

AN EXPERIMENTAL STUDY DESIGNED TO EVALUATE
THE EFFECTIVENESS OF AN
INDIVIDUALIZED LEARNING METHOD OF
INSTRUCTION WHEN COMPARED TO THE
GENERAL LECTURE -
DISCUSSION METHOD OF INSTRUCTION

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This is to certify that the

thesis entitled
AN EXPERIMENTAL STUDY DESIGNED TO EVALUATE
THE EFFECTIVENESS OF AN INDIVIDUALIZED
LEARNING METHOD OF INSTRUCTION WHEN
COMPARED TO THE GENERAL LECTURE-
DISCUSSION METHOD OF INSTRUCTION

presented by

Urban Theodore Oen

**has been accepted towards fulfillment
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Dr. H. P. Sweany

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ABSTRACT

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Purposes of the study

1. To develop and test the effectiveness of an individualized learning manual on turfgrass sales and service in developing in high school junior and senior vocational agriculture students the competencies necessary for initial employment in the turfgrass industry.
2. To identify the extent to which reading comprehension, interest in turfgrass work, attitude toward individualized instruction, personality, previous knowledge, instructor's prior teaching experience and instructor's experience in teaching turfgrass relate to the learning and development of turfgrass competencies.
3. To identify teacher opinions as to the strengths and weaknesses of the individualized learning manual and the research study.

Method of investigation

Twenty-nine Michigan high schools located in central Michigan participated in the study. The schools were randomly assigned to one of three methods of instruction by a table of random numbers. The three methods were: (1) individualized instruction method; (2) lecture-discussion method; and (3) non-instruction (control) method. Teachers using the individualized and lecture-discussion methods of instruction were provided with manuals and accompanying slides, audio-visual and curriculum materials, and an explanation of the procedures for the study. The teachers using the non-instruction (control) method were not furnished any teaching materials until the conclusion of the project.

Five antecedent variable tests were administered to the 632 students of the three methods before instruction began. At the conclusion of the project, the teachers were mailed a comprehensive battery of post-tests which were completed by all the students participating in the project.

Analysis of data

The Finn program, which is a univariate and multivariate analysis of variance and covariance using univariate statistics, was employed to analyze the data. A 13 x 13 intercorrelation matrix was used. Comprising the matrix were seven post-tests and six antecedent variables. Of the

antecedent variables four were test scores and two were teacher variables.

In addition a calculation of least squares (regression) and multiple correlation was performed to determine the correlation between the antecedent variables and the post-tests.

Summary of the findings

1. There was a significant difference between the averaged mean post-test scores of students of the individualized and lecture-discussion methods of instruction and the non-instruction (control) method, as measured by univariate and multivariate analyses of variance and covariance. The data indicate that the averaged higher mean post-test scores obtained by students of the two instructional methods over the non-instruction (control) method was a result of instruction, not chance.
2. There was a significant difference between the mean post-test scores of students of the individualized and lecture-discussion methods of instruction as measured by univariate and multivariate analyses of variance and covariance with each covariable considered individually.

3. There was no significant difference between the mean post-test scores of students of the individualized and lecture-discussion methods of instruction as measured by univariate and multivariate analyses of covariance with six covariables. The level of significance was .0576.
4. Students using ~~the~~ individualized instruction method scored significantly higher than students of the lecture-discussion method on the following subject areas: A. Exploring career opportunities; B. Salesmanship and human relations; C. Turfgrass establishment, care, and maintenance; D. Identification and control of weeds; E. Seed, turfgrass, and weed specimen identification; and F. Interpretation and location of information in turfgrass references. There was no significant difference between the post-test scores of students of the two instructional methods on the following areas: A. Types and characteristics of turfgrasses; and B. Fertilization and liming of turfgrasses.
5. The averaged effects of the two instructional methods were significantly better than the non-instruction (control) method in developing in students the ability to locate and interpret information contained in turfgrass references. The

individualized method was significantly better than the lecture-discussion method of instruction in developing in students the ability to locate and interpret information contained in turfgrass references.

6. There was a correlation between the antecedent and dependent variables which means that post-test scores can be predicted from the antecedent variable scores.
7. The teachers indicated that the individualized learning manual was complete and accurate and very appropriate in developing understandings, knowledges, and skills in turfgrass.

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DEDICATION

This work is dedicated to my father and mother, Marvin T. and Anna L. Oen, whose constant financial help, encouragement, and assistance has contributed immeasurably to the completion of the Doctoral Program and the accomplishment of this study. Special thanks is given to my nine brothers and sisters who also provided financial assistance and/or help in collating materials or in encouragement for me to complete the lengthy thesis study. My brothers and sisters who helped are: Joseph, Helen, Reverend Edward, William, Theresa, Bernadette, Mary, Monica, and Patricia.

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The writer recognizes that many educators through their consultation, assistance and participation in the project have contributed immeasurably to the successful completion of this study.

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A sincere note of thanks is given to the ~~twenty-nine~~ teachers of vocational agriculture from Michigan who participated in this study and without whose assistance the study could not have been conducted. The names of these teachers are listed in the appendix.

Thanks is also due Dr. Andrew Porter, Mike Gordan, and John Draper of the Office of Research Consultation,

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CHAPTER I

INTRODUCTION

Traditionally the high school vocational agriculture instructor developed an instructional program based upon the occupational demands of the local community which, to some extent, fulfilled the needs of most of the students enrolled in high school vocational agriculture classes. However, with the declining numbers of students entering farming and an increase in the number of youth desiring to go into off-farm agricultural work, the vocational agriculture curriculum in many communities has failed to provide adequate preparation for both farm and off-farm occupations.

The Vocational Education Act of 1963¹ and the 1968 Amendments² provided the authority for and impetus of change by mandating that the curriculum of vocational agriculture be broadened to include training for farm and off-farm occupations. The expansion of the agriculture curriculum and the development of new programs for off-farm agriculture have created an exigency for new instructional materials.

¹U.S. Congress, An Act, Public Law 88-210, 88th Congress, H.R. 4955, December 18, 1963.

²U.S. Congress, An Act, Public Law 90-576, 90th Congress, H.R. 18366, October 16, 1968.

The development of instructional materials has not kept pace with the expanding high school vocational agriculture curriculum. In addition, instructional materials developed one year may be completely outdated the next, causing a problem for the high school vocational agriculture teachers.

To compound the problem, today's students enrolled in vocational agriculture classes have a variety of backgrounds and hold differing vocational and occupational objectives. Because of this, teachers are finding it increasingly difficult to teach. The teaching approach and the learning materials must be adapted to meet the needs of these heterogeneous students in a single classroom.

Obviously, we cannot organize specialized classes to meet the vocational and occupational objectives of all students enrolled in vocational agriculture. The number of classes required would far exceed the supply of teachers available. In addition the practicality of providing such specialized classes, each having a limited enrollment, could not be justified.

Nevertheless, we ought to devise ways to meet the needs of students with different objectives when they are enrolled in the same classes. One approach to accomplish this goal is through individualized instruction in classes where some diversity exists.

The concept of individualized instruction is not new. Many teachers of vocational agriculture have been using some form of individualized instruction in their classrooms for years. Good teachers have always tried to provide for individual students' needs and interests. However, this approach necessitates the availability of new instructional resources so students can study appropriate content alone or in small groups in areas of common interest. It would be too much to expect the high school teacher to develop manuals and audiovisual materials on all the different occupational areas of agriculture and agri-industry. Therefore, development of such materials rests with others, such as state supervisory personnel and teacher education curriculum experts in agricultural education.

In an attempt to help teachers provide instruction to students with differing occupational objectives, Clark³ developed a unique approach. Rather than providing completely structured units of subject matter, which soon become out-dated, his approach has been to provide introductory textual material followed by many suggested student activities. Students study their chosen occupational field and complete those units of instruction which prepare them for job entry in agri-industry.

³Instructional Units for Use in High School Programs in Agricultural Business was the title of the project directed by Dr. Raymond Clark during 1968-69 (East Lansing: College of Education, Michigan State University).

An individualized student learning manual on turf sales and service based upon Clark's approach has been developed and was evaluated in this study. The turf unit differs from the other units in that it contains behavioral objectives for each lesson. In addition, a complete packet of audiovisual and curriculum materials was assembled and distributed to the students along with the manual.

The development of the units by Clark⁴ and associates and the preparation of the turf sales and service manual are attempts to help meet the need for learning materials for students with varying occupational objectives. The development of new materials does not necessarily guarantee their effectiveness in preparing students in the subject area. The question advanced by many high school teachers is, "How well do students learn from individualized learning situations as compared to our traditional instruction?" Other questions are: "Can all of our students learn by individualized instruction?" "How does a teacher work with students using this new study method?" "How does a teacher measure or evaluate student progress and accomplishments?" This study will concentrate on the first two questions.

Need for the study

Briefly, the need for this study may be summarized as follows:

⁴Ibid.

1. There is a need to ascertain the effectiveness of an individualized learning manual in preparing students for an occupation.
2. There is a need to determine whether there is a difference in what can be learned by students using the individualized instruction method when compared to students of the traditional lecture-discussion method of instruction. For example, can students through individualized instruction solve problems and identify actual specimens as well as those students in a lecture-discussion class.
3. There is a lack of sufficient research to substantiate whether slow learners and low-motivated students can learn by this method of instruction.
4. Since the turf manual like the other units is highly verbal in nature, there is a need to determine the characteristics of those students who perform best with the use of the manual and those who fare the poorest.
5. There is a need for the development and availability of increased instructional materials to help teachers individualize instruction.

Purposes of the study

The purposes of this study are:

1. To test the effectiveness of an individualized learning manual on turfgrass sales and service in

developing in high school junior and senior vocational agriculture students the competencies necessary for initial employment in the turfgrass industry. In addition, a comparison of the effectiveness of the individualized learning method of instruction will be made with a general lecture-discussion method of instruction.

2. To identify the extent of relationship that reading comprehension, interest in turfgrass work, attitude toward individualized instruction, personality, previous knowledge, and previous work experience have on learning and developing the turfgrass competencies.
3. To identify teacher opinions as to the strengths and weaknesses of the individualized learning manual and the research study.

Statement of the problem

Will the use of an individualized learning manual and audiovisual and curriculum materials on turfgrass sales and service develop in high school junior and senior vocational agriculture students the competencies deemed necessary for a beginning job in a turfgrass business as well as a general lecture-discussion method of instruction as determined by a battery of comprehensive post-tests?

Objectives

1. To compare the averaged effects of the individualized and lecture-discussion methods of instruction with

the non-instruction (control) method in developing turfgrass competencies in students as measured by student achievement on the seven comprehensive post-tests.

2. To compare the effectiveness of the individualized learning method of instruction to a general lecture-discussion method of instruction in developing turfgrass competencies in students as measured by student achievement on the seven comprehensive post-tests.
3. To identify the extent to which each of the following factors is related to student learning:
 - A. Student's reading comprehension
 - B. Student's attitude toward individualized instruction
 - C. Student's interest in turfgrass work
 - D. Student's prior knowledge of turfgrass
 - E. Student's personality
 - F. Student's hours devoted to turfgrass study
 - G. Instructor's teaching experience recorded in years
 - H. Instructor's prior experience in teaching turfgrass
4. To identify the extent to which factors A through D and G through H listed in objective number three, when considered individually or combined as a group, are related to student learning.

5. To identify the correlation between factors A through F, listed in objective number three, and the dependent variable (post-test scores) of students of the different methods of instruction.
6. To compare the effectiveness of the different methods of instruction in developing in students the ability to locate and interpret information in turfgrass references.
7. To identify teacher opinions as to the strengths and weaknesses of the individualized learning manual and the research study.

Hypotheses

The following null hypotheses will be tested in the study:

1. There will be no difference in student achievement on the seven comprehensive post-tests between the averaged effects of the individualized and lecture-discussion methods of instruction and the non-instruction (control) method.
2. There will be no difference in student achievement on the seven comprehensive post-tests between the individualized learning method of instruction and the general lecture-discussion method of instruction.
3. There will be no difference between the effectiveness of the different methods of instruction in developing

in students the ability to locate and interpret information contained in turfgrass references.

4. There will be no correlation between the antecedent variables listed below and the dependent variable (post-test scores) of students of the different methods of instruction.
 - A. Student's reading comprehension
 - B. Student's attitude toward individualized instruction
 - C. Student's interest in turfgrass work
 - D. Student's prior knowledge of turfgrass
 - E. Student's personality
 - (1) Neuroticism Scale
 - (2) Extraversion Scale
 - (3) Lie Scale
 - F. Hours of turfgrass study

Assumptions

1. It is assumed that students enrolled in the same vocational agriculture class have different educational and occupational objectives.
2. It is assumed that several roles of teacher education institutions engaged in agricultural education are: preparing instructional materials for the teachers of vocational agriculture in the home state; and researching how materials should be organized and used by different types of students.

3. It is assumed that the evaluation of the individualized learning manual by the teachers will be useful in the designing and construction of future individualized learning manuals.

Limitations

1. The study was limited to high school juniors and seniors of selected vocational agriculture programs within a 100 mile radius north and west of East Lansing, Michigan.
2. The study was limited to those schools willing to participate in the project.

Definition of terms

For the purpose of this study, the following terms were used in these capacities:

1. Agricultural business or agri-business.--The operation of those businesses involved in the manufacture and distribution of farm supplies; production on the farm; and the storage, processing, and distribution of farm commodities and items made from them.
2. Antecedent variables.--Variables that were measured or determined before instruction began.
3. Attitude toward individualized instruction.--The student's feeling or mood toward individualized instruction. A student's attitude toward individualized instruction was measured by a 20-item Likert type forced-choice scale, (See Appendix H).

4. Audiovisual and curriculum materials.--Any aids used to enhance teaching and learning; for this study the printed student learning manual, six different sets of 2 x 2 colored slides and scripts, projector-viewer, Michigan State University Extension and Crop Science manuals and handouts, and publications and charts from educational institutions and commercial companies, (See Appendix D for a complete listing).
5. Competency.--Having the knowledge, fitness or ability to perform a specific skill.
6. Effectiveness.--Refers to the resulting competencies the program produces in the students.
7. Individualized instruction.--Refers to a method of instruction in which each pupil works alone, or in a small group, on assignments designated to meet his interests, needs, and abilities, at his own pace. The subject matter studied may be cooperatively determined by the teacher and the learner. During classtime the teacher is available to answer questions and provide needed assistance. (In this study the subject matter and assignments all dealt with turfgrass.)
8. Individualized learning.--Refers to learning in which a student works at a pace suited to his needs and abilities. The student may work as an individual or in a small group. In this type of learning the

teacher does not lecture to the pupils but works with them on an individual or small group basis. The student is mainly responsible for his learning.

9. Individualized learning unit or manual.--A series of lessons of related subject matter, each of which is sub-divided into the following pattern: lesson title, terminal behavioral objectives, text, learning activities, evaluation activities, and references.
10. Interest.--A reasoned enthusiasm one holds for some subject. In this study, interest refers to enthusiasm exhibited by a student toward work in some turfgrass sales and service business. Interest was measured by a 75-item interest scale, (See Appendix G).
11. Jury of experts.--A competent group of people recognized by others in their respective fields as being authorities. The jury of experts validated subject matter content for the study.
12. Job-entry.--Refers to a beginning level of entry into a job.
13. Lecture-discussion.--Refers to the traditional classroom instructional procedure utilized by vocational agriculture instructors. It consists primarily of problem-solving and student-centered approaches and relies heavily on the interests and needs of the majority of the students.

14. Personality.--Refers to the aggregate of the personal character, quality, or being of an individual. Personality was measured in this study by the use of the Eysenck Personality Inventory which measures introversion-extraversion, neuroticism, and lie.
15. Post-tests.--A battery of examinations administered after instruction. Based on the terminal behavioral objectives contained in the individualized learning manual, the post-tests consisted of true-false, multiple-choice, matching, objective questions, problems, and specimen identification, (See Appendix I).
16. Reading comprehension.--A composite of a student's vocabulary and reading ability. In the study, the Cooperative English Tests of Princeton were used.
17. Terminal behavioral objective.--An objective stated in terms of a desired behavior to be demonstrated by the learner at the termination of formal study.
18. Turfgrass sales and service.--Refers to those functions or activities within the turfgrass industry which are sales and/or service only.
19. Vocational and occupational objectives.--Refer to the specific area or field of employment in which students are preparing to enter upon graduation from high school.
20. Vocational agriculture instructor.--One who is employed by a public school to teach one or more

classes in vocational agriculture, of a federally reimbursable program.

21. Vocational education in agriculture.--Refers to those educational activities relating to the preparation of students for employment in farming or off-farm agri-industries.

CHAPTER II

REVIEW OF RELATED LITERATURE

A review of the related literature and research which deals directly and indirectly with individualized instruction is presented in this chapter. The literature is reported under the following headings: (1) History of individualized instruction, (2) Research in non-agriculture disciplines, (3) Related research in agricultural education, (4) Individualized instruction research in agricultural education, and (5) Summary of the review of literature.

History of individualized instruction

The idea of providing individualized instruction to students is not new. American educators have been concerned with the problem of effective teaching that meets the individual differences of students for at least one hundred years. Before 1850, most schools were of the ungraded type.⁵⁻⁶

⁵Harold G. Shane, "The School and Individual Differences," Individualizing Instruction, The Sixty-first Yearbook of the National Society for the Study of Education, Part I, ed. Nelson B. Henry (Chicago: The University of Chicago Press, 1962), p. 47.

⁶Delmo Della Dora, "One Hundred Years of Grouping Practices" (Mimeographed paper prepared for the Wayne County Study of the Gifted and the Michigan Association for Supervision and Curriculum Development), p. 1.

Formal learning in the pre-1850 school began very much as an individual affair; that is, pupils came to school to receive instruction individually from the teacher. Education was generally for a select few; therefore, fewer pupils attended school. This made possible the provision of individualized instruction for those students. For example, in the one-room school pupils proceeded on an individual basis rather than as a group.⁷

Since 1850, several organizational trends have emerged in our schools: (1) to reduce individual differences found in the nongraded schools before 1850 by introducing grade levels; (2) to make the graded approach less arbitrary by recognizing that pupils progress at different rates of speed on multiple-track or individualized programs; (3) to group students by ability within a given grade level; (4) to introduce ungraded grouping.⁸

Just prior to World War I, Burke, Washburne and Parkhurst, and others conceived and developed plans for individualizing instruction. Two of the most prominent plans were the Dalton Plan of Dalton, Massachusetts and the Winnetka Plan of Winnetka, Illinois. Both plans substituted individual progress standards for group promotion standards. In the former plan, students made a "contract" to finish a

⁷Robert G. Scanlon and John O. Bolvin, Individually Prescribed Instruction (Philadelphia, Pennsylvania: Research for Better Schools, Incorporated), p. 2.

⁸Shane, op. cit., p. 48.

certain number of units of work within a specified period of time and in the latter, students took self-administered tests to determine if they were ready for the teacher tests. However, neither of these plans provided for depth or breadth of learning.⁹ In an attempt to develop a complete, effective program of individualized instruction educators have continuously introduced other plans. Shane¹⁰ identified 35 educational plans developed within the United States in recent years for coping with individual differences.

Bolvin¹¹ identified five factors which have contributed to this new emphasis of interest in individualized instruction. These are:

. . . (1) the introduction of programmed instruction, (2) the development of nongraded and team-teaching programs, (3) the wider application of the use of computers, (4) the changing technology and its application to educational problems, and (5) the recent involvement by subject-matter scholars and behavioral scientists in the more practical problems of education.

Other factors not identified by Bolvin but considered by many educators to be the most important reasons for individualizing instruction are the recognition of the worth and dignity of an individual and the individual's need to succeed.

The emphasis of individualized instruction is on the pupil as an individual. Pupils vary as to interest,

⁹Dora, op. cit., p. 2.

¹⁰Shane, op. cit., p. 49.

¹¹John O. Bolvin, "Implications of the individualization of Instruction for Curriculum and Instructional Design," Audiovisual Instruction (March, 1968), p. 238.

intellectual ability, reading capacity, learning rate, and many other factors. All of these factors are important reasons why instruction should be individualized. Kelley,¹² adds to these factors as he points out a strong reason for individualizing instruction. He states:

The growing self must feel that it is involved, that it is really part of what is going on, that in some degree it is helping shape its own destiny, together with the destiny of all. Perhaps there is no one quality more important for the developing self than this feeling of involvement in what is taking place. This is what gives a person a "reason to be."

The concept of individualizing is confusing to many educators. Often individualizing means allowing students to proceed at their own rate using identical materials and references. In reality, to individualize is to treat each student uniquely taking into account his distinctive characteristics among which are personal educational goals, ability to learn, need for reinforcement and actual experiences. Individualized instruction involves the interaction of persons, procedures, and materials.

There are many ways of individualizing instruction. Wilhelms¹³ identified three ways in which courses or subjects

¹²Earl C. Kelley, "The Fully Functioning Self," Perceiving, Behaving, Becoming (Washington, D.C.: Association for Supervision and Curriculum Development, National Education Association, 1962), p. 17.

¹³Fred T. Wilhelms, "The Curriculum and Individual Differences," Individualizing Instruction, The Sixty-first Yearbook of the National Society for the Study of Education, Part I, ed. Nelson B. Henry (Chicago, Illinois: The University of Chicago Press, 1962), pp. 64-69.

can be individualized: (1) through rate of progress, (2) through content and purpose, and (3) through curriculum organization.

Individualization by rate of progress largely fails to come to grips with the fundamental differences among students. Such differences as interests and purposes, personal needs, and modes of thinking and learning are totally ignored in this type of individualization.

Individualization through content and purpose does satisfy the requirements of meeting needs, interests, and abilities of students. This is not a simple matter of "watering down" standard content or lowering the standards. It simply means that educators are willing to search endlessly for methods that will help students learn. It means that content is seen as means to an end and not as the end itself.

Individualization through curriculum organization contributes toward satisfying the requirements of meeting the interests and needs of individuals. The curriculum is organized in such a way that instruction can be individualized. Instead of organizing courses on a semester or yearly basis, courses can be organized into shorter periods of time, covering a broader range of subjects and providing a wider range of subjects for students.

Some educators view individualized instruction as simply providing tutorial assistance for pupils or as an

opportunity for independent study. Other educators interpret individualized instruction to mean the planning and implementing of an individualized program of studies suited to each student's needs and interests and based upon his characteristics as a learner. The latter definition is viewed by many educators as the most acceptable form of individualizing instruction; however, to accomplish this goal is not easy.

DeHaan and Doll¹⁴ point out the difficulty when they state:

Individualization of teaching is, under the best of conditions, a difficult, easily misunderstood function. Individualization of teaching goes beyond the content of the curriculum and beyond standardized instruction. Certainly it goes beyond routine and academic achievement, for individualization gives personal relevance to experiences which the individual learner shares with other members of his group.

Individualization of instruction may help an individual to discover, develop and release his potential to the fullest. Teachers need to emphasize discovery of potential in learners.

The dynamics of human behavior are a very important aspect of individualizing instruction. Alam and Davis¹⁵ both stated that the learning process needs to be considered in

¹⁴Robert F. DeHaan and Ronald C. Doll, "Individualization and Human Potential," Individualizing Instruction, ed. Ronald C. Doll (Washington, D.C.: Association for Supervision and Curriculum Development, 1964), p. 13.

¹⁵Information obtained in office conference with Dale Alam and Alice Davis, Professors of Curriculum, College of Education, Michigan State University (July 12, 1968).

individualizing programs. Some of the basic assumptions which stem from present knowledge and which promise to be basic in efforts to take a more dynamic approach to individual and group behavior are identified by Shane.¹⁶ These are:

. . . (a) all behavior is caused; (b) all behavior has a purpose; (c) there are multiple forces motivating behavior; (d) at times these forces are in conflict with each other; (e) overt behavior is an attempt by the human to maintain a balance between the unconscious forces from within and the demands of reality from without; (f) man is an emotional being rather than a rational being; (g) emotions have first call on a person's psychic energy -- the remaining psychic energy may be used for rational purposes; and (h) group forces such as structure, goals, cohesion, norms, and locomotion influence and, at times, determine the behavior of a child in proportion to the child's attraction to the group.

With these eight factors in mind, it then becomes germane and feasible to examine certain conditions and practices that are relevant to a teacher encountering the many factors affecting individual differences. Those educational practices which have a direct impact on individual differences and human development include: (1) class size, (2) teacher-pupil ratios, (3) promotions, (4) the reporting and recording of pupil progress, (5) the school's philosophy on examinations, honors, and awards, (6) concepts of the contribution of curricular and extracurricular activities to the child's growth and development, and (7) local practices in regard to discipline and attitude development.¹⁷

¹⁶Shane, op. cit., p. 51.

¹⁷Shane, op. cit., pp. 53-54.

All of these help to determine whether an individualized program will be successful or not.

It was stated earlier that not all children are alike. Some major differences occur in the socio-economic and cultural backgrounds of students. Even if these differences are removed or compensated for, other differences can also be observed. For example, Minor¹⁸ notes that there is basic evidence to indicate that the manner in which each person takes in sensory data is different. All too often, teachers assume that every child receives sensory data in the same manner. In working with youngsters who have learning difficulties, Minor found that there are sensory preferences in children whose complete sensory equipment is intact. For example, for some, kinesthetic experiences must be utilized to reinforce what the eye sees and the ear hears. For others, the inability to shift from one sensory mode to another creates problems in reading. The teacher must provide the opportunities for and encouragement of a fuller utilization of all the senses.

