.

Multiple testing and treatment was controlled by determining whether or not the intact classes of students were participating in another study. The teachers
reported that their classes were not participating in another study.

Reactive arrangements were controlled by conducting the research within an ordinary classroom setting. The students were not told that they were participating in an experiment. The pretest was administered as though the teacher was interested in determining the extent of the student's understanding of tree identification previous to starting the unit. The non-relevant pretest was designed to act as a placebo in the study and provide no clues as to the contents of the tree identification posttest or what was included in the treatment. The non-relevant pretest was designed to require approximately the same amount of time to complete as did the tree identification test. The treatment was presented as an ordinary classroom event and occurred during the regularly scheduled classroom periods in the school calendar. April, May and June were the seasonal months during which tree identification is normally taught. The posttest was included as a regular examination at the end of the unit. Random assignment of the students to subgroups within intact classes was accomplished without the students knowledge or involvement and without change in the classroom environment. The teacher was provided with a Test Form Sheet and a simple explanation for dividing the class into subgroups. A copy of the Test Form Sheet is
Data and Instrumentation

A tree identification test was developed by the researcher to quantify the dependent variable, posttest score. The initial test was comprised of fifty-five multiple choice items and ten matching items. The test questions were referenced to four student behavioral objectives. The behavioral objectives used in this study were:

1. When provided with representative pictures, drawings, or specimens of leaves from selected forest trees common to Ohio, the student will identify by name the trees represented by using the identifying features of the leaves.

2. When provided with representative pictures, drawings, or specimens of twigs from selected forest trees common to Ohio, the student will identify by name the trees represented by using the identifying features of the twigs.

3. When provided with representative pictures, drawings, or specimens of fruit from selected forest trees common to Ohio, the student will identify by name the tree represented by using the identifying features of the fruit.
4. When provided with representative pictures, drawings, or specimens of leaves, twigs and fruit of forest trees common to Ohio, the student will use a dichotomus tree key to key-out the selected tree(s).

The behavioral objectives were also used to establish parameters for the expected level of mastery to be demonstrated by the student at the completion of the tree identification unit. Each teacher in each level of the treatment received a copy of the behavioral objectives to use in the teaching process. The questions were designed to measure the students' knowledge of tree identification as designated by the four behavioral objectives.

The design and construction of the test items was directed toward obtaining measures of achievement that could be expressed in terms of student behavior. The six principles of criterion-referenced testing developed by Gronlund (1973) were used to provide a general framework within which the test items were designed and developed.

Before pilot-testing, the tree identification test was reviewed by several teachers who had previously taught tree identification to high school students enrolled in vocational agricultural programs. The test was
also reviewed by graduate students and staff in the Department of Agricultural Education, The Ohio State University.

During September 1975, the tree identification test was pilot tested with ninety-seven vocational agriculture high school students enrolled in a Franklin County public school. Approximately 50 percent of the students taking the test were previously exposed to some tree identification instruction. The remaining 50 percent were not previously exposed to tree identification instruction.

After completion of the pilot testing, the data were processed to locate non-discriminating test items and to establish the reliability of the test. Two reliability estimates were calculated utilizing the Kuder-Richardson 20 and 21 formulas. The Kuder-Richardson 20 is an index of internal consistency and is a function of the number of items on the test, the variability of the scores, and the proportion passing and failing each item. The Kuder-Richardson 21 is also an estimate of internal consistency and is computed in the same manner as the Kuder-Richardson 20 except the mean score of the group is used instead of the proportion passing and failing each item. The reliability index for the initial sixty-five item test used as the pilot test was .76 for
the Kuder-Richardson 20 and .72 for the Kuder-Richardson 21.

The test items were reviewed in consideration of the relative difficulty of each item and the discrimination index of each item. Comments from the teacher involved in the pilot testing were also incorporated into the evaluation and revision.

The relative difficulty of the item indicates the percentage of students missing the item. The higher the percentage of students missing the item, the more difficult the item was. The mean item difficulty for the initial test was .66. Stanley (1964) in discussing item difficulty stated: "In general achievement tests, the nearer this average is to 50 percent the better." The section of the test using matching items showed an overall high relative difficulty of .81. The teacher reported that there was some confusion on the part of the students as to the procedure involved with matching the correct answers with the illustrated twigs. To avoid confusion, the matching items were changed to congruous multiple choice items.

The discrimination index reflects the degree to which the item discriminates between the upper and lower 27.5 percent of the cases in the group. Five items had an item discrimination index below zero. This showed that the students in the lower 27.5 percent of the cases did
better on these items than those students in the top 27.5 percent of the cases. These items were reviewed for the delineation of the tree species represented by line drawings and the distinction between the descriptor and distractors. In most cases, only the distractors were changed to provide a greater disparity among the possible answers. The line drawings were improved for three items.

The revised instrument used to quantify the dependent variable, was a sixty-five item multiple choice test developed to measure student knowledge of tree identification. A copy of the tree identification test is included in Appendix K. The sixty-five items on the test were referenced to the four student behavioral objectives previously explained. An analysis of the sixty-five items as they were referenced to the four behavioral objectives is included in Appendix J. An item analysis program was run on the revised sixty-five item multiple choice tree identification test after it was administered as the posttest in the study. This item analysis included 284 students who had taken the posttest. The reliability index for the tree identification test used in the study was .87 for the Kuder-Richardson 20 and .85 for the Kuder-Richardson 21. Senter (1969) in his explanation of coefficient of correlation in predicting test reliability stated:
Reliability coefficients for most widely used standard psychological and educational tests range from about .80 to perhaps as high as .95 or so. Tests having reliability coefficients within this range are usually considered sufficiently reliable to be of practical use. (p. 434)

The mean item difficulty was .50 and the mean item discrimination was .39.

The tree identification test was used as both pretest and posttest. When used as a pretest, the tree identification test was administered by the regular classroom teacher to one-half the class by random assignment. A non-relevant pretest was administered to the remainder of the class. The random division of intact classes into subgroups is discussed in Appendix E. The tree identification test and the non-relevant pretest were administered concurrently to the respective subgroups within each intact class.

During posttesting, only the tree identification test was administered to the students within intact classes. Both subgroups received the tree identification test. The instructions, provided the teacher for the administration of the pretest and posttest, are included in Appendices B and H.

**Monitoring Assigned Variables**

Additional data were collected from the teachers and students participating in the study. These data were
collected to provide insight into the effectiveness of teaching when instructional materials were used. The assigned variables were related to the posttest scores.

A twenty-two item questionnaire was prepared to monitor certain teaching techniques used by the teachers to teach tree identification. The teaching techniques listed in the items on the questionnaire were examples of the teaching techniques illustrated and discussed in the teacher's guide, *Teaching Tree Identification* (1975). A Likert-type scale was used to indicate the extent to which the teachers used certain teaching techniques. There were six responses on the extent scale ranging from "did not use" to "used extensively." Another Likert-type scale was used to indicate the teacher's perceived value of the teaching technique used. There were six responses on the scale ranging from "of no value" to "of great value." A copy of the questionnaire provided the teacher is included in Appendix N.

An item analysis program as designed by Johnson and McCabe (1975) was run on the twenty-two item questionnaire after it was completed and returned by the teachers who participated in the study. The Kuder-Richardson test for reliability for the extent portion of the questionnaire was .85 and .82 for the value portion. The overall Kuder-Richardson test for reliability for both the extent and value portions of the questionnaire was .84.
Teachers were also asked to provide information concerning:

1. years of teaching experience teaching tree identification.
2. years work experience working on jobs requiring knowledge of tree identification.
3. hours allotted to classroom study and identification of trees.
4. hours allotted to outdoor study and identification of trees.

Students were asked to provide information concerning:

1. months of work experience working on jobs that required knowledge of tree identification.
2. was homework assigned?
3. was a tree identification book or manual provided for use with homework assignments, classroom discussions and lectures or outdoor tree identification and studies?
4. extent to which the tree identification book or manual was used as a reference in doing homework.
5. extent to which the tree identification book or manual was used as a reference while studying tree identification in the outdoors.
6. extent to which the tree identification book or manual was used as a reference in the classroom.

7. how interesting was the tree identification book or manual in different learning situations?

A copy of the student questionnaire is included in Appendix M.

The student questionnaire was administered at the end of the unit after the tree identification posttest was completed and turned in to the teacher. The teachers filled in the questionnaire after completion of the tree identification unit.

Development of the Student Reference

A student manual, *Tree Identification* (1975), was developed by the investigator to be used by high school students within the central hardwood forest region. The major timber species and a sampling of wildlife species were included in the manual. Four major identifying characteristics of trees were used in the format design for presenting the information describing each species. The four characteristics are: bark, twig and bud, fruit, and leaf. A range map was also included for each species.

Black and white photographs were included in the format to illustrate each of the four major identifying
characteristics of a species. The wording used to describe the characteristics was purposefully kept at an easy reading level substituting everyday language for botanical terminology. Tree keys were included in the front of the manual to guide the student through the steps of properly identifying a tree. Pagination of the species included in the manual was according to the identifying characteristics of the leaves.

Often students comment that tree identification is presented in a dry scientific style placing emphasis on rote memorization and repetition. The trees are "memorized" and the principles of tree identification escape the student. When transported to another area, the student "forgets" the mental cues used to identify the trees in the home area.

In providing suggestions as to style of presentation and technique in teaching tree identification, a teacher's guide, *Teaching Tree Identification* (1975), was developed by the investigator. The guide provided the teacher with an outline for teaching the unit on tree identification and examples of selected teaching techniques were illustrated and discussed. The teaching techniques included in the guide were based on techniques found to be successful through research and experience in classroom and outdoor situations. The selected teaching techniques were modified to make tree identification
fun, interesting and relevant to the lives of both
teacher and student.

Data Collection

During February 1976 a package of instructional
materials was mailed to each of the twenty-one teachers.
Each package contained, a set of instructions, a Test Form
Sheet, a partial check list of forest trees to be covered
on the posttest, and a list of four student behavioral
objectives. These items are included in Appendices B, E,
F, and G. The control group of seven teachers received
all of the items listed above but no student manuals or
teacher's guide. In addition to the items listed above,
the second group of seven teachers received student manuals,
and the third group of seven teachers received student
manuals and a teacher's guide.

During March 1976, the investigator visited each
teacher to discuss the use of the instructional materials
and testing procedure, and to check on the random division
of the classes into two equivalent subgroups. At this time,
both the non-relevant and tree identification pretests and
additional instructions were given to the teacher. A copy
of the tests are included in Appendices K and L. During
the visitation, one teacher indicated that he no longer
wished to participate in the study. Another teacher, who
previously had not been included in the study and wished
to participate, was assigned to take the place of the teacher who dropped out.

Both forms of the pretests and the respective answer sheets were mailed to the investigator by the teachers after pretesting the students prior to teaching the tree identification unit. The pretests and answer sheets for a teacher included in the control group were lost in the mail.

During May 1976, the investigator mailed the tree identification posttests, answer sheets, teacher's questionnaire, students' questionnaires and posttesting instructions to all teachers in the study. A copy of the teacher's and student's questionnaire is included in Appendices M and N.

The posttest answer sheets, teachers' questionnaire and students' questionnaires were mailed to the investigator after the teacher had completed the tree identification unit. All teachers included in the study returned the posttest answer sheets. Nineteen teachers returned the students' questionnaire; one teacher in the student manual only group and one teacher in the control group did not return student questionnaires for their classes. Nineteen teachers returned the teacher's questionnaire; one teacher in the control group and one teacher in the student manual-teacher's guide group did not return their questionnaire. One teacher in the student manual only group did not fill in the background information section of the questionnaire.
Analysis

The two-way analysis of variance design used for testing hypothesis one is shown in table one. The unit of analysis used in the study was equivalent subgroups within intact classes. The subgroups were randomly assigned to either a tree identification pretest or a non-relevant pretests. The use of the non-relevant pretest is shown in table one as "no pretest." Intact classes were randomly assigned to one of three levels of treatment, type of instructional materials. The dependent variable was the mean score on the posttest for the subgroups within intact classes.

TABLE 1

TWO-WAY ANALYSIS OF VARIANCE DESIGN
LEVEL OF TREATMENT BY LEVEL OF TESTING

<table>
<thead>
<tr>
<th>Type of Instructional Material</th>
<th>Testing Variable</th>
<th>Student Manual-Teacher's Guide</th>
<th>Student Manual Only</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>A1</td>
<td>A2</td>
<td>A3</td>
</tr>
<tr>
<td>Pretest B1</td>
<td>Class 1 a1b1</td>
<td>Class 8 a2b1</td>
<td>Class 15 a3b1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 a1b1</td>
<td>9 a2b1</td>
<td>16 a3b1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 a1b1</td>
<td>10 a2b1</td>
<td>17 a3b1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 a1b1</td>
<td>11 a2b1</td>
<td>18 a3b1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 a1b1</td>
<td>12 a2b1</td>
<td>19 a3b1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6 a1b1</td>
<td>13 a2b1</td>
<td>20 a3b1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7 a1b1</td>
<td>14 a2b1</td>
<td>21 a3b1</td>
<td></td>
</tr>
<tr>
<td>No Pretest B2</td>
<td>1 a1b2</td>
<td>8 a2b2</td>
<td>15 a3b2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 a1b2</td>
<td>9 a2b2</td>
<td>16 a3b2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 a1b2</td>
<td>10 a2b2</td>
<td>17 a3b2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 a1b2</td>
<td>11 a2b2</td>
<td>18 a3b2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 a1b2</td>
<td>12 a2b2</td>
<td>19 a3b2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6 a1b2</td>
<td>13 a2b2</td>
<td>20 a3b2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7 a1b2</td>
<td>14 a2b2</td>
<td>21 a3b2</td>
<td></td>
</tr>
</tbody>
</table>
Pearson product-moment correlation coefficients were calculated for testing the relationships in hypotheses two, three, four and five. Data generated by this study were analyzed using the Instructional and Research Computer Center facilities of The Ohio State University and the Statistical Package For The Social Sciences (SPSS) system of computer programs.
CHAPTER IV

FINDINGS OF THE STUDY

This study was designed to determine the effectiveness of the use of a student reference in teaching tree identification to vocational agricultural students. Twenty-one teachers in Ohio participated in the study. The classes of these twenty-one teachers were randomly assigned to three groups: seven teachers used a teacher's guide, *Teaching Tree Identification* (1975), and a student manual, *Tree Identification* (1975), seven teachers used the student manual only, and seven teachers used the references that they normally used in teaching tree identification. Selected independent variables were investigated to determine their relationship to students' posttest scores.

Comparison of the treatment groups

Intact classes were randomly assigned to one of the levels of the treatment, type of instructional materials. The intact classes were also randomly divided into two equivalent subgroups which were randomly assigned to one of the levels of testing, tree identification pretest or non-relevant pretest. A statistical comparison was made to determine if random assignment of vocational agriculture
classes to levels of the treatment did result in equivalence of the three groups used in the study. The pre-test scores are representative of one subgroup of students from each of the intact classes. The subgroup receiving the non-relevant pretest was the no-pretest group and had no pretest score.

A computer program for analysis of variance as described in the manual, *Statistical Package For The Social Sciences* (1975), was used to determine if significant differences existed between the three groups on the pretest. Table 2 presents the means and standard deviations and Table 3 presents the analysis of variance findings. The pretest results of one teacher in the control group were lost in transit through the mail. For the statistical analysis, the missing case was given a pretest value equal to the mean (26.21) for the control group.

The F value of the analysis of variance in Table 3 was not significant at the .05 level. The results of the analysis of data show no significant difference between the pretest means of the three groups. It was concluded that the random assignment of intact classes to levels of the treatment did provide pre-experimental equivalence of the groups.

**Hypothesis One**

Students taught tree identification using the student manual, *Tree Identification* (1975), and the
### TABLE 2

**MEANS AND STANDARD DEVIATIONS OF SUBGROUPS RECEIVING THE TREE IDENTIFICATION PRETEST BY LEVEL OF TREATMENT**

<table>
<thead>
<tr>
<th>Level of Treatment</th>
<th>n</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher's guide and Student Manual</td>
<td>7</td>
<td>26.44</td>
<td>6.04</td>
</tr>
<tr>
<td>Student Manual Only</td>
<td>7</td>
<td>24.60</td>
<td>3.64</td>
</tr>
<tr>
<td>Control</td>
<td>7</td>
<td>26.21</td>
<td>4.67</td>
</tr>
</tbody>
</table>

### TABLE 3

**ANALYSIS OF VARIANCE:**

**PRETEST SCORES COMPARING SUBGROUPS RECEIVING THE TREE IDENTIFICATION PRETEST BY LEVELS OF TREATMENT**

<table>
<thead>
<tr>
<th>Source</th>
<th>d.f.</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>2</td>
<td>1417.60</td>
<td>708.80</td>
<td>0.291a</td>
</tr>
<tr>
<td>Within Groups</td>
<td>18</td>
<td>40807.20</td>
<td>2267.07</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>42224.80</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*a not significant at the .05 level*
teacher's guide, *Teaching Tree Identification* (1975), will score significantly higher on the posttest than students taught tree identification using the student manual only. Both groups of students (teacher's guide and student manual and student manual only) will score higher on the posttest than students taught tree identification without the use of the student manual and the teacher's guide.

A two-way analysis of variance design was used to test the null form of this hypothesis. The two independent variables were:

1. Level of treatment-type of instructional materials
   a. teacher's guide and student manual
   b. student manual only
   c. control (instructional materials normally used by the teacher)

2. Level of testing
   a. pretest-posttest
   b. posttest only

The dependent variable was the mean score for subgroups on the tree identification posttest. The unit of analysis used in this study was a subgroup within intact classes. The subgroups were randomly assigned to either the tree identification pretest or a non-relevant pretest. Only those students who were available for both
the pretesting and the posttesting were included in the study.

A two-way analysis of variance as described in the manual, *Statistical Package For The Social Sciences* (1975), was used to analyze the mean posttest scores of subgroups. The means and standard deviations of the posttest scores are reported in Table 4 by level of treatment and level of pretesting. The results of the two-way analysis of variance for hypothesis one are reported in Table 5.

### TABLE 4

**POSTTEST MEANS OF SUBGROUPS BY TYPE OF INSTRUCTIONAL MATERIALS**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A&lt;sub&gt;1&lt;/sub&gt;</td>
<td>A&lt;sub&gt;2&lt;/sub&gt;</td>
<td>A&lt;sub&gt;3&lt;/sub&gt;</td>
<td></td>
</tr>
<tr>
<td>Pretest</td>
<td>34.04 (n=7)</td>
<td>31.83 (n=7)</td>
<td>30.22 (n=7)</td>
<td>32.03</td>
</tr>
<tr>
<td>No Pretest</td>
<td>33.09 (n=7)</td>
<td>33.27 (n=7)</td>
<td>29.73 (n=7)</td>
<td>32.03</td>
</tr>
<tr>
<td>Type Means</td>
<td>33.57</td>
<td>32.55</td>
<td>29.98</td>
<td>32.03&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup>Grand Mean
TABLE 5
TWO-WAY ANALYSIS OF VARIANCE:
POSTTEST SCORES COMPARING GROUPS ASSIGNED TO LEVELS
OF TREATMENT AND LEVELS OF PRETESTING

<table>
<thead>
<tr>
<th>Source</th>
<th>d.f.</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Treatments A</td>
<td>2</td>
<td>9600.78</td>
<td>4800.39</td>
<td>1.235a</td>
</tr>
<tr>
<td>Between Testing B</td>
<td>1</td>
<td>.00</td>
<td>.00</td>
<td>.000</td>
</tr>
<tr>
<td>Interaction (A x B)</td>
<td>2</td>
<td>1131.41</td>
<td>565.70</td>
<td>.146a</td>
</tr>
<tr>
<td>Within Groups</td>
<td>36</td>
<td>139903.74</td>
<td>3886.22</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>41</td>
<td>150635.93</td>
<td>3674.05</td>
<td></td>
</tr>
</tbody>
</table>

*not significant at the .05 level

The two-way analysis of variance test revealed that the means of the subgroups did not differ significantly. Type of treatment, the pretesting variable, and the interaction between pretest and treatment were all non-significant as shown by the F values in Table 5. The null hypothesis was not rejected.

It was concluded from the analysis of data that the use of the combination of the student manual, *Tree Identification* (1975), and the teacher's guide, *Teaching Tree Identification* (1975), and the use of the student manual only as instructional references in teaching tree identification to vocational agricultural high school students did
not make a significant difference in student achievement as measured by the posttest scores.

The level of performance demonstrated by the students on the tree identification criterion-referenced posttest, as shown in Table 6, suggested that the students did not master the skills, knowledge and processes involved in the identification of trees as designated by the four behavioral objectives provided each teacher. Assuming a required proficiency level of 90 percent or better (58 items out of 65) for the student to have been considered successful in mastering the tree identification unit, posttest scores showed the majority of students did not display the desired criterion behavior. If the criterion-referenced test was constructed properly, it can be said that of the sixty-five items defining the expected criterion behavior, the student should have missed only 10 percent or less. The students' scores on the posttest showed that none of the students achieved 90 percent or better.

When asked about the effectiveness of the instructional materials used in the study; nine teachers indicated that the tree identification test adequately covered all the characteristics used in identifying trees; six said "no," and six did not respond. Two of the six responding "no" indicated that bark identification should have been included in the tree identification test. Bark characteristics were not included in the behavioral objectives or
TABLE 6
DISTRIBUTION OF SCORES BY LEVEL OF TREATMENT AND TEACHER

<table>
<thead>
<tr>
<th>Use of Teacher's Guide and Student Manual-Level 1</th>
<th>Pretest</th>
<th>Posttest by Subgroup</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>31.50 (7)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>32.80 (7)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>35.80 (7)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>37.75 (7)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>37.00 (7)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>33.25 (8)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>29.83 (7)</td>
<td></td>
</tr>
<tr>
<td>Student Manual Only-Level 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>25.50 (7)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>20.50 (7)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>42.25 (8)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>29.30 (10)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>43.33 (6)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>58.33 (5)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>54.00 (6)</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>33.50 (3)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>33.43 (8)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>25.00 (7)</td>
<td></td>
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<td>4</td>
<td>29.83 (6)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>40.50 (6)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>32.17 (6)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>27.00 (7)</td>
<td></td>
</tr>
</tbody>
</table>

*a* mean score for group

(n) = number of cases
the test, because of the relative difficulty in quantifying student knowledge of bark characteristics by a pencil and paper test.

When asked about the adequacy of the instructional materials provided, ten of the teachers using the teacher's guide and/or student manual responded that the reading level was appropriate for the students, that the materials adequately explained how to identify the tree species, and that the illustrations and/or pictures showed enough detail to be used in identification of trees. Four teachers did not respond. Seven of the teachers in the control group used their own materials.

The teacher's perceived adequacy of the instructional materials and the sufficiency of the tree identification criterion-referenced test in measuring the desired criterion behavior prompted the investigator to consider other plausible explanations for the low scores on the posttest within the groups using the teacher's guide and/or student manual. Stated below are some of the written and verbal comments volunteered by teachers who used the instructional materials in the study. Personal observations made by the investigator previous to and during the study are also included.

Teacher 4, assigned to use the student manual and teacher's guide, did not use the instructional materials to teach the tree identification unit. A state FFA tractor judging contest and other FFA contests were prepared for in
lieu of teaching tree identification. The mean scores listed in Table 6 for teacher 4 show that the class regressed slightly in terms of student achievement from the time the pretest was administered to the time the posttest was administered.

Teachers 2 and 6, assigned to use the student manual and teacher's guide, reported that the unseasonably cold weather retarded the spring leafing-out of trees in their area which reduced the number of outdoor classes used to teach tree identification.

Teacher number 1, assigned to use the student manual only, returned the student answer sheets incorrectly marked with many sheets showing evidence of students simply blackening in the answer boxes in a random fashion. This class was not assigned any homework. These observations were reinforced by the low mean score for the class.

Teacher 3, assigned to use the student manual only, stated in a note, "the reference material was excellent.... few students had experience with use of the keys." "Our use of the materials was limited."

Teacher 4, assigned to use the student manual only, used a tree identification slide set developed while working as a curriculum materials specialist during a masters degree program. This teacher had experience preparing and using curriculum materials in the teaching-learning process. The class mean score was the highest of the mean scores in the
group using the student manual only.

One teacher, assigned to use the student manual only, indicated that he was uncertain as to the length of time to allot to teaching the tree identification unit.

Several teachers indicated that they did not read the instructions and had not integrated the instructional materials into their lesson plans. This was reported to the investigator at the time of visitation of the teachers previous to the teaching of the tree identification unit. In some cases, the investigator had to issue an additional set of instructions, behavioral objectives, partial check list of trees native to Ohio, and a test form sheet to replace those lost by the teacher.

Teacher 3 in the control group was undergoing evaluation for a contract renewal during the same time period assigned to teach the tree identification unit. From personal conversation with the teacher the investigator concluded that an extra effort was made by the teacher to insure satisfactory performance by the students.

Four of the seven teachers in the control group indicated that their students had received some tree identification instruction previous to the study. This was reflected in two of the cases by a slightly higher pretest score. The posttest score for one of the cases was slightly higher than the group mean.
The observations made by the investigator previous to and during the study implied a lack of control of the teacher's extent of use of the materials, the length of time used to teach the tree identification unit, the integration of the materials into the lesson plans, the use of other complementary instructional materials in combination with the student manual and the teacher's guide, and the teacher's attitude toward the importance of the tree identification unit in his or her program.

Hypothesis Two

There is a positive relationship between students' scores on the criterion-referenced posttest and the following independent variables:

a. months of work experience in jobs held by the student that required knowledge of tree identification.

b. extent to which the tree identification book or manual was used by the student as a reference in completing homework assignments.

c. extent to which the tree identification book or manual was used by the student as a reference in the classroom.

d. extent to which the tree identification book or manual was used by the student as a reference in the outdoors.
e. extent to which the tree identification book or manual was interesting to the student.

A Likert-type scale was used to indicate the extent to which the tree identification book or manual was used by the student in different learning environments. There were six responses on the extent scale ranging from "did not use" to "used extensively." A Likert-type scale was also used to indicate the extent to which the tree identification book or manual was interesting to the student. There were six responses on the extent scale ranging from "not interesting" to "very interesting." Work experience for the student was measured in months. Other questions asked the student required a simple "yes" or "no" response. A copy of the student questionnaire is included in Appendix M.

A Pearson product-moment correlation coefficient as described in the manual, Statistical Package For The Social Sciences (1975), was used to analyze the data from the student questionnaire. The results of the Pearson product-moment correlation coefficients for hypothesis two are reported in Table 7.

The teachers returned 234 student questionnaires at the end of the study. Two teachers, one from the control group and one from the student manual only group, did not return the student questionnaires for their classes. Data on student use of the instructional materials obtained by questionnaire from the three groups were analyzed together.
### TABLE 7

**CORRELATION MATRIX:**

RELATIONSHIPS FOR STUDENT POSTTEST SCORE AND VARIABLES ASSOCIATED WITH STUDENT USE OF REFERENCES

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Interest in Reference</td>
<td>1.000</td>
<td>0.046*</td>
<td>0.055*</td>
<td>0.264*</td>
<td>0.032*</td>
<td>0.481*</td>
<td>0.181*</td>
<td>0.333*</td>
<td>0.052</td>
<td>0.252</td>
</tr>
<tr>
<td>2. Homework Assignment</td>
<td>1.000</td>
<td>0.178*</td>
<td>-----</td>
<td>0.070*</td>
<td>0.064</td>
<td>-0.043</td>
<td>0.093</td>
<td>0.101</td>
<td>0.147</td>
<td>0.214</td>
</tr>
<tr>
<td>3. Homework Reference Provided</td>
<td>1.000</td>
<td>-----</td>
<td>0.251*</td>
<td>0.267</td>
<td>0.304*</td>
<td>-0.036</td>
<td>0.057</td>
<td>0.224</td>
<td>0.245</td>
<td></td>
</tr>
<tr>
<td>4. Extent Reference Used for Homework</td>
<td>1.000</td>
<td>-0.081</td>
<td>0.400*</td>
<td>-0.065</td>
<td>0.320*</td>
<td>-0.076</td>
<td>0.172*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Classroom Reference Provided</td>
<td>1.000</td>
<td>-0.054</td>
<td>0.337*</td>
<td>0.035</td>
<td>0.053</td>
<td>0.027*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Extent Reference Used in Classroom</td>
<td>1.000</td>
<td>0.152*</td>
<td>0.472*</td>
<td>0.200*</td>
<td>0.200</td>
<td>0.169</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Outdoors Reference Provided</td>
<td>1.000</td>
<td>0.055</td>
<td>0.016</td>
<td>0.031*</td>
<td>0.031</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Extent Reference Used in Outdoors</td>
<td>1.000</td>
<td>-0.136*</td>
<td>0.153*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Months of Work Experience</td>
<td>1.000</td>
<td>0.109*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Posttest Score</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*significant at the .05 level  
**significant at the .01 level  
(n) = number of cases
For the variable, months of work experience in jobs held by the student, the number of months indicated by 223 students (95 percent of the cases) ranged from 0 to 36 with an average of 3.6 months. The calculated correlation coefficient for the students' months of work experience and posttest score was significant at the .05 level. An r of 0.11 indicated a low positive association between the students' work experience and posttest score.