Other recent research into the cognitive life of children has indicated that there is individual patterning of thought and that each child has a different cognitive style.

¹⁸Frances Minor, "A Child Goes Forth: Ideas Invite Involvement," Individualizing Instruction, ed. Ronald C. Doll (Washington, D.C.: Association for Supervision and Curriculum Development, 1964), p. 58.

A teacher must be sensitive to these differences in cognitive patterning and shape his teaching strategies accordingly.¹⁹

Individualization of teaching is a matter of degree rather than an all-or-none endeavor. DeHaan and Doll²⁰ have identified some of the conditions for individualization of instruction. They are:

1. In individualizing teaching, the emphasis is on the pupil as a person, the teacher as a person, and the interaction that takes place between them. In such an interpersonal relationship, the pupil can face the world and accept himself in a way which facilitates release of potential.
2. Individualization occurs when a teacher recognizes and responds to the emotional reactions of the learner as well as to his academic achievement, his intellectual mistakes, or his mental deficiencies, i.e., when the teacher responds to the pupil as a whole person and not just as a learner of specific subject matter.
3. Individualization occurs when the teacher goes beyond ordinary achievement. One teacher, for example, may teach the three R's with precision and persistence; as a consequence, his pupils achieve well. His educational goal is reached. Another teacher makes achievement in the three R's a means to the end of motivating the pupil to further learning, of exciting the pupil about some aspect of his world to be further explored, of releasing in a learner confidence in his own competency, of triggering in another learner a burst of creative endeavor. The second teacher has come closer to individualizing teaching than has the first.
4. Individualization also occurs when the teacher considers the pupil to be an individual with unique perceptions, values, concepts and needs, and when he creatively fashions learning opportunities to enhance the pupil's individuality.

¹⁹Ibid., pp. 62-64.

²⁰DeHaan and Doll, op. cit., pp. 18-20.

5. Individualization is meant to lead to commitment and purpose, to sensitivity to others' needs, to awareness of the demands of truth and justice.

Individualization of instruction does not replace or supersede the content of education. Rather, it brightens and enhances content. Individualization of teaching is increased when education relies as much as possible upon reality and actual experiences for its content. Teachers have taken advantage of this aspect for years in teaching vocational agriculture classes. Problem-solving and student-centered approaches rather than subject-centered approaches have been the basis for teaching vocational agriculture. However, DeHaan and Doll²¹ state that educational activities in and of themselves do not necessarily release potential within students. Just because teachers have made teaching student-centered and based upon problem experiences does not mean that they are releasing the "learning" potential which is bound up within students.

In development of materials and learning experiences in an individualized setting, it is necessary to provide self-instructional materials. Without the use of self-instructional materials, individualization would not be manageable within the context of an operating school situation. Bolvin²² points this out as he states:

²¹Ibid., p. 23.

²²Bolvin, op. cit., pp. 241-242.

There are several basic assumptions underlying the implementation of individualized instruction and several goals associated with the individualizing of instruction that have implications for materials development. Examples of these assumptions are as follows: (1) for individualization to be economically and operationally feasible, much of the instructional materials must be self-instructional, (2) the student should be actively involved in the learning process, (3) not all students require the same amount or kind of practice to achieve mastery of a given objective, and (4) different styles of learning require different techniques of instruction. The goals of individualized instruction that have implications for materials design are as follows: (1) a pupil can proceed to mastery at his own rate, (2) every pupil is able to evaluate his own progress, (3) different learning materials are available to accommodate different learning styles, and (4) pupils are able to become self-directed and self-initiated learners.

In general, the implications are that individualized learning materials must be available for those students able to use them and must accommodate various learner characteristics, such as level of reading and interest. Materials should be developed along a continuum going from very easy to very difficult and students should be able to enter and leave the continuum at any point. Bolvin²³ states that:

A key aspect of individualization of instruction is that each student should be permitted to work at the places in the learning sequence most appropriate for him with amounts and kinds of instruction adapted to his individual needs.

The teacher is the key to success or failure of an individualized instruction program. He must be aware of his role and the desired outcomes of the instruction. He also should be provided alternative courses of action. Bolvin²⁴ in his discussion on the role of the teacher states:

²³Ibid., p. 241.

²⁴Ibid., p. 242.

The concern of educators for adapting instruction to the needs of individual students is placing more and more demands upon those involved in curriculum and instructional design. The role of the teacher in such a system makes it mandatory that he be provided with well-defined outcomes to be achieved by the learner, information as to what learner characteristics are related to what kinds of learning, sufficient information about each learner in order to assess his abilities, and a well-defined set of alternatives from which to select the means of assisting a learner to attain the goals desired. This would seem to suggest that those responsible for providing the necessary tools and information to the teacher must begin by defining the objectives of the system, then analyzing the inputs in terms of learner characteristics, determining ways of measuring these factors, and defining and describing all the relevant conditions related to the system.

Research in non-agriculture disciplines

Many studies have been completed in educational fields other than agricultural education. These studies have identified certain factors which are applicable to individualized instruction in agricultural education.

Goodlad²⁵ observed that many teachers using the newer curriculum materials in the classrooms for the first time without in-service education simply could not adapt to what is required. Long conditioned to deductive approaches, the teachers turned materials intended for student investigation into objects of rote response. This points out very clearly the importance of preparing teachers in the underlying assumptions and concepts of the new materials. Teachers

²⁵John I. Goodlad, Renata Von Stoephasius, and M. Frances Klein, The Changing School Curriculum (New York: The Fund for the Advancement of Education, 1966), p. 102.

not only need to be introduced to the mechanics of using the new materials but also need to understand the new concepts and principles involved.

Lindvall and Bolvin²⁶ found it essential that the prospective Individually Prescribed Instruction teacher be provided with approximately four to six weeks of full-time training in summer workshops to adequately prepare him to use the new materials.²⁷ They also follow the basic assumption that the implementation of individualization in the classroom requires (1) teachers who are sensitive to individual differences and who have the skills essential for individual instruction and (2) a system and materials that provide the teacher with the help and guidance he needs to provide individualization.

Postlethwait and Novak²⁸ and Curl²⁹ in a study on the use of 8mm loop films in individualized instruction found

²⁶C. M. Lindvall and John O. Bolvin, "The Preparation of Teachers For Individually Prescribed Instruction" (Pittsburgh: Learning Research and Development Center, University of Pittsburgh, February, 1968), p. 3. (mimeographed)

²⁷Scanlon and Bolvin, op. cit., p. 2, define IPI as: "'Individually Prescribed Instruction (IPI) consists of planning and conducting with each student a program of studies that is tailored to his learning needs and to his characteristics as a learner. IPI takes into account such parameters of individual differences as rate of learning, amount of practice and, to some extent, preference for mode of instruction.'"

²⁸S. N. Postlethwait and Joseph D. Novak, "The Use of 8mm Loop Films In Individualized Instruction," Annals of the New York Academy of Sciences (New York: The New York Academy of Sciences, March 31, 1967), pp. 464-470.

²⁹David H. Curl, "Automated Equipment Operation Training," Audiovisual Instruction (September 1965), pp. 564-565.

that students' grades improved and the amount of subject matter learned could be increased with individualized instruction.

Postlethwait and Novak restructured a freshman botany course on an individualized instruction basis with the use of 8mm film loops. This restructuring, called integrated learning, involves three study sessions:

1. A General Assembly Session (GAS) which was scheduled
2. An Integrated Quiz Session (IQS) which was scheduled
3. An Independent Study Session (ISS) which was unscheduled.

The General Assembly Session was scheduled for one hour each week under the direction of the senior instructor and included many attributes of the conventional lecture.

The IQS Session met for one-half hour each week with senior-level instructors. Eight to twelve students were seated around a table containing materials from the previous week's study. The senior-instructor orally quizzed the students to determine their competence of the subject and to identify weaknesses.

The Independent Study Session (ISS) occurred at the convenience of the student in a learning center which was open from 7:30 a.m. until 10:30 p.m., Monday through Friday. The ISS room was equipped with individual study booths and demonstration tables containing many demonstrations and specimens to be studied that week. Each booth was equipped with a tape player, an 8mm technicolor projector, loop films,

specimens, experimental equipment, microscope, slides, charts, diagrams, and other materials appropriate to the week's work. The student was free to work independently or in cooperation with fellow students or the teaching assistant.

The effectiveness of this approach was demonstrated by an improvement in students' grades at all levels. In addition the amount of subject matter covered was increased 50 percent and personal contact and interest in the subject also improved.

Curl utilized the self-instructional technique with 8mm film loops and programed 2 x 2 slides to teach audio-visual equipment operation to education students. The students approached this learning situation in a completely unstructured manner, working with the equipment in any sequence, testing themselves, and allotting as much time as they felt they needed for each situation. The program has been very successful in teaching the use of audiovisual equipment.

Glaser³⁰ reports that changes in classroom communication structure occurred after the initiation of individualized instruction. Twenty-one experimental classes in four schools were observed, once before the introduction of the individualized program and four times after the program

³⁰Robert Glaser, Adapting The Elementary School Curriculum to Individual Performance, Reprint 26 (Pittsburgh, Pennsylvania: The University of Pittsburgh Learning Research and Development Center, 1967), p. 16.

started. Control classes were observed three times during the school year. The following was reported.

In the control classes, three aspects of the communication pattern appeared as follows: (1) over half of the communications in the classroom were noninstructional; (2) about 90 percent of the communications were teacher-initiated; half of these were directed to the single student and half to groups of students; and (3) when the teacher talked to one student, it was most likely that the communication was noninstructional; when the teacher talked to more than one student, it was likely that the communication was instructional. Before the initiation of the individualized program, the communication pattern in the experimental classes was highly similar to this control-school pattern. After the introduction of the individually prescribed instruction procedure, the following appeared: (1) over three quarters of the communications were instructional in nature; (2) 20 percent of the communications were teacher-initiated; of these, three quarters were directed to the single student; (3) about 80 percent of the communications were student initiated; of these, three quarters were instructional in nature; and (4) there was a trend for the overall number of communications to decrease in the experimental classes.

In general, in analyzing the experimental and control groups one can conclude that in the IPI classrooms, the responsibility for teacher-student communication fell upon the student and that the content of most communications was instructional in nature.

In the study of mathematics under the IPI curriculum, students showed continual progress throughout the course of the year.³¹

³¹Ibid., pp. 17-36.

Appleby³² in an Iowa study of 195 high school seniors attempted to determine the effects of individualized reading as a method of teaching literature in the secondary school. He found that individualized reading is significantly more effective than required reading or no instruction in literature in making students aware of the satisfactions and contributions literature may make to their information of intimate personal relations, socio-civic matters, and philosophy of life and religion. Appleby concluded that students in a system of one-semester English electives are more inclined to desire certain kinds of satisfactions from the study of literature than are those in a required English program.

Armstrong³³ in an experimental investigation of the instructional effectiveness of published programmed instructional materials versus individualized instruction for trade and industrial education in area vocational-technical schools found that individualized instruction was as effective as programmed instruction (based on achievement). He also found no significant difference in retention between the

³²Bruce Charles Appleby, "The Effects of Individualized Reading on Certain Aspects of Literature Study With High School Seniors" (Unpublished Ph.D. dissertation, The University of Iowa, 1967).

³³William Harrell Armstrong, "An Experimental Investigation of The Instructional Effectiveness of Published Programmed Instructional Materials vs. Individualized Instruction In Area Vocational-Technical Schools" (Unpublished Ph.D. dissertation, The Florida State University, 1967).

two concluding that they were equally effective for both high and low achievers.

In an experimental comparison of two methods of tutoring--programed versus directed--with 204 first grade children, Harris³⁴ found that programed tutoring resulted in greater gains at the end of the semester.

Teacher role and behavior is an important item in individualizing instruction. In the report on the Western States Small Schools Project, Stutz and Merrell³⁵ found that a redefinition of the role of the teacher was necessary in order to operate a successful individualized instruction program. Evans,³⁶ Holden,³⁷ Danowski,³⁸ and Darrah,³⁹ in

³⁴Phillip Lee Harris, "The Experimental Comparison of Two Methods of Tutoring: Programmed Versus Directed" (Unpublished Ed.D. dissertation, Bloomington: Indiana University, 1967).

³⁵Individualizing Instruction in Small Schools, ed. Rowan C. Stutz and Russel G. Merrell (Salt Lake City, Utah: Western States Small School Project, 1966), p. 4.

³⁶Marvin LeRoy Evans, "A Comparative Study of Secondary School Independent Study Programs" (Unpublished Ed.D. dissertation, University of Oregon, 1968).

³⁷George Scott Holden, "Changes In Instructional Behavior of Teachers Who Use Computer Processed Materials Designed For the Individualization of Instruction" (Unpublished Ed.D. dissertation, Buffalo: State University of New York at Buffalo, 1967).

³⁸Charles Edward Danowski, "An Analysis of Some Characteristics of Teachers of Small Classes" (Unpublished Ed.D. dissertation, Columbia: Columbia University, 1964).

³⁹Charles A. Darrah, "A Case Study of Differences In Classroom Practices Among Four Plans of Instructional Organization In the Elementary School" (Unpublished Ed.D. dissertation, Pittsburgh: University of Pittsburgh, 1967).

studies involving teacher role and characteristics of teachers, found that teachers either changed or possessed characteristics which fostered individualized instruction.

Evans⁴⁰ in a comparative study of secondary school independent study programs found a relationship between fourteen items and successful programs. Some of these are:

1. The extent to which staff members gave attention to and were knowledgeable about program objectives was a factor in the success of the program.
2. The ability of teachers to identify sources of strong leadership in the independent study program was positively related to the success of the program.
3. Teachers in successful programs assumed greater leadership responsibilities.
4. Successful programs provided more opportunities for each student to be engaged in learning activities uniquely fitted to his needs than did less successful programs.
5. Teachers in successful programs were provided with time to work individually with students in independent study program activities.
6. Successful schools deliberately build into the program a wide variety of motivational techniques designed to stimulate student interest in independent study activities.

Holden⁴¹ found significant changes in instructional behavior of teachers who used resource guides in the individualization of instruction with computer processed materials. The changes increased the number and improved the quality of the following individualized instruction tasks:

⁴⁰Evans, op. cit.

⁴¹Holden, op. cit.

- A. Encouraging pupils to engage in independent thinking;
- B. Creating an accepting atmosphere in the classroom;
- C. Making appropriate selection and use of instructional materials;
- D. Making appropriate selection and use of teaching methods;
- E. Motivating pupils through challenge without threat;
- F. Employing a wider variety of instructional materials;
- G. Using a greater number of individual and small group methods of teaching, and fewer large group methods; and
- H. Encouraging more pupil involvement and interaction.

Holden also found that resource guides fail to produce significant changes in teachers' sensitivities to the needs of pupils or in their sensitivities to the effects of the physical setting.

In an analysis of some characteristics of teachers of small classrooms who do not individualize instruction compared with characteristics of teachers who individualize instruction, Danowski⁴² found that teachers who individualize instruction have:

- 1. Favorable opinions of pupils;
- 2. An educational viewpoint geared to individual pupils;
- 3. Favorable opinions of administrators and other school personnel.

He also found characteristic of teachers who individualize:

⁴²Danowski, op. cit.

1. Classroom behavior which is responsible, business-like, and systematic;
2. Classroom behavior which is warm, understanding and friendly;
3. Favorable opinions of democratic classroom procedures;
4. Classroom behavior which is stimulating and imaginative.

Darrah⁴³ in a case study of differences in classroom practices among four plans of instructional organization in the elementary school found that careful planning for individualized instruction results in improved classroom situations with respect to most aspects of instructional activity.

Neufeld⁴⁴ in his review of literature for an individualized instruction project found that the personality structure of pupils in many classes was not compatible with the instructional method in use. There was also indication that children with a low measure of mental ability could achieve if learning conditions were changed.

⁴³Darrah, op. cit.

⁴⁴K. Allen Neufeld, "Differences In Personality Characteristics Between Groups Having High and Low Mathematical Achievement Gain Under Individualized Instruction" (Unpublished Ph.D. dissertation, Madison: The University of Wisconsin, 1967).

Lindvall and Cox⁴⁵ and Wang⁴⁶ state that, in measuring rate of learning of individualized instruction programs, one should consider pupil aptitude, achievement, interest and learning styles. Wang also adds that classroom performance correlates with learning.

Related research in agricultural education

Very few studies have been completed on individualized instruction in agricultural education. Therefore, selected studies comparing method of instruction were reviewed to ascertain research procedure and methodology and to identify from the findings those factors which might be important to consider in a study of methods.

⁴⁵C. M. Lindvall and Richard C. Cox, "The Role of Evaluation in Programs for Individualized Instruction," Educational Evaluation: New Roles, New Means, The Sixty-eight Yearbook of the National Society for the Study of Education, Part II, ed. Ralph W. Tyler (Chicago: University of Chicago Press, 1969), p. 156.

⁴⁶Margaret Wang, "An Investigation of Selected Procedures For Measuring and Predicting Rate of Learning in Classrooms Operating Under a Program of Individualized Instruction," Unpublished Ph.D. dissertation, Pittsburgh University, Reported in ERIC, Research in Education (Volume 4, Number 1, January, 1969).

Hannemann,⁴⁷ Norton,⁴⁸ McClay,⁴⁹ and Legg⁵⁰ found that programed instruction was effective in teaching certain skills in vocational agriculture.

Hannemann found that programed instruction was an effective method for teaching parliamentary procedure to vocational agriculture students in South Dakota. His post-test-only study revealed that students learned more in less time than when taught by conventional lecture-discussion methods. Norton found that programed instructional materials could teach psychomotor skills more effectively to persons of high dexterity than to those of low dexterity.

Legg and McClay compared the effectiveness of programed instruction and lecture-discussion methods of teaching agricultural finance and credit to vocational agriculture students and found the mean test scores favored the lecture-

⁴⁷James W. Hannemann, "The Effectiveness of Teaching Parliamentary Procedure Through the Use of Programmed Instruction" (Unpublished M.S. Thesis, Ithaca, New York: Cornell University, 1964).

⁴⁸Robert E. Norton, Using Programmed Instruction With and Without Self-Instructional Practice to Teach Psychomotor Skills (Ithaca, New York: Cornell University, June, 1967), p. 53.

⁴⁹David R. McClay, "A Test of Programmed Instruction in Farm Credit," The Agricultural Education Magazine (October, 1964), p. 100.

⁵⁰Otto Legg, "Programmed Instruction and Lecture-Discussion Methods Compared for Effectiveness in Teaching Agriculture Finance to Vocational Agriculture Students" (Unpublished Ed.D. Thesis, University Park: Pennsylvania State University, 1962).

discussion method. Legg⁵¹ concluded that the programmed instruction method may be of greatest aid to students desiring to study areas of special interest or as supplemental material to areas of knowledge not included by other methods. The auto-instruction group completed the unit in an average of five hours while the lecture-discussion group required an average of twelve hours. In a follow-up study the second year McClay⁵² found no significant difference in knowledge gained between the two groups of students of the two methods of instruction. He concluded that experience in working with new methods of instruction improves the level of learning and instruction.

Some researchers found that self-instructional materials allowed students to work at different paces and also increased teacher-student contact. Zarraga,⁵³ in the use of auto-instructional materials to teach farm business management to vocational agriculture seniors, concluded that the method permitted individual instruction for students of all ranges of ability and allowed for different rates of learning by permitting students to work at their own pace. It also permitted individual study by a student with limited intercession of a live instructor.

⁵¹Ibid.

⁵²McClay, op. cit.

⁵³Jose Cruz Zarraga, "The Development and Experimental Trial of Programmed Learning Material In Teaching Farm Business Management to Vocational Agriculture Students" (Unpublished Ph.D. dissertation, Minneapolis: University of Minnesota, 1963).

Drawbaugh⁵⁴ and Shontz⁵⁵ found that teaching unit methods were superior to the instructor's method of instruction. It was concluded that well organized teaching plans are required if students are to be taught effectively.

Drawbaugh⁵⁶ compared the effectiveness of three kinds of plant growing facilities and three teaching methods for learning plant science principles and found that achievement in knowledge of greenhouse management and of plant science principles was greater for students taught by the laboratory manual and the functional experience approach than students taught by the teacher's own method.

Shontz⁵⁷ compared the educational effectiveness of three methods of teaching agricultural occupations information associated with land use and conservation to 9th and 10th grade students of vocational agriculture. He found that both the integrated and separate-units teaching methods were superior to the instructor's own method.

⁵⁴Charles C. Drawbaugh, "Greenhouse Facilities For Teaching," The Agricultural Education Magazine (January, 1965), pp. 178-179.

⁵⁵David F. Shontz, "An Experiment in Teaching Agricultural Occupations Information to High School Students" (Unpublished Ed.D. dissertation, University Park: The Pennsylvania State University, 1963).

⁵⁶Drawbaugh, op. cit.

⁵⁷Shontz, op. cit.

Individualized instruction research
in agricultural education

Very little research on individualized instruction has been completed in agricultural education. In a comprehensive evaluation of the individualized instruction units published by the College of Education, Michigan State University, Oen⁵⁸ found that teachers and students indicated a need for more and better audiovisual materials to accompany the units. Many students indicated that they were unsure of what they were expected to learn due to the absence of specific terminal behavioral objectives. In addition they were unable to evaluate their performance from the suggested evaluation activities or experiences.

The students agreed that the units were helpful in preparing them for sales and service work in agri-industry. Eighty-six percent indicated they learned a great deal in studying the units. Eighty-six percent of the students stated that they received enough help from their instructor while studying the units.

The instructors stated that if a complete audiovisual package were furnished with the units, they could spend more time in helping the students and less time in running around trying to locate materials for student use.

⁵⁸Urban T. Oen, "Evaluation of the Individualized Instruction Units: Final Report" (Unpublished report, East Lansing: College of Education, Michigan State University, May 15, 1969).

McCarley,⁵⁹ in comparing the individualized instruction method to the lecture-discussion method in teaching the grading of corn, found that the individualized instruction group gained significantly more on the post-tests than the lecture-discussion group.. He also found that agricultural interest and academic rank had no significant influence on student achievement. As a method of instruction, the individualized instructional unit was well received and well-liked by the students.

Lambert,⁶⁰ in a study of the teacher's role in individualized instruction found that vocational agriculture instructors and principals in Michigan, rated the following two activities as the most important: "discusses career goals with individual students," and "incorporates laboratory activities that complement the classroom work."

Summary of the review of literature

From the review of literature it appears that:

1. Teachers need to be introduced to the mechanics of using the new instructional materials. They need

⁵⁹Walter William McCarley, "An Experimental Study to Evaluate the Effectiveness of an Individualized Instructional Method and the Lecture-Discussion Method for Teaching Vocational Agriculture Classes" (Unpublished Ph.D. thesis, East Lansing: College of Education, Michigan State University, 1969), pp. 101-105.

⁶⁰Roger Henry Lambert, "Teachers' Perceptions and Principals' Expectations For The Teacher's Role In Individualized Instruction" (Unpublished Ph.D. thesis, East Lansing: College of Education, Michigan State University, 1970).

to know what new concepts and principles are to be developed in students by use of the new materials.

2. Units of instruction are an effective means of teaching.
3. Individualization of instruction is effective if:
 - A. the students are actively involved;
 - B. the students set their own goals;
 - C. the instruction is of interest to the students;
 - D. the instruction meets the students' needs and is geared to their abilities;
 - E. teachers understand their role with this method of instruction;
 - F. a wide variety of motivational techniques are used;
 - G. the students can proceed at their own pace;
 - H. adequate materials and facilities are made available;
 - I. students are properly oriented and acclimated to this type of instruction;
 - J. the instructional materials are self-instructional;
 - K. pupils can evaluate their own progress;
 - L. different learning materials are available to accomodate different learning styles;
 - M. the lessons contain terminal behavioral objectives;
 - N. instruction involves the interaction of persons, procedures, and materials;
 - O. content relies on reality and actual experiences;
 - P. teachers are provided time to work with the students individually.

4. When researching individualized instruction programs, the following factors should be considered: pupil aptitude, achievement, interest, learning styles and classroom performance.

CHAPTER III

RESEARCH DESIGN AND PROCEDURE

The research design, the procedure of the study, and the methods used to analyze the data are found in this chapter. The chapter contains discussions of the following areas: (1) research design, (2) development and pre-testing of the individualized learning manual, (3) selection of the study sample, (4) development of the instruments, and (5) analysis of the data.

Research design

Professionals from the Office of Research Consultation* were contacted and apprized of the purposes and objectives of the study. It was agreed that the research design used would be a modification of Stanley and Campbell's⁶¹ designs number four and six. The design was:

⁶¹Donald T. Campbell and Julian C. Stanley, Experimental and Quasi-Experimental Designs for Research (Chicago: Rand McNally and Company, 1963), pp. 13-37.

* The Office of Research Consultation is a part of the College of Education, Michigan State University.

R	O ₁	X ₁	O ₂	(Individualized learning method)
R	O ₃	X ₂	O ₄	(Lecture-discussion method)
R	O ₅		O ₆	(Non-instruction (control) method)

Where: R = Random assignment of schools
 X = Treatment
 O_{1,3,5} = Antecedent variables
 O_{2,4,6} = Post-tests

This particular design was chosen because it controls all the internal sources of validity listed in Stanley and Campbell and facilitates precision by use of analysis of covariance. Porter⁶² suggested that a minimum of ten schools be randomly assigned to each method in order to obtain sufficient statistical power to test the hypotheses. The school was the experimental unit.

Development and pre-testing of the individualized learning manual

The original manual on turf sales and service was developed during the Winter Term, 1969. The content of the manual was determined by reviewing the literature dealing with turfgrass. Dr. Beard⁶³ reviewed the manual and made suggestions for strengthening it.

⁶²Andrew Porter, Office of Research Consultation, College of Education, Michigan State University, 1969.

⁶³James Beard is a professor and turfgrass specialist in Crop and Soil Sciences, College of Agriculture, Michigan State University.

The manual and accompanying audiovisual and curriculum materials were pre-tested in three Michigan high schools: Grand Ledge, Tecumseh and Goodrich during May, 1969. A total of 45 high school vocational agriculture students participated in the pre-study. Upon finishing the study, each student completed a post-test and a student evaluation of the manual. In addition, the three vocational agriculture teachers completed an evaluation of the manual. The comments and suggestions of both evaluations were incorporated into the final turfgrass individualized learning manual.

The content of the revised individualized turfgrass manual was determined by a study completed during May and June of 1969.⁶⁴ This study identified the competencies considered necessary for a beginning sales and service employee in the turfgrass industry. Those competencies considered desirable or essential were included in the revised manual, (See Appendix A for the list of turfgrass competencies).

The pattern and model for development of the final individualized learning manual was based upon the suggestions

⁶⁴Urban T. Oen, "Employment Opportunities and Needed Competencies In Selected Nursery, Turfgrass, Arboriculture, and Landscaping Businesses in the Lansing, Michigan Area" (Mimeographed, East Lansing: College of Education, Michigan State University, September 12, 1969), pp. 9-12. (The completion of this study validated the content of the individualized learning manual as it identified the final competencies to include in the manual).

of Lindvall,⁶⁵ Craig,⁶⁶ Ebel,⁶⁷ and Yelon.⁶⁸ The pattern for developing the individualized learning manual is contained in Figure 3.1.

The individualized learning manual contained ten individual lessons based upon the competencies deemed desirable or essential in the study by Oen.⁶⁹ Each lesson contained specific behavioral objectives followed by a brief textual introduction to the subject covered in the lesson. The textual introduction was followed by many job-oriented learning activities. A self-evaluation section followed the learning activities which in turn was followed by a listing of suggested references.

⁶⁵Letter from Dr. C. M. Lindvall, Professor of Education, and evaluation specialist of the Learning Research and Development Center, University of Pittsburgh, Pittsburgh, Pennsylvania, July 2, 1969.

⁶⁶Conference with Dr. Robert Craig, Department Chairman, Counseling, Personnel Services, and Educational Psychology, College of Education, Michigan State University, January 15, 1969.

⁶⁷Conference with Dr. Robert Ebel, Evaluation Specialist, College of Education, Michigan State University, February 6, 1969.

⁶⁸Conference with Dr. Stephen Yelon, Professor of Educational Psychology, College of Education, Michigan State University, March 4, 1969.

⁶⁹Oen, op. cit.

FIGURE 3.1

PATTERN FOR DEVELOPMENT OF THE
INDIVIDUALIZED LEARNING MANUAL

1. Identify the name of the manual
2. Develop the objectives of the manual
3. Prepare an introduction to the manual
4. Identify the individual lessons
5. Prepare terminal behavioral objectives for each lesson
6. Prepare a textual introduction for each lesson
7. Identify the learning activities for each lesson
8. Identify appropriate audiovisuals and curriculum materials
9. Develop self-evaluation questions and problems
10. Prepare a list of appropriate references which can be used with each lesson

The final draft of the individualized learning manual was reviewed by Payne⁷⁰ and King⁷¹ of Crop and Soil Sciences as technical authorities and by Sweany⁷² and Clark⁷³ of the College of Education as experts in agricultural education.

Selection of the study sample

Teachers of vocational agriculture in central Michigan were polled by questionnaire at their annual conference⁷⁴ to identify those interested in participating in the turf-grass study. (The questionnaire is contained in Appendix B). Thirty-seven of the thirty-nine teachers in the sample area responded to the survey. Three teachers unable to meet the eligibility criteria were immediately eliminated from the study. The criteria for selection of schools and teachers was:

1. The schools had to be located in central Michigan

⁷⁰Kenyon Payne, Professor of Crop and Soil Sciences, College of Agriculture, Michigan State University, East Lansing, Michigan.

⁷¹John King, Instructor, Crop and Soil Sciences, College of Agriculture, Michigan State University, East Lansing, Michigan.

⁷²H. Paul Sweany, Professor of Agricultural Education, College of Education, Michigan State University, East Lansing, Michigan.

⁷³Raymond M. Clark, Professor of Agricultural Education, College of Education, Michigan State University, East Lansing, Michigan

⁷⁴"Fiftieth Annual Conference for Teachers of Vocational Agriculture" (East Lansing: Kellogg Center for Continuing Education, Michigan State University, July 28-31, 1969).

2. Teachers had to be willing to teach by whichever method of instruction, individualized or lecture-discussion, assigned to them.
3. The instruction was mainly limited to junior and senior vocational agriculture classes.*
4. The teachers had to be willing to follow a pre-determined procedure.

Thirty-four schools were randomly assigned by a table of random numbers,⁷⁵ to one of the three methods of instruction used in the research design. Each school was assigned a two-digit number. As each number was drawn, the school was assigned one of the three methods of instruction using the following procedure. The first school identified was assigned the individualized learning method, the second school the lecture-discussion method, and the third school the non-instruction (control) method. This sequence was repeated until all schools were allotted one of the three methods of instruction.

Since it had been decided earlier that only 30 schools would be needed for the project, four schools were labeled as alternates. Between the time of the conference and the beginning of school, three teachers dropped from the

⁷⁵N. H. Downie and R. W. Health, Basic Statistical Methods, Second Edition (New York: Harper and Row, Publishers, 1965), pp. 316-317.

* Some of the classes contained freshmen and sophomores along with the juniors and seniors.

study leaving 31 schools participating in the research project, ten in each method of instruction and one alternate for the lecture-discussion method. Two schools had scheduling problems and were unable to complete the study in time for the analysis; therefore, 29 schools completed the study. (Appendix L contains a listing of teachers and schools completing the study).

The teachers were informed at the conference that three orientation meetings would be held to familiarize them with the study and to distribute the audiovisual and curriculum materials.

A letter was mailed to each teacher August 16, 1969, to remind him of the upcoming meetings, dates, times, and places. Included was a reminder to each teacher of the particular method he had been assigned. Another letter was mailed to the superintendent of each participating school informing him of the study and the upcoming meetings, (See letters in Appendix C).

Teachers using the individualized learning method of instruction met at Greenville Senior High School on Wednesday, August 27, 1969, from 1-4:30 p.m. The teachers using the lecture-discussion method of instruction met either at Portland High School on August 28, 1969 at 9:00 a.m. or at Mount Pleasant High School on August 29, 1969 at 1:00 p.m. Mimeographed instructions were distributed at the meetings

along with the individualized learning manuals,⁷⁶ antecedent variable tests, multiple copies of reference materials, five slide sets and scripts, and other audiovisual and curriculum materials, (See Appendix D for listing of materials in portfolio distributed to each teacher).

In addition, the instructions and project procedures were reviewed with the teachers, (See Appendix E for directions given to the teachers).

The teachers using the individualized learning method of instruction were provided an individualized learning manual for each student. The teachers were instructed not to "teach" but to work with the students on an individualized or small group basis.

Teachers using the lecture-discussion method of instruction were provided one individualized learning manual for use in teaching the same materials covered by the

⁷⁶Urban T. Oen, Turf Sales and Service Unit: An Individualized Learning Manual, Student Manual (East Lansing: College of Education, Michigan State University, 1969).

The individualized learning manual was 119 pages in length and contained ten lessons; however, the teachers agreed that only eight weeks of study time were available so lessons 6, 8, 9, and 10 were omitted from the study. The lessons and titles included in the study were:

- Lesson 1: Exploring Career Opportunities in the Turfgrass Industry
- Lesson 2: Salesmanship and Human Relations
- Lesson 3: Types and Characteristics of Turfgrass
- Lesson 4: Turfgrass Establishment, Care, and Maintenance
- Lesson 5: Fertilization and Liming
- Lesson 7: Identification and Control of Weeds

teachers of the individualized learning method of instruction. They were told not to read the objectives to the students nor to show them the manual. They were asked to teach from a sales and service standpoint using the terminal behavioral objectives as a guide for their instruction.

The meetings were tape recorded for the five teachers who were unable to attend. That tape along with the audiovisual and curriculum materials was mailed to four of the five teachers; one was personally visited to orient him to the project. He also was provided a tape of the meeting. In addition a personal telephone call was placed to each teacher unable to attend the group meetings to make sure he understood the project procedure.

The teachers of the non-instruction (control) method were not called together for a group meeting. They were informed that they were a part of the research project but, due to the lack of audiovisual materials, they would be unable to start until a later date. At no time were they ever designated as a control school.*

* After administering the antecedent variable tests, teachers of the non-instruction (control) method were told that as soon as the other groups finished, they would be provided materials for the study. After eight weeks, they were sent the post-tests and asked to administer them before they could begin their part of the study. They were then provided the same instructional materials as the other two groups to begin teaching turfgrass.

Development of the instruments

Five antecedent variable tests and seven post-tests were used in the study. Three of the antecedent variable tests and the post-tests were self-constructed while two antecedent variable tests were commercially prepared. Each is described separately in this section. In addition, a time and activities chart was constructed, along with a teacher survey to be completed at the conclusion of the study.

Turfgrass pre-study analysis test.--A ninety item turfgrass pre-study analysis test was developed and pre-tested with the three pilot schools in the spring of 1969. The purpose of the test was to identify the amount of turfgrass knowledge possessed by the students before instruction began.

Most of the items for the turfgrass knowledge pre-study analysis test were obtained from previously validated turfgrass exams constructed by The Pennsylvania State University⁷⁷ and The Ohio State University.⁷⁸ Other test items were constructed by the researcher. Forty-five students completed the pre-study analysis and recorded their answers

⁷⁷"Turfgrass Maintenance and Establishment Examination," contained in: Turfgrass Maintenance and Establishment: A Teacher's Manual (University Park, Pennsylvania: Department of Agricultural Education, The Pennsylvania State University, 1968).

⁷⁸"A Test for Students of Vocational Agriculture on Lawns," contained in: Establishment and Maintenance of Lawns (Columbus, Ohio: Department of Agricultural Education, The Ohio State University, 1965).

on IBM sheets. The sheets were read and scored by the IBM 1230 Optical Scanner of the Office of Evaluation Services, Michigan State University. The data were then transferred to the Data Processing Department where an IBM 360 performed an item analysis using the Kuder-Richardson Reliability Formula Number 20. A .7044 reliability was obtained.

The following item statistics were obtained on each question: (1) index of difficulty, (2) index of discrimination, (3) Biserial Correlation, (4) Point Biserial Correlation, and (5) Student T and mean score rights and wrongs. The Office of Research Consultation suggested that all questions receiving a negative correlation and/or an index of discrimination of a negative value or a value below 17 be eliminated. As a result, 30 questions were eliminated and other similar questions were added. The final pre-study analysis test contained 85 items, (See Appendix F). The 85 item test was administered to 566 students in the study in September, 1969. An item analysis was completed on this test, but due to the use of a ten choice IBM answer sheet, it was impossible to obtain one reliability coefficient. Questions 1-60 had a reliability of .7666 while questions 61-85 had a reliability of .9300.

Cooperative English Test, Form 2A.--The Cooperative English Test, Form 2A, was a standardized test from Educational Testing Service⁷⁹ for grades 9-12. The purpose of

⁷⁹Cooperative English Tests--Reading Comprehension--Form 2A (Princeton, N.J.: Educational Testing Service, 1960).

the 40 minute two-part test was to identify the reading comprehension of the students. Part one--vocabulary--contained 60 items and allowed 15 minutes for completion. Part two measured reading and comprehension and contained 60 questions with 25 minutes allowed for completion. The students recorded their answers directly on IBM 1230 answer sheets. A reliability of .94 was reported for Form 2A by Educational Testing Service.⁸⁰

Eysenck Personality Inventory, Form B.--The Eysenck Personality Inventory,⁸¹ a standardized test containing 57 yes-no items, was developed by Educational and Industrial Testing Service. The Inventory measured personality in terms of two pervasive, independent dimensions: extraversion-introversion and neuroticism-stability. Each of these traits was measured by 24 yes-no response questions. A response distortion (lie) scale was also included to detect attempts to falsify responses. Nine questions were included to detect distortion.

The responses of the 504 students completing this test were recorded on Michigan State University IBM true-false answer sheets and machine scored. A score was obtained for each of the three dimensions measured.

⁸⁰Technical Report: Cooperative English Tests (Princeton, N.J.: Educational Testing Service, 1960), p. 19.

⁸¹Eysenck Personality Inventory, Form B (San Diego, California: Educational and Industrial Testing Service, 1963).

Repeat reliability (test-retest) reported by EITS for high school and college populations ranged from .84 to .94. In addition the test was reported to be valid according to factorial, concurrent, and construct validity techniques.⁸²

Agricultural occupations interest scale.--A 75 item forced-choice response agricultural occupations interest scale was adapted from the 100 point scale developed by Hamilton,⁸³ (See Appendix G). However, whereas the Hamilton scale contained only one item on turfgrass work, the adapted scale contained 22 items. Students were asked to mark on 10-choice IBM answer sheets their degree of preference in Part I, according to the following scale: 1 = like; 2 = uncertain; and 3 = dislike. On Part II of the test, students were forced to choose the activity they preferred of the two activities listed.

The interest scale was scored using three keys. Of the 75 items, only the 22 turfgrass items were scored. The following weighted scale was used: Those items marked number one or "like" were weighted three points. Those items marked as "uncertain" were weighted two points. Those items marked as "dislike" were weighted one point. On Part II of the

⁸²H. J. Eysenck and Sybil B. G. Eysenck, Eysenck Personality Inventory Manual (San Diego, California: Educational and Industrial Testing Service, 1968), pp. 14-17.

⁸³William H. Hamilton and Charles W. Hill, Development of a Scale to Measure Interest in Agricultural Occupations (Ithaca, New York: Cornell University, 1967).

test, the students were awarded three points for each turfgrass activity marked. The highest possible total score of the scale was 66 points.

The purpose of the interest scale was to identify those students interested in turfgrass sales and service work.

Individualized learning attitude scale.--A 20-item Likert-type attitude scale was developed to measure student attitude toward individualized instruction. The scale was patterned after Pearson's⁸⁴ 20-item attitude scale on programmed instruction, (See Appendix H).

Content validity was determined by having Pearson and several graduate students in curriculum analyze the scale and rate the items from 0, no apparent validity, through 4, very high validity. Those items receiving a rating of two or lower were eliminated or modified.

The Scoring Service was unable to obtain the reliability of the instrument since weighted scores were used.

The scale was scored from 1 to 5 with one for strongly agree and five for strongly disagree. Items 2, 5, 11, 12, 13, 18, 19, and 20 were reversed or negatively stated, and therefore the scale was reversed in scoring these items.

⁸⁴Harry A. Pearson, "Programmed Instruction For Groups of Teachers in Remote Locations: Prototype Development" (Unpublished Ph.D. dissertation, East Lansing: College of Education, Michigan State University, 1969).

Post-test turfgrass examinations.--A comprehensive battery of post-test examinations were developed to determine the students' achievement. The questions on the post-tests were based upon the terminal behavioral objectives of the individualized learning manual. Some of the items were obtained from the pre-study analysis while others came from tests constructed by The Pennsylvania State University⁸⁵ and The Ohio State University.⁸⁶ The remaining items were constructed by the researcher.

Post-tests one, two, and three contained a total of 56 test items and six background items. The items were multiple-choice, short-answer, matching and problems. Lessons one, two, three and four of the individualized learning manual were covered in these three examinations, (See Appendix I).

Post-tests four and five, containing 22 questions covering lessons five and seven, consisted of true-false, multiple-choice, matching, short-answer, and problem items. Post-test six contained 19 items requiring specimen identification of three turfgrass seed samples, four turfgrass samples, and 12 weeds.

Post-test seven, containing 12 items, was a timed test used to identify whether there was a difference in the

⁸⁵"Turfgrass Maintenance and Establishment Examination," op. cit.

⁸⁶"A Test For Students of Vocational Agriculture on Lawns," op. cit.

ability of students to locate and interpret information quickly as a result of their method of study and instruction.

Students were provided two handouts and asked to use them in completing the test. One handout, "Selecting A Turf Fertilization Program,"⁸⁷ had been used by the students as a reference during the study. A second handout was a 26 page publication prepared for the Michigan State University Turfgrass Field Day⁸⁸ and had not been seen by the students. Interpretation items and a problem were included as a part of post-test seven.

In completing the post-tests, students recorded their answers on IBM answer sheets and directly in the test booklet. The short-answers and problems were graded and an appropriate number was coded onto the IBM sheet. The sheets were read and scored by an IBM 1230 Optical Scanner. In addition, an IBM 360 performed an item analysis using the Kuder-Richardson Reliability Formula Number 20.

Post-tests one through three were completed by 535 students. A reliability of .9157 was obtained on these examinations. Post-tests four through seven were completed by 525 students; a reliability of .8779 was obtained. Two

⁸⁷Paul E. Rieke, "Selecting A Turf Fertilization Program" (East Lansing: Department of Crop and Soil Sciences, Michigan State University).

⁸⁸"A Review of Turfgrass Research at Michigan State University: Turfgrass Field Day" (East Lansing: Department of Crop and Soil Sciences, Michigan State University, September 4, 1969).

reliability coefficients were obtained on the post-tests because all the data were recorded on two IBM sheets which were read separately by the optical scanner.

Time and activities chart.--A time and activities chart was developed and completed by each student in order to identify the amount of time devoted to individual, small group, and large group study, (See Appendix J). Students completed the chart at the end of each class period.

The purpose of the time and activities chart was to determine whether the amount of time devoted to study was related to the post-test scores. In addition, it was a check to insure that the study had been either individualized or taught by the teacher according to the predetermined project procedure.

Final teacher survey.--At the conclusion of the study, a survey was mailed to each teacher asking him to evaluate: (1) the individualized learning manual, (2) the project procedure, and (3) the project evaluation techniques, (See Appendix K). A self-addressed, stamped envelope was enclosed with the survey. All teachers completed and returned the survey.

The purpose of the survey was to identify opinions of teachers as to the worth of the individualized learning manual. It also provided an opportunity for the teachers to make suggestions concerning the research project.

Analysis of the data

The Office of Evaluation Services of Michigan State University scored all the antecedent variable tests and the post-tests used in the study. IBM sheets were read and scored by an IBM 1230 Optical Scanner which was connected to an IBM key punch machine. The raw scores were punched onto IBM cards along with the test identification number and the individual student number. The cards were programed through the CDC 3600 to obtain school means for each test. The school means were key punched onto IBM cards so that the data could be statistically analyzed.

In addition to the student data, data concerning the teacher were also coded onto the IBM card. If the teacher had taught a lesson or unit on turfgrass in any previous year a one was coded onto the card; if he had never taught a lesson or unit on turfgrass a two was coded onto the card. The years of teaching experience were also coded onto the IBM card according to the following code:

<u>Code</u>	<u>Years of Experience</u>
1	0 - 3
2	4 - 9
3	10 - 19
4	20 and over

Research specialists of the Office of Research Consultation of the College of Education, Michigan State

University assisted in the preparation of the computer program to analyze the data. They recommended a multivariate analysis of variance and covariance using the Finn program and a multiple correlation program to analyze the data.⁸⁹

The Finn program is a discriminatory analysis program in which all the dependent variables are analyzed at one time to determine what single derived value best reflects the difference between the three populations. The value derived from the analysis is called a discriminant function. It is assumed that for each population the characteristics have a multivariate normal distribution, with different means, but common variances and covariances.

Essentially the multivariate analysis of variance and covariance allows the researcher to extend tests of significance from single population characteristics to sets of population characteristics using univariate tests of significance such as the t-test, F-test, and the χ^2 -test.⁹⁰

One primary purpose of the Finn program is to determine what characteristics or combination of characteristics, best reflects the population differences which are being studied.

⁸⁹Jeremy D. Finn, Multivariate: Fortran Program For Univariate and Multivariate Analysis of Variance and Covariance (Buffalo, New York: Department of Educational Psychology, State University of New York at Buffalo, May, 1967).

⁹⁰Carl A. Bennett and Norman L. Franklin, Statistical Analysis In Chemistry and The Chemical Industry (New York: John Wiley and Sons, Incorporated, 1954), pp. 288-295.

The means and the sums and cross products of deviations were obtained for each population. The differences and the joint sums were used to solve for the coefficients of the discriminant function.

In addition to the Finn program, a multiple correlation of the data was performed to determine the correlation, if any, between scores students obtained on the antecedent variable tests and their post-test scores. In order to obtain the multiple correlations all the antecedent variable tests and the post-test data contained on the many IBM cards had to be combined on one card. A special computer program was written and run to accomplish this. Data were missing from some of the cards as some students were absent when some of the tests were administered. It was decided that those students who had not completed all the tests would be eliminated.

The IBM cards were programed through the CDC 3600 using the Michigan State University Agricultural STAT Series Number Eight (LSDEL), which is a stepwise deletion of variables from a least square equation, to determine the correlation if any between the scores students obtained on the antecedent variable tests and their post-test scores.⁹¹

⁹¹Michigan State University, Agricultural Experiment Station, LSDEL: Stepwise Deletion of Variables From A Least Squares Equation (STAT Series Description Number Eight, November, 1969).

CHAPTER IV

ANALYSIS OF THE DATA

The analysis of the data is presented in this chapter in the order of presentation relative to the objectives and hypotheses contained in Chapter I. Each null hypothesis is restated in the chapter to facilitate reader understanding of the analysis of the data. The chapter is divided into two parts. Part I contains the analysis of the data pertaining to the students. Part II contains the evaluation by the teachers of the individualized learning manual and of the project and project procedure.

Part I - Student Data

The units of analyses for hypotheses one, two, and three were school means while the units of analyses for hypothesis four were individual student scores. The units of analyses for the data contained in Tables 4.1, 4.2 and 4.3 were also school means.

Mean post-test scores of students

The means and the pooled within standard deviations of the post-test scores of the vocational agriculture

students of the two instructional methods and the non-instruction (control) method are contained in Table 4.1.

A visual comparison of the mean post-test scores shows that on all seven post-tests, the individualized instruction method ranked highest, the lecture-discussion method ranked second, and the non-instruction (control) method ranked third. On post-tests two and four, there was very little difference between the mean scores of students of the individualized and lecture-discussion methods of instruction, which resulted in very small pooled within standard deviations. Post-test two covered types and characteristics of turfgrasses while four covered fertilization and liming.*

Antecedent variable mean scores

The antecedent variables were determined or measured before instruction began. The mean scores and pooled within standard deviations of the antecedent variables of the high

* Each post-test tested the students on different areas of competencies. The following is a list of competencies covered by each post-test. See Appendix I for a listing of questions covered under each competency.

<u>Post-test</u>	<u>Areas of Competencies covered</u>
1	Career Opportunities and Salesmanship and Human Relations
2	Types and Characteristics of Turfgrasses
3	Turfgrass Establishment, Care, and Maintenance
4	Fertilization and Liming
5	Identification and Control of Weeds
6	Seed, Turfgrass and Weed Specimen Identification
7	Interpretation and Location of Information (open book test)

TABLE 4.1

MEANS AND STANDARD DEVIATIONS OF THE POST-
TEST SCORES OF THE VOCATIONAL AGRICULTURE
HIGH SCHOOL STUDENTS OF THE TWO
INSTRUCTIONAL METHODS AND THE
NON-INSTRUCTION (CONTROL)
METHOD

Method of Instruction	Mean Post-test Scores						
	Post-test						
	1	2	3	4	5	6	7
Individualized (N = 9 schools)	16.77	3.47	12.83	3.89	5.20	8.56	5.57
Lecture-Discussion (N = 10 schools)	13.11	3.41	8.48	3.81	3.68	5.87	3.57
Non-Instruction (Control) (N = 10 schools)	9.01	1.66	3.65	2.67	1.63	1.06	3.27
Pooled Within Standard Deviation	2.80	.74	2.39	.62	1.19	1.88	1.27

school vocational agriculture students and teachers of the two instructional methods and the non-instruction (control) method are shown in Table 4.2. There were only small differences between the mean antecedent variable scores of the students of the three methods of instruction. Very little difference existed, too, between the teacher variables, i.e., the years of teaching experience and previous turfgrass experience. These small differences were expected since the groups were randomly equivalent at the outset.