For the variable, extent to which the tree identification book or manual was used by the student as a reference in completing homework assignments, 152 students (65 percent of the cases) responded. The mean of the 152 responses was 2.6, which indicated the extent of use was slightly below average. The calculated correlation coefficient for the extent to which the tree identification book or manual was used by the student as a reference in completing homework assignments and the students' posttest score was significant at the .05 level. An r of 0.17 indicated a low positive association between the extent of use and the students' posttest score.

For the variable, extent to which the tree identification book or manual was used by the student as a reference in the classroom, 224 students (96 percent of the cases) responded. The mean of the 224 responses was 2.9, which indicated the extent of use was about average. The calculated correlation coefficient was significant at the .01
level. An r of 0.20 indicated a low positive association between the extent of use of a reference in the classroom and the students' posttest score.

For the variable, extent to which the tree identification book or manual was used by the student as a reference in the outdoors, 183 students (78 percent of the cases) responded. The mean of the 183 responses was 2.7, which indicated the extent to which the tree identification book or manual was used was about average. The calculated correlation coefficient for the extent to which the tree identification book or manual was used by the student as a reference in the outdoors and the students' posttest score was significant at the .05 level. An r of 0.16 indicated a low positive association between the extent of use of a reference for outdoor study and the students' posttest score.

For the variable, extent to which the tree identification book or manual was interesting to the student, 216 students (92 percent of the cases) responded. The mean of the 216 responses was 2.5, which indicated the extent to which the tree identification book or manual was interesting was slightly below average interest. The calculated correlation coefficient for the extent to which the tree identification book or manual was interesting to the student and the students' posttest score was significant at the .01 level. An r of 0.28 indicated a low positive association between the extent of interest in the reference and the students'
posttest scores.

The Pearson product-moment correlation coefficients calculated for hypothesis two supported the research hypothesis. There was a low positive significant relationship between students' scores on the posttest and the independent variables listed in hypothesis two.

Intercorrelations Among Independent Variables

As reported in Table 7, the calculated correlation coefficient of 0.26 for the extent a reference was used by the student in completing homework, 0.48 for the extent a referenced was used in the classroom, and 0.34 for the extent a reference was used in the outdoors indicated a low to moderate positive relationship between student interest in a reference and the extent to which a reference was used in certain learning situations.

As reported in Table 7, the calculated correlation coefficient of 0.40 for the extent a reference was used in the classroom and an r of 0.32 for the extent to which a reference was used in the outdoors indicated a moderate positive relationship between the extent to which a tree identification reference was used in one learning situation and the extent to which a reference was used in another learning situation.
As reported in Table 7, the calculated correlation coefficient of -0.20 for the extent a reference was used in the classroom and an r of -0.14 for the extent a reference was used in the outdoors indicated a low negative relationship between the students' months of work experience and the use of a reference in two different learning situations.

Hypothesis Three

There is a positive relationship between students' scores on the criterion-referenced posttest and the following independent variables:

a. number of years work experience by the teacher in jobs requiring a knowledge of tree identification.

b. number of hours allotted by the teacher to outdoor study and identification of trees.

c. number of courses the teacher has taken beyond the high school level requiring knowledge of tree identification.

The teacher's questionnaire was in two parts. The first part used a Likert-type scale to indicate the "extent used" and the "value" for each of twenty-two teaching techniques. There were six responses on the extent scale ranging from "did not use" to "used extensively" and six responses on the value scale ranging from "of no value" to "of great value." The second part of the teacher's questionnaire
asked the teacher to indicate the number of years that he or she had taught tree identification, the number of years work experience in jobs requiring a knowledge of tree identification, the number of courses taken beyond the high school level requiring knowledge of tree identification, the length of time in weeks used in teaching the tree identification unit, the number of hours allotted to outdoor study and identification of trees, and the number of hours allotted to classroom study and identification of trees. A copy of the teacher's questionnaire is included in Appendix N.

A Pearson product-moment correlation coefficient as described in the manual, *Statistical Package For The Social Sciences* (1975), was used to analyze the data from the teachers' questionnaire. The results of the Pearson product-moment correlation for hypothesis three and four are reported in Table 8. Data on the teacher's background and teaching techniques used, obtained by questionnaire from the three groups, were analyzed together. Two teachers choose not to return their questionnaire, one from the control group and one from the student manual-teacher's guide group. Nineteen teachers returned a questionnaire. One of the nineteen did not chose to fill in the second part of the questionnaire asking for background information.

For the variable, number of years work experience in jobs requiring a knowledge of tree identification, 18
## TABLE 8

### CORRELATION MATRIX: POSTTEST SCORE AND VARIABLES ASSOCIATED WITH TEACHERS' BACKGROUND

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Teaching Experience</td>
<td>1.000</td>
<td>0.575&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.054</td>
<td>0.213</td>
<td>-0.086</td>
<td>-0.109</td>
<td>-0.074</td>
</tr>
<tr>
<td></td>
<td>(18)</td>
<td>(18)</td>
<td>(18)</td>
<td>(17)</td>
<td>(17)</td>
<td>(18)</td>
<td></td>
</tr>
<tr>
<td>2. Work Experience</td>
<td>1.000</td>
<td>0.216</td>
<td>0.383&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.185</td>
<td>0.194</td>
<td>0.044</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(18)</td>
<td>(18)</td>
<td>(18)</td>
<td>(17)</td>
<td>(17)</td>
<td>(18)</td>
<td></td>
</tr>
<tr>
<td>3. Courses Taken</td>
<td>1.000</td>
<td>-0.036</td>
<td>0.467&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-0.175</td>
<td></td>
<td>0.596&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(18)</td>
<td>(18)</td>
<td>(18)</td>
<td>(17)</td>
<td>(17)</td>
<td>(18)</td>
<td></td>
</tr>
<tr>
<td>4. Length of Teaching Time</td>
<td>1.000</td>
<td>0.193</td>
<td>0.429&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td>-0.064</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(17)</td>
<td>(17)</td>
<td>(17)</td>
<td></td>
<td>(17)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Hours of Outdoor Study</td>
<td>1.000</td>
<td>0.061</td>
<td>0.461&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(17)</td>
<td>(17)</td>
<td>(17)</td>
<td></td>
<td>(17)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Hours of Classroom</td>
<td>1.000</td>
<td>-0.477&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(17)</td>
<td></td>
<td>(17)</td>
<td></td>
<td>(17)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Posttest Score</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup>Significant at the .05 level  
<sup>b</sup>Significant at the .01 level  

(n)= number of cases
teachers responded. The number of years work experience ranged from 0 to 20 with an average of 5.4 years. The calculated correlation coefficient for the number of years work experience in jobs requiring a knowledge of tree identification and the students' posttest scores was not significant at the .05 level. The data in this study did not support the research hypothesis.

For the variable, number of hours allotted to outdoor study and identification of trees, 17 teachers responded. The number of hours ranged from 3 to 27 with an average of 12.5 hours. The calculated correlation coefficient for the number of hours allotted to outdoor study and identification of trees and students' posttest scores was significant at the .05 level. An r of 0.46 indicated a moderate positive association between the number of hours allotted to outdoor study of trees and the students' posttest score.

For the variable, number of courses the teacher has taken beyond the high school level requiring knowledge of tree identification 18 teachers responded. The number of courses taken ranged from 0 to 15 with an average of 4.4 courses. The calculated correlation coefficient for the number of courses taken and the students' posttest scores was significant at the .01 level. As reported in Table 8, an r of 0.60 indicated a substantial positive association between the number of courses taken by the teacher requiring knowledge of tree identification and
student achievement.

Hypothesis Four

There is a negative relationship between students' scores on the criterion-referenced posttest and the following independent variables:

a. number of years experience teaching tree identification completed by the teacher.
b. number of hours allotted by the teacher to classroom study and identification of trees.

A Pearson product moment-correlation coefficient was used to analyze the data pertaining to hypothesis four. The results of the analysis are reported in Table 8.

For the variable number of years experience teaching tree identification completed by the teacher, 18 teachers responded. The number of years teaching experience ranged from 0 to 12 years with an average of 3.9 years. The calculated correlation coefficient for the number of years experience teaching tree identification and the students' post-test scores was not significant at the .05 level. The data in this study did not support the research hypothesis. It was of interest to note that, although the relationship was not significant, it was in a negative direction. This followed the findings of other studies.

For the variable, number of hours allotted to classroom study and tree identification, 18 teachers responded. The number of hours allotted to classroom study
of trees ranged from 5 to 25 hours with an average of 14.1 hours. The calculated correlation coefficient for the number of hours allotted to classroom study and the students' posttest scores was significant at the .05 level. An r of -0.48 indicated a moderate negative association between the number of hours allotted to classroom study and the students' posttest scores.

Intercorrelations Among Independent Variables

It was concluded from the analysis of data as reported in Table 8, the calculated correlation coefficient of 0.38 for the teacher's work experience and an r of 0.43 for the hours allotted to classroom study indicated a moderate positive relationship between teaching time and the teacher's work experience and hours allotted to classroom study.

The calculated correlation coefficient of 0.47 for the number of courses taken by the teacher requiring knowledge of tree identification and the number of hours allotted by the teacher to outdoor study of trees indicated a moderate relationship between the teachers' education in areas of subject matter related to courses taught and hours allotted to outdoor study.

Hypothesis Five

There is a positive relationship between students' scores on the criterion-referenced posttest and the following
independent variables:

a. the number of teaching techniques used by the teacher in teaching tree identification.

b. the extent to which certain teaching techniques are used by the teacher.

c. the teachers' perception of the value of certain teaching techniques used in teaching tree identification.

A Pearson product moment-correlation coefficient was used to analyze the data pertaining to hypothesis five. The results of the analysis for section "a" of hypothesis five are reported in Table 9.

For the variable, number of teaching techniques used by the teacher in teaching tree identification, 19 teachers responded. The number of teaching techniques used ranged from 4 to 22 with an average of 12. The calculated correlation coefficient for the number of teaching techniques used and the students' posttest scores was significant at the .05 level. An $r$ of $-0.41$ indicated a moderate negative association between the number of teaching techniques used in teaching tree identification and the students' posttest scores. The direction of relationship reported was opposite to the direction stated in the research hypothesis.

The calculated correlation coefficient for the extent to which certain teaching techniques are used by the
### TABLE 9
RELATIONSHIPS FOR NUMBER OF TEACHING TECHNIQUES USED AND VARIABLES

<table>
<thead>
<tr>
<th>Variable</th>
<th>( r )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Years Teaching Experience</td>
<td>0.044</td>
</tr>
<tr>
<td>2. Courses Taken By The Teacher</td>
<td>-0.060</td>
</tr>
<tr>
<td>3. Years Work Experience</td>
<td>0.250</td>
</tr>
<tr>
<td>4. Weeks Teaching Tree I.D. Unit</td>
<td>0.429(^a)</td>
</tr>
<tr>
<td>5. Hours Allocated To Outdoor Study</td>
<td>0.207</td>
</tr>
<tr>
<td>6. Hours Allocated To Classroom Study</td>
<td>0.766(^b)</td>
</tr>
<tr>
<td>7. Posttest Score</td>
<td>-0.412(^a)</td>
</tr>
</tbody>
</table>

\(^a\)significant at the .05 level  
\(^b\)significant at the .01 level  
\((n) = \text{number of cases}\)
teacher and the students' posttest score revealed significant relationships. The results of the analysis for sections "b" and "c" of hypothesis five are reported in Table 10.

The extent to which the teacher used the following three teaching techniques was significant to the students' posttest scores:

1. cassettes or reel to reel tapes prepared to be used in individual study by the student \( (r = -0.43, p < .05) \). The students' posttest scores were related in a negative direction to the extent of use of cassette or reel to reel tapes in individual study by the student.

2. classroom demonstrations showing how-to-do-it for assigned projects (i.e., twig collections, leaf collections, key construction, etc.) \( (r = 0.49, p < .01) \). The students' posttest scores were moderately related in a positive direction to the extent of use of classroom demonstrations showing how-to-do-it for assigned projects.

3. normal tests and quizzes used for grading purposes and to monitor student rate and extent of progress \( (r = 0.38, p < .05) \). The students' posttest scores were moderately related in a positive direction to the extent of use of normal tests and quizzes used for grading
purposes and to monitor student rate and extent of progress.

The calculated correlation coefficient for the value of certain teaching techniques used by the teacher in teaching tree identification and the students' posttest score revealed significant relationships. The result of the analysis for section "c" of hypothesis five are reported in Table 10.

The value, as perceived by the teacher, of the following teaching techniques was significant to the students' posttest score:

1. slides used with classroom and/or laboratory presentations ($r = 0.38$, $p < .05$). The analysis of data showed that the teachers' perceived value of the use of slides in classroom or laboratory presentations was moderately related in a positive direction to the students' posttest score.

2. cassette or reel to reel tapes prepared to be used in individual study by the student ($r = -0.43$, $p < .05$). The analysis of data showed that the teachers' perceived value of the use of cassette or reel to reel tapes prepared to be used in individual study by the student was moderately related in a negative direction to the students' posttest score.
<table>
<thead>
<tr>
<th>Teaching Technique</th>
<th>Extent Used In Teaching</th>
<th>Value In Teaching Tree Identification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. mimeographed and/or ditto sheets</td>
<td>0.262</td>
<td>0.192</td>
</tr>
<tr>
<td>2. land laboratories</td>
<td>-0.075</td>
<td>-0.210</td>
</tr>
<tr>
<td>3. field trips</td>
<td>0.258</td>
<td>0.360</td>
</tr>
<tr>
<td>4. overhead transparencies</td>
<td>0.279</td>
<td>0.368</td>
</tr>
<tr>
<td>5. slides in the classroom or laboratory</td>
<td>0.225</td>
<td>0.383a</td>
</tr>
<tr>
<td>6. slides for individual study</td>
<td>0.168</td>
<td>0.168</td>
</tr>
<tr>
<td>7. cassette or reel to reel tape for individual study</td>
<td>-0.428a</td>
<td>-0.428a</td>
</tr>
<tr>
<td>8. electric quizboard</td>
<td>0.152</td>
<td>0.292</td>
</tr>
<tr>
<td>9. punch board quizzes</td>
<td>-0.169</td>
<td>-0.131</td>
</tr>
<tr>
<td>10. sliding quizzes</td>
<td>0.263</td>
<td>0.176</td>
</tr>
<tr>
<td>11. stimulus cards</td>
<td>0.191</td>
<td>0.155</td>
</tr>
<tr>
<td>12. crossword puzzles</td>
<td>-0.169</td>
<td>-0.117</td>
</tr>
<tr>
<td>13. classroom demonstrations</td>
<td>0.494b</td>
<td>0.316</td>
</tr>
<tr>
<td>14. scavenger hunt</td>
<td>0.084</td>
<td>0.229</td>
</tr>
<tr>
<td>15. leaf collection</td>
<td>0.234</td>
<td>0.247</td>
</tr>
<tr>
<td>16. twig collection</td>
<td>0.309</td>
<td>0.263</td>
</tr>
<tr>
<td>17. leaf prints</td>
<td>0.050</td>
<td>-0.001</td>
</tr>
<tr>
<td>18. simulation</td>
<td>-0.256</td>
<td>-0.166</td>
</tr>
<tr>
<td>19. grade contracts</td>
<td>-0.324</td>
<td>-0.344</td>
</tr>
<tr>
<td>20. normal tests and quizzes</td>
<td>0.378a</td>
<td>0.131</td>
</tr>
<tr>
<td>21. resource person</td>
<td>-0.084</td>
<td>0.044</td>
</tr>
<tr>
<td>22. behavioral objectives</td>
<td>-0.155</td>
<td>-0.142</td>
</tr>
</tbody>
</table>

*Significant at the .05 level (n = 19)*

*Significant at the .01 level*
CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The Problem and Hypotheses

Because the tree identification materials are unique in format and approach in presenting the basic principles of tree identification to the student, the investigator decided to field test the student manual and teacher's guide before sale and distribution. It was decided to evaluate the effectiveness of instruction that included the use of either the student manual only or both the student manual and the teacher's guide.

The problem investigated was: what is the effect, in terms of students' scores on a criterion-referenced test, of the type of instructional materials used in teaching tree identification to high school students enrolled in vocational agriculture? The treatment, type of instructional materials, included three levels which are as follows:


2. a student manual, *Tree Identification* (1975), used without the teacher's guide.
3. references and instructional materials
normally used by the teacher in teaching
tree identification to vocational agriculture
high school students. The teacher's guide and
student manual was not available to this group.

Student achievement was measured by the score on
a criterion-referenced test on tree identification.

In consideration of the purpose of the study and
the specific objectives, the following hypotheses were
developed to guide the investigator in the evaluation of
the effectiveness of instruction that includes the use of
tree identification instructional materials.

1. Students taught tree identification using the
student manual, *Tree Identification* (1975), and the teacher's
guide, *Teaching Tree Identification* (1975), will score signif-
ificantly higher on the posttest than students taught tree
identification using the student manual only. Both groups
of students (teacher's guide and student manual and stu-
dent manual only) will score higher on the posttest than
students taught tree identification without the use of the
student manual or teacher's guide.

2. There is a positive relationship between stu-
dents' scores on the criterion-referenced posttest and the
following independent variables:

   a. months of work experience in jobs held
      by the student that required knowledge
of tree identification.

b. extent to which the tree identification book or manual was used by the student as a reference in completing homework assignments.

c. extent to which the tree identification book or manual was used by the student as a reference in the classroom.

d. extent to which the tree identification book or manual was used by the student as a reference in the outdoors.

e. extent to which the tree identification book or manual was interesting to the student.

3. There is a positive relationship between students' scores on the criterion-referenced posttest and the following independent variables:

a. number of years work experience by the teacher in jobs requiring a knowledge of tree identification.

b. number of hours allotted by the teacher to outdoor study and identification of trees.

c. number of courses the teacher has taken beyond the high school level requiring knowledge of tree identification.
4. There is a negative relationship between students' scores on the criterion-referenced posttest and the following independent variables:
   a. number of years experience teaching tree identification completed by the teacher.
   b. number of hours allotted by the teacher to classroom study and identification of trees.

5. There is a positive relationship between students' scores on the criterion-referenced posttest and the following independent variables:
   a. the number of teaching techniques used in teaching tree identification.
   b. the extent to which certain teaching techniques are used by the teacher.
   c. teacher's perception of the value of certain teaching techniques used in teaching tree identification.

Procedure

Intact classes of twenty-one vocational agriculture teachers in Ohio were randomly assigned to one of the three levels of the treatment, type of instructional materials. The classes of the twenty-one teachers who participated in the study were obtained from districts within the commercial timber regions of Ohio where tree identification is part of the natural resources-vocational agriculture
curriculum. The twenty-one teachers in the study agreed to teach a tree identification unit in the late spring of 1976.

The design used in the study was a modification of the Solomon Four-Group Design as defined by Stanley and Campbell (1963). The twenty-one classes were randomly assigned to one of the three levels of treatment providing seven classes for each group. The levels of treatment included the use of a teacher's guide, *Teaching Tree Identification* (1975), in combination with a student manual, *Tree Identification* (1975), the use of the student manual only, and a control group. Each level of the treatment was provided with behavioral objectives for the student and a check list of trees that would be considered in the posttest. Each intact class was randomly divided into two equivalent subgroups for pretesting purposes. One subgroup received a non-relevant pretest and the other subgroup received the actual tree identification test. This was accomplished to establish equivalency of the groups before the study began and to test for interaction between pretesting and the treatment.

Certain extraneous variables that could be related to the dependent variable were monitored and described. The extent to which teachers used selected teaching techniques, the value they assigned the techniques, and certain descriptive characteristics of teachers were investigated. Students were asked to supply information concerning the
extent they used tree identification instructional references provided by the teacher. These variables were correlated with students' posttest scores. Prior to the onset of the study, a personal visit was made to each of the teachers by the investigator to explain the testing procedure and the division of the classes into two groups. Other correspondence was conducted by mail or telephone.

A sixty-five item multiple choice tree identification test was developed to quantify the dependent variable, students' posttest score. The sixty-five items were referenced to four behavioral objectives which defined the level of mastery to be exhibited by the students at the end of the tree identification unit. The tree identification test was pilot tested and revised previous to use in the study.

A questionnaire was developed for use by the teacher to monitor certain teaching techniques used and to gather background information. A Likert-type scale was used to measure the extent of use and perceived value for each teaching technique.

A questionnaire was developed for use by the student to monitor the extent to which tree identification references were used in certain learning situations. Students were also asked to indicate the months of work experience on jobs requiring knowledge of tree identification. Only students who were present for both the pretest and the posttest were included in the study.
The analysis of data for hypothesis one was a two-way analysis of variance. Pretest equivalence was established by a one-way analysis of variance. Hypotheses two through five were tested by the use of a Pearson product-moment correlation coefficient. A .05 level of significance was used in testing the null hypotheses.

**Summary of the Findings**

The results of the two-way analysis of variance for testing hypothesis one determined that there was no significant difference in the students' posttest scores between the three levels of the treatment, type of instructional material. The use of the student manual, *Tree Identification* (1975), and the teacher's guide, *Teaching Tree Identification* (1975), and the use of the student manual only in teaching tree identification to vocational agriculture high school students did not make a significant difference in student achievement as measured by the students' posttest score.

The results of the Pearson product-moment correlation coefficient for testing the five subsections of hypothesis two revealed a relatively low degree of relationship in a positive direction for students' posttest scores and the following independent variables:

a. months of work experience in jobs held by the student that required knowledge of tree identification.
b. extent to which the tree identification book or manual was used by the student as a reference in completing homework assignments.

c. extent to which the tree identification book or manual was used by the student as a reference in the classroom.

d. extent to which the tree identification book or manual was used by the student as a reference in the out-of-doors.

e. extent to which the tree identification book or manual was interesting to the student.

The results of the Pearson product-moment correlation coefficient for testing the three subsections of hypothesis three revealed a moderate to substantial degree of relationship in a positive direction for the students' posttest scores and the number of hours allotted by the teacher to outdoor study and identification of trees and the number of courses the teacher had taken beyond the high school level requiring knowledge of tree identification. The calculated correlation coefficient for the number of years work experience by the teacher in jobs requiring knowledge of tree identification and the students' posttest scores did not support the research hypothesis of a positive relationship for number of years work experience and student achievement.

The results of the correlation coefficient for
testing the two subsections of hypothesis four revealed:

a. the association between the number of years experience teaching tree identification by the teacher and the students' posttest scores was not significant. The findings did not support the research hypothesis.

b. students' posttest scores were moderately related in a negative direction to the number of hours allotted by the teacher to classroom study.

The results of the correlation coefficient for testing the three subsections of hypothesis five revealed:

a. the students' posttest scores were moderately related in a negative direction to the number of teaching techniques used in teaching tree identification. The relationship was inverse to the research hypothesis.

b. students' posttest scores were moderately related in a negative direction to the extent of use of cassette or reel to reel tapes in individual study. The relationship was inverse to the research hypothesis.

c. students' posttest scores were moderately related in a positive direction to the extent of use of classroom demonstrations showing how-to-do-it for assigned projects.
d. students' posttest scores were moderately related in a positive direction to the extent of use of normal tests and quizzes used for grading purposes and to monitor the students' rate and extent of progress.

e. the teachers' perceived value of the use of slides in classroom and laboratory presentations was moderately related in a positive direction to the students' posttest scores.

f. the teachers' perceived value of the use of cassette or reel to reel tapes prepared to be used in individual study by the student was moderately related in a negative direction to the students' posttest score. The relationship was inverse to the research hypothesis.

Conclusions

It was concluded from the analysis of the data obtained from twenty-one classes of vocational agriculture students and the respective teachers within Ohio that:

1. The use of the student manual, *Tree Identification* (1975), and the teacher's guide, *Teaching Tree Identification* (1975), made no significant difference in student
achievement, as measured by posttest scores, when compared to students taught tree identification without the use of the student manual and teacher's guide.

2. Student achievement, as measured by posttest scores, was related in a positive direction to the extent of student use of instructional materials in different learning environments, the extent of student interest generated by the use of instructional materials, the number of hours allotted by the teacher to teaching tree identification in the outdoors, the number of courses taken beyond the high school level by the teacher requiring knowledge of tree identification, the extent of use of classroom demonstrations and normal tests and quizzes by the teacher, and the teachers' perceived value of the use of slides in classroom and laboratory presentations.

3. Student achievement, as measured by posttest scores, was related in a negative direction to the number of hours allotted by the teacher to classroom study of tree identification, the number of teaching techniques used by the teacher in teaching tree identification, the extent of use of cassettes or reel to reel tapes
prepared to be used in individual study by
the student, and the teachers' perceived
value of the use of cassette or reel to reel
tapes prepared to be used in individual study
by the student.

Recommendations

Based on the findings of the study, the experience
of the investigator in conducting the study and the develop­
ment of the instructional materials used in the study,
the following recommendations are presented:

1. In consideration of the findings reported in
Table 7 the following recommendations are
presented: teachers should be encouraged to
assign homework and provide the student with
a suitable reference to use in completing the
homework assignments; teachers should be
encouraged to provide a suitable reference
for student use in both indoor and outdoor
learning situations; teachers should encourage
student use of the references provided; and
teachers should provide references that are
interesting to the student.

2. In consideration of the findings reported in
Table 8 the following recommendations are
presented: the teacher should carefully
consider the balance between the hours allotted to outdoor study and the hours allotted to classroom study when tree identification or other forestry resource related subjects are being taught; and teachers should be encouraged to take courses in the subject matter areas corresponding to the courses that the teacher is assigned to teach.

3. In consideration of the findings reported in Tables 9 and 10, the following recommendation is presented: the teacher should be encouraged to take refresher courses in teaching methodology and use of audio-visual and other teaching techniques which include the use of prepared instructional materials.

Recommendations For Further Study

Based on the findings of this study and the experience of the investigator while conducting the study, the following recommendations are presented:

1. In studies evaluating instructional materials the teacher's background characteristics, the student's background characteristics, the extent of the use of the instructional materials by the teacher and the student, the attitude of the teacher and the student toward
the instructional materials provided and the unit taught should be monitored and correlated with student achievement.

2. In studies evaluating instructional materials, the extent of the use of complementary references used by the teachers in teaching a unit other than the references provided for evaluation should be monitored and correlated with student achievement or controlled for in the design of the study.

3. In studies evaluating instructional materials, tests used to quantify the dependent variable, student achievement, should be administered as a normal test and used by the teacher to determine student achievement. If answer sheets are used, answer sheets indicating adaptation to computer scoring should not be used to prevent the students from knowing that they are in an experiment. Student answers should be transferred from a normal answer sheet to the computer adopted sheet.

4. Teachers participating in an evaluation of instructional materials should receive adequate instruction, prior to the study, demonstrating how to use the materials in
certain situations and how to integrate the use of the materials into their lesson plans. The teacher should develop lesson plans using the instructional materials and the number of hours allotted by the teacher to classroom study, laboratory, field trips, land laboratory should be determined prior to the onset of the study. The investigator may want to build the variable, orientation of the teachers, into the design of the study.

5. The time schedule of the study should be such that teachers and students participating in the study would not be influenced, distracted or hindered in the normal use of the instructional materials by outside stimuli (i.e., FFA contests, contract evaluation, vacations, conferences).

6. The teachers involved in an evaluation of instructional materials should read the instructional materials provided and take a test similar to the test administered to the students. The investigator may want to correlate the teacher's score with the students' score.
APPENDIX A

CORRESPONDENCE
October 3, 1975

TO: Selected Teachers of Vocational Agriculture

FROM: Harlan E. Ridenour, Director and Richard L. Geesey, Curriculum Materials Specialist

SUBJECT: Tree Identification Curriculum Materials Evaluation

During your district meeting at the July, 1975 Vocational Agricultural Teacher's Conference, you filled out a card indicating an interest in participating in an evaluation of tree identification curriculum materials. Please read the following brief explanation of the evaluation process and return the enclosed post card indicating whether or not you wish to participate in the evaluation.

The Ohio Agricultural Education Curriculum Materials Service is interested in evaluating a new student manual, Tree Identification, and a teacher's handbook, Teaching Tree Identification. The findings from this evaluation will be reviewed when revising curriculum materials used in teaching tree identification. We would like to invite you to participate in this evaluation.

The evaluation will involve the teacher using either the student manual or a combination of the student manual and teacher's handbook as an integral part of the lesson plans for teaching tree identification. We are asking the participating teachers to use the curriculum materials during the latter part of April and the first three weeks of May 1976. The participating teachers will be provided with sufficient copies of the student manual and where applicable, a copy of the teacher's handbook to use in the evaluation. There will be no cost on the part of the teacher or student.

A mastery test has been developed consisting of sixty-five questions referenced to the objectives of the tree identification unit. The teacher will be asked to administer the tree identification mastery test to one half of the class at the beginning of the unit. A non-relevant test will be provided for the teacher to administer to the second half of the class at the beginning of the unit. The mastery test and the non-relevant test will be administered at the same time.
A detailed set of instructions will be mailed with the objectives and the tree identification mastery test. The objectives will be mailed early in 1976 to allow time for the teacher to integrate the objectives into the lesson plan. The tree identification mastery test will be mailed early in April 1976.