TABLE 4.2

ANTECEDENT VARIABLE MEAN SCORES AND STANDARD DEVIATIONS OF
THE HIGH SCHOOL VOCATIONAL AGRICULTURE STUDENTS AND
TEACHERS OF THE TWO INSTRUCTIONAL METHODS AND THE
NON-INSTRUCTION (CONTROL) METHOD

Method of Instruction	Antecedent Variable Mean Scores					
	Student Variables			Teacher Variables		
	Pre-Study Analysis	Interest	Attitude	Cooperative English	Teaching Experience	Turfgrass Experience
Individualized (N = 9 schools)	31.33	34.89	52.81	53.51	2.22	1.22
Lecture-Discussion (N = 10 schools)	30.14	36.72	52.76	54.55	2.70	1.10
Non-Instruction (Control) (N = 10 schools)	31.91	35.88	50.71	57.81	2.50	1.40
Pooled Within Standard Deviation	2.44	4.08	2.46	5.37	1.11	.43

Students on the average correctly answered 34 percent of the 90 items of the turfgrass pre-study analysis (turfgrass knowledge pre-test). The students on the average were uncertain of their interest in turfgrass work since the mean average of 35.7 fell in the uncertain range. A score of 22 would show total dislike, 44 would show uncertainty, and 66 would indicate complete interest in turfgrass work.

The students were uncertain of their attitude toward individualized instruction as the mean attitude scores ranged from 50 to 52 points on a scale ranging from 20 points for strongly favoring to 100 points for strongly unfavorable. The uncertain range on the scale was between 50 and 70 points.

The mean scores of students on the Cooperative English Test had the greatest variance and largest pooled within standard deviation. Thus, students of the different schools were shown to be unequal in comprehension and verbal ability.

Correlation between antecedent and dependent variables

The correlations between the dependent and antecedent variables using school means as the unit of analysis are contained in Table 4.3. The overall general low correlations between the dependent and antecedent variables indicate that the antecedent variables are not good predictors of post-test scores. The correlations do reveal some interesting relationships; for instance, there were negative correlations between teaching experience and post-test one ($-.442$) and

TABLE 4.3
CORRELATION MATRIX (WITHIN CELLS) BETWEEN THE
ANTECEDENT AND DEPENDENT VARIABLES

Variable	Post-test					
	1	2	3	4	5	6
<u>Dependent variables</u>						
Post-test 1	1.000					
Post-test 2	0.559	1.000				
Post-test 3	0.708	0.503	1.000			
Post-test 4	0.385	0.580	0.269	1.000		
Post-test 5	0.583	0.585	0.515	0.558	1.000	
Post-test 6	0.369	0.503	0.496	0.375	0.470	1.000
Post-test 7	0.543	0.528	0.514	0.215	0.568	0.523
<u>Antecedent variables</u>						
Pre-study analysis	0.041	0.175	0.159	0.020	0.073	0.154
Interest	0.292	0.014	0.153	0.292	0.392	-0.124
Attitude	-0.259	0.251	-0.008	0.205	-0.021	0.295
Cooperative English	0.245	0.133	0.140	-0.272	-0.108	-0.011
Teaching Experience	-0.442	-0.372	-0.174	-0.156	-0.050	0.041
Turfgrass Experience	-0.152	-0.059	-0.158	0.263	-0.202	-0.148

TABLE 4.3--continued

7	Pre-study Analysis	Interest	Attitude	Coopera- tive English	Teaching Experi- ence	Turfgrass Experi- ence
1.000						
0.492	1.000					
-0.027	-0.048	1.000				
-0.043	-0.099	-0.152	1.000			
0.366	0.437	-0.057	-0.286	1.000		
-0.177	0.262	-0.063	-0.006	-0.035	1.000	
-0.378	-0.195	0.074	0.372	-0.325	-0.252	1.000

post-test two ($-.372$). Post-test one covered career opportunities and salesmanship and human relations while two covered types and characteristics of turfgrasses. The inverse relationship shows that students of those teachers with more teaching experience tended to do poorer on post-tests one and two than did students of teachers with less teaching experience.

Post-test seven, an open book test covering location and interpretation of turfgrass information, was positively correlated ($.366$) with the Cooperative English Test and negatively correlated ($-.378$) with turfgrass experience. This indicates that students with high reading comprehension and verbal ability tended to score high on post-test seven while students with low reading comprehension and low verbal ability tended to score lower. The negative correlation between post-test seven and turfgrass experience indicates that students of teachers who had previously taught turfgrass tended to score higher on post-test seven than did students of teachers who had not previously taught turfgrass.

Overview of the analyses performed

The purpose of this section of Chapter IV is to provide the reader with a synopsis of the different analyses performed with the data and an overview of the significance of the analyses. Such a summary is normally given at the end of the discussion of Chapter IV; however, it was included here to help facilitate reader understanding. An in-depth

explanation of the analyses performed between the mean post-test scores of students of the different methods of instruction follows this brief presentation, beginning on page 79. A summary of the analyses performed for the four hypotheses is contained in Table 4.4.

Averaged effects of individualized
and lecture-discussion methods versus the
non-instruction (control) method

Null hypothesis number one was: There will be no difference in student achievement on the seven comprehensive post-tests between the averaged effects of the individualized and lecture-discussion methods of instruction and the non-instruction (control) method. To test for hypothesis one, the following analyses were performed: (1) univariate and multivariate analyses of variance; (2) multivariate analyses of covariance with each covariable considered individually; and (3) univariate and multivariate analyses of covariance with all six covariables controlled.

The univariate and multivariate analyses of variance generated an F value of 11.525 which was significant at the .0001 level. The multivariate analyses of covariance with the effects of each covariable considered individually resulted in F values all of which were significant at the .0001 level.* The univariate and multivariate analyses of covariance with all six covariables controlled resulted in

* Analyses of covariance are normally performed for refinement of the analyses; however, with a .0001 level of significance, nothing was gained by such an analysis.

TABLE 4.4

SUMMARY TABLE OF ALL ANALYSES PERFORMED FOR
THE FOUR HYPOTHESES

	Hypothesis	
	1	2
Method of Instruction	Averaged Effects of individualized and lecture-discussion vs. non-instruction (control)	Individualized instruction vs. lecture-discussion
Statistical method	Multivariate analyses of variance Multivariate analyses of covariance Each antecedent variable analyzed individually Multivariate analyses of covariance All six antecedent variables at one time	Multivariate analyses of variance
F Ratio	11.525	3.353
P less than	.0001	.0157

TABLE 4.4--continued

Hypothesis			
	2 (cont.)	3	4
Method of Instruction	Individualized instruction vs. lecture-discussion	Averaged Effects of Individualized and Lecture-discussion vs. non-individualized vs. Lecture-discussion	All methods of instruction
Statistical method	Multivariate analyses of covariance Each antecedent variable analyzed individually	Multivariate analyses of covariance with all six antecedent variables at one time	Multiple regression correlation between dependent & antecedent variables
F Ratio	Pre-study 2.942 Interest 3.534 Attitude 3.340 Coop. Eng. 3.324 Teach. Exp. 3.387 Turf. Exp. 3.927	2.65	* I = 4.73 L-D = 5.86 Com = 10.33 C = 7.37
P less than	Pre-study .0290 Interest .0134 Attitude .0172 Coop. Eng. .0175 Teach. Exp. .0162 Turf. Exp. .0083	ANOVA = 11.75 ANOCO = 9.92 ANOVA = .0021 ANOCO = .0051	.0005

* I = Individualized; L-D = Lecture-Discussion; Com = Individualized & Lecture-discussion; C = Control.

ANOVA = Analysis of variance

ANOCO = Analysis of covariance

an F value of 4.52 which was significant at the .008 level. Therefore, null hypothesis number one was rejected as there was a significant difference between the two instructional methods and the non-instruction (control) method. The individualized and lecture-discussion methods of instruction were significantly better than the non-instruction (control) method. The data indicate that the higher scores obtained by the students of the two instructional methods were a result of instruction, not chance.

Individualized instruction versus lecture-discussion

Null hypothesis number two was: There will be no difference in student achievement on the seven comprehensive post-tests between the individualized learning method of instruction and the general lecture-discussion method of instruction. To test for hypothesis two, the following analyses were performed: (1) univariate and multivariate analyses of variance of the mean post-test scores; (2) multivariate analyses of covariance with each covariable considered individually; and (3) univariate and multivariate analyses of covariance with all six covariables controlled.

The univariate and multivariate analyses of variance of mean post-test scores of students of the individualized and lecture-discussion methods of instruction resulted in an F value of 3.35 which was significant at the .0157 level. The mean post-test scores of students using the individualized

instruction method were significantly higher than the mean post-test scores of students studying with the lecture-discussion method of instruction.

A multivariate analyses of covariance with each covariable considered individually with the post-test scores resulted in F values which were significant at the .05 level. There was still a significant difference between the post-test scores of students of the individualized and lecture-discussion methods of instruction after removing the variance attributed to each of the antecedent variables.

The univariate and multivariate analyses of covariance of the mean post-test scores with all six covariables controlled between students of the two instructional methods resulted in an F value of 2.65 which was not significant at the .05 level. Therefore, null hypothesis number two was not rejected as there was no significant difference between the mean post-test scores of students of the two instructional methods. There was a significant difference in five of the seven post-test univariate F values which are shown in Table 4.13 but not in Table 4.3.

There are two plausible explanations for the loss of significance on the final univariate and multivariate analyses of covariance with all six covariates controlled: (1) loss of degrees of freedom in the statistical model employed to analyze the data; and (2) chance differences that occurred in the antecedent variable scores. Each of these possibilities will be explained in detail later in the chapter.

Comparison of the different methods
of instruction in developing in
students the ability to locate
and interpret information

Null hypothesis number three was: There will be no difference between the effectiveness of the different methods of instruction in developing in students the ability to locate and interpret information contained in turfgrass references. To test for hypothesis three analyses of variance and covariance were performed on post-test seven which compared: (1) the averaged effects of individualized instruction and lecture-discussion with non-instruction (control); and (2) the individualized instruction method with the lecture-discussion method.

The F values of both the analyses of variance and covariance were significant at the .05 level; therefore, the hypothesis was rejected. Students of the two instructional methods were able to locate and interpret information better than students of the non-instruction (control) method while students of the individualized instruction method performed significantly better than students using the lecture-discussion method.

Correlation between the antecedent
variables and the dependent variable

Null hypothesis number four was: There will be no correlation between the antecedent variables and the dependent variable (post-test scores) of students of the different methods of instruction. Multiple regression correlation

analyses were performed between the antecedent variables and the dependent variables for students of each method of instruction as well as for a combination of students of the two instructional methods. The high F values generated from the multiple regression analyses resulted in a significance of less than .0005 which indicates that the antecedent and dependent variables were correlated and that post-test scores can be predicted from the antecedent variable scores. (This concludes the overview. The following is an in-depth discussion of the analyses of data for each hypothesis.)

Analyses of data for hypothesis number one

Null hypothesis number one was: There will be no difference in student achievement on the seven comprehensive post-tests between the averaged effects of the individualized and lecture-discussion methods of instruction and the non-instruction (control) method.

The univariate and multivariate analyses of variance comparison of the averaged mean post-test scores of students of the two instructional methods with the non-instruction (control) method are shown in Table 4.5. The univariate F values (obtained by single one-way analyses of variance) were significant at the .0001 level for the scores of the first six post-tests and at the .0185 level for post-test seven. The multivariate test of equality of mean vectors, which is a composite analysis of all seven variables at one time, was significant at the .0001 level.

TABLE 4.5

UNIVARIATE AND MULTIVARIATE ANALYSES OF
VARIANCE COMPARING THE AVERAGE OF THE
TWO INSTRUCTIONAL METHODS WITH THE
NON-INSTRUCTION (CONTROL) METHOD

Post-test	Between Mean Squares	Univariate F	P Less Than
1	222.85	28.54	.0001
2	20.68	38.27	.0001
3	311.21	54.62	.0001
4	9.08	23.62	.0001
5	50.27	35.50	.0001
6	242.36	68.76	.0001
7	10.17	6.33	.0185

Degrees of freedom for hypothesis = 1
Degrees of freedom for error = 26

F Ratio for multivariate test of equality of mean
vectors = 11.525 df = 7 and 20 P less than .0001

A summary of the discriminant function coefficients of the univariate and multivariate analyses of variance comparing the averaged mean post-test scores of the two instructional methods with the non-instruction (control) method is contained in Table 4.6. Standardized coefficients of post-tests three, six and seven were highest, revealing that these three post-tests contributed the most in discriminating between the scores of the students of the two instructional methods and the non-instruction (control) method.

TABLE 4.6

SUMMARY OF THE DISCRIMINANT FUNCTION
 COEFFICIENTS OF THE UNIVARIATE AND
 MULTIVARIATE ANALYSES OF VARIANCE
 COMPARING THE AVERAGE OF THE TWO
 INSTRUCTIONAL METHODS WITH THE
 NON-INSTRUCTION (CONTROL) METHOD

Post-test	Raw Coefficients	Standardized Coefficients
1	-.0123	-.0342
2	-.3028	-.2226
3	-.1848	-.4411
4	.0947	.0588
5	-.2208	-.2628
6	-.3649	-.6851
7	.4831	.6124

Multivariate analyses of covariance were performed individually for each of the following antecedent variables:

- A. Student's prior knowledge of turfgrass
- B. Student's interest in turfgrass work
- C. Student's attitude toward individualized instruction
- D. Student's reading comprehension
- E. Instructor's teaching experience recorded in years
- F. Instructor's prior experience in teaching turfgrass

A summary of the multivariate analyses of covariance performed between the averaged mean post-test scores of

students of the two instructional methods and the non-instruction (control) method is contained in Table 4.7. The table shows there was a significant difference between the mean post-test scores after covarying out each antecedent variable. The multivariate test of equality of mean vectors was significant at the .0001 level for each of the six analyses.

TABLE 4.7
MULTIVARIATE ANALYSES OF COVARIANCE, WITH SIX
ANTECEDENT VARIABLES CONSIDERED INDIVIDUALLY,
COMPARING THE AVERAGE OF THE TWO
INSTRUCTIONAL METHODS AND THE
NON-INSTRUCTION (CONTROL)
METHOD

Antecedent Variables	F-Ratio for Multivariate Test of Equality of Mean Vectors	P Less Than
Pre-study Analysis	10.2110	.0001
Interest	11.1336	.0001
Attitude	8.8969	.0001
Cooperative English	9.4660	.0001
Teaching Experience	10.9714	.0001
Turfgrass Experience	10.1380	.0001

df = 7 and 19 for each analyses

Univariate and multivariate analyses of covariance were performed with all of the antecedent variables simultaneously controlled. The univariate and multivariate analyses

of covariance comparing the averaged mean post-test scores of students of the two instructional methods and the non-instructional (control) method are contained in Table 4.8. The univariate F for each post-test variable was significant at the .05 level. The multivariate test of equality of mean vectors was significant at the .008 level.

TABLE 4.8

UNIVARIATE AND MULTIVARIATE ANALYSES OF
COVARIANCE WITH SIX COVARIABLES
COMPARING THE AVERAGE OF TWO
INSTRUCTIONAL METHODS WITH
THE NON-INSTRUCTION
(CONTROL) METHOD

Post-test	Between Mean Squares	Univariate F	P Less Than
1	150.89	24.25	.0001
2	9.51	21.12	.0002
3	175.45	27.79	.0001
4	4.73	12.69	.0020
5	21.64	16.53	.0007
6	110.94	30.04	.0001
7	4.76	4.58	.0450

Degrees of freedom for hypothesis = 1
Degrees of freedom for error = 20

F-Ratio for multivariate test of equality of mean vectors =
4.5189 df = 7 and 14 P less than .008

Since there was a real or significant difference between the mean post-test scores of students of the two instructional methods and the non-instruction (control) method for each of the three analyses, null hypothesis number one was rejected. The data indicate that the difference between the averaged post-test scores of students of the two instructional methods and the non-instruction (control) method was a result of instruction, not chance.

A summary of the discriminant function coefficients of the univariate and multivariate analyses of covariance of mean post-test scores with six covariables comparing the average of the two instructional methods with the non-instruction (control) method is contained in Table 4.9. To maximally differentiate between the students of the two instructional methods and the non-instruction (control) method, the first six post-test scores should be contrasted with post-test seven. That is, by discriminating between the scores of post-tests one through six with seven, the best explanation of the differences between the methods was obtained.

Analyses of data for hypothesis number two

Null hypothesis number two was: There will be no difference in student achievement on the seven comprehensive post-tests between the individualized learning method of instruction and the general lecture-discussion method of instruction.

TABLE 4.9

SUMMARY OF THE DISCRIMINANT FUNCTION
COEFFICIENTS OF THE UNIVARIATE AND
MULTIVARIATE ANALYSES OF COVARIANCE
WITH SIX COVARIABLES COMPARING THE
AVERAGE OF TWO INSTRUCTIONAL
METHODS WITH THE NON-
INSTRUCTION (CONTROL)
METHOD

Post-test	Raw Coefficients	Standardized Coefficients
1	-.0216	-.0538
2	-.2752	-.1846
3	-.1809	-.4546
4	-.0754	-.0460
5	-.1770	-.2025
6	-.3014	-.5791
7	.4350	.4438

The univariate and multivariate analyses of variance comparing the mean post-test scores of students of the two instructional methods are shown in Table 4.10. The univariate F's for five of the seven post-test variables were significant at the .05 level. The univariate F's for post-tests two (types and characteristics of turfgrasses) and four (fertilization and liming) were not significant. The multivariate test of equality of mean vectors was significant at the .0157 level indicating that the individualized instruction method was better than the lecture-discussion method.

TABLE 4.10

UNIVARIATE AND MULTIVARIATE ANALYSES OF
VARIANCE COMPARING THE INDIVIDUALIZED
AND LECTURE-DISCUSSION METHODS OF
INSTRUCTION

Post-test	Between Mean Squares	Univariate F	P Less Than
1	63.34	8.11	.0085
2	.02	.03	.8681
3	89.77	15.76	.0006
4	.03	.08	.7841
5	10.94	7.73	.0100
6	34.16	9.69	.0045
7	18.88	11.75	.0021

Degrees of freedom for hypothesis = 1
Degrees of freedom for error = 26

F-Ratio for multivariate test of equality of mean vectors =
3.3534 df = 7 and 20 P less than .0157

A summary of the discriminant function coefficients of the univariate and multivariate analyses of variance of the mean post-test scores of the individualized and lecture-discussion methods of instruction is contained in Table 4.11. The standardized coefficients of the scores of post-tests two (types and characteristics of turfgrasses) and three (turfgrass establishment, care, and maintenance) were high, revealing that these two post-tests contributed the most

in discriminating between the scores of the students of the two instructional methods.

TABLE 4.11

SUMMARY OF THE DISCRIMINANT FUNCTION COEFFICIENTS
OF THE UNIVARIATE AND MULTIVARIATE ANALYSES
OF VARIANCE COMPARING THE INDIVIDUALIZED
AND LECTURE-DISCUSSION METHODS
OF INSTRUCTION

Post-test	Raw Coefficients	Standardized Coefficients
1	-.0314	-.0878
2	1.1307	.8313
3	-.2382	-.5685
4	.0327	.0203
5	-.2320	-.2760
6	-.1818	-.3414
7	-.3066	-.3887

Multivariate analyses of covariance were performed individually for each of the following antecedent variables:

- A. Student's prior knowledge of turfgrass
- B. Student's interest in turfgrass work
- C. Student's attitude toward individualized instruction
- D. Student's reading comprehension
- E. Instructor's teaching experience recorded in years
- F. Instructor's prior experience in teaching turfgrass

There was a significant difference at the .05 level between the mean post-test scores of students of the two instructional methods after covarying out the effects of each antecedent variable as shown in Table 4.12.

TABLE 4.12

MULTIVARIATE ANALYSES OF COVARIANCE WITH SIX
ANTECEDENT VARIABLES CONSIDERED INDIVIDUALLY
COMPARING THE INDIVIDUALIZED AND LECTURE-
DISCUSSION METHODS OF INSTRUCTION

Antecedent Variable	F-Ratio for Multivariate Test of Equality of Mean Vectors	P Less Than
Pre-study Analysis	2.9420	.0290
Interest	3.5335	.0134
Attitude	3.3398	.0172
Cooperative English	3.3240	.0175
Teaching Experience	3.3866	.0162
Turfgrass Experience	3.9271	.0083

df = 7 and 19 for each analyses

Univariate and multivariate analyses of covariance were performed with all six of the antecedent variables. The univariate and multivariate analyses of covariance with all six covariables comparing the mean post-test scores of students of the individualized and lecture-discussion methods of instruction are shown in Table 4.13. By covarying out the effects of all six covariables at one time, only five

of the seven post-tests had significant univariate F's at the .05 level. The univariate F's for post-test two (types and characteristics of turfgrass) and post-test four (fertilization and liming) were not significant at the .05 level. The multivariate test of equality of mean vectors generated a significance of .0576.

TABLE 4.13

UNIVARIATE AND MULTIVARIATE ANALYSES OF
COVARIANCE WITH SIX COVARIABLES
COMPARING THE INDIVIDUALIZED
INSTRUCTION METHOD WITH THE
LECTURE-DISCUSSION METHOD

Post-test	Between Mean Squares	Univariate F	P Less Than
1	48.041	7.721	.0116
2	.065	.144	.7088
3	68.792	10.897	.0036
4	.001	.003	.9549
5	10.041	7.667	.0119
6	24.629	6.670	.0178
7	10.325	9.919	.0051

Degrees of freedom for hypothesis = 1

Degrees of freedom for error = 20

F-Ratio for multivariate test of equality of mean vectors =
2.6456 df = 7 and 14 P less than .0576

The univariate ~~and~~ multivariate analyses of variance
and the multivariate analyses of covariance comparisons, with

the effects of each covariable considered individually, resulted in an acceptable level of significance at the .05 level to reject hypothesis two. However, the multivariate test of equality of mean vectors with all six covariables controlled at one time resulted in a significance of .0576, just above the accepted level of significance needed to reject hypothesis number two. For post-tests one, three, five, six and seven, hypothesis number two was rejected as there was a significant difference in the univariate F values. The students of the individualized method of instruction scored significantly higher than students of the lecture-discussion method on the following subject areas: (1) exploring career opportunities in the turfgrass industry and salesmanship and human relations, (2) turfgrass establishment, care, and maintenance, (3) identification and control of weeds, (4) seed, turfgrass, and weed specimen identification, and (5) location and interpretation of information in turfgrass references.

There was no significant difference between the post-test scores of the students on the following subject areas: (1) types and characteristics of turfgrasses, and (2) fertilization and liming of turfgrasses. (The fact that many teachers normally teach units on the latter two subject areas may account for the resultant non-significant difference in the mean post-test scores of students of the two instructional methods.)

There are two plausible explanations for the loss of significance on the final univariate and multivariate analyses of covariance with all six covariables controlled: (1) loss of degrees of freedom in the statistical model employed to analyze the data, and (2) chance differences occurring in the antecedent variable scores. It was difficult to determine which caused the non-achievement of significance. In either case, had the .10 level of significance been chosen the individualized instruction method would have been significant.

The loss of the degrees of freedom in the statistical model employed for the analyses of the data seems to be the better of the two explanations. For each covariable added to the analysis, one degree of freedom was lost; hence, six degrees of freedom were lost by the addition of all six covariables at one time. It was pointed out earlier in Table 4.12 that when each of the covariables was analyzed separately, there was a significant difference between the mean post-test scores of students of the two instructional methods. The data in Table 4.14 add weight to this theory as it shows that when the covariables were analyzed in pairs and/or as many as four covariables analyzed at one time, there was a significant difference between the two instructional methods. Generally, as the degrees of freedom to vary were lost, the significance of difference between the

mean post-test scores of students of the two instructional methods decreased.

TABLE 4.14

MULTIVARIATE ANALYSES OF COVARIANCE WITH
VARYING ANTECEDENT VARIABLES COMPARING
THE INDIVIDUALIZED INSTRUCTION METHOD
WITH THE LECTURE-DISCUSSION METHOD

Antecedent Variables Controlled	F Ratio	df	P Less Than
Pre-study and Interest	3.1349	7 and 18	.0240
Pre-study and Cooperative English	2.7684	7 and 18	.0387
Interest and Attitude	3.5391	7 and 18	.0144
Teaching Experience and Turfgrass Experience	3.6583	7 and 18	.0125

Pre-study, Interest, Attitude and Cooperative English	2.8215	7 and 16	.0407
All six antecedent variables	2.6456	7 and 14	.0576

In general, there was a significant difference between the mean post-test scores of the students of the individualized and lecture-discussion methods of instruction; students of the individualized instruction method did better on the post-tests than students of the lecture-discussion method.

The chance differences that occurred in the antecedent variable scores may be a reason for the non-significance between the two instructional methods. The data in Table

4.13 suggest that even though the teachers and schools were randomly assigned, the groups probably were not equal; the random fluctuation between the teachers and the students magnified the differences and after controlling for the covariables, the significance rose above the .05 level. The six covariables accounted for 29.9 percent of the variation of the dependent variables.

A summary of the discriminant function coefficients of the univariate and multivariate analyses of covariance of mean post-test scores with six covariates controlled of the students of the individualized and lecture-discussion methods of instruction is contained in Table 4.15. The standardized discriminant function coefficients were highest on post-tests two and five indicating that these two post-tests contributed most in discriminating between the scores of students of the two instructional methods.