We are interested in keeping the use of the objectives and mastery test as close to a normal classroom situation as possible. We would like the student to remain unaware that he or she is participating in an evaluation process. This will give us more reliable information concerning the effectiveness of tree identification curriculum materials as used in everyday classroom situations.

Enclosed is a card to indicate whether or not you will be willing to participate in the evaluation. Thank you for your interest in the evaluation and we are looking forward to working with you.

Please return the enclosed card this week.
TO: Selected Teachers of Vocational Agriculture

FROM: Harlan E. Ridenour, Director and Richard L. Geese, Curriculum Materials Specialist

SUBJECT: Tree Identification Curriculum Materials Evaluation

October 3, 1975

During your district meeting at the July, 1975 Vocational Agricultural Teacher's Conference, you filled out a card indicating an interest in participating in an evaluation of tree identification curriculum materials. Please read the following brief explanation of the evaluation process and return the enclosed post card indicating whether or not you wish to participate in the evaluation.

The Ohio Agricultural Education Curriculum Materials Service is interested in evaluating a tree identification mastery test. The mastery test consists of sixty-five questions. The findings of this evaluation will be used to revise curriculum materials specific to teaching tree identification. We would like to invite you to participate in this evaluation.

The evaluation will involve the teacher using a set of student objectives as an integral part of the lesson plans for teaching tree identification. We are asking the participating teachers to teach a tree identification unit using the student objectives during the latter part of April and the first three weeks of May 1976. The participating teachers will be provided with sufficient copies of the objectives and the tree identification mastery test. There will be no cost on the part of the teacher or student.

The teacher will be asked to administer the tree identification mastery test to one half of the class at the beginning of the unit and again to the entire class upon completion of the unit. A non-relevant test will be provided for the teacher to administer to the second half of the class at the beginning of the unit. The mastery test and the non-relevant test will be administered at the same time.
A detailed set of instructions will be included with the curriculum materials. The curriculum materials will be mailed early in 1976 to allow time for the teacher to read both the manual and handbook and to integrate the materials into the lesson plans. This will allow time for the teacher to become acquainted with the materials and receive answers to any questions concerning the use of the materials and the evaluation procedure.

We are interested in keeping the use of the materials and the administration of the mastery tests as close to a normal classroom situation as possible. We would like the student to remain unaware that he or she is participating in an evaluation process. This will give us more reliable information concerning the effectiveness of the tree identification curriculum materials as used in everyday classroom situations.

Enclosed is a card to indicate whether or not you will be willing to participate in the evaluation. Thank you for your interest in this evaluation and we are looking forward to working with you.

Please return the enclosed card this week.
APPENDIX B

PRETESTING INSTRUCTIONS
TO THE TEACHER
SAMPLE COPY

INSTRUCTIONS TO THE TEACHER

Use of the Instructional Materials:

This mailing contains the instructional materials that have been prepared for your use in teaching tree identification to your students. You will find the following materials in this box:

1. ___ Copies of a selected portion of a student manual, Tree Identification.

2. One copy of the teacher's guide, Teaching Tree Identification.

3. One copy of the Student Behavioral Objectives.

4. One copy of a Partial Check List of Forest Trees Common to Ohio.

5. One copy of a Test Form Sheet on which you list alphabetically the students of the class that are participating in the evaluation.

6. One postcard.

Please check to see that you have received all of the materials listed above. The enclosed number of copies of the selected portion of the student manual is the same as the number of students indicated on the postcard that you returned in October 1975. If you need additional copies, please indicate the number needed on the enclosed postcard and return it to this office as soon as possible.

Due to the cost of developing and printing the portions of the student manual, the amount of instructional materials provided will necessarily be limited to the students in the class involved in the evaluation.

Read through the instructional materials to get the flavor of their content. This will help you understand the focus of the materials and the format used in describing the identifying characteristics of the selected trees. This will also help you decide as to how you can best use the materials in your classroom.
The Partial Check List of Forest Trees Common to Ohio can be used as an index to the species contained in the selected portion of the student manual. These species will be included as part of the evaluation. Scientific names will not be tested.

The teacher's guide was developed to provide examples of teaching techniques that motivate the student to be more involved in the teacher-learner process. Many of the techniques illustrated can be easily initiated and will usually encourage the student to use the references and instructional materials provided by the teacher.

The four student behavioral objectives should be used to guide the student toward the goal of learning how to identify trees and the level of mastery that he or she should be able to demonstrate at the end of the unit.

After reading through the instructional materials, please integrate the materials into your lesson plans. You may use the instructional materials in any manner that you wish. The instructional materials do not have to be returned upon completion of the unit.

*These instructions were sent to the teachers using both the student manual and the teacher's guide. (Level 1 of the treatment, Type of Instructional Materials)
SAMPLE COPY

INSTRUCTIONS TO THE TEACHER

Use of the Instructional Materials:

This mailing contains the instructional materials that have been prepared for your use in teaching tree identification to your students. You should find the following materials in this box:

1. ____ Copies of a selected portion of a student manual, Tree Identification.
2. One copy of the Student Behavioral Objectives
3. One copy of a Partial Check list of Forest Trees Common to Ohio.
4. One copy of a Test Form Sheet on which you list alphabetically the students of the class that are participating in the evaluation.
5. One postcard.

Please check to see that you have received all of the materials listed above. The enclosed number of copies of the selected portion of the student manual is the same as the number of students indicated on the postcard that you returned in October 1975. If you need additional copies, please indicate the number on the enclosed postcard and return it to this office as soon as possible.

Due to the cost of developing and printing the portions of the student manual the amount of instructional materials provided will necessarily be limited to the students in the class involved in the evaluation.

Read through the instructional materials to get the flavor of their content. This will help you understand the focus of the materials and the format used in describing the identifying characteristics of the selected trees. This will also help you decide as to how you can best use the materials in your lesson plans.

The Partial Check List of Forest Trees Common to Ohio can be used as an index to the species contained in the selected portion of the student manual. These species will
be included as part of the evaluation. Scientific names will not be tested.

The four student behavioral objectives should be used to guide the student toward the goal of learning how to identify trees and the level of mastery that he or she should be able to demonstrate at the end of the unit.

After reading through the instructional materials, please integrate the materials into your lesson plans. You may use the instructional materials in any manner that you wish. The instructional materials do not have to be returned upon completion of the unit.

"These instructions were sent to the teachers using only the student manual. (Level 2 of the treatment, Type of Instructional Materials)"
INSTRUCTIONS TO THE TEACHER

Use of the Instructional Materials:

This mailing contains the instructional materials that have been prepared for your use in teaching tree identification to your students. You should find the following materials in this envelope:

1. One copy of the Student Behavioral Objectives.
2. One copy of a Partial Check List of Forest Trees Common to Ohio.
3. One postcard.
4. One copy of the Test Form Sheet on which you list alphabetically the students of the class that are participating in the evaluation.

The four student behavioral objectives should be used to guide the student toward the goal of learning how to identify trees and the level of mastery that he or she should be able to demonstrate at the end of the unit.

The Partial Check List of Forest Trees Common to Ohio can be used as a guideline as to the species of trees that are to be included as part of the evaluation.

After checking through the instructional materials and dividing your class into two groups, please indicate the number of students receiving Test A and Test B on the postcard. This will enable us to send you the correct quantity of each test.

Instructions for dividing your class into two groups is explained on the following page.

*These instructions were sent to the teachers using the instructional materials that they would normally use in teaching tree identification. (Level 3 of the treatment, Type of Instructional Materials)
NECESSARY PREPARATIONS TO BE COMPLETED BEFORE ADMINISTERING THE PRETEST

The pretest, pretest answer sheet and additional instructions for administering the pretest will be mailed to you during the first week in April. The pretest consists of two different tests, Test A and Test B. One half of the class will be administered Test A and the remaining half of the class will be administered Test B. Test A is the actual tree identification pretest. Test B is the non-relevant pretest.

It is necessary to divide your students into two groups before administering the pretest. This will be done on paper only. The setting of the normal classroom environment and the seating arrangement will remain unchanged. It is necessary to divide the students into two groups to know which form of pretest to give to each student.

Attached to this instruction sheet is the Test Form Sheet that should be used to divide the students. Please safeguard this test form. You will need the Test Form Sheet to tell the students whether Test Form A or B should be indicated on the answer sheet. The student must indicate the pretest form (Test A or Test B) on both the pretest answer sheet and the posttest answer sheet. This is very important to the evaluation and should be checked
before mailing the answer sheets to the Curriculum Materials Service.

Using the Test Form Sheet provided you, list the students alphabetically by their last name. You will notice that each line is numbered, starting with one and ending with twenty-five. The students that fall on the even numbered lines will receive the actual tree identification pretest, Test A. The students that fall on the odd numbered lines will receive the non-relevant pretest, Test B.

The pretest, pretest answer sheets and additional instructions for administering the pretest will be mailed to you during the first week in April. You want to be sure to plan to administer the pretests before you begin to teach the tree identification unit. You may want to give the pretest during the first class period of the unit. This pretest process is very important, because it shows us how much knowledge the student has before starting the unit. Pre-addressed envelopes will be included with the April mailing and we are asking you to return the pretests and answer sheets to the curriculum Materials Service after pretesting the students.

After checking through the instructional materials, and dividing your students into two groups, please indicate the number of students receiving Test A and Test B on the postcard. This will enable us to send you the correct quantity of each test.
A WORD ABOUT THE POSTTEST

The posttest will be mailed to you during the first week of May. All of the students in your class will receive the same posttest. You will need the Test Form Sheet that you used to divide the students into two groups to tell the students to blacken in either Test Form A or Test Form B on the answer sheet. As mentioned previously, it is very important that we know which form of the pretest that the student was assigned. You should plan to administer the posttest immediately after completing the tree identification unit. You may want to administer the posttest during the last class period of the unit.

Included with the posttest and the posttest answer sheets in the May mailing will be questionnaires for the teacher and for the student. Please fill in these questionnaires after the posttesting is completed.

Pre-addressed return envelopes will be included with the May mailing and we will be asking that you return only the posttest answer sheets, the teacher and student questionnaires, and the Test Form Sheet. The instructional materials and the tests will be yours to do with as you choose.

We are interested in keeping the use of the instructional materials and the administration of the tests as close to a normal classroom situation as possible. We would like the student to remain unaware that he or she is participating in an evaluation. This will give us more
reliable information concerning the effectiveness of the
tree identification instructional materials as used in
everyday classroom situations. Please use the instructional
materials sent to you as you would use them normally in
teaching tree identification.

"These instructions were sent to all the teachers participating in the study."
INSTRUCTIONS TO THE TEACHER

NOTE: THESE TESTS SHOULD BE GIVEN BEFORE YOU BEGIN TEACHING THE TREE IDENTIFICATION UNIT AND RETURNED AS SOON AS POSSIBLE AFTER COMPLETING THE PRETESTING.

STUDENTS ARE NOT TO PUT ANY INFORMATION ON THE ANSWER SHEET THAT IS NOT SPECIFICALLY ASKED FOR ON THE STUDENT INSTRUCTION SHEET.

ONLY PENCILS MAY BE USED TO MARK ON THE ANSWER SHEETS.

TESTING PROCEDURES:

1. Distribute one answer sheet and one copy of the test to each student.

2. Read all of the instructions aloud to the students and have them fill in the answer sheet as requested.

3. Please note that the students are not to fill in the following items on the answer sheet:
   a. social security number
   b. section number
   c. sex

4. The students must print in their name and blacken in the appropriate letters below each letter of their name. Also, they must fill in the "Test Form," "Instructor," (your name) "Number," (grade in school) and "Campus," (name of school).

5. Make a random check of student's answer sheets to see if they have them properly completed before starting the test.
6. Before allowing students to begin the test, emphasize that these tests will not affect their class grades and that they should select the one best answer for each question.

7. Mention to the students that there are two test forms and the answers to the questions are different, so they are not to attempt to copy from their neighbors.

If the students question the use of the pretests, it may be explained that the test will show how much they know as of this point in time in their education and the tests will help in organizing instructional materials to be used in the tree identification unit.

8. Begin the test—there is no time limit for the test, however, it should not take more than 30-45 minutes to complete.

9. When the student has completed the test, collect ALL tests and answer sheets.

10. Check to see that all appropriate blocks are marked properly. MAKE SURE THE TEST FORM (A or B), THEIR NAME AND OTHER INFORMATION LISTED ON THE INSTRUCTIONS FOR STUDENTS SHEET IS ON THE ANSWER SHEET IN THE PROPER PLACE.

MAILING PROCEDURES:

1. Put answer sheets and the tests in the return envelope.

2. Make sure you put your return address on the outside of the envelope.

3. Please return all materials by 4th. class mail (Book Rate). This will save on postage and we will get them just as quickly.
SUMMARY COMMENTS:

1. If you have any problems, please call collect; Phone: 614-422-5227. Please ask for Richard Geesey.

2. Give the pretest and return the pretest and answer sheets to our office as soon as possible after you administer them.
APPENDIX C

PRETESTING INSTRUCTIONS
TO THE STUDENT
PRETESTING

INSTRUCTIONS TO THE STUDENTS

1. Do not fill in any blocks on the answer sheet that you are not told to fill in.

2. Turn the answer sheet so the instructions for putting your name on the form are in the upper right hand corner.

3. Make sure you have a black lead pencil. Pens will not work. BLACKEN IN the correct boxes.

4. PRINT your last name and first name in the boxes, then blacken the matching letters below each box. If either your last or first name has more letters than boxes, put as many of the letters of your name as you can in the boxes provided. There are:

   12 boxes for your last name
   7 boxes for your first name

   REMEMBER, print in your last name and THEN your first name.

5. Now look in the lower right hand corner of the answer sheet. On the line labeled "Instructor" print in your teacher's name. On the line labeled "Number" place your grade in school. On the line labeled "Campus" write in the name of your school. Indicate Test Form A or B.

6. Now turn the answer sheet around so that you can read the question numbers. Note that the numbers go ACROSS the page in rows--left to right. Be sure that you answer in the correct row and after the correct number.

7. Questions on this test are answered by marking the boxes on the answer sheet which has been given you. PLEASE DO NOT WRITE ON THE TEST. PLACE YOUR ANSWERS ON THE ANSWER SHEET ONLY.

8. The pages of the tests are printed on both sides. The questions are numbered in order.
9. Does everyone understand how to take the test? If not, ask now!

10. If you have any questions, please hold up your hand.
To: Teachers participating in the evaluation of tree identification instructional materials

From: Richard L. Geesey

Thank you for helping to evaluate the instructional materials that you use to teach tree identification. This information will give us an insight as to your needs and the needs of the student.

Please remember to follow the procedure listed below for pretesting:

- divide the class into two groups using the Test Form Sheet provided.

- even numbered students receive the tree I.D. test (test A) and the odd numbered students receive the non-relevant test (test B).

- pretest the students immediately before starting to teach the tree I.D. unit.

- make sure the students fill in their name, test form, grade in school, your name and the name of your school in the appropriate spaces and boxes.

- mail both test forms and answer sheets to the Curriculum Materials Service immediately after pretesting in the envelop provided.

While teaching the tree I.D. unit please keep the following questions in mind as to the effectiveness of the instructional materials that you use:

1. Is the reading level appropriate for your students?

2. Do the materials adequately explain how to identify the tree species?

3. Do the illustrations and/or pictures show enough detail to be used to help identify the tree species?

4. What instructional materials would you like to have to teach tree identification?
5. Does the tree I.D. test cover the I.D. characteristics adequately?

6. What tree I.D. instructional materials do you use most often in your tree I.D. unit?

7. Are the tree keys easy to read and to use?

Your cooperation and effort will make this evaluation effective and meaningful.
April 23, 1976

To: Teachers participating in the evaluation of tree identification instructional materials.

From: Richard L. Geesey

Just a reminder to those teachers who have not pretested their classes and returned the pretests and answer sheets to the Curriculum Materials Service Office.

Please remember to follow the procedure listed below for pretesting your class:

1. Divide the class into two groups using the Test Form Sheet provided you.

2. The even numbered students receive the tree I.D. test (test form A), and the odd numbered students receive the non-relevant test (test form B).

3. PRETEST THE STUDENTS IMMEDIATELY BEFORE STARTING TO TEACH THE TREE I.D. UNIT.

4. Make sure the students fill in their name, test form, grade in school, your name and the name of your school in the appropriate spaces and boxes.

5. Mail both test forms and the answer sheets to the Curriculum Materials Service Office immediately after pretesting your class. A pre-addressed envelope has been previously provided for this purpose.

While you are teaching the tree I.D. unit, please keep the following questions in mind as to the effectiveness of the instructional materials that you are using:

1. Is the reading level appropriate for your students?

2. Do the materials adequately explain how to identify the tree species?
3. Do the illustrations and/or pictures show enough detail to be used in identification of trees?

4. What instructional materials would you like to have available to teach tree identification?

5. Does the tree identification test adequately cover the tree I.D. characteristics?

6. What tree I.D. instructional materials would you recommend for student use based on your own experience?

7. If you use tree keys, are they easy to read and use?

Your cooperation and effort will make this evaluation effective in the production of better instructional materials. The posttests will be mailed to you during the first week in May.
RANDOM DIVISION OF INTACT CLASSES INTO EQUIVALENT SUBGROUPS

The intact classes were randomly divided into two equivalent subgroups and then randomly assigned to one level of testing, pretest or no-pretest. To divide the classes into two equivalent subgroups, the teachers were instructed to list their students alphabetically by their last name on the Test Form Sheet. All students whose name fell on the even numbered lines were assigned to take the actual tree identification test. All students whose name fell on the odd numbered lines were assigned to take the non-relevant test. Previous to the study, the investigator assigned the level of pretesting to the odd and even numbered lines by the flip of a coin.

This procedure allowed for random division of the intact classes into two subgroups without any physical rearrangement of the normal classroom environment. Therefore, the students were unaware that they were assigned to a specific subgroup for pretesting purposes. The teachers were instructed to tell the students that there were two different tests and the answers were different. If the students questioned the use of the pretests, the teacher was instructed to tell the students that the tests will indicate how much they know as of this point in time in their education and that the test will help in organizing
instructional materials to be used in the tree identification unit.
TEST FORM SHEET

PLEASE LIST YOUR STUDENTS ALPHABETICALLY. The students that fall on the even numbered lines (2, 4, 6, ...) will receive the actual tree identification pretest (Test A). The students that fall on the odd numbered lines (1, 3, 5, ...) will receive the non-relevant (Test B). Please return this sheet along with the posttest answer sheets and the student and teacher questionnaires at the completion of the evaluation. Return addressed envelopes will be included with the May posttest mailing.

1. __________________________ 18. __________________________
2. __________________________ 19. __________________________
3. __________________________ 20. __________________________
4. __________________________ 21. __________________________
5. __________________________ 22. __________________________
6. __________________________ 23. __________________________
7. __________________________ 24. __________________________
8. __________________________ 25. __________________________
9. __________________________
10. __________________________
11. __________________________
12. __________________________
13. __________________________
14. __________________________
15. __________________________
16. __________________________
17. __________________________

All even numbered students receive the actual tree identification pretest (Test A).

All odd numbered students receive the non-relevant pretest (Test B).

The student's answer sheet must show which pretest form was taken. Have the student blacken in the Test Form column on the answer sheet. Either Test Form A or B should be indicated.
APPENDIX F

A PARTIAL CHECK LIST OF FOREST TREES GROWING IN OHIO
<table>
<thead>
<tr>
<th>COMMON NAME</th>
<th>SCIENTIFIC NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>White pine</td>
<td>Pinus strobus</td>
</tr>
<tr>
<td>Pitch pine</td>
<td>Pinus rigida</td>
</tr>
<tr>
<td>Virginia pine</td>
<td>Pinus virginiana</td>
</tr>
<tr>
<td>Eastern larch</td>
<td>Larix laricina</td>
</tr>
<tr>
<td>Eastern hemlock</td>
<td>Tsuga canadensis</td>
</tr>
<tr>
<td>Black walnut</td>
<td>Juglans nigra</td>
</tr>
<tr>
<td>Shagbark hickory</td>
<td>Carya ovata</td>
</tr>
<tr>
<td>Pignut hickory</td>
<td>Carya glabra</td>
</tr>
<tr>
<td>Mockernut hickory</td>
<td>Carya tomentosa</td>
</tr>
<tr>
<td>Bitternut hickory</td>
<td>Carya cordiformis</td>
</tr>
<tr>
<td>Shellbark hickory</td>
<td>Carya laciniosa</td>
</tr>
<tr>
<td>Black locust</td>
<td>Robinia pseudoacacia</td>
</tr>
<tr>
<td>Sassafras</td>
<td>Sassafras albidum</td>
</tr>
<tr>
<td>White oak</td>
<td>Quercus alba</td>
</tr>
<tr>
<td>Northern red oak</td>
<td>Quercus rubra</td>
</tr>
<tr>
<td>Scarlet oak</td>
<td>Quercus coccinea</td>
</tr>
<tr>
<td>Yellow poplar</td>
<td>Liriodendron tulipifera</td>
</tr>
<tr>
<td>American chestnut</td>
<td>Castanea dentata</td>
</tr>
<tr>
<td>American beech</td>
<td>Fagus grandifolia</td>
</tr>
<tr>
<td>Chinkapin oak</td>
<td>Quercus muehlenbergii</td>
</tr>
<tr>
<td>Chestnut oak</td>
<td>Quercus prinus</td>
</tr>
<tr>
<td>Black willow</td>
<td>Salix nigra</td>
</tr>
<tr>
<td>Black cherry</td>
<td>Prunus serotina</td>
</tr>
<tr>
<td>American elm</td>
<td>Ulmus americana</td>
</tr>
<tr>
<td>Eastern cottonwood</td>
<td>Populus deltoides</td>
</tr>
<tr>
<td>American basswood</td>
<td>Tilia americana</td>
</tr>
<tr>
<td>White ash</td>
<td>Fraxinus americana</td>
</tr>
<tr>
<td>Sugar maple</td>
<td>Acer saccharum</td>
</tr>
<tr>
<td>Red maple</td>
<td>Acer rubrum</td>
</tr>
<tr>
<td>Black maple</td>
<td>Acer nigrum</td>
</tr>
<tr>
<td>Silver maple</td>
<td>Acer saccharinum</td>
</tr>
</tbody>
</table>
APPENDIX G

STUDENT BEHAVIORAL OBJECTIVES
STUDENT BEHAVIORAL OBJECTIVES

1. When provided with representative pictures, drawings, and/or specimens of leaves from selected forest trees common to Ohio, the student will identify by name the tree represented by using the identifying features of the leaves.

2. When provided with representative pictures, drawings, and/or specimens of twigs from selected forest trees common to Ohio, the student will identify by name the tree represented by using the identifying features of the twigs.

3. When provided with representative pictures, drawings, and/or specimens of fruit from selected forest trees common to Ohio, the student will identify by name the tree represented by using the identifying features of the fruit.

4. When provided with representative pictures, drawings, and/or specimens of leaves, twigs and fruit of forest trees common to Ohio, the student will use a dichotomus tree key to key-out the selected tree(s).
APPENDIX H

POSTTESTING INSTRUCTION
TO THE TEACHER
INSTRUCTIONS TO THE TEACHER:

THE POSTTESTS SHOULD BE GIVEN IMMEDIATELY AFTER YOU FINISH TEACHING THE TREE IDENTIFICATION UNIT. IF POSSIBLE, THE POSTTEST SHOULD BE GIVEN DURING THE LAST CLASS PERIOD OF THE TREE IDENTIFICATION UNIT. PLEASE BE CERTAIN THAT THE FOLLOWING MATERIALS ARE RETURNED IN THE PRE-ADDRESSED ENVELOPE INCLUDED IN THIS MAILING:

1. The posttest answer sheet.
2. The questionnaires for both teacher and student.
3. The TEST FORM SHEET used to divide your class into two groups.
4. Any comments that you would like to make about the evaluation.

TESTING PROCEDURE:

The following procedure is suggested in administering the posttest and questionnaires to the student:

1. Distribute one answer sheet and one copy of the posttest to each student. Do not hand out the questionnaire until the student is finished taking the posttest.
2. Read all of the instructions aloud to the students and have them fill in the answer sheets as instructed.
3. Please note that the students are not to fill in the following items on the answer sheet:
   a. social security
   b. section number
   c. sex
4. The student must print in their name and blacken in the appropriate letters below each letter of their name. Also, they must fill in the lines for: "Instructor," (your name) "Number," (grade in school) and "Campus," (name of school).

5. Make a random check of student's answer sheets to see if they have them properly completed.

6. Before allowing the students to begin the test, emphasize that these tests will not affect their class grades and that they should select the one best answer for each question.

7. Begin the test—there is no time limit for the test, however it should not take more than 30-45 minutes to complete.

8. When the students have completed the test, collect the posttests and answer sheets. Check to see that all appropriate blocks are marked properly.

9. Hand out the student questionnaire. The student may not understand the graduation on the scale used for questions 4, 6, 8, and 9. Please refer to the SAMPLE QUESTIONNAIRE included with the instructions. The graduations of the scale are explained in more detail.

10. Collect all questionnaires. Check to see that all questions have been answered.

MAILING PROCEDURE:

1. Place answer sheets, teacher and student questionnaire, TEST FORM SHEET, and your comments in the pre-addressed envelope.

2. Mail these materials to the Curriculum Materials Service as soon as you are finished with the posttesting.
SUMMARY COMMENTS:

If you have any problems, please call collect. Phone: 614-422-5227 Please ask for Richard Geesey.

Your cooperation and effort will make this evaluation effective in the production of better instructional materials. Thank you for your kind consideration.

You may keep the instructional materials and post-test to use as you wish.
APPENDIX I

POSTTESTING INSTRUCTIONS
TO THE STUDENT
INSTRUCTIONS TO THE STUDENT:

1. Do not fill in any blocks on the answer sheet that you are not told to fill in.

2. Make sure you have a black lead pencil. Pens will not work. BLACKEN IN the correct boxes for your name, Test Form, and the answers to the tree identification test.

3. Turn the answer sheet so the instructions for printing your name on the form are in the upper right hand corner.

4. PRINT your last name and first name in the boxes, then blacken the matching letters below each box. If either your last or first name has more letters than boxes, put as many of the letters of your name as you can in the boxes provided. There are:

   12 boxes for your last name
   7 boxes for your first name

REMEMBER, print in your last name and then your first name.

5. Now look in the lower right hand corner of the answer sheet. On the line labeled "Instructor" print in your teacher's name. On the line labeled "Number" place your grade in school. On the line labeled "Campus" write in the name of your school. Under the column labeled TEST FORM, indicate form A or B. (The teacher may want to read the test form A or B from the Test Form Sheet for each student. If you do not have the Test Form Sheet, leave the Test Form column blank.)

6. Now turn the answer sheet around so you can read the question numbers. Note that the numbers go across the page in rows—left to right.

7. Questions on this test are answered by blacking in the boxes corresponding to the letter of the correct answer. Be sure that you place your answer in the correct row and after the
8. The pages of the tests are printed on both sides. The questions are numbered in order.
APPENDIX J

TREE IDENTIFICATION TEST ITEMS
AS REFERENCED TO
STUDENT BEHAVIORAL OBJECTIVES
1. When provided with representative pictures, drawings, and/or specimens of leaves from selected forest trees common to Ohio, the student will identify by name the tree represented by using the identifying features of the leaves.

Test Items 1 through 20

2. When provided with representative pictures, drawings, and/or specimens of twigs from selected forest trees common to Ohio, the student will identify by name the tree represented by using the identifying features of the twigs.

Test Items 36 through 60

3. When provided with representative pictures, drawings, and/or specimens of fruit from selected forest trees common to Ohio, the student will identify by name the tree represented by using the identifying features of the fruit.

Test Items 21 through 35

4. When provided with representative pictures, drawings, and/or specimens of leaves, twigs and fruit of forest trees common to Ohio, the student will use a dichotomus tree key to key-out the selected tree(s).