Analyses of data for hypothesis number three

Null hypothesis number three was: There will be no difference between the effectiveness of the different methods of instruction in developing in students the ability to locate and interpret information contained in turfgrass references.

A summary of the analyses for hypothesis number three is contained in Tables 4.16 and 4.17. Univariate analyses of variance and covariance comparing the averaged mean post-test scores of students of the two instructional methods and

TABLE 4.15

SUMMARY OF THE DISCRIMINANT FUNCTION COEFFICIENTS
OF THE UNIVARIATE AND MULTIVARIATE ANALYSES OF
COVARIANCE WITH SIX COVARIATES COMPARING THE
INDIVIDUALIZED INSTRUCTION METHOD WITH THE
LECTURE-DISCUSSION METHOD

Post-test	Raw Coefficients	Standardized Coefficients
1	-.0657	-.1638
2	1.3512	.9064
3	-.1787	-.4489
4	.2244	.1369
5	-.6680	-.7644
6	-.1109	-.2131
7	-.0586	-.0597

TABLE 4.16

UNIVARIATE ANALYSES OF VARIANCE AND
COVARIANCE WITH SIX COVARIABLES
COMPARING THE AVERAGE OF THE TWO
INSTRUCTIONAL METHODS ON POST-
TEST SEVEN WITH THE NON-
INSTRUCTION (CONTROL) METHOD

Analysis Performed	Between Mean Squares	Univariate F	P Less Than
ANOVA	10.17	6.33	.0185
AN of Covariance	4.76	4.58	.0450

the non-instruction (control) method are shown in Table 4.16. The analyses were significant at the .0185 and .0450 levels of significance, respectively, and reveal that students of the two instructional methods were able to locate and interpret information contained in turfgrass references better than the non-instruction (control) method students.

TABLE 4.17

UNIVARIATE ANALYSES OF VARIANCE AND
COVARIANCE OF POST-TEST SEVEN WITH
SIX COVARIABLES COMPARING THE
INDIVIDUALIZED INSTRUCTION
METHOD WITH THE LECTURE-
DISCUSSION METHOD

Analysis Performed	Between Mean Squares	Univariate F	P Less Than
ANOVA	18.88	11.75	.0021
AN of Covariance	10.33	9.92	.0051

Univariate analyses of variance and covariance comparing the mean post-test scores of students of the individualized and lecture-discussion methods of instruction are contained in Table 4.17. The analyses were significant at the .0021 and .0051 levels of significance, respectively, and reveal that students of the individualized instruction method were able to locate and interpret information contained in turfgrass references better than students of the lecture-discussion method of instruction.

Therefore, null hypothesis number three was rejected as there was a significant difference between the methods of instruction.

Analyses of data for
hypothesis number four

Null hypothesis number four was: There will be no correlation between the antecedent variables listed below and the dependent variable (post-test scores of students) of the different methods of instruction.

- A. Student's reading comprehension
- B. Student's attitude toward individualized instruction
- C. Student's interest in turfgrass work
- D. Student's prior knowledge of turfgrass
- E. Student's personality
 - (1) Neuroticism scale
 - (2) Extraversion scale
 - (3) Lie scale
- F. Hours of turfgrass study.*

In order to perform these analyses, all the different antecedent variable scores were combined on one IBM card for each student. In addition, the seven post-test variable scores were added together by the computer to form one composite dependent variable score. The unit of analysis used to test this hypothesis was students' scores and not school

* Hours of study was included with the antecedent variables.

means as in the other analyses. In order for the analyses to be most meaningful, students of the two instructional methods and the non-instruction (control) students were kept separate. In addition, students of the two instructional methods were combined for one analysis.

A summary of the four individual analyses performed, using the Agricultural STAT Series Number Eight (LSDEL) which is a stepwise deletion of variables from a least square equation, is contained in Table 4.18. The LSDEL program eliminated one antecedent variable at a time from the analysis until the stopping criteria was met; for this study the .05 level of significance was chosen. The variables selected for deletion at each step were the variables which would be missed the least; that is, when the least squares equation was recalculated, a greater part of the variation in the dependent variable was accounted for by the remaining antecedent variables than if any other antecedent variables had been deleted. In other words, those variables which contributed the least to the multiple correlation were dropped until the difference between the beginning and ending multiple correlation was significantly different or until the .05 level of significance was reached. The remaining antecedent variables were significantly correlated with the dependent variable.

TABLE 4.18
SUMMARY OF THOSE ANTECEDENT VARIABLES
SIGNIFICANTLY CORRELATED WITH THE
DEPENDENT VARIABLE

Antecedent Variable	Method of Instruction			
	Individu- alized	Lecture- Discussion	Individualized and Lecture- Discussion	Non- Instruction (Control)
Hours*			X	
Pre-study analysis	X	X	X	
Neuroticism	X		X	
Extraversion				
Lie	X		X	
Cooperative English				X
Attitude				X
Interest				
Beginning Multiple R	.52	.55	.52	.55
Ending Multiple R	.51	.46	.52	.54

* Hours was not an antecedent variable but was included in the analysis.

An analysis of the table shows that only one antecedent variable, the pre-study analysis, was significantly related to the post-test scores of the students of the individualized and lecture-discussion methods of instruction.

Only the pre-study analysis was related with the post-test scores of students of the lecture-discussion method while the other methods had at least two or more antecedent variables related to the dependent variable (post-test scores). In addition, two antecedent variables, interest and extraversion, were not significantly correlated with the post-test scores of the students of the different methods of instruction.

An examination of the multiple correlation coefficients at the bottom of the table reveals that the correlation coefficients changed very little when calculated with all eight antecedent variables and when recalculated with those antecedent variables that were not deleted. This indicates that not much precision in prediction was lost by eliminating some of the antecedent variables.

The null hypothesis was rejected as the antecedent variables were related to the dependent variable.

An individual analysis of each method of instruction is contained in the following tables.

A summary of the analysis of variance for overall regression in the dependent variable accounted for by the pre-study analysis, and the Neuroticism and Lie Scales of the Eysenck Personality Inventory of the students of the individualized method of instruction is contained in Table 4.19. The F value for the regression about the mean of the three antecedent variables was significant at the $< .0005$

TABLE 4.19

ANALYSIS OF VARIANCE FOR OVERALL REGRESSION OF VARIATION
IN THE DEPENDENT VARIABLE ACCOUNTED FOR BY THE THREE
ANTECEDENT VARIABLES OF STUDENTS OF THE
INDIVIDUALIZED INSTRUCTION METHOD OF
INSTRUCTION

Source	Sum of Squares	df	Mean Square	F	Significance	
Regression (About Mean)	5,257.37	3	1,752.46	12.42	< 0.0005	
Error	14,962.04	106	141.15			
Total (About Mean)	20,219.42	109				
Variable	Regression Coefficients	Standard Error of Coefficients	F	Significance	Partial Correlation Coefficients	R 2 Deletes
Constant	55.22	6.06	83.16	< 0.0005		
Pre-study Analysis	0.60	0.13	20.59	< 0.0005	0.40	0.12
Neuroticism	- 0.79	0.28	7.99	0.006	- 0.27	0.20
Lie	- 2.97	0.84	12.60	0.001	- 0.33	0.17

N = 110 students

R = 0.51

R 2 = 0.26

level. The three antecedent variables correlated .51 with the dependent variable and accounted for 26 percent of the variance of the dependent variable. The analysis reveals that the pre-study analysis and the Neuroticism and Lie Scales of the Eysenck Personality Inventory contributed most in predicting the post-test scores of the students of the individualized instruction method. The pre-study analysis was positively related to the post-test scores while the Neuroticism and Lie Scales were negatively correlated. This indicates that students who score high on the pre-study analysis tend to score high on the post-test while students who score high on the Neuroticism and Lie Scales tend to score low on the post-test. The formula for predicting post-test scores was: $Y' = 55.22 + .60 (\text{pre-study analysis score}) - .79 (\text{neuroticism score}) - 2.97 (\text{lie score})$.

A summary of the analysis of variance for the overall regression of the variation in the dependent variable accounted for by the pre-study analysis of students of the lecture-discussion method of instruction is contained in Table 4.20. The F value of 31.19 for the regression about the mean accounted for by the pre-study analysis was significant at the $< .0005$ level. The pre-study analysis correlated .46 with the dependent variable and accounted for 21 percent of the variation of the dependent variable.

TABLE 4.20

ANALYSIS OF VARIANCE FOR OVERALL REGRESSION OF VARIATION
IN THE DEPENDENT VARIABLE ACCOUNTED FOR BY THE ONE
ANTECEDENT VARIABLE OF STUDENTS OF THE
LECTURE-DISCUSSION METHOD OF INSTRUCTION

Source	Sum of Squares	df	Mean Square	F	Significance
Regression (About Mean)	4,997.88	1	4,997.88	31.19	< 0.0005
Error	18,749.85	117	160.26		
Total (About Mean)	23,747.73	118			

Variable	Regression Coefficients	Standard Error of Coefficients	F	Significance	Partial Correlation Coefficients	R 2 Deletes
Constant	9.63	5.50	3.07	0.082		
Pre-study Analysis	1.00	0.18	31.19	< 0.0005	0.46	- 0.00

The analysis reveals that the pre-study analysis contributed most in predicting the post-test scores of the students of the lecture-discussion method of instruction. The pre-study analysis was positively related to the post-test indicating there was a positive correlation between the scores obtained on the pre-study analysis and the post-test scores. The formula for predicting post-test scores of the students was: $Y' = 9.63 + 1.0 (\text{pre-study analysis score})$.

The analysis of variance for overall regression of variation in the dependent variable accounted for by the hours of study, pre-study analysis, Neuroticism and Lie Scales of the Eysenck Personality Inventory of students of the two instructional methods is contained in Table 4.21. The F value of 20.87 was significant at $< .0005$ level. The four antecedent variables correlated .52 with the dependent variable and accounted for 27 percent of the variation of the dependent variable.

The analysis reveals that the hours of study, pre-study analysis, Neuroticism and Lie Scales contributed most in predicting the post-test scores of the students of the two instructional methods. The pre-study analysis was positively related to the post-test scores while the hours of study, and the Neuroticism and Lie Scales were negatively correlated. The formula for predicting post-test scores for students of the two instructional methods was: $Y' = 43.69$

TABLE 4.21

ANALYSIS OF VARIANCE FOR OVERALL REGRESSION OF VARIATION
IN THE DEPENDENT VARIABLE ACCOUNTED FOR BY THE FOUR
ANTECEDENT VARIABLES OF STUDENTS OF THE
INDIVIDUALIZED AND LECTURE-DISCUSSION
METHODS OF INSTRUCTION

Source	Sum of Squares	df	Mean Square	F	Significance	
Regression (About Mean)	17,718.80	4	4,429.70	20.87	< 0.0005	
Error	47,533.89	224	212.20			
Total (About Mean)	65,252.69	228				
Variable	Regression Coefficients	Standard Error of Coefficients	F	Significance	Partial Correlation Coefficients	R 2 Deletes
Constant	43.69	6.82	41.07	< 0.0005		
Hours	- 0.25	0.11	5.00	0.026	- 0.15	0.26
Pre-study Analysis	0.90	0.13	50.33	< 0.0005	0.43	0.11
Neuroticism	- 0.83	0.26	10.13	0.002	- 0.21	0.24
Lie	- 2.41	0.67	13.07	< 0.0005	- 0.24	0.23

N = 229

R = 0.52

R² = 0.27

- .25 (hours of study) + .90 (pre-study analysis score)
- .83 (neuroticism score) - 2.41 (lie score).

The analysis of variance for overall regression of variation in the dependent variable accounted for by the Cooperative English and attitude scores of students of the non-instruction (control) method is contained in Table 4.22. The F value of 25.66 was significant at $< .0005$ level. The two antecedent variables correlated .54 with the dependent variable and accounted for approximately 30 percent of the variation of the dependent variable.

The analysis reveals that the Cooperative English Test and the students' attitude toward individualized instruction contributed most in predicting the post-test scores of the non-instruction (control) students. The Cooperative English Test was positively correlated while the Attitude Test was negatively correlated. The formula for predicting post-test scores for the students was: $Y' = 25.79 + .18$ (Cooperative English Test score) - .23 (attitude score).

Part II - Teacher Data

Evaluation by the teachers

At the conclusion of the research project, the teachers were surveyed to obtain their opinions and recommendations concerning the individualized learning manual,

TABLE 4.22

ANALYSIS OF VARIANCE FOR OVERALL REGRESSION OF VARIATION
IN THE DEPENDENT VARIABLE ACCOUNTED FOR BY THE TWO
ANTECEDENT VARIABLES OF STUDENTS OF THE
NON-INSTRUCTION (CONTROL) METHOD

Source	Sum of Squares	df	Mean Square	F	Significance	
Regression (About Mean)	2,368.09	2	1,184.05	25.66	< 0.0005	
Error	5,629.22	122	46.14			
Total (About Mean)	7,997.31	124				
Variable	Regression Coefficients	Standard Error of Coefficients	F	Significance	Partial Correlation Coefficients	R 2 Deletes
Constant	25.79	4.65	30.74	< 0.0005		
Cooperative English	0.18	0.03	29.71	< 0.0005	0.44	0.12
Attitude	- 0.23	0.07	10.20	0.002	- 0.28	0.24
N = 125			R = 0.54		R 2 = 0.296	

the project procedure, and the project evaluation techniques. Appendix K contains a copy of the Final Teacher Survey. All of the teachers completed and returned the questionnaire.

The same questionnaire was used by the teachers of the individualized instruction method and the lecture-discussion method; however, the comments were kept separate in this section. Besides a listing of the rated comments, some of the most relevant free responses were also included. All of the free comments are contained in Appendix M.

To facilitate the computation and analysis of the data in the agreement tables, the following values and range intervals were used.

<u>Agreement</u>	<u>Computational Value Assigned</u>	<u>Interval Limits</u>
Strongly Agree	5	4.50 - 5.00
Agree	4	3.50 - 4.49
Uncertain	3	2.50 - 3.49
Disagree	2	1.50 - 2.49
Strongly Disagree	1	1.00 - 1.49

Evaluation of the manual

The nine teachers using the individualized instruction method agreed that thirteen of the fifteen items listed concerning the manual were important as they rated these 3.56 and higher, (See Table 4.23). The teachers strongly agreed that: (1) upon completion of each lesson, the student should complete a teacher administered quiz which would be graded by

TABLE 4.23

EVALUATION OF THE INDIVIDUALIZED LEARNING
MANUAL BY THE NINE TEACHERS USING THE
INDIVIDUALIZED INSTRUCTION METHOD

Items Evaluated	Agreement					Mean
	5	4	3	2	1	
1. Upon completion of each lesson, the student should complete a teacher administered quiz which would be graded by the teacher for feedback.....	8	1				4.89
2. The audiovisual materials (slides, references, etc.) are very helpful and add to understanding of the unit....	7	2				4.78
3. Students need to be motivated by the teacher in order to study the unit.....	5	4				4.56
4. The instructor has a great deal to do with the success or failure of the unit.....	7	2				4.56
5. Instructors need to be very familiar with the units before actual instruction begins.....	4	5				4.44
6. The unit and reference materials were complete and accurate.....	4	5				4.44
7. The learning activities are very appropriate in developing understandings, knowledges and skills needed by a beginning employee in turfgrass sales and service..	4	4	1			4.33

TABLE 4.23--continued

Items Evaluated	Agreement					Mean
	5	4	3	2	1	
8. The turfgrass unit can be used by individual students wishing to study turfgrass....	4	4		1		4.22
9. Students felt lost without a standard with which they could compare themselves.....	2	7				4.22
10. The text section provides the students with a good idea of the things they need to learn in the lessons.....	2	6		1		4.00
11. The lessons are very appropriate.....	3	4	1	1		4.00
12. The introduction section of the manual provides the students with a good understanding of turfgrass sales and service.....	2	5	1	1		3.89
13. The lesson behavioral objectives are complete, accurate and appropriate.....	1	4	3	1		3.56
14. Teacher administered quizzes should be administered weekly.....		4	2	3		3.11
15. The student self-evaluation questions are adequate in determining whether the students master the unit.....		3	3	2	1	2.89

Code: 5 = Strongly agree
 4 = Agree
 3 = Uncertain
 2 = Disagree
 1 = Strongly disagree

the teacher for feedback; (2) the audiovisual materials were helpful and added to understanding of the manual; (3) students need to be motivated by the teacher in order to study the manual; and (4) the instructor has a great deal to do with the success or failure of the particular manual being used by the students. The teachers were uncertain whether teacher administered quizzes should be given weekly and whether the student self-evaluation questions were adequate in determining whether the students had mastered the material contained in the manual.

In free responses, several teachers indicated that it is very important for the instructor to provide a good orientation before students begin studying the individualized learning manual. Teachers felt that with a proper orientation, students interested in turfgrass work can study the materials by themselves. Several teachers indicated that the behavioral objectives were too idealistic and/or difficult for high school students. (See Appendix M for complete text of teacher comments.)

The ten teachers using the lecture-discussion method also agreed that thirteen of the fifteen items were important in teaching by the individualized instruction method. They rated as most important: (1) the instructor has a great deal to do with the success or failure of the manual and (2) the audiovisual materials were helpful and added to understanding of the unit, (See Table 4.24). There was not much

TABLE 4.24
EVALUATION OF THE INDIVIDUALIZED LEARNING
MANUAL BY THE TEN TEACHERS USING THE
LECTURE-DISCUSSION METHOD

Items Evaluated	Agreement					Mean
	5	4	3	2	1	
1. The instructor has a great deal to do with the success or failure of the unit.....	7	3				4.7
2. The audiovisual materials (slides, references, etc.) are very helpful and add to understanding of the unit....	5	5				4.5
3. Instructors need to be very familiar with the units before actual instruction begins.....	4	5	1			4.3
4. The unit and reference materials were complete and accurate.....	2	8				4.2
5. The learning activities are very appropriate in developing understandings, knowledges and skills needed by a beginning employee in turfgrass sales and service..	2	8				4.2
6. Students need to be motivated by the teacher in order to study the unit.....	4	4	2			4.2
7. The turfgrass unit can be used by individual students wishing to study turfgrass...	4	4	1	1		4.1
8. The lessons are very appropriate.....	1	9				4.1

TABLE 4.24--continued

Items Evaluated	Agreement					Mean
	5	4	3	2	1	
9. The text section provides the students with a good idea of the things they need to learn in the lessons.....	3	5	1	1		4.0
10. The lesson behavioral objectives are complete, accurate and appropriate....	1	7	1	1		3.8
11. The student self-evaluation questions are adequate in determining whether the students master the unit.....	2	3	5			3.7
12. The introduction section of the manual provides the students with a good understanding of turfgrass sales and service.....	1	5	3	1		3.6
13. Upon completion of each lesson, the student should complete a teacher administered quiz which would be graded by the teacher for feedback.....		6	3	1		3.5
14. Teacher administered quizzes should be administered weekly.....		5	4	1		3.4
15. Students felt lost without a standard with which they could compare themselves....		2	5	3		2.9

Code: 5 = Strongly agree
 4 = Agree
 3 = Uncertain
 2 = Disagree
 1 = Strongly disagree

difference in the general order of ranking between the teachers of the two methods of instruction except for one item: "Students felt lost without a standard with which they could compare themselves." This was ranked 8.5 and rated 4.22 by teachers using the individualized instruction method and ranked 15 and rated 2.9 by teachers using the lecture-discussion method. However, this disagreement was not seen as a conflict. The teachers using the individualized instruction method agreed that their students felt lost without a standard with which they could compare themselves while the teachers using the lecture-discussion method had a standard (other student's grades) and, therefore, this item was rated as not too important by them. The teachers using the lecture-discussion method were not in a position to properly rate the item.

In free responses, several of the teachers using the lecture-discussion method indicated that the text section was inadequate and needed teacher supplement. It was also suggested that the introductory section of the manual be adjusted to cover the broad subject area as well as specific fields.

Several teachers indicated that the manual was put together very well and that it was more complete than one in almost any other field.

Evaluation of the project procedure

The nine teachers using the individualized instruction method strongly agreed that poor readers did not react well to the individualized learning manual. They also

indicated that only students who are interested in a particular subject area should study on an individualized basis and that the manual should be studied throughout the year on a seasonal basis as the present manual contains too much information to be absorbed at one time or in one study span, (See Table 4.25).

The teachers also felt that most high school students are not capable of disciplining themselves to study on an individualized basis.

In free responses several teachers stated that students need help in getting used to studying on an individualized basis and that many were not mentally prepared for self-control. One teacher indicated that many of his students said they should be made to study.

Some of the teachers stated that the poor readers became upset with the manual; that it was too much reading for them. The teachers suggested the use of more audio-visual materials and more manual labor by which the poor readers can learn.

The ten teachers using the lecture-discussion method rated the items approximately the same as the teachers using the individualized instruction method, except that the former rated as highest the item which stated that the manual should be studied throughout the year and on a seasonal basis, (See Table 4.26).

In free responses, some of the teachers indicated that the poor readers liked the visual materials and work

TABLE 4.25

EVALUATION OF THE PROJECT PROCEDURE BY THE
NINE TEACHERS USING THE INDIVIDUALIZED
INSTRUCTION METHOD

Items Evaluated	Agreement					Mean
	5	4	3	2	1	
1. Poor readers do not react well to this unit.....	7	2				4.78
2. An entire class should not be given individualized material but rather selected individuals who are interested in the subject and who seek to become qualified for entry jobs and continued advancement should be given the materials.....	6	1	2			4.44
3. The manual should be studied throughout the year and on a seasonal nature such as much of the agriculture curriculum.....	3	4	1	1		4.00
4. The study was too large.....	3	2	2	2		3.67
5. Most high school students are capable of disciplining themselves to study on an individualized basis.....		2	1	4	2	2.33

Code: 5 = Strongly agree
 4 = Agree
 3 = Uncertain
 2 = Disagree
 1 = Strongly disagree

TABLE 4.26
EVALUATION OF THE PROJECT PROCEDURE BY THE
TEN TEACHERS USING THE
LECTURE-DISCUSSION METHOD

Items Evaluated	Agreement					Mean
	5	4	3	2	1	
1. The manual should be studied throughout the year and on a seasonal nature such as much of the agriculture curriculum.....	3	6	1			4.2
2. Poor readers do not react well to this unit.....	4	4	2			4.2
3. An entire class should not be given individualized material but rather selected individuals who are interested in the subject and who seek to become qualified for entry jobs and continued advancement should be given the materials.....	4	3	1	1	1	3.8
4. The study was too large.....	3	2	5			3.8
5. Most high school students are capable of disciplining themselves to study on an individualized basis.....		1	6	2	1	2.4

Code: 5 = Strongly agree
 4 = Agree
 3 = Uncertain
 2 = Disagree
 1 = Strongly disagree

experience best. They also indicated that many students would need help if working on an individualized basis.

Project evaluation techniques

The nine teachers using the individualized instruction method agreed that the pre-tests and post-tests were comprehensive and adequate, (See Table 4.27). They were uncertain whether there were too many pre-tests.

TABLE 4.27

EVALUATION OF THE PROJECT EVALUATION TECHNIQUES BY THE NINE TEACHERS USING THE INDIVIDUALIZED INSTRUCTION METHOD

Items Evaluated	Agreement					Mean
	5	4	3	2	1	
1. The post-tests were comprehensive and adequate.....	3	3	1	2		3.78
2. The type of pre-tests were adequate.....		6	1	2		3.44
3. There were too many pre-tests.....	2	2	1	4		3.22

Code: 5 = Strongly agree
 4 = Agree
 3 = Uncertain
 2 = Disagree
 1 = Strongly disagree

In free responses, several teachers indicated that the knowledge test would be adequate as a pre-test. One teacher felt the post-tests were too long, another felt an oral examination should also have been given.

Some of the teachers felt that the habits of juniors and seniors were too rigid to permit study on an individualized basis, thus it would be better to begin this type of study with freshmen and sophomores. Five teachers stated that they would like to see other units developed on animal science or plant science and put together the same way as the turfgrass manual with accompanying audiovisual materials. They felt this unit was a big improvement over other units developed by the Agricultural Education Department.

The teachers using the lecture-discussion method ranked the three items the same as the teachers using the individualized instruction method, (See Table 4.28). They felt there were too many pre-tests but were not sure which ones would be best to use. They indicated that they did not spend as much time teaching the materials as they felt would be necessary in order to do a good job. They suggested in future projects that more time be allowed before actual instruction begins to allow them time to order films and other reference materials.

TABLE 4.28

EVALUATION OF THE PROJECT EVALUATION
TECHNIQUES BY THE TEN TEACHERS
USING THE LECTURE-DISCUSSION
METHOD

Items Evaluated	Agreement					Mean
	5	4	3	2	1	
1. The post-tests were comprehensive and adequate.....	1	9				4.1
2. The type of pre-tests were adequate.....	2	4	3	1		3.7
3. There were too many pre-tests.....	2	2	5	1		3.5

Code: 5 = Strongly agree
 4 = Agree
 3 = Uncertain
 2 = Disagree
 1 = Strongly disagree

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter describes: (1) the purpose of the study, (2) statement of the problem, (3) the objectives, (4) method of investigation, (5) analysis of the data, (6) major findings, (7) conclusions, and (8) recommendations. The summary of findings and conclusions are divided into two parts: those that pertain to the students and those that pertain to the teachers.