Test Items 61 through 65
APPENDIX K

TREE IDENTIFICATION TEST
CORRECTLY IDENTIFY THE TREE BY THE ILLUSTRATED LEAF
CAREFULLY BLACKEN IN ONE CORRECT ANSWER
ON THE ANSWER SHEET

1. A. Red Maple
   B. Shagbark Hickory
   C. Yellow Poplar
   D. Sassafras

2. A. Scarlet Oak
   B. Sycamore
   C. Red Oak
   D. Silver Maple

3. A. Hackberry
   B. Sassafrass
   C. White Oak
   D. White Ash

4. A. Scarlet Oak
   B. Silver Maple
   C. American Elm
   D. Swamp White Oak

GO ON TO NEXT PAGE
CORRECTLY IDENTIFY THE TREE BY THE ILLUSTRATED LEAF

5. A. Boxelder  
   B. Red Oak  
   C. Red Maple  
   D. Eastern Cottonwood

6. A. Chestnut Oak  
   B. Mossycup Oak  
   C. Basswood  
   D. Yellow Birch

7. A. Shagbark Hickory  
   B. Boxelder  
   C. Staghorn Sumac  
   D. Bitternut Hickory

8. A. Silver Maple  
   B. White Oak  
   C. Black Oak  
   D. Bur Oak

GO ON TO NEXT PAGE
CORRECTLY IDENTIFY THE TREE BY THE ILLUSTRATED LEAF
CAREFULLY BLACKEN IN ONE CORRECT ANSWER
ON THE ANSWER SHEET

9. A. Bitternut Hickory
   B. Ash Leaf Maple
   C. Pignut Hickory
   D. Black Walnut

10. A. Basswood
    B. American Elm
    C. Eastern Cottonwood
    D. Chestnut Oak

11. A. White Ash
    B. Chestnut Oak
    C. Black Locust
    D. Black Walnut

12. A. American Elm
    B. Persimmon
    C. Hackberry
    D. Black Cherry

GO ON TO NEXT PAGE
CORRECTLY IDENTIFY THE TREE BY THE ILLUSTRATED LEAF
CAREFULLY BLACKEN IN ONE CORRECT ANSWER
ON THE ANSWER SHEET

13. A. Black Walnut
    B. Black Locust
    C. Black Cherry
    D. Shagbark Hickory

14. A. Red Maple
    B. Basswood
    C. Yellow Poplar
    D. Eastern Cottonwood

15. A. White Ash
    B. Black Walnut
    C. Pignut Hickory
    D. Sugar Maple

16. A. Red Maple
    B. Burr Oak
    C. Basswood
    D. Sugar Maple

GO ON TO NEXT PAGE
CORRECTLY IDENTIFY THE TREE BY THE ILLUSTRATED LEAF
CAREFULLY BLACKEN IN ONE CORRECT ANSWER
ON THE ANSWER SHEET

17. A. Chestnut Oak  
B. White Oak  
C. Red Oak  
D. Sassafras

18. A. Red Oak  
B. White Oak  
C. Sassafras  
D. Silver maple

19. A. Black Cherry  
B. Basswood  
C. American Elm  
D. Eastern Cottonwood

20. A. Black Gum  
B. Chestnut Oak  
C. Black Cherry  
D. American Beech

GO ON TO NEXT PAGE
**Indicate the correct number of needles per fascicle or leafstalk for each of the conifers listed below. Carefully blacken in one correct answer on the answer sheet.**

<table>
<thead>
<tr>
<th></th>
<th>White Pine</th>
<th>Pitch Pine</th>
<th>Virginia Pine</th>
<th>Hemlock</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>B</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>C</td>
<td>2 &amp; 3</td>
<td>2 &amp; 3</td>
<td>2 &amp; 3</td>
<td>2 &amp; 3</td>
</tr>
<tr>
<td>D</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>E</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

**Indicate which of the conifers listed below has prickles on its cones. Carefully blacken in one correct answer on the answer sheet.**

25. A. White Pine  
   B. Virginia Pine  
   C. Eastern Hemlock  
   D. Eastern Larch
PLEASE NOTE:

This page not included in material received from the Graduate School. Filmed as received.

UNIVERSITY MICROFILMS
CORRECTLY IDENTIFY THE TREE BY THE ILLUSTRATED FRUIT
CAREFULLY BLACKEN IN ONE CORRECT ANSWER
ON THE ANSWER SHEET

26. A. Hickory
   B. Oak
   C. Black Gum
   D. Persimmon

27. A. Basswood
   B. Catalpa
   C. Black Locust
   D. Black Cherry

28. A. Yellow Poplar
   B. Ash
   C. Elm
   D. Maple

29. A. Black Walnut
   B. Chestnut
   C. Hickory
   D. Oak

30. A. Cucumbertree
   B. Ash
   C. Yellow Poplar
   D. Pine

GO ON TO NEXT PAGE
CORRECTLY IDENTIFY THE TREE BY THE ILLUSTRATED FRUIT
CAREFULLY BLACKEN THE CORRECT ANSWER
ON THE ANSWER SHEET

31. A. Black Locust
    B. Black Cherry
    C. Basswood
    D. Black Gum

32. A. Cedar
    B. Horse Chestnut
    C. Cucumber Tree
    D. Black Walnut

33. A. Sassafras
    B. Catalpa
    C. Yellow Poplar
    D. Black Locust

34. A. Persimmon
    B. Oak
    C. Hickory
    D. Beech

35. A. Elm
    B. Ash
    C. Maple
    D. Eastern Cottonwood
CORRECTLY IDENTIFY THE NUMBERED TWIG PART BY SELECTING THE CORRECT DESCRIPTIVE WORD
CAREFULLY BLACKEN IN ONE CORRECT ANSWER ON THE ANSWER SHEET

36. A. Leaflet
   B. Lateral Bud
   C. Bud Scale
   D. False Terminal Bud
   E. Terminal Bud Scale Scars

37. A. Bracts
   B. Lateral Bud
   C. Terminal Bud
   D. Lenticel
   E. Pith

38. A. Lenticels
   B. Bracts
   C. Bundle Scars
   D. Twig Scars
   E. Stipular Scars

39. A. Twig Scars
   B. Terminal Bud Scale Scars
   C. Pith
   D. Lenticels
   E. Bundle Scars

40. A. Bundle Scars
    B. Twig scar
    C. Lenticels
    D. Bracts
    E. Pith

GO ON TO NEXT PAGE
(10) SELECT THE CORRECT WORD THAT DESCRIBES THE NUMBERED TWIG PART
CAREFULLY BLACKEN IN ONE CORRECT ANSWER ON THE ANSWER SHEET

41. A. Leaf Scar
   B. Pith
   C. Bud Scale
   D. Terminal Bud
   E. Lenticels

42. A. Superposed Bud
   B. Twig Scar
   C. Lenticel
   D. Leaf Scar
   E. False Terminal Bud

43. A. Bracts
   B. Twig Scar
   C. Leaf Scar
   D. Stipular Scar
   E. Pith

44. Describe the arrangement of the buds on TWIG A.
   A. Alternate
   B. Opposite
   C. Whorled
   D. False-Terminal
   E. Superposed

45. Describe the type of terminal bud on TWIG B.
   A. Alternate
   B. Opposite
   C. Whorled
   D. False-Terminal
   E. Accessory
CORRECTLY IDENTIFY THE TREE by the illustrated twig
CAREFULLY BLACKEN IN ONE CORRECT ANSWER
ON THE ANSWER SHEET

46. A. Cottonwood
   B. Yellow Poplar
   C. Pignut Hickory
   D. Shagbark Hickory

47. A. White Oak
   B. Black Walnut
   C. Basswood
   D. Yellow Poplar

48. A. Black Locust
   B. Black Oak
   C. Shagbark Hickory
   D. Basswood

49. A. Pignut Hickory
   B. White Oak
   C. Bitternut Hickory
   D. White Ash

50. A. White Ash
   B. Red Oak
   C. Black Walnut
   D. Sugar Maple

GO ON TO NEXT PAGE
51. A. Pignut Hickory  
   B. American Elm  
   C. Red Oak  
   D. Sugar Maple

52. A. White Ash  
   B. Cottonwood  
   C. Basswood  
   D. Pignut Hickory

53. A. American Elm  
   B. Black Locust  
   C. Bitternut Hickory  
   D. Shagbark Hickory

54. A. Bitternut Hickory  
   B. Red Oak  
   C. White Oak  
   D. Sugar Maple

55. A. Yellow Poplar  
   B. Black Cherry  
   C. American Beech  
   D. Cottonwood

GO ON TO NEXT PAGE
56. A. Black Cherry  
B. Black Oak  
C. White Oak  
D. American Beech

57. A. Pignut Hickory  
B. Silver Maple  
C. Sugar Maple  
D. Black Walnut

58. A. Cottonwood  
B. Black Locust  
C. White Ash  
D. Black Walnut

59. A. American Beech  
B. American Elm  
C. Black Oak  
D. Yellow Poplar

60. A. Basswood  
B. American Elm  
C. Black Walnut  
D. Shagbark Hickory

GO ON TO NEXT PAGE
USE THIS LEAF KEY TO CORRECTLY IDENTIFY THE LEAVES ON PAGES 15 & 16

1. Leaves alternate ........................................ 2

1. Leaves opposite .................................... 7

2. Leaves simple ........................................ 3

2. Leaves compound ................................... 6

3. Leaves toothed and lobed ..................................... 4

3. Leaves toothed, but not lobed .............................. 5

4. The leaf edge is irregularly large-toothed to wavy toothed. White Poplar

The leaf is lobed with palmately veining; the leaf base is broadly rounded.

4. The leaf edge is finely toothed. The heart-shaped leaves have both entire and lobed outlines on the same tree. Red mulberry

5. The leaf is lance-shaped in outline and pointed at both the base and the tip. The leaf edge is regularly and sharply single-toothed. The parallel leaf veins end in a tooth along the margin. American chestnut

5. The leaf scars are not toothed except for a pair of large teeth near the base. The twig is smooth. The leaf scar is heart-shaped. The bundle scars form a U. Maple

6. The leaf has 11 or more very short stemmed leaflets. The leaflets are not toothed except for a pair of large teeth near the base. The leaf edge is finely and double-toothed with sharp pointed teeth. Black birch

6. The leaf has 11 or more leaflets with no stems. The leaflet margins are sharply toothed. The egg-shaped leaf scars nearly encircle the bud. The bundle scars form three scattered groups. Sumac

7. Leaves simple ......................................... 8

7. Leaves compound ..................................... 11

8. Leaf edge smooth ..................................... 9

8. Leaf edge toothed ................................... 10

9. Leaf heart-shaped with a long stem. The leaf veins do not parallel the leaf edge.

9. Leaf heart-shaped with a long tapering tip and pointed base. Catalpa

10. The leaf edge is lobed with scattered large teeth. The egg-shaped leaf has a blunt tip and a short stem. Prunus

10. The leaf edge is double-toothed, but not lobed. The lance-shaped leaf has a long tapering tip and pointed base. Viburnum

11. Leaves pinnately compound ........................................ 12

11. Leaves palmately compound .......................... 13

12. Leaves with 3 to 7 leaflets (uncommonly 7). The leaflet edge may be smooth or having a few large teeth. The end leaflet is often 2-pointed and somewhat lobed. Acer

12. Leaves with 3 to 7 leaflets. The leaflet margins are sharply toothed. The egg-shaped leaflets have short stems. Sambucus

13. Leaf with 7 to 9 leaflets arranged like the spokes of a wheel. The wedge-shaped leaflets have irregularly toothed edges. A long stem attaches the leaf to the twig. Horse chestnut

13. Leaf with 5 leaflets arranged like the spokes of a wheel. The long reversed egg-shaped leaflets have pointed tips and bases. The margins are finely toothed. A long stem attaches the leaf to the twig. Aesculus
61. A. Cornus  
   B. American Chestnut  
   C. Acer  
   D. Sambucus

62. A. Red Mulberry  
   B. Acer  
   C. Sumac  
   D. White Poplar

63. A. Horse Chestnut  
   B. Sambucus  
   C. Tree-of-Heaven  
   D. Aesculus
IDENTIFY THE TREE BY USING THE LEAF KEY ON PAGE 14
CAREFULLY BLACKEN IN THE CORRECT ANSWER
ON THE ANSWER SHEET

64. A. Black Birch
    B. American Chestnut
    C. Sumac
    D. Cornus

65. A. Aesculus
    B. Horse Chestnut
    C. Tree-of-Heaven
    D. Viburnum

END OF EXAM
APPENDIX L

NON-RELEVANT PRETEST
READ THE FOLLOWING QUESTIONS
BLACKEN IN ONE CORRECT ANSWER ON THE ANSWER SHEET

TEST B

1. The tree in the diagram has been:
   A. girdled
   B. frilled
   C. injected
   D. stripped

2. Of the following factors, the one least important to the life of tree seedling before planting is:
   A. wind
   B. rain
   C. freezing
   D. lack of nutrition

3. The tool in the drawing which is used to plant tree seedlings is a:
   A. tree injector
   B. tree girdler
   C. dibble bar
   D. tree friller

4. The arrow in the diagram points to the Christmas tree's:
   A. taper
   B. crown
   C. handle
   D. candle

5. The fastest method of planting trees by hand is:
   A. the bar-slit method
   B. the dug-hole method
   C. the grub-hoe-slit method
   D. the side-hole method

6. Which Christmas tree in the diagram has the correct taper: (based on base/height)
   A. 4/6
   B. 5/6
   C. 6/6
   D. none of these
7. The most important decision in artificially reproducing a stand of trees is:
   A. the method of reforestation to be used
   B. the seed bed preparation that is required
   C. selection of the tree species
   D. determining the spacing between tree

8. Fall planting of seedlings in northern climates is usually not recommended due to the problem of:
   A. wildlife eating the seedlings
   B. frost-heaving of the seedlings
   C. freezing of the seedlings
   D. ice and snow damage to seedlings

9. In the diagram, removal of trees 1 and 2 would be an example of a:
   A. liberation cutting
   B. weeding cutting
   C. release cutting
   D. both A and B are correct

10. Weeding and cleaning cuts are readily used in stands that:
    A. have reproduced by seeds
    B. are pure stands
    C. are even-aged
    D. are primarily coniferous

11. Burning to help prepare the site to be planted or direct seeded to trees:
    A. has been a success
    B. is too costly
    C. may be successful if the fuel and weather conditions are right
    D. both A and B are correct
12. A common herbicide used in killing trees is:
   A. 2,4,5-T
   B. malathion
   C. parathion
   D. diethylstilbestrol

13. The tree indicated by the number 1 in the drawing would be classified as:
   A. dominant
   B. codominant
   C. intermediate
   D. overtopped

14. In determining the timing and amount of thinning or release cuttings in a timber stand the most important factor to consider is:
   A. the money from the pulpwood
   B. the age of the trees
   C. the average height and DBH
   D. the individual quality of the tree

15. The best method of removing a large limb from a tree is indicated by: (arrows indicate direction of cut)

   A. 
   B. 
   C. 
   D. 

16. The drawing which indicates a limb that has been properly pruned from a tree is:

   A. 
   B. 
   C. 
   D. 
17. The tree crown classification which is characterized by trees receiving light from above but with little from the side(s) is:
   A. dominant
   B. codominant
   C. intermediate
   D. overtopped

18. Of the following factors, the least important when selecting trees to be left after a thinning cut is:
   A. the relative position of the crown
   B. the healthness of the tree
   C. the condition of the tree trunk
   D. the DBH of the trees

19. Artificial pruning of crop trees is often necessary because:
   A. the initial planting of the trees is not dense enough
   B. some species do not readily lose their lower branches
   C. some trees will grow much faster after being pruned
   D. both A and B are correct

20. The tree in the diagram has been:
   A. frilled
   B. stripped
   C. girdled
   D. injected

21. When thinning a timber stand, the trees that are to be removed should be:
   A. cut and left where it falls
   B. killed with herbicides
   C. removed when most economically feasible
   D. both A and B are correct
22. Cutting made past the sapling stage for the purpose of improving the composition or quality of the timber stand are called:

A. liberation cuttings
B. weeding cuttings
C. cleaning cuttings
D. improvement cuttings

23. When clearcutting in a large forest, the size of the patches that are cut is usually governed by:

A. the amount of erosion that will occur in the clearcut area
B. the size of the forest
C. the area that will be seeded naturally by surrounding trees
D. the slope of the area

24. The tree sapling shown in the drawing is:

A. bare root
B. ball and burlap
C. waxed
D. containerized

25. The tree sapling shown in the drawing has an approximate root to shoot ratio of:

A. the ideal
B. 30/70
C. 20/80
D. 60/40

26. Tree seedlings that are marked 3-0:

A. means 3 years in the seedbed
B. means 3 years in the transplant bed
C. have a 3 inch taproot
D. are too young to plant

27. If the specifications recommend one tree per each 64 square feet of area, what would the spacing be:

A. 5 x 5  C. 6 x 8
B. 5 x 8  D. 8 x 8
28. The injury on the tree trunk shown at the left is a:
   A. cat face
   B. canker
   C. fire scar
   D. can be both A and C

29. The distance between whorls as shown in the drawing is: (standard for Christmas trees)
   A. 2-4 inches
   B. 6-8 inches
   C. 9-12 inches
   D. 13-16 inches

30. The highest percentage of chain saw injuries are to the:
   A. wrist, hand and fingers
   B. shoulders and arms
   C. right side of the body
   D. left side of the body

31. In felling a tree, the correct angle for the notch is: (see drawing)
   A. 20 degrees
   B. 35 degrees
   C. 45 degrees
   D. 90 degrees

32. Usually, the back cut is made ______ inches above the horizontal cut of the notch. (see drawing)
   A. 1 inch
   B. 2 inches
   C. 3 inches
   D. 4 inches

33. If a tree has not fallen after making the back cut the fellor should:
   A. completely cut through to the notch
   B. make a larger notch
   C. use a sledge and wedges
   D. attach a rope to the top and pull the tree over
34. When bucking felled trees, the saw operator should:
   A. stand to one side of the saw
   B. stand on the downhill side of the log
   C. undercut the log when possible
   D. both A and C are correct

35. As the tree is falling, the fellor should:
   A. select an escape route
   B. set the saw beside the tree and run
   C. alert anyone within hearing by yelling "timber"
   D. be alert for falling limbs or the tree kicking back

36. Bud grafting should be done when:
   A. both the stock and the bud are dormant
   B. the stock is dormant and the bud is actively growing
   C. the stock is actively growing and the bud is dormant
   D. both the stock and the bud are actively growing

37. Budding should be done in the:
   A. spring
   B. summer
   C. fall
   D. dormant period (winter)

38. The layer of cells located immediately under the bark is the:
   A. cambium
   B. scion
   C. xylem
   D. phloem
39. Budding is a method of:
   A. sexual propagation
   B. asexual propagation
   C. bark grafting
   D. scion grafting

40. A "whip" is normally known as:
   A. a seedling
   B. a pruned-off branch
   C. a scion
   D. both A and C

41. The procedure of grafting shown in the drawing is known as:
   A. terminal stem grafting
   B. cleft grafting
   C. bud grafting
   D. none of the above

42. The "T" cut shown in the drawing should be made:
   A. at the base of a bud
   B. in new wood
   C. through the bark and one layer of inner wood
   D. all of the above

43. In the final stage the graft is wrapped to:
   A. keep the sun from scalding it
   B. keep moisture in
   C. hold the graft in place
   D. both b and c

44. The method of propagation where the new plant gets its food and water supplied by a parent plant is known as:
   A. division
   B. layering
   C. graftage
   D. none of the above
45. The illustration shows an example of a type of graft called:
   A. top grafting
   B. cleft grafting
   C. approach grafting
   D. whip grafting

46. At the time of grafting, the buds on the scion should be:
   A. growing actively
   B. removed
   C. dormant
   D. covered with wax

47. The mass of cells that develops from and around the wounded plant tissue at the junction of the graft union is called:
   A. scionized tissue
   B. bridge tissue
   C. callus tissue
   D. cambium layer

48. The illustration is an example of a type of graft called:
   A. bud graft
   B. cleft graft
   C. whip or tongue graft
   D. bridge graft

49. When grafting, the upper portion of the graft from which the new stem and branch grows is called the:
   A. scion
   B. top shoot
   C. callus
   D. stock

50. Trees with damaged bark can be:
   A. bark grafted
   B. bridge grafted
   C. bud grafted
   D. cleft grafted
51. Removing the longer shoots of a shrub in order to obtain a more balanced and compact appearance is called:
   A. heading back
   B. suckering
   C. budding
   D. leading

52. Cutting the leader or terminal branches of evergreens causes:
   A. more branching
   B. more terminal growth
   C. root bound conditions
   D. "bleeding"

53. Removing half of the "candle" refers to:
   A. a method of pruning
   B. a method of grafting
   C. a method of propagation
   D. a method of liberation

54. When removing a broken limb which of the following techniques is best:

   A. 
   B. 
   C. 
   D. 

55. The least desirable shape of hedge for the leaves to receive maximum sunlight:

   A. 
   B. 
   C. 
   D. 
56. The arrow in the drawing of a tree being felled is pointing to the:
   A. brace
   B. "harbor chair"
   C. hinge
   D. splinter

57. Stump height should be:
   A. 1 foot
   B. 2 feet
   C. in proportion to the diameter
   D. ground level

58. The drawing to the left shows ______ board feet in the illustrated board.
   A. 1
   B. 2
   C. 3
   D. 4

59. The first step in grading a board is to:
   A. determine the species
   B. compute the number of board feet
   C. determine the best side of the board
   D. estimate the grade of the board

60. The clear board shown in the drawing can be placed in the standard hardwood lumber grade of:
   A. FAS
   B. Selects
   C. 1 common
   D. 3 A
APPENDIX M

STUDENT'S QUESTIONNAIRE
Student Name: _________________________ School: ______________________________________

Please Answer The Following Questions:

1. How many months of work experience do you have working on jobs that required you to know the names of trees? ______ (1 year = 12 months)

2. Were you assigned tree identification homework to be done outside the normal school hours? Yes____ No_____

3. Was a tree identification book or manual provided by the teacher for you to use in doing the assigned homework? Yes_____ No_____.

4. To what extent did you use the tree identification book or manual provided by your teacher as a reference in completing the homework assignments? (Check one number below)

   Did not use Little use Used Used
   0 1 2 about average extensively
   3 4 5

5. Was a tree identification book or manual provided by the teacher for you to use as a reference in the classroom? Yes_____ No_____.

6. To what extent did you use the tree identification book or manual, provided by your teacher, as a reference in the classroom? (Check one number below)

   Did not use Little use Used Used
   0 1 2 about average extensively
   3 4 5

7. Was a tree identification book or manual provided by the teacher for you to use as a reference while identifying tree in the out-of-doors? Yes____ No_____.
8. To what extent did you use the tree identification book or manual provided by your teacher as a reference while identifying trees in the out-of-doors?
(Check one number below)

<table>
<thead>
<tr>
<th>Did not use</th>
<th>Little use</th>
<th>Used about average</th>
<th>Used extensively</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>

9. How interesting was the tree identification book or manual provided for your use? If you were not provided with a book or manual, leave the answer blank.
(Check one number below)

<table>
<thead>
<tr>
<th>Not interesting</th>
<th>Little interest</th>
<th>About average</th>
<th>Very interesting</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>
FOR EACH TEACHING TECHNIQUE LISTED ON THE FOLLOWING PAGES, PLEASE INDICATE (1) IN THE LEFT HAND COLUMN THE EXTENT TO WHICH YOU USED THE TEACHING TECHNIQUE, AND (2) IN THE RIGHT HAND COLUMN THE VALUE YOU THINK THE TEACHING TECHNIQUE HAD IN TEACHING TREE IDENTIFICATION. CIRCLE ONE ANSWER FOR EACH ITEM.

Example:

<table>
<thead>
<tr>
<th>EXTENT USED</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>did not use</td>
<td>0 1 2 3 4 5</td>
</tr>
<tr>
<td>used exten-</td>
<td></td>
</tr>
<tr>
<td>sively</td>
<td></td>
</tr>
<tr>
<td>Spelling contests in which scientific names were pronounced for the student to spell</td>
<td>no value</td>
</tr>
<tr>
<td>EXTENT USED</td>
<td>VALUE</td>
</tr>
<tr>
<td>-------------</td>
<td>-------</td>
</tr>
<tr>
<td>did not use</td>
<td>TEACHING TECHNIQUES</td>
</tr>
<tr>
<td>0 1 2 3 4 5</td>
<td>(-)-extensively</td>
</tr>
</tbody>
</table>

(1) Mimeographed and/or ditto sheets used as handouts to supplement classroom and laboratory assignments

(2) Sessions in land laboratories on or within walking distance of the school property

(3) Field trips requiring travel to nurseries, state forests, parks, arboretums and other similar areas where students can study tree identification

(4) Overhead transparencies used with classroom and/or laboratory presentations

(5) Slides used with classroom and/or laboratory presentations
<table>
<thead>
<tr>
<th>EXTENT USED</th>
<th>TEACHING TECHNIQUES</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>did not use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 1 2 3 4 5</td>
<td>Slides prepared to be used in individual study by the student</td>
<td>0 1 2 3 4 5</td>
</tr>
<tr>
<td>0 1 2 3 4 5</td>
<td>Cassette or reel to reel tapes prepared to be used in individual study by the student</td>
<td>0 1 2 3 4 5</td>
</tr>
<tr>
<td>0 1 2 3 4 5</td>
<td>Electric quizboard and accompanying quizzes; quizboard signals when correct answer is chosen</td>
<td>0 1 2 3 4 5</td>
</tr>
<tr>
<td>0 1 2 3 4 5</td>
<td>Punch board quizzes; answers provided by student punching out correct choice</td>
<td>0 1 2 3 4 5</td>
</tr>
<tr>
<td>0 1 2 3 4 5</td>
<td>Sliding quizzes; answers shown on back of quizzes; used with an opaque cover</td>
<td>0 1 2 3 4 5</td>
</tr>
<tr>
<td>EXTENT USED</td>
<td>VALUE</td>
<td></td>
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<tr>
<td>------------</td>
<td>-------</td>
<td></td>
</tr>
<tr>
<td>did not use</td>
<td>no value</td>
<td></td>
</tr>
<tr>
<td>0 1 2 3 4 5</td>
<td>0 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>used extensively</td>
<td>TEACHING TECHNIQUES of great value</td>
<td></td>
</tr>
<tr>
<td>0 1 2 3 4 5</td>
<td>0 1 2 3 4 5</td>
<td></td>
</tr>
</tbody>
</table>

11. Stimulus cards; flash card type quiz with answers on back of card or on a tape

12. Crossword puzzles keyed to students using tree identification references to find the correct answers

13. Classroom demonstrations showing how-to-do-it for assigned projects (i.e., twig collections, leaf collections, key construction, etc.)

14. Scavenger hunt requiring students to find items that can be related to tree identification

15. Leaf collection projects requiring students to collect, mount, and identify trees by their leaves
<table>
<thead>
<tr>
<th>EXTENT USED</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>did not use</td>
<td>0</td>
</tr>
<tr>
<td>used</td>
<td>1</td>
</tr>
<tr>
<td>extensively</td>
<td>2</td>
</tr>
<tr>
<td><strong>TEACHING TECHNIQUES</strong></td>
<td>no value</td>
</tr>
<tr>
<td>(16) Twig collection projects requiring students to collect, mount, and identify trees by their twigs</td>
<td>0 1 2 3 4 5</td>
</tr>
<tr>
<td>(17) Leaf prints requiring the student to collect leaves, make inked prints and identify the trees by their leaves</td>
<td>0 1 2 3 4 5</td>
</tr>
<tr>
<td>(18) Simulation of real life situations requiring use of tree identification techniques and knowledge of tree species (i.e., role playing in the buying and selling of timber)</td>
<td>0 1 2 3 4 5</td>
</tr>
<tr>
<td>(19) Grade contracts providing a written agreement between student and teacher describing the particular requirements necessary to achieve a letter grade</td>
<td>0 1 2 3 4 5</td>
</tr>
<tr>
<td>EXTENT USED</td>
<td>VALUE</td>
</tr>
<tr>
<td>-------------</td>
<td>-------</td>
</tr>
<tr>
<td>did not use</td>
<td>0 1 2 3 4 5</td>
</tr>
<tr>
<td>used extensively</td>
<td></td>
</tr>
</tbody>
</table>

(20) Normal tests and quizzes used for grading purposes and to monitor student rate and extent of progress

(21) Resource persons visited or brought into the school environment (i.e., foresters, nurserymen, soil conservation fieldmen)

(22) Student behavioral objectives that were provided to use with the study
PLEASE ANSWER THE FOLLOWING QUESTIONS:

23. How many years teaching experience do you have teaching tree identification? ____

24. Indicate the number of courses taken (beyond the high school level) that required knowledge of tree identification. (i.e., dendrology, horticulture, etc.) ____

25. How many years work experience do you have working on jobs that required knowledge of tree identification. (i.e., landscaping, timber buying, arborist, etc.) ____

26. Indicate the month and day you began the tree identification unit and the month and day ended. (i.e., April 19 - May 7)

Began: ___________________________  Ended: ___________________________

month  day  month  day

27. How many hours (teaching the tree identification unit) were allotted to outdoor study and identification of trees? ____

28. How many hours (teaching the tree identification unit) were allotted to classroom study and identification of trees? ____

29. Have your students had a previous unit or part of a unit on tree identification during the fall of 1975 or the spring of 1976? Yes____  No____

30. Please list the two references that you used the most while teaching tree identification. (i.e., textbooks, a selected portion of a student manual, a teacher's guide, forest service publications, etc.) If only one reference is used, leave the second line blank. If the title and author is unknown, list the source.

1. ___________________________  2. ___________________________

Title  Author  Title  Author
APPENDIX O

MAP OF OHIO SHOWING DISTRICTS FOUR, THIRTEEN AND FOURTEEN
MAP OF OHIO SHOWING DISTRICTS
FOUR, THIRTEEN AND FOURTEEN
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