Purposes of the study

The purposes of this study were:

1. To develop and test the effectiveness of an individualized learning manual on turfgrass sales and service in developing in high school junior and senior vocational agriculture students the competencies necessary for initial employment in the turfgrass industry. In addition, a comparison of the effectiveness of the individualized learning method of instruction was made with a general lecture-discussion method of instruction.

2. To identify the extent to which reading comprehension, interest in turfgrass work, attitude toward individualized instruction, personality, and previous knowledge relate to learning and development of the turfgrass competencies.
3. To identify teacher opinions as to the strengths and weaknesses of the individualized learning manual and the research study.

Statement of the problem

Will the use of an individualized learning manual and audiovisual and curriculum materials on turfgrass sales and service develop in high school junior and senior vocational agriculture students the competencies deemed necessary for a beginning job in a turfgrass business as well as a general lecture-discussion method of instruction as determined by a battery of comprehensive post-test examinations?

Objectives

1. To compare the averaged effects of the individualized and lecture-discussion methods of instruction with the non-instruction (control) method in developing turfgrass competencies in students as measured by student achievement on the seven comprehensive post-tests.
2. To compare the effectiveness of an individualized learning method of instruction to a general lecture-

discussion method of instruction in developing turfgrass competencies in students as measured by student achievement on the seven comprehensive post-tests.

3. To identify the extent to which each of the following factors are related to student learning:
 - A. Student's reading comprehension
 - B. Student's attitude toward individualized instruction
 - C. Student's interest in turfgrass work
 - D. Student's prior knowledge of turfgrass
 - E. Student's personality
 - F. Student's hours devoted to turfgrass study
 - G. Instructor's teaching experience recorded in years
 - H. Instructor's prior experience in teaching turfgrass
4. To identify the extent to which factors A through D and G through H listed in objective number three, when considered individually and combined as a group, are related to student learning.
5. To identify the correlation between factors A through F listed in objective number three and the dependent variable of students of the different methods of instruction.
6. To compare the effectiveness of the different methods of instruction in developing in students the ability to locate and interpret information in turfgrass references.

7. To identify teacher opinions as to the strengths and weaknesses of the individualized learning manual and the research study.

Method of investigation

An individualized learning manual on turfgrass sales and service was developed and pre-tested with vocational agriculture students in three high schools in Michigan in May, 1969. The students completed a post-test and a student evaluation of the manual. The teachers also evaluated the manual. A revised manual containing ten lessons was developed during the summer of 1969.

Teachers of vocational agriculture of central Michigan were asked to volunteer to participate in the study during their annual conference in July, 1969. The teachers were placed into three groups by a table of random numbers. Group one used the individualized instruction method, group two used the lecture-discussion method, and group three used the non-instruction (control) method.

Workshops were held in late August for the teachers of the different groups. Teachers of the individualized and lecture-discussion methods of instruction were provided with manuals and accompanying slides, audiovisual and curriculum materials and an explanation of the procedures for the study. They also were provided with five antecedent variable tests to be completed before instruction began.

At the conclusion of the project, the teachers were mailed a comprehensive battery of post-tests which were completed by all the students participating in the project.

Analysis of the data

IBM sheets completed by the students were read and scored by an IBM 1230 Optical Scanner which was connected to an IBM key punch machine. The raw scores and total scores of the tests were punched onto IBM cards. The cards were programed through the CDC 3600 to obtain school means for each test which were key punched onto IBM cards so that the data could be statistically analyzed.

The Finn program, which is a univariate and multivariate analysis of variance and covariance using univariate statistics, and a 13 x 13 intercorrelation matrix were employed to analyze the data. Comprising the matrix were seven post-tests and six antecedent variables. Of the antecedent variables four were test scores and two were teacher variables.

In addition, all of the post-test and antecedent variable data contained on the many multiple IBM cards were combined on one card so that a calculation of least squares (regression) and multiple correlation could be run with the data. The cards were then programed through the CDC 3600 using the Michigan State University Agricultural STAT Series Number Eight (LSDEL), a stepwise deletion of variables from

a least square equation, to determine the correlation, if any, between the scores students obtained on the antecedent variable tests and the scores they obtained on the post-tests.

Summary of major findings

The major findings of the study were as follows:

Averaged effects of the individualized and lecture-discussion methods versus the non-instruction (control) method

1. There was a significant difference between the averaged mean post-test scores of students of the individualized and lecture-discussion methods of instruction and the non-instruction (control) method as measured by univariate and multivariate analyses of variance. The difference was significant at the .0001 level. Post-tests two, six, and seven contributed the most in discriminating between the averaged post-test scores of students of the two instructional methods and the non-instruction (control) method.
2. There was a significant difference between the averaged mean post-test scores of students of the individualized and lecture-discussion methods of instruction and the non-instruction (control) method as measured by multivariate analyses of covariance. Each of the six covariables considered individually was significant at the .0001 level of significance.

3. There was a significant difference between the averaged mean post-test scores of students of the individualized and lecture-discussion methods of instruction and the non-instruction (control) method as measured by univariate and multivariate analyses of covariance with six covariables controlled. The univariate F of each post-test was highly significant and the multivariate analyses of covariance was significant at the .008 level. The data indicate that the averaged higher mean post-test scores obtained by the students of the two instructional methods over the non-instruction (control) method was a result of instruction, not chance.

The standardized discriminant function coefficients were negative on post-tests one through six and positive on post-test seven. Thus, by discriminating between the scores of post-tests one through six with seven, the best explanation of the differences between the groups was obtained.

Individualized instruction method
versus lecture-discussion method

4. There was a significant difference between the mean post-test scores of students of the individualized and lecture-discussion methods of instruction as measured by univariate and multivariate analyses of variance. The level of significance was .0157.

The mean post-test scores of students of the individualized instruction method were significantly higher than the mean post-test scores of students studying by the lecture-discussion method of instruction. The univariate F values as measured by one-way analyses of variance were significant on post-tests one, three, five, six, and seven but were not significant on post-tests two and four.

Post-tests two and three contributed the most in discriminating between the mean scores of students of the two instructional methods.

5. There was a significant difference between the mean post-test scores of students of the two instructional methods as measured by multivariate analyses of covariance with each of the six antecedent variables considered individually. The levels of significance were equal to or less than .029 for each of the analyses.

The post-test scores of students of the individualized method of instruction were higher than the scores of students of the lecture-discussion method of instruction after removing the variance attributed to each of the antecedent variables.

6. There was no significant difference between the mean post-test scores of students of the individualized and lecture-discussion methods of instruction as

measured by univariate and multivariate analyses of covariance with six covariables controlled. The level of significance was .0576. There was a significant difference between the univariate F values of post-tests one, three, five, six, and seven while the F values of post-tests two and four were not significant.

The standardized discriminant function coefficients were highest on post-tests two and five indicating that these two post-tests contributed most in discriminating between the mean scores of students of the two instructional methods.

7. Students using the individualized instruction method scored significantly higher on the post-tests than students of the lecture-discussion method on the following subject areas:
 - A. Exploring career opportunities;
 - B. Salesmanship and human relations;
 - C. Turfgrass establishment, care, and maintenance;
 - D. Identification and control of weeds;
 - E. Seed, turfgrass, and weed specimen identification; and
 - F. Interpretation and location of information in turfgrass references.
8. There was no significant difference between the post-test scores of students of the two instructional methods on the following subject areas:

- A. Types and characteristics of turfgrasses; and
- B. Fertilization and liming of turfgrasses.

Many vocational agriculture teachers in Michigan normally teach units on the latter two subject areas which may explain why no significant difference in the mean post-test scores of the students was found.

Comparison of the different methods
of instruction in developing in stu-
dents the ability to locate and
interpret information

- 9. The individualized method of instruction was significantly better than the lecture-discussion method of instruction in developing in students the ability to locate and interpret information contained in turfgrass references as measured by student scores on post-test seven. The F values of both the analyses of variance and covariance were significant at the .05 level.
- 10. The averaged effects of the individualized and lecture-discussion methods of instruction were significantly better than the non-instruction (control) method in developing in students the ability to locate and interpret information contained in turfgrass references as measured by student scores on post-test seven. The F values of both the analyses of variance and covariance were significant at the .05 level.

Correlation between the antecedent
variables and the dependent
variable

11. There was a correlation between the antecedent and dependent variables meaning that post-test scores can be predicted from the antecedent variable scores.
12. The pre-study analysis scores were positively related while the Neuroticism and Lie Scale scores of the Eysenck Personality Inventory were negatively related to the post-test scores of students using the individualized instruction method. The three antecedent variables correlated .51 with the dependent variable and accounted for 26 percent of the variation of the dependent variable.
13. The pre-study analysis scores were positively related to the post-test scores of students of the lecture-discussion method. The pre-study analysis correlated .46 with the dependent variable and accounted for 21 percent of the variation of the dependent variable.
14. The pre-study analysis scores were positively related to the post-test scores of the students of the two instructional methods while hours of study and Neuroticism and Lie Scale scores of the Eysenck Personality Inventory were negatively related. The four antecedent variables correlated .52 with the

dependent variable and accounted for 27 percent of the variation of the dependent variable.

15. The Cooperative English Test scores were positively related to the post-test scores of students of the non-instruction (control) method while the attitude toward turfgrass scores were negatively related. The two antecedent variables correlated .54 with the dependent variable and accounted for approximately 30 percent of the variation of the dependent variable.
16. The interest scores and Extraversion scores of the Eysenck Personality Inventory were not significantly related to the post-test scores of any of the students of the different methods of instruction.

Evaluation of the manual, project and project procedure by the teachers

17. The teachers using the individualized instruction method strongly agreed that: (1) upon completion of each lesson, the student should complete a teacher administered quiz which would be graded by the teacher for feed-back; (2) the audiovisual materials were helpful and added to understanding of the manual; (3) students need to be motivated by the teacher in order to study the manual; (4) the instructor has a great deal to do with the success or failure of the particular manual being used by the students; and (5) poor readers did not react well to the

individualized learning manual. The teachers using the lecture-discussion method also strongly agreed with items two and four and agreed with items one, three, and five.

18. Teachers using either instructional method agreed that: (1) instructors need to be very familiar with the units before actual instruction begins; (2) the manual and reference materials were complete and accurate; (3) the learning activities were very appropriate in developing understandings, knowledges, and skills needed by a beginning employee in turfgrass sales and service; (4) the turfgrass unit can be used by individual students wishing to study turfgrass; (5) the text, lessons, and the introductory sections were very appropriate; (6) the lesson behavioral objectives were complete and accurate; (7) the manual should be studied by interested students, and not an entire class, throughout the year and on a seasonal nature; (8) the present study conducted was too large or encompassing; and (9) the post-tests were comprehensive and adequate.
19. Teachers using the individualized instruction method agreed that students felt lost without a standard with which they could compare themselves while teachers of the lecture-discussion method rated this item as "uncertain."

20. The teachers using the lecture-discussion method of instruction "agreed" with the following items while the teachers using the individualized instruction method were uncertain whether: (1) the self-evaluation questions were adequate in determining whether the students had mastered the subject; (2) the type of pre-tests (antecedent variable tests) were adequate; and (3) there were too many pre-tests. Teachers using either instructional method were uncertain whether teacher administered quizzes should be administered weekly.
21. Teachers using either instructional method disagreed with the item that most high school students are capable of disciplining themselves to study on an individualized basis.

Conclusions

The following conclusions were drawn from analyzing the student data:

1. The non-structured individualized learning manual was effective in teaching turfgrass knowledges and skills to high school vocational agriculture students in Michigan.
2. The averaged higher mean post-test scores obtained by the students of the two instructional methods

over the non-instruction (control) method were a result of instruction, not chance.

3. The individualized learning method of instruction was significantly more effective in teaching the following subject areas and/or competencies than was the lecture-discussion method:
 - A. Exploring career opportunities in the turfgrass industry;
 - B. Salesmanship and human relations;
 - C. Turfgrass establishment, care, and maintenance;
 - D. Identification and control of weeds;
 - E. Seed, turfgrass, and weed specimen identification; and
 - F. Location and interpretation of information in turfgrass references.
4. Neither the individualized nor the lecture-discussion method of instruction was more effective in teaching students: (A) types and characteristics of turfgrasses, and (B) fertilization and liming of turfgrasses.
5. In general, there was a significant difference between the mean post-test scores of the students of the two instructional methods; therefore, it can be concluded that students using the individualized instruction method did significantly better on the post-tests than students of the lecture-discussion method.
6. The individualized method of instruction was significantly better than the lecture-discussion method of

instruction in developing in students the ability to locate and interpret information contained in turfgrass references.

7. The averaged effects of the individualized and lecture-discussion methods of instruction were significantly better than the non-instruction (control) method in developing in students the ability to locate and interpret information contained in turfgrass references.
8. Post-test scores can be predicted from the antecedent variable scores.
 - A. The pre-study analysis and the Neuroticism and Lie Scales of the Eysenck Personality Inventory were the best predictors of the post-test scores of students of the individualized instruction method.
 - B. The pre-study analysis was the best predictor of post-test scores of students of the lecture-discussion method.
 - C. The pre-study analysis, hours of study, and the Neuroticism and Lie Scales of the Eysenck Personality Inventory were the best predictors of post-test scores of students of the two instructional methods.
 - D. The Cooperative English and attitude tests were the best predictors of the post-test scores of students of the non-instruction (control) method.
 - E. The interest test and the Extraversion Scale of the Eysenck Personality Inventory were not good predictors of post-test scores of the students of the three methods of instruction.

The following conclusions were drawn from the teacher comments; in their opinion:

9. The individualized learning manual and accompanying reference materials were complete and accurate.
10. The format and content of the manual, i.e., introduction, text, lessons, terminal behavioral objectives, learning activities and self-evaluation questions were complete, accurate, and very appropriate in developing understandings, knowledges, and skills in turfgrass.
11. The audiovisual and curriculum materials were helpful and added to understanding of the manual.
12. The manual should be studied only by interested students on a seasonal nature throughout the year and not completed all at one time.
13. Instructors need to be very familiar with the subject areas of the individualized learning manuals before actual instruction begins.
14. The instructor has a great deal to do with the success or failure of the particular manual being used by the students.
15. Students need to be motivated by the teacher in order to study the individualized learning manual.
16. Poor readers did not react well to the individualized learning manual because of its high verbal content.

17. Upon completion of each lesson, the student should complete a teacher administered quiz or give an oral report which would be graded by the teacher for feedback. This was recommended as the teachers were uncertain whether the self-evaluation questions were adequate in determining whether the students had mastered the subject.
18. Students felt lost without a standard with which they could compare themselves.
19. Most high school vocational agriculture students are not capable of disciplining themselves to study on an individualized basis. They need help and feedback from the teacher especially during the first week to help them study on an individualized basis.
20. The research project conducted was too large or encompassing for most teachers of vocational agriculture.
21. The post-tests were comprehensive and adequate.

Recommendations

1. The state staff and university personnel in agricultural education should encourage the development of instructional materials and additional individualized learning manuals in other areas of agriculture patterned after the manual used in this study.

2. Adequate and appropriate audiovisual and curriculum materials need to be developed and/or obtained for each individualized learning manual developed.
3. The teacher educators at Michigan State University should provide appropriate experiences for prospective vocational agriculture teachers during pre-service education in the appropriate use of individualized instruction materials. This could be accomplished by: (A) placing student teachers in centers where the supervising teachers employ individualized instruction techniques; and/or (B) develop a methods class so that, as a regular activity, students can experience individualized instruction.
4. The state staff and university personnel in agricultural education should provide appropriate in-service seminars or workshops on the use of individualized learning manuals and on the techniques of individualized instruction to insure successful teaching by this method. The following points should be covered in the workshop or seminar:
 - A. Only interested students should complete the individualized learning manuals.
 - B. Instructors need to be very familiar with the subject areas of the individualized learning manuals before actual instruction begins.
 - C. The instructor has a great deal to do with the success or failure of the particular manual being used by the students.

- D. Students need to be motivated by the teacher in order to study the individualized learning manual.
 - E. Poor readers do not react well to the present form of the individualized learning manual because of its high verbal content. Poor readers need more help and more audiovisual materials and more learning-by-doing activities to help them succeed.
 - F. Many students feel lost without a standard with which to compare themselves. Teachers need to develop standards and means for evaluating students. Teacher administered quizzes, oral reports, and other such measures should be employed at the completion of each lesson. The feedback from the teacher on these activities is considered essential in order to reinforce the student.
 - G. Many high school students are not capable of disciplining themselves to study on an individualized basis. During the beginning of study on an individualized basis, teachers should provide day to day standards to help the students establish standards and a pace of study suitable for each student. Students need a lot of help during the first several weeks in studying by this method.
5. In future research projects, the number of pre-tests and post-tests should be kept to a minimum. A knowledge pre-test and a test of the students ability, such as the Cooperative English Test, are probably adequate. In addition, the length of the study should be either of a shorter duration in number of weeks involved, or spread out over a whole year.

Recommendations for further study

There remain many unanswered questions in teaching by the individualized learning method. As a result of the

study the writer became aware of the need for research in the following areas:

1. There is a need to identify the cognitive, affective, and psychomotor skills that can be taught effectively by the individualized instruction method.
2. There is need for a study in which many students within a particular room would study their areas of interest on an individualized basis for an extended period of time.
3. There is a need for a study which includes freshmen and sophomores as well as juniors and seniors to identify the cognitive, affective, and psychomotor skills that can be taught most effectively to students of different abilities and different grade levels.

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APPENDICES

APPENDIX A

Appendix A-1
Turfgrass Competencies Needed

IMPORTANCE AND MEANS FOR COMPETENCIES A HIGH
SCHOOL GRADUATE SHOULD POSSESS IN ORDER TO
OBTAIN AN ENTRY LEVEL JOB IN THE TURFGRASS
SALES AND SERVICE INDUSTRY AS INDICATED
BY SELECTED ORNAMENTAL HORTICULTURE
INDUSTRY PERSONNEL IN THE
LANSING, MICHIGAN AREA

Competency	Importance			Mean
	Unnecessary (1)	Desirable (2) N = 16	Essential (3)	
Operation of Equipment		7	9	2.56
Mowing		7	9	2.56
Cultivation		7	9	2.56
Application of Fertilizer, when & how much		10	6	2.38
Establishment of a Turf	1	9	6	2.31
Identification & control of weeds	1	9	6	2.31
Types of fertilizer & characteristics		11	5	2.31
Employee Relations with supervisor		11	5	2.31
Employee relations with fellow-employee		11	5	2.31
Customer relations	1	9	6	2.31
Communications	1	11	4	2.19
Identification & control of diseases	2	9	5	2.19
Types of turf	1	11	4	2.19
Application of seed	1	11	4	2.19
Salesmanship	3	8	5	2.13
Identification & control of insects	2	11	3	2.06
Soil & water management	2	12	2	2.00
Soils	3	11	2	1.94
Setting up window & store displays	10	4	2	1.50
Sales records/accounting	10	4	2	1.50
Receiving, marking & shipping	12	1	3	1.44
Inventory and Stock Control	10	5	1	1.44
Developing advertisements	13	2	1	1.25

Appendix A-1--continued

Competency	Importance			Mean
	Unnecessary (1)	Desirable (2) N = 16	Essential (3)	
Office machines	12	4		1.25
Warehousing	13	3		1.19
Others:				
Grading		1		2.00

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Appendix A-2
Turfgrass Competencies Needed

IMPORTANCE AND MEANS FOR COMPETENCIES A HIGH
SCHOOL GRADUATE SHOULD POSSESS IN ORDER TO
OBTAIN AN ENTRY LEVEL JOB IN THE TURFGRASS
SALES AND SERVICE INDUSTRY AS INDICATED
BY SPECIALISTS

Competency	Importance			Mean
	Unnecessary (1)	Desirable (2) N = 17	Essential (3)	
Types of turf		4	13	2.76
Establishment of a turf		4	13	2.76
Types of fertilizer and characteristics		6	11	2.65
Application of fertilizer, when & how much	1	4	12	2.65
Operation of equipment		6	11	2.65
Mowing		6	11	2.65
Application of seed		7	10	2.59
Cultivation		8	9	2.53
Employee relations with fellow employee	2	4	11	2.53

920en, Employment Opportunities and Needed Competencies In Selected Nursery, Turfgrass, Arboriculture, and Landscaping Businesses In The Lansing, Michigan Area, op.cit., p. 10.

Appendix A-2--continued

Competency	Importance			Mean
	Unnecessary (1)	Desirable (2) N = 17	Essential (3)	
Communications	2	5	10	2.47
Employee relations with supervisor	2	6	9	2.41
Identification and control of weeds		10	7	2.41
Soils	1	8	8	2.41
Soil & water management	2	7	8	2.35
Salesmanship	2	7	8	2.35
Customer relations	2	7	8	2.35
Identification and control of diseases	1	11	5	2.24
Identification and control of insects	2	10	5	2.18
Sales records/accounting	5	7	5	2.00
Receiving, marking and shipping	3	12	2	1.94
Inventory and stock control	4	10	3	1.94
Warehousing	7	6	4	1.82
Setting up window and store displays	8	8	1	1.59
Developing advertisements	8	8	1	1.59
Office machines	9	6	2	1.59
Others:				
Equipment repair		1		2.00
Identification of turfgrasses		1		2.00
Ecology			1	3.00

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⁹³Ibid., p. 11.

APPENDIX B

Appendix B-1

Cover Letter For Teacher Survey

MICHIGAN STATE UNIVERSITY East Lansing • Michigan

College of Education

July 28, 1969

Dear

A project to evaluate the effectiveness of pupil learning with individualized instruction is being planned. You have been recommended by the state staff and by the teacher education staff as a possible participant in the study.

The experimental sales and service unit selected for the study is on turfgrasses. The unit includes lessons on: (1) exploring career opportunities in the turfgrass industry, (2) salesmanship and human relations, (3) types and characteristics of turfgrasses, (4) establishment, care and maintenance, (5) fertilization and liming, (6) weeds, insects, and diseases, and (7) the operation, adjustment, and maintenance of equipment.

The teachers participating in the study will be furnished the units, slides, transparencies, bulletins, and other necessary teaching materials. Special help will also be provided in conducting such a program. In one-half of the cooperating schools, the individualized method of learning will be used. The other half will use the traditional group method of instruction. You may choose whether you want to teach by the group method or the individual method. In either case you would be expected to follow quite closely the lessons as outlined in the manual. You would also be expected to give a pretest and a posttest to the students. These are being developed at the present time. No particular school will be identified by name and the students will be combined from the schools in the analysis of the data.

I worked with Dr. Raymond Clark this past year on the individualized instruction project and due to the continuing interest in the state, additional materials and research needed to be completed. Therefore, this unit was developed and the ensuing project was designed.

You are asked to respond to the following short survey. Please indicate your willingness to cooperate with the study planned to take place during September and October, 1969. The unit and study are mainly designed for juniors and seniors. (Complete the form and return it as you leave to Urban Oen who will be standing by the exit.)

After we have identified your interest, a short group session will be held during your annual conference for all interested teachers in order to develop our strategy for working with you on the project. Some of you may wish to enroll in an individualized study course which is going to be offered in Grand Rapids during the Fall Term under the direction of Dr. H. Paul Sweany. Special help with individualized instruction will be provided teachers enrolled in the course.

Sincerely,

Urban T. Oen
Agriculture Education

Appendix B-2

Teacher Survey

1. Name _____
School _____
Address _____
2. Number of years of teaching experience _____
3. I normally teach____ do not teach____ lessons or units of instruction on some phase of turfgrass or lawn care, culture, or management. If yes, at what grade level?
freshman____ sophomore____ junior____ senior____.
4. Are you willing to participate in this project?
yes____ no____ need additional information before
deciding_____
5. If yes, how many students would be able to participate?

No. enrolled

juniors _____
seniors _____

6. Are your junior and senior classes separate____ or together____?
7. Do you have any preference whether you teach by the regular group method of instruction or by the individualized learning method?

Prefer:

group method _____

individual learning method _____

8. Would you be willing to teach by either method, if assigned to you? yes_____ no_____

APPENDIX C

Appendix C-1

Letter to Cooperating Teachers

August 16, 1969

Dear

Three meetings have been scheduled for the schools participating in the turfgrass sales and service research project. The individualized learning group will meet at Greenville on Wednesday, August 27, 1969 at 1:00 P.M. The teaching group will meet at Portland on August 28, 1969 at 9:00 A.M. and at Remus on August 29, 1969 at 1:00 P.M. Those in the teaching group may attend either the Portland or Remus school meeting but not both. Those of you in the combination group will be called together around the end of September or the first part of October to be given the materials and your instructions. Due to the large number of schools participating, we had to stagger the project in order to share the materials.

As a participating school, you are expected to attend your particular group meeting. During the meeting, all instructional materials will be handed out and the procedure for teaching will be explained. Please try to determine the number of juniors and seniors who will be enrolled in the study and bring this figure with you to the group meeting.

If you cannot participate in the project or attend the group meeting, please let me know immediately so that the other schools can be contacted.

Would teachers in the individualized group please send me a clean, blank tape recorder tape by August 25th?

Sincerely,

Urban T. Oen
301 K Erickson

Appendix C-2

Letter to School Administrators

August 16, 1969

Dear

While the vocational agriculture teachers were on the Michigan State campus for their annual conference during the last week of July, they were given an opportunity to express interest in teaching an experimental unit of instruction on turfgrass sales and service. Your teacher expressed an interest in participating in the study and utilizing the instructional materials that will be provided.

As a result of the expressed interest, we have randomly assigned the teachers to one of the two methods of instruction. The teachers will be given the units, slides, tapes, bulletins, and other materials, and in addition will be provided assistance in completing the suggested course of study.

The study will enable us to make a comparison between the achievement of students who will participate in individualized learning vs. instruction by our traditional methods in vocational agriculture. In addition we will seek to identify those characteristics of students who make the greatest progress utilizing individualized learning.

I trust that you will be willing to have your teacher participate in this study on turfgrass sales and service and will be interested in the application of the findings to other units of instruction designed to meet the varying needs and occupational objectives of students.

I am planning on meeting with the teachers at centrally located schools during the last week of August to give them all the materials and to explain the procedure for teaching the unit. This meeting will also give me an opportunity to answer specific questions which the teachers might have.

Sincerely,

Urban T. Oen
Agriculture Education

APPENDIX D

Appendix D

Audiovisual and Curriculum Materials
Distributed to the Schools

Books

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Bulletins

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21. Lawn Weed Control With Herbicides, Home and Garden Bulletin No. 123. Washington, D.C.: U.S. Government Printing Office.
22. Lime For Michigan Soils, E-471. East Lansing: Cooperative Extension Service, Michigan State University, July, 1966.

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58. "Weed Identification," (37-2" X 2" colored slides with script), University Park, Pennsylvania 16802: Department of Agricultural Education, The Pennsylvania State University, 1968. Price - \$6.00.
59. "Weed Identification," (24-2" X 2" colored slides), Marysville, Ohio: O.M. Scott and Sons.

Charts

60. Two weed identification charts by O.M. Scott and Sons were furnished to each school.

Tapes

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APPENDIX E

Appendix E-1

ORIENTATION MEETING FOR COOPERATING TEACHERS

Individualized Instruction Group

August 27, 1969, 1:00 p.m., Greenville H. S.

Each student will be given an individualized learning manual on Turf Sales and Service. The manual contains ten lessons.

The students are to work individually or in small groups while studying the lessons. As a teacher, your job is to answer student questions, to evaluate work completed by students, to assist with any problems, to coordinate role-playing demonstrations, and to provide general help when needed. At no time are you to "teach" as you may have done in the past. You may want to call the class together to solve common problems, or for field trips, or for resource speakers.

You are to orient the students to individualized learning. Show the transparency on Pattern for Individualized Learning. Play the tape and explain the student-teacher role in studying the manual.

The students are to read the text material, study the 2" X 2" colored slides, complete the learning activities, and the evaluation activities. Each student is to complete the time and activities chart at the end of each class period.

Due to the limited number of slides and other references, you may want to divide the class into eight groups to complete lessons 3-10. As a group completes a lesson, they should begin another lesson. At no time are you to delay a group from beginning another lesson even though others may not have finished. One variable we are researching is time to completion versus comprehension of knowledge. You may want to complete lessons one and two with the whole class studying at one time before dividing into groups.

The Sawyer projector-viewer does not have a fan to cool the bulb; therefore, it is very important that the projectors not be moved or jarred until the bulb has cooled for at least twenty (20) minutes.

Appendix E-2

ORIENTATION MEETING FOR COOPERATING TEACHERS

Teaching Group (Lecture-Discussion)

You are being provided the same materials as the teachers in the individualized learning group. However, you are to teach by a lecture-discussion method of instruction and are to complete assignments as a class exercise. The students in the lecture-discussion classes are not to see the individualized learning manual. You may reproduce the worksheets and transparencies for your students to use. The manuals are provided to you so that you know the specific objectives to be reached by the students and the materials to be covered by you.

You are not to read the objectives to the students nor tell them the objectives. The objectives are in behavioral terms and are to be attained by your students without your telling them what they are. (You can give quizzes.)

Appendix E-3

PROJECT PROCEDURE

1. Administer the pre-study analysis examination. Have the students complete the IBM answer sheets using a soft pencil. Return the answer sheets to me.
2. Administer the Cooperative English Exams. Be sure to follow the directions and time limits exactly as stated on the tests. Mail the exams and answer sheets back to me.
3. Administer the attitude and interest inventories.
4. Administer the Eysenck Personality Inventory. After the students complete the inventory, have them transfer their answers to the MSU, T-F IBM answer sheets. Return the tests and answer sheets to me.
5. Begin to teach turfgrass sales and service. The individualized teachers should hand out the units and orient the students. The lecture-discussion group should orient the

students and begin to teach. The third group of teachers will have to wait until the first part of October to begin step 5.

6. When all students complete the units or when you complete your teaching, a post-test examination is to be given. These will be mailed to you upon completion of the project.

APPENDIX F

Appendix F

TURFGRASS PRE-STUDY ANALYSIS

The purpose of this pre-study analysis is to provide your instructor with an indication of the turfgrass competencies or skills you may have developed and those which you need to develop. This information will aid your instructor in teaching the unit on turfgrass sales and service. Please work as fast and accurately as you can and answer all questions. There is no penalty for guessing.

Directions: Do not write on this analysis booklet. Use the separate answer sheet. Fill in the top where it says name, date, student number, etc. Please add the name of your school at the top of the page. Use a number two pencil or the scoring pencil furnished. Blacken out the space of the most appropriate answer for each question. If you erase, please erase completely. Do not fill in more than the space. For example, if the answer to a question is number two, blacken in space number two for the question as follows:

1. 2. 3. 4. 5.

Do not bend, fold, or tear the answer sheet. Return the answer sheet and the pencil to the instructor when you finish.

SECTION I: True and False

Answer the following questions true or false. Blacken in number 1 if you believe the statement is true. Blacken in number 2 if you feel the statement is false.

1. Tall fescue is one of the most wear-resistant grasses used in Michigan.
2. Most lawns in Michigan would benefit from a higher percentage of ryegrass in the seeding.
3. The plant food element needed most by lawns is potassium.
4. Liquid fertilizers will produce much better results than the same plant nutrients applied in dry form.
5. Lime is needed on a lawn if the pH is 6.0 or below.

6. Small lawn seeds should be covered with not over 1/4" of soil.
7. Mulch should always be removed after the lawn has become established.
8. Rolling a lawn in the spring is an excellent practice to help smooth uneven lawns.
9. Clipping should be done slightly higher with a rotary than with a reel type mower.
10. Weeds will not usually be a serious problem if good lawn management practices are followed.
11. Management practices on lawns have little effect on fungus growths in the lawns.
12. An insecticide which destroys white grubs will also rid a lawn of moles.
13. No more than 2 pounds of Nitrogen per 1,000 square feet should be applied on a lawn at one time.
14. Respect for authority of a turfgrass sales and service employee is not necessary as long as you get the job done on time.
15. While on the job, any ideas you get you should keep to yourself unless you will get paid for them.
16. Constructive criticism is used by the boss only to make you feel bad.

SECTION II: Multiple Choice

Select the answer which best completes the statement.
Blacken in the appropriate number.

17. The most drought tolerant of the following listed grasses is:
 1. Kentucky bluegrass.
 2. Creeping bentgrass.
 3. Tall fescue.
 4. Perennial ryegrass.

18. The grass which should be mowed the highest is:
 1. Kentucky bluegrass.
 2. Merion bluegrass.
 3. Creeping bentgrass.
 4. Tall fescue.
19. In preparing the seedbed for a new lawn a practice which is not desirable is:
 1. Add a small amount of sand to the soil.
 2. Add organic matter to the soil.
 3. Slope the soil away from the house.
 4. Allow subsoil to settle before adding topsoil.
20. The fertilizing element least likely to be lacking in lawns is:
 1. Potassium.
 2. Nitrogen.
 3. Phosphorus.
 4. None of these.
21. The grass most likely to grow well in shade is:
 1. Tall fescue.
 2. Kentucky bluegrass.
 3. Perennial ryegrass.
 4. Red fescue.
22. The grass most likely to survive and grow well under close clipping is:
 1. Red fescue.
 2. Bentgrasses.
 3. Perennial ryegrass.
 4. Kentucky bluegrass.
23. The grass most likely to survive under heavy wear is:
 1. Tall fescue.
 2. Red fescue.
 3. Bentgrasses.
 4. Kentucky bluegrass.
24. A fertilizer practice which will not help avoid plant burn is:
 1. Water immediately after fertilizing.
 2. Do not apply over 2 pounds Nitrogen per 1,000 square feet.
 3. Use ammonium sulfate.
 4. Use granulated rather than pulverized fertilizer.

25. All of the following practices should be considered in lawn irrigation except:
 1. Depth of water in the soil.
 2. Amount of water runoff.
 3. Whether or not the sun is shining at the time of irrigation.
 4. Type of soil to be irrigated.
26. A time of seeding in Central Michigan which would give the best chance of success is:
 1. March 15--April 15.
 2. August 15--September 15.
 3. October 15--November 15.
 4. December 1--30.
27. When killing weeds in lawns with 2,4-D the formulation should be:
 1. Ester.
 2. Amine.
 3. Either ester or amine.
 4. Neither ester nor amine.
28. Grass leaves affected with reddish-brown or orange spots on the blades have:
 1. Leaf spot.
 2. Brown patch.
 3. Rust.
 4. Fade-out.
29. Reed sedge peat and moss peat are organic materials especially recommended as soil physical conditioners because they:
 1. Decompose slowly.
 2. Are easily incorporated.
 3. Are not very costly.
 4. Are readily available.
30. Basic fertilizer for turfgrass establishment consists of:
 1. Phosphate materials.
 2. Potash materials.
 3. Phosphate and/or potash materials.
 4. Nitrogen, phosphate, and potash materials.
31. The form of lime recommended for use on turfgrass areas is:
 1. Ground limestone.
 2. Burned lime (calcium oxide).
 3. Hydrated lime (calcium hydrate).
 4. Marl.

32. The best pH range for most turfgrasses is:
1. 4.5 - 5.0.
 2. 5.0 - 6.0.
 3. 6.0 - 7.0.
 4. 7.0 - 7.5.
33. Whenever large amounts of sand and peat are used to alter the physical condition of the soil, it will be necessary to adjust certain maintenance practices. Two of these maintenance practices are:
1. Fertilization and mowing.
 2. Fertilization and spraying for weeds.
 3. Mowing and spraying for weeds.
 4. Fertilization and irrigation.
34. Straw mulch should be completely removed from a newly seeded area when the grass:
1. Emerges from the ground.
 2. Is 1/2" to 1" high.
 3. Is 1" to 2" high.
 4. Is tall enough to be mowed.
35. The optimum height to mow Kentucky bluegrass for a home lawn is:
1. 3/4 inch.
 2. 1 inch.
 3. 1-1/2 inches.
 4. 1-1/2 - 2 inches.
36. Sand and peat are mixed into soils used on golf greens and tees to:
1. Provide nutrients.
 2. Build resilience and resist compaction.
 3. Promote deep rooting and provide nutrients.
 4. Promote deep rooting and neutralize acidity.
37. Identify the method of vegetative reproduction pictured below:
1. Tillers.
 2. Stolons.
 3. Rhizomes.
 4. Ligules.



38. Perennial ryegrass is an example of a bunch grass. A bunch grass reproduces by:
1. Basal tillers.
 2. Rhizomes.
 3. Stolons.
 4. Seeds.

39. Thatch is the result of:
1. A nutrient deficiency.
 2. Insect damage.
 3. Poor soil drainage.
 4. An accumulation of dead plant materials.
40. The main purpose of aerating a turf is to:
1. Improve drainage.
 3. Reduce surface compaction of the soil.
 3. Get fertilizer to the plant roots.
 4. Thin the turf.
41. The amount of water that should be applied to a turf is determined by the:
1. Number of days since the last watering.
 2. Depth of water penetration into the soil.
 3. Type of grass species found in the turf.
 4. Condition of grass, time of day, and temperature.
42. Vertical mowing is a cultural practice designed to:
1. Correct the development of grain and thatch.
 2. Correct the effects of over-fertilization.
 3. Improve the putting condition of a golf green.
 4. Renovate the old turf for reseeding.
43. A light application of water is used to correct "temporary wilt" on golf greens. This practice is called:
1. Syringing.
 2. Sprinkling.
 3. Wetting.
 4. Damping-off.
44. A chemical which retards the growth of plants and which is used on highway grasses to reduce the number of mowings is:
1. Sodium arsenite.
 2. 2-4, 5T.
 3. Cycocel.
 4. Maleic hydrazide.
45. In selecting a mowing height for golf fairways, consideration should be given to the maintenance requirements of the grass species and to playing conditions. Which of the following mowing heights would you select to meet both needs if the fairway was seeded primarily with Kentucky bluegrass:
1. $\frac{3}{4}$ to 1 inch.
 2. $1\frac{1}{4}$ to $1\frac{1}{2}$ inch.
 3. $1\frac{3}{4}$ to 2 inches.
 4. $2\frac{1}{4}$ to $2\frac{1}{2}$ inches.

46. The most common mowing height for Bluegrass tees is:
1. 1/2 inch.
 2. 1 inch.
 3. 1-1/2 inches.
 4. 2 inches.
47. Top-dressing is a golf course cultural practice designed to:
1. Remove excessive water.
 2. Increase the soil fertility level.
 3. Control thatch and correct "grain."
 4. Control grubs in the soil.
48. The amounts of plant nutrients are noted on each bag of fertilizer. A fertilizer with an analysis of 10-6-4 contains:
1. 10%N, 6% K₂O, and 4% P₂O₅.
 2. 10 lbs. N, 6 lb. K₂O, and 4 lb. P₂O₅
 3. 10%N, 6% P₂O₅, and 4% K₂O.
 4. 10 lbs. N, 6 lb. Phosphorous, and 4 lb. Potassium.
49. "Grain" is a term used to describe a turf condition caused by:
1. Using a dull mower.
 2. Operating a mower too fast.
 3. Continued mowing in the same direction.
 4. Improper application of fertilizer.
50. In which compound does some of the nitrogen become available more slowly to turfgrasses over a period of time?
1. Ammonium nitrate.
 2. Ammonium sulfate.
 3. Natural organics.
 4. Urea.
51. A turf fungus disease which lives on organic materials in the soil and which appears in a circular pattern of darker green turf is called:
1. Dollar spot.
 2. Brown patch.
 3. Fairy ring.
 4. Nematodes.
52. Loyalty is best defined as:
1. Faithfulness to the company.
 2. Work for self improvement only.
 3. Eight hours a day devoted to the company.
 4. All of the above.

53. Cooperation is:
1. The same as following all ideas of co-workers.
 2. Sharing responsibility for a job.
 3. Joint action with others in pursuit of a common well being.
 4. Working as best as you can while on the job.
54. Which of the following traits is not a desirable personal quality?
1. Enthusiasm.
 2. Tactfulness.
 3. Tolerance.
 4. Argumentative.

SECTION III: Matching

Blacken the space that best describes the term in the left column.

- | | |
|-----------------|---|
| 55. Phosphorus. | 1. Promotes hardiness and disease resistance. |
| 56. Nitrogen. | 2. Stimulates rapid growth. |
| 57. Potash. | 3. Supplied by manganese sulfate. |
| 58. Lime. | 4. Promotes root growth. |
| | 5. Raises soil pH test. |

Turfgrass Species

Growth Habit/Cultural Requirement

- | | |
|-------------------------|--|
| 59. Kentucky bluegrass. | 1. Used in shady areas, high wear resistance, can survive in wet or dry conditions. |
| 60. Tall fescue. | |
| 61. Creeping bentgrass. | 2. Used primarily on home lawns in Michigan. It grows best in sunny areas and on fertile well-drained soil. |
| 62. Merion bluegrass. | 3. Has a high moisture and fertility requirement--tolerates a wide variety of soil conditions--used on putting greens. |
| | 4. Can be cut lower than other bluegrasses due to 90 degree leaf angle. |

Weed

- 63. Common Chickweed.
- 64. Crabgrass.
- 65. Dandelion.
- 66. Ground Ivy.
- 67. Buckhorn.

Type of Weed and Control

- 1. Annual grass - DCPA.
- 2. Perennial Broadleaf - 2,4-D.
- 3. Annual Broadleaf - MCPP.
- 4. Perennial Broadleaf - Silvex.

Insects

- 68. Chinch Bugs.
- 69. Grubs.
- 70 Leafhoppers.
- 71. Sod Webworms.
- 72. Millipedes.

Chemical which controls them

- 1. Dieldrin.
- 2. Carbaryl.
- 3. Diazinon.

Disease

- 73. Melting - Out.
- 74. Dollar - Spot.
- 75. Fairy Ring.
- 76. Snow - Mold.
- 77. Powdery mildew.

Symptoms

- 1. Round brown or bleached spots from 1-1/2" - 6" in diameter.
- 2. Early spring; circular, dead, bleached areas appear.
- 3. Thinning of the lawn; brownish undercast, brown to purple spots on leaves.
- 4. Grass blades covered with a powdery - like growth.
- 5. A circular ring of fast-growing dark green grass often surrounding a ring of thin or dead grass.

SECTION IV:

Complete the following mathematical problems.

78. A lawn measured 90' x 100'. At a rate of 1-1/2 pounds of bluegrass per 1,000 square feet how much would the seed cost for this lawn if bluegrass seed costs \$.56 per pound? How much seed would be needed?

Seed Needed

1. 13.0 lbs.
 2. 14.0 lbs.
 3. 13.5 lbs.
 4. 13.25 lbs.
 5. None of these
79. Cost of seed in number 78.
1. \$7.28.
 2. \$7.35.
 3. \$7.56.
 4. \$7.40.
 5. None of these

SECTION V: Interpretation of Data

Mark number 1 for each statement that is true and can be proven by the following data. Mark a 2 for each statement that may or may not be true but cannot be answered sufficiently from the following data. Mark a 3 for each statement that is incorrect according to the data below.

Height of Mower Cut--Merion Bluegrass

Mower type and height of cut	Percent bare spots	Density*	Color**	Overall appearance***
Reel 1"	2	9.5	4.8	8.2
Rotary 1"	6	8.0	2.2	5.0
Reel 2"	1	10.0	3.5	8.0
Rotary 2"	1	9.8	2.5	7.2

*Scale 1-10..10 = very dense.....1 = bare soil
 **Scale 1- 5.. 5 = dark green.....1 = light green to brown
 ***Scale 1-10..10 = good appearance..1 = unsatisfactory
 appearance

80. The density of the lawn is greatest where a reel mower is used at a height of 2".
81. The overall appearance of the lawns mowed with a rotary mower is better than those mowed with a reel type.
82. Using a rotary mower on a bentgrass lawn hurts the color.
83. Fewer bare spots are found with a 2" height of cut than with a 1" height.
84. A reel type mower leaves the lawn with a better color than the rotary type mower.
85. A rotary mower cuts better on ryegrass than on Merion bluegrass.

APPENDIX G

Appendix G

AGRICULTURAL OCCUPATIONS INTEREST SCALE

Name _____ Sex ____ Grade in School ____
School _____ Student number _____

Part I.

Instructions: Please mark the following items quickly giving your first impression. Blacken number 1 on the answer sheet if you like the activity described. Blacken number 2 only if you cannot decide whether or not you like the activity. Blacken number 3 if you dislike the activity.

1=like 2=uncertain 3=dislike

1. Deliver supplies such as feed to a farm.
2. Work for a greenhouse operator
3. Work for a golf course
4. Repair farm machinery in the field
5. Sell farm machinery at a dealership
6. Plan floral arrangements
7. Work for a lawn and garden center
8. Pot plants in a greenhouse
9. Work for a sod farm
10. Clean and adjust farm equipment
11. Operate a farm
12. Establish and maintain lawns for a landscape contractor
13. Operate a logging tractor
14. Demonstrate new products to farmers
15. Be an athletic field superintendent
16. Farm manager

17. Golf course superintendent
18. Manage a hunting reserve
19. Buy and sell new or used farm machinery
20. Sell lawn and turf grass supplies
21. Farm machinery parts manager
22. Sodding and landscaping service manager
23. Care for farm animals
24. Start plant cuttings
25. Lay sod
26. Help customers determine livestock feed efficiency
27. Plant commercial forests
28. Operate a corn picker
29. Develop a camping area
30. Turfgrass disease specialist
31. Treat tree injuries to prevent decay
32. Take a farm inventory
33. Operate a logging business
34. Care for a lawn or turf
35. Control insects in a park
36. Be a farm machinery salesman
37. Be a sodding and landscaping salesman
38. Raise flowers
39. Plant vegetable crops
40. Extension turfgrass specialist
41. Plan a fire fighting system for a forest area
42. Take telephone orders

43. Own a farm supply business
44. Own a golf course
45. Drive a milk truck
46. Weigh grain and compute the number of bushels
47. Operate a gang mower
48. Do turfgrass research
49. Do crop pest research
50. Develop new crop varieties
51. Establish a golf green
52. Develop a picnic area
53. Prepare the company payroll
54. Mix the feed the company sells
55. Assemble farm machinery
56. Wait on customers in a florist's shop
57. Figure the amount of chemicals to apply to a football field
58. Figure the amount of feed ingredients for a grain ration
59. Administer medications to animals

Part II Preferences

For each of the following pairs, blacken the 1 or 2 on the answer sheet of the activity you prefer. Mark only one of each pair.

60. (1) Sell fertilizer for a farm crop
(2) Test the soil for fertilizer need
61. (1) Repair a farm tractor
(2) Operate the tractor on the farm
62. (1) Plan conservation practices for a given farm
(2) Carry out the conservation practices on the farm

- 63. (1) To be a dairy scientist
(2) To be a turfgrass scientist
- 64. (1) Work for a greenhouse operator
(2) Work for a farmer
- 65. (1) Work for a logging contractor
(2) Work for a garden store
- 66. (1) To demonstrate farm tractors
(2) To demonstrate vertical mowers, golf carts, or aerifiers
- 67. (1) Operate a ski slope
(2) Operate a farm
- 68. (1) Operate a fertilizer business
(2) Operate a logging firm
- 69. (1) Keep the parts inventory in a machinery dealership
(2) Drive the delivery truck
- 70. (1) Keep farm records
(2) Keep business records
- 71. (1) Pot plants in a greenhouse
(2) Fill orders for farm supplies
- 72. (1) Sell bulldozers
(2) Operate the bulldozer
- 73. (1) Advise customers on animal feeding problems
(2) Advise customers on lawn and turf problems
- 74. (1) Test milk
(2) Produce the milk
- 75. (1) Judge livestock
(2) Plan an advertising campaign

APPENDIX H

Appendix H

INDIVIDUALIZED LEARNING ATTITUDE SCALE

In this Attitude Scale, the term "Individualized Learning" refers to a method of course organization in which each pupil works individually on an assignment according to his interests, needs, and abilities and proceeds through it at his own pace. The subject matter to be studied may be cooperatively determined by the teacher and the learner. The student is mainly responsible for his learning. During class time the teacher is available to answer questions and provide needed assistance.

The subject matter may be learned through textbooks, by teaching machines, computer, slides, films, transparencies, audio and/or video tapes, etc.

DIRECTIONS:

There are 20 statements about individualized learning. Consider each statement separately and indicate the extent to which you agree or disagree with it by marking the appropriate number on the IBM answer sheet. Your response will not affect your grade in this course.

The numbers and corresponding responses are:

1. strongly agree
 2. agree
 3. no opinion
 4. disagree
 5. strongly disagree
-
1. Individualized learning is based on the same learning principles as good traditional classroom instruction.
 2. Individualized assignments may hinder one's social development.
 3. It is enjoyable to study subjects on one's own.
 4. Through individualized learning, the teacher has more time to give to the individual needs of students.
 5. Most students like to be responsible for their education.

Answer Key

1. Strongly agree
 2. Agree
 3. No opinion
 4. Disagree
 5. Strongly disagree
-
6. Individualized learning allows one to work at his own speed.
 7. Regardless of ability, all students should be graded the same.
 8. If some subjects were available in my school on an individualized learning basis, I would volunteer to enroll in them.
 9. Individualized learning allows one to study in depth in areas of interest.
 10. Individualized learning provides a better way of grading students since each student is evaluated according to his ability and personal progress.
 11. Working on one's own is boring.
 12. Most students do not care what method of course organization is used in their educational pursuits.
 13. Individualized assignments encourage students to do less work than with traditional classroom instruction.
 14. Individualized learning should result in a better education for most students.
 15. Since students can review slides and other references as often as they wish in individualized learning, students should achieve a better understanding of the subject.
 16. Increased student/teacher contact in individualized study may help the student understand the subject better than with traditional classroom instruction.
 17. One will work harder if he is studying the subject by himself.
 18. I usually perform better when I attend group instruction and am competing with fellow students.

Answer Key

1. Strongly agree
2. Agree
3. No opinion
4. Disagree
5. Strongly disagree

19. Students may learn less with individualized instruction if they are given the option to choose "what" and "how much" they study.
20. I prefer to attend classes taught by the traditional method of instruction.

APPENDIX I

Appendix I-1

TURFGRASS EXAMINATION, PART I

NAME _____ STUDENT NUMBER _____

(Post-tests One through Three)

Use a number two pencil or a scoring pencil. On the answer sheet, print in the appropriate places your name (last name first), the date, your student number, and circle whether male or female.

Place the name of your school on the line marked course name. Fill in the blanks for instructor and name of test. Place Part I on the line following the word "form."

Write your student number in the vertical column of blank boxes under the heavy arrow. Please use a four-digit student number. If your student number is one, place three zero's in front of it. Your four digit number would read 0001. If your number is 100 your four digit number would be 0100, etc. Now blacken in the corresponding numbers in the box.

Be sure to follow the directions carefully in each section. At times you will answer directly in the test booklet. Be sure that when you return to recording your answers on the separate answer sheet that you begin with the appropriate numbers. Most of the time you will record your answers on the separate answer sheet.

On the separate answer sheet, blacken out the space of the most appropriate answer for each question. If you erase, please erase completely. Do not fill in more than the space.

Please work as fast and as accurately as you can and answer all questions. There is no penalty for guessing.

SECTION I: Background

1. What specific area of turfgrass sales and/or service work are you most interested in? (mark only one)
 1. Types and characteristics of turfgrasses
 2. Turfgrass establishment, care, and maintenance
 3. Fertilization and liming
 4. Soil and water management
 5. Identification and control of weeds
 6. Identification and control of insects and other pests
 7. Identification and control of diseases
 8. Operation, adjustment, and maintenance of equipment
 9. General turfgrass work--all or most of the above
 10. None--not interested in working in the turfgrass industry

2. What type of job in the turfgrass industry do you hope to reach someday? (mark only one)
 1. Turfgrass sales and service work
 2. Turfgrass sales work only
 3. Turfgrass service work only
 4. Research at University or in industry (college education required)
 5. Golf course superintendent
 6. Manager of a city, state, or national park
 7. Manager of a turf service firm
 8. Manager of a sod farm
 9. Other work in the industry
 10. None--I do not wish to work in the turfgrass industry.

3. What type of occupation in the turfgrass industry do you wish to enter for your life career? (mark only one)
 1. Professional (you need a college education to enter - Examples are: agronomist, scientist, extension turfgrass specialist, etc.)
 2. Managerial -(Examples: Sod farm manager, landscape or nursery manager, golf course superintendent)
 3. Technical - (Some post-secondary education may be necessary. An example is a turfgrass laboratory technician)
 4. Sales and/or Service - (Turf service firm or sod farm salesman, or lawn service firm employee, etc.)
 5. General laborer - General laborer for any of the businesses, golf courses, sod farms, landscapers, etc.
 6. Other not listed
 7. None - I do not wish to enter any turfgrass occupation.

4. What job(s) do you now hold or have you held in the past for a turfgrass business? (mark only one)

- | <u>Job</u> | <u>Length of Employment</u> |
|---|----------------------------------|
| 1. Golf course employee---- | one summer and/or year |
| 2. Golf course employee---- | two or more summers and/or years |
| 3. Nursery or landscape turf employee----- | one summer and/or year |
| 4. Nursery or landscape turf employee----- | two or more summers and/or years |
| 5. Sod farm employee----- | one summer and/or year |
| 6. Sod farm employee----- | two or more summers and/or years |
| 7. Turfgrass service firm-- | one summer and/or year |
| 8. Turfgrass service firm-- | two or more summers and/or years |
| 9. Other jobs with turfgrass businesses | |
| 10. None - I have never worked for any turfgrass business | |

5. Previous years of study you have completed on turfgrass or lawn culture, care, or maintenance, etc.? (mark only one)

1. Freshman year only
2. Freshman and sophomore years
3. Sophomore year only
4. Sophomore and junior years
5. Junior year only
6. Freshman, sophomore, and junior years
7. Freshman and junior years
8. None - This is the first time I have ever studied about turfgrass.

6. Year in school and previous years of vocational agriculture and/or horticulture completed.

<u>Year in School</u>	<u>Previous years completed</u>
1. Freshman	-
2. Sophomore	0
3. Sophomore	1
4. Junior	0
5. Junior	1
6. Junior	2
7. Senior	0
8. Senior	1
9. Senior	2
10. Senior	3

(Post-test One)

SECTION II: Career Opportunities

List four turfgrass businesses of the turfgrass industry in your community and/or county.

7. _____
8. _____
9. _____
10. _____

List a beginning job in a turfgrass business and five competencies an employee should possess in order to obtain the job.

Business selected _____ Beginning
job _____
Competencies needed to obtain the job:

11. _____
12. _____
13. _____
14. _____
15. _____

SECTION III: Salesmanship and Human Relations

Blacken in number one on the answer sheet for those personal qualities which you feel are desirable of a turfgrass employee and mark number two for those which you feel are undesirable.

Answer Key: 1 = desirable 2 = undesirable

Personal Qualities

16. Enthusiasm
17. Only does what told to do
18. Honesty
19. Argumentative
20. Self-confidence

Multiple Choice

Select the best answer which completes the statement or answers the question. Mark your answer in the appropriate space on the answer sheet.

21. Loyalty is best defined as:

1. Work for self improvement only
2. Eight hours a day devoted to the company
3. Faithfulness to the company
4. Both one and three

22. Cooperation is:

1. Joint action with others in pursuit of a common well being
2. Working as best as you can while on the job
3. Sharing responsibility for a job
4. The same as following all ideas of co-workers.

23. It is possible that things which you enjoy may:

1. Appeal to others
2. Not appeal to others
3. Be distasteful to others
4. All of these

24. As an employee of a turfgrass business it is not necessary to be friendly as long as you:

1. Do your job
2. Act as though you are friendly
3. Get to work on time
4. None of these

25. Responsibility is:

1. The development of one's own rules of conduct
2. Acceptance of and follow through with rules of the company and society
3. Checking on fellow employees to see that they complete all their work
4. Being responsible for only your own work assignment

26. When you are criticized by your boss, it is best to:
1. Act indifferent
 2. Listen, but always explain why you did what you did
 3. Tell him that if he can do the job better, he should do it
 4. Take it constructively
27. If you are asked a question by a customer and do not know the answer, you should:
1. Tell the customer what you think the answer is
 2. Tell the customer you do not know
 3. Tell the customer you are not sure but you will find out
 4. Ask the customer to see another salesman.

Please mark number one on the answer sheet for those items which you feel may be necessary for a salesman to know in order to determine a customer's needs and mark number two for those which you feel may be unnecessary.

Answer key: 1 = necessary 2 = unnecessary

- | | |
|-----|--------------------------|
| | <u>Item</u> |
| 28. | The customer's name |
| 29. | Customer's buying habits |
| 30. | Customer's interests |
| 31. | To know the product |

(Post-test Two)

Section IV: Types and Characteristics of Turfgrasses

Matching - match the vegetative characteristics and the growth habits and/or cultural requirements in the right hand column with the appropriate turfgrasses in the left hand column.

- | <u>Turfgrass</u> | <u>Vegetative Characteristics</u> |
|-------------------------------------|---|
| 32. Colonial
Bentgrass | 1. Boat-shaped leaf tips; folded in the bud; 90° leaf angle |
| 33. Tall
Fescue | 2. Spreads by rhizomes; folded in the bud and has bristle-like leaf blade |
| 34. Merion
Kentucky
Bluegrass | (vegetative characteristics continued) |

Vegetative Characteristics (cont.)

3. Rolled in the bud; small pointed leaf blades with prominent veination; normally does not produce either stolons or rhizomes.
4. Rolled in the bud and has short auricles. Prominent veination in the leaf blade; has a broad and course leaf blade and does not spread by rhizomes.

- | | <u>Turfgrass</u> | <u>Growth Habit and/or Cultural Requirement</u> |
|-----|---------------------|---|
| 35. | Kentucky Bluegrass | 1. Shade tolerant; will grow well in droughty soils; spreads by rhizomes but is slow growing. Needs heavy fertilization, watering, and frequent clipping or will be crowded out by other grasses. |
| 36. | Creeping Red Fescue | |
| 37. | Creeping Bentgrass | 2. Used in shady areas, high wear resistance, can survive in wet or dry conditions. Not well adapted for Michigan lawns. |
| | | 3. Grows best in sunny areas and on fertile well-drained soil. It is a perennial cool season turfgrass. |
| | | 4. Has a high moisture and fertility requirement; tolerates a wide variety of soil conditions; can be clipped very close. |

Multiple Choice - Select the answer which best completes the statement or answers the question. Mark your answer in the appropriate space on the answer sheet.

38. The most drought tolerant of the following listed grasses is:
 1. Kentucky bluegrass
 2. Creeping bentgrass
 3. Tall fescue
 4. Perennial ryegrass

39. The grass most likely to survive under heavy wear is:

1. Tall fescue
2. Red fescue
3. Bentgrasses
4. Kentucky bluegrass

40. The grass most likely to grow well in shade is:

1. Tall fescue
2. Kentucky bluegrass
3. Perennial ryegrass
4. Red fescue

(Post-test Three)

Section V: Turfgrass Establishment, Care, and Maintenance

List in chronological order the procedure or steps to follow in establishing a turfgrass by seeding. (Some steps are listed for you.)

Preparing the Seedbed

- A. Control weedy perennial grasses
- B. Complete final contour

41. C. _____
42. D. _____
43. E. _____

Planting the Lawn

Seeding - seed uniformly

Care after Seeding

- A. Rake lightly - do not cover by more than $\frac{1}{4}$ " of soil

44. B. _____
45. C. _____
46. D. _____
47. E. _____
48. F. _____
- G. Follow good management practices on established turf

Complete the following mathematical problem:

A customer wishes to purchase Kentucky bluegrass seed for his 150' X 90' lawn. At the rate of $1\frac{1}{2}$ pounds of seed per 1,000 square feet, how many lbs. of seed would be needed? How much would the seed cost the customer if Kentucky bluegrass seed sells for \$.85 per pound?

(Select the answer which is most nearly correct and mark the corresponding number on the answer sheet.)

49. Seed Needed (pounds)

- 1. 10
- 2. 15
- 3. 20
- 4. 25
- 5. 30
- 6. 35

50. Cost of Seed

- 1. \$ 8.50
- 2. \$12.75
- 3. \$17.00
- 4. \$21.25
- 5. \$25.50
- 6. \$29.75

Suppose you analyzed a customer's lawn and decided that the best course of action for the customer to follow would be renovate his lawn. List 6 of the 10 steps you would recommend to the customer to follow in renovating his lawn.

51.

52.

53.

54.

55.

56.

Multiple Choice: Select the best answer which completes the statement or answers the question. Mark your answer in the appropriate space on the answer sheet.

57. The most common mowing height for bluegrass tees is:

1. $\frac{1}{2}$ inch
2. 1 inch
3. $1\frac{1}{2}$ inches
4. 2 inches

58. Vertical mowing is a cultural practice designed to:

1. Correct the development of grain and thatch
2. Correct the effects of over-fertilization
3. Improve the putting conditions of a golf green
4. Renovate the old turf for re-seeding

59. A time of seeding in central Michigan which would probably give the best chance of success is:

1. March 15 - April 15
2. August 15 - September 1
3. September 2 - September 20
4. September 21 - October 15

60. Thatch is the result of:

1. A nutrient deficiency
2. Insect damage
3. Poor soil drainage
4. An accumulation of dead plant material

61. The optimum height to mow Kentucky bluegrass for a home lawn is:

1. $\frac{3}{4}$ inch
2. 1 inch
3. $1\frac{1}{2}$ inches
4. $1\frac{1}{2}$ -2 inches

62. The grass most likely to survive and grow well under close clipping is:

1. Red fescue
2. Bentgrasses
3. Perennial ryegrass
4. Kentucky bluegrass

Appendix I-2

TURFGRASS EXAMINATION PART II

Name _____ Student Number _____

(Post-tests Four through Six)

Begin with a new answer sheet. Fill in the top of the sheet as you did with Part I except indicate Part II for the form of the exam.

(Post-test Four)

SECTION I: Fertilization and Liming

Answer the following statements either true or false. Blacken number one on the answer sheet if you believe the statement is true. Blacken number two if you feel the statement is false.

Key: 1 = True 2 = False

1. Liming reduces harmful concentrations of aluminum, manganese, and iron.
2. Liming increases the availability of phosphorus.
3. All liming materials supply magnesium to the soil.
4. Liming promotes unfavorable microbial activity.

Matching - Match the characteristics of the right hand column with the correct fertilizer element in the left hand column.

- | <u>Fertilizer Element</u> | <u>Characteristic</u> |
|---------------------------|--|
| 5. Nitrogen | 1. Promotes root growth |
| 6. Potash | 2. Stimulates rapid growth |
| 7. Phosphorus | 3. Promotes hardiness and disease resistance |
| | 4. Raises the soil pH. |

Multiple Choice: Select the best answer.

8. The best pH range for most turfgrasses is:

1. 4.5 - 5.0
2. 5.0 - 6.0
3. 6.0 - 7.0
4. 7.0 - 7.5

(Post-test Five)

SECTION II: Identification and Control of Weeds

Matching - Match the control in the right hand column with the appropriate weed in the left column. You may use an answer more than once.

<u>Weed</u>	<u>Herbicide Control</u>
9. Annual bluegrass	1. Arsenates, lead and calcium; azak; benefin, bensulide; DCPA; siduron; or DSMA
10. Crabgrass	2. 2,4-D
11. Ground Ivy	3. Amitrol-T or dalapon
12. Mouse-eared chickweed	4. MCPP or silvex
13. Plantains	5. Arsenates, lead and calcium or bensulide
14. Thistles	
15. White Clover	
16. Bentgrasses	

Suppose two liquid herbicides which control broad leaf weeds were sold by your firm. Assume that a customer wanted to buy the most economical herbicide to control broad leaf weeds in his lawn. Given the following information, which herbicide would you recommend? (Compare on a cost per 100 square feet of coverage. Please carry out your answers to two decimal places.)

- A. One quart \$1.98 - Covers 4,120 square feet
- B. One quart \$4.10 - Directions: Use 3 tablespoonfuls per gallon of water. Each gallon of mixture covers 430 square feet of lawn.

NOTE: For Conversion:

One gallon = 128 liquid ounces

One cup = 8 ounces

Two cups = one pint

Two tablespoonfuls = one fluid ounce

(Please show your work)

Answers

	<u>Herbicide</u>	<u>Sq. feet covered</u>	<u>Cost per 100 square feet of lawn covered</u>
17.	A.	4,120	
18.	B.		
19.	Which herbicide would you recommend to the customer:_____		

List three good cultural practices which should result in weed control in a turf.

20. _____

21. _____

22. _____

PART III

(Post-test Six)

This part of the test will measure how well you can identify actual specimens of turfgrass seeds, turfgrass plants, and weeds. The specimens are labeled by number.

Match the turfgrass listed in the right hand column with the appropriate seed or plant specimen. Mark your response on the separate answer sheet.

<u>Actual Seed Samples</u>	<u>Turfgrass</u>
23.	1. Kentucky bluegrass
24.	2. Tall fescue
25.	3. Creeping bentgrass
	4. Creeping red fescue

<u>Actual Turfgrass Samples</u>
26.
27.
28.
29.

Actual Weed Specimens

Please list the actual name of the specimen in the blanks below. If a plantain, chickweed, thistle, or clover, etc., is present, please list the full name such as common chickweed, etc. There is no penalty for guessing.

- | | |
|-----------|-----------|
| 30. _____ | 36. _____ |
| 31. _____ | 37. _____ |
| 32. _____ | 38. _____ |
| 33. _____ | 39. _____ |
| 34. _____ | 40. _____ |
| 35. _____ | 41. _____ |

Appendix I-3

POST-TEST EXAMINATION, PART IV

Name _____ Student Number _____

(Post-test Seven)

This part of the test is timed. The purpose is to see how well you can perform in answering questions with the use of references. You should read the problems or questions and then locate the answers in the references as quickly as possible. You are cautioned not to foresake the accurateness of the answer for the sake of speed. When you complete this section, hold up your hand and your instructor will indicate the lapsed time. Enter this time in the blanks provided. The speed to completion will not affect your grade.

42. Assume that a customer came to you for fertilizer recommendations for his merion bluegrass lawn for the year. He has 10,000 square feet of lawn area. Refer to Tables one and two of the handout, Selecting A Turf Fertilization Program by Paul E. Rieke. Select a nitrogen carrier fertilizer from Table 2 and indicate the amount of fertilizer needed to satisfy the requirements as stated in Table 1.

Answer the following questions:

- A. Nitrogen carrier fertilizer selected _____
- B. Pounds of nitrogen which you recommended per 1,000 square feet per year. (use a whole number) _____
- C. Pounds of nitrogen carrier fertilizer (indicated in answer A) in which you would sell the customer to satisfy his lawn nitrogen requirements for the year. _____

(Please show work)

Refer to the Michigan State University Turfgrass Field Day handout to complete this part of the test.

Interpretation of Data

Mark number one on the answer sheet for each statement that is true and can be proven by the data in Tables 10 and 11. Mark number 2 for each statement that may or may not be true but cannot be answered sufficiently from the data. Mark number 3 for each statement that is incorrect according to the data in the tables.

Key: 1 = True
2 = Insufficient data
3 = False

Table 10, page 16.

43. The quality of the merion bluegrass turf decreased from 1967 to 1968 with the use of ureaformaldehyde.
44. The use of 33-0-0 in May and November resulted in a better quality turf in 1968 than when only applied in May.
45. The use of fertilizer reduced the number of dandelions per 1,000 square feet of the merion bluegrass turf.

Table 11, page 17.

46. The quality ratings of all three bluegrass plots were better at the 8 lbs./1,000 square feet rate when compared with the 2 lbs./1,000 square feet ratings.
47. Windsor is a better turfgrass than Delta.
48. Dandelion population is not affected by increased nitrogen rates.

Read the following problems, then answer the question by finding the answers in the Turfgrass Field Day report. The purpose of the problems is to evaluate your effectiveness of finding answers to questions or problems in a fast and efficient manner.

49. Suppose a customer was interested in establishing a bentgrass golf green in his back yard. What variety or varieties would you recommend to him based only upon the 1969 visual quality ratings? (Select only one)
NOTE: Planting stock must be available to him.

Variety recommended _____

50. Suppose a customer with a Windsor Kentucky bluegrass lawn was interested in obtaining a high quality lawn. Based upon the research, how many pounds of nitrogen per 1,000 square feet of turf would you recommend that he apply in order to obtain a quality lawn?

Pounds of N recommended: _____

- 51.-53. Suppose a customer came to you for advice on selecting a turfgrass for the part of the lawn to the north of his home. The soil is very sandy and many parts are shaded quite heavily due to the home and many large trees. The customer does not irrigate and prefers not to irrigate his turf.

The front lawn of the customer is on the sunny south side of the home. This part of the lawn is his "show" area.

The customer is interested in only a "functional" back yard. One in which grass will grow and survive over the winter. What turfgrass would you recommend to the customer for his northern portion of the lawn and why?

Turfgrass recommended by you: (circle the correct answer)

Answers

1. ~~Kentucky~~ bluegrasses
2. Tall fescue
3. Ryegrass
4. Bentgrasses
5. Red fescue

Why did you recommend the above turfgrass? (please be brief)

THE END Time to completion: _____ minutes.

APPENDIX J

APPENDIX K

Appendix K

FINAL TEACHER SURVEY

Return to:

Urban Oen
 4465 Kenneth
 Apt. 210D
 Okemos, MI 48864

A. Background

1. Name _____
 School _____
 Address _____
 School telephone number _____
 Home telephone number _____
2. Number of years of teaching experience _____
3. Have you ever taught lessons or units of instruction on some phase of turfgrass or lawn care, culture, or management.
 Yes _____ No _____
4. Number of students enrolled in your classes and grade level who studied turfgrass sales and service. (This is needed because some students did not take all the tests and we need an accurate count.)

	<u>No. enrolled who participated</u>
Freshmen.	_____
Sophomores.	_____
Juniors.	_____
Seniors	_____

B. Evaluation of the Manual

The following suggestions concerning the turfgrass manual were made by teachers enrolled in an independent study. Please indicate your agreement or disagreement with their suggestions and add your own comments to each item.

	Strongly agree	Agree	Un- certain	Dis- agree	Strongly disagree
1. The unit and reference materials were complete and accurate..... Comments:					
2. The instructor has a great deal to do with the success or failure of the unit. Comments:					
3. Instructors need to be very familiar with the units before actual instruction begins.... Comments:					
4. Upon completion of each lesson, the student should complete a teacher administered quiz which would be graded by the teacher for feedback... Comments:					
5. Teacher administered quizzes should be administered weekly. Comments:					
6. The turfgrass unit can be used by individual students wishing to study turfgrass..... Comments:					

	Strongly agree	Agree	Un- certain	Dis- agree	Strongly disagree
7. Students felt lost without a standard with which they could compare themselves..... Comments:					
8. Students need to be motivated by the teacher in order to study the unit..... Comments:					
9. The lesson behavioral objectives are complete, accurate and appropriate..... Comments:					
10. The lessons are very appropriate..... Comments:					
11. The introduction section of the manual provides the students with a good understanding of turfgrass sales and service..... Comments:					
12. The text section provides the students with a good idea of the things they need to learn in the lessons..... Comments:					

	Strongly agree	Agree	Un certain	Dis-agree	Strongly Disagree
13. The learning activities are very appropriate in developing understandings, knowledges and skills needed by a beginning employee in turfgrass sales and service..... Comments:					
14. The student self evaluation questions are adequate in determining whether the students master the unit..... Comments:					
15. The audiovisual materials (slides, references, etc.) are very helpful and add to understanding of the unit..... Comments:					
16. Other comments on evaluation of the manual:.....					
<u>C. Project Procedure</u>					
1. The study was too large..... Comments:					

	Strongly Agree	Agree	Un- certain	Dis- agree	Strongly disagree
2. The manual should be studied throughout the year and on a seasonal nature such as much of the agriculture curriculum.. Comments:					
3. Most high school students are capable of disciplining themselves to study on an individualized basis.... Comments:					
4. An entire class should not be given individualized material but rather selected individuals who are interested in the subject and who seek to become qualified for entry jobs and continued advancement should be given the materials. Comments:					
5. Poor readers do not react well to this unit..... Comments:					
6. Other comments on project procedure...					

	Strongly Agree	Agree	Un- certain	Dis- agree	Strongly Disagree
D. <u>Project Evaluation Techniques</u>					
1. There were too many pre-tests..... Comments: (How many would you recommend?)					
2. The type of pre- tests were ade- quate..... Comments: (Which ones would you recommend?)					
3. The post-tests were comprehensive and adequate..... Comments:					

4. Other comments on project evaluation:

E. Other specific comments concerning this study not covered
elsewhere in this questionnaire:

APPENDIX L

Appendix LSCHOOLS, TEACHERS, AND NUMBER OF STUDENTS
PARTICIPATING IN THE STUDY

High School	Vocational Agri- culture Instructor	Number of Students Participating in the Study			
		Freshmen	Sophomores	Juniors	Seniors
1. Cedar Springs...	Melvin Matchett.....		1	18	11
2. Greenville.....	Eldon Horton.....		2	11	4
3. Central Mont- calm.....	Keats Rasmussen.....			1	13
4. St. Louis.....	Ken Kernstock.....			22	
5. Manchester.....	Roger Merillat.....			15	
6. Bay City Handy..	Clarence Miller.....			9	6
7. Belding.....	Richard Bird.....			15	16
8. Lakewood.....	Ronald Stevens.....			24	
9. Carson City-- Crystal.....	Maxwell Simon.....			17	14
10. Chesaning.....	Norwin Braun.....		10	4	
11. Mt. Pleasant....	Gordon Struble.....			8	5
12. Big Rapids.....	Warren Reynolds.....			10	7
13. Bath.....	William Vondrassek...		4	10	1
14. Portland.....	Clark Bullen.....			10	13
15. Saranac.....	Lyle Plews.....			21	7
16. Caledonia.....	William Harrison.....	12	1	7	7
17. Chippewa Hills..	Daniel Latendresse...			13	9
18. Bay City Central.....	Max Brown.....			8	8
19. Hopkins.....	Roy Miller.....			14	12
20. Romeo.....	David Howell.....			8	17
21. Ashley.....	Howard Bryant.....			8	7
22. Coopersville....	Roger Peacock.....			25	25
23. Ionia.....	Charles VanDenburg...			15	15
24. Bangor.....	Lynn Munson.....			10	10
25. Montabella.....	John Heron.....			11	9
26. Rockford.....	Fred Bartlett.....			12	13
27. Ovid-Elsie.....	Al Ackley.....			9	7
28. Laingsburg.....	Al Stoutenburg.....			8	7
29. Sparta.....	Arnold Mokma.....			11	5
Totals		12	18	354	248

APPENDIX M

1. The first part of the document is a letter from the President of the United States to the Congress, dated January 1, 1861.

2. The second part is a report from the Secretary of the Treasury, dated January 1, 1861.

3. The third part is a report from the Secretary of the Interior, dated January 1, 1861.

4. The fourth part is a report from the Secretary of the Navy, dated January 1, 1861.

5. The fifth part is a report from the Secretary of the War, dated January 1, 1861.

6. The sixth part is a report from the Secretary of the State, dated January 1, 1861.

7. The seventh part is a report from the Secretary of the Army, dated January 1, 1861.

8. The eighth part is a report from the Secretary of the Marine Corps, dated January 1, 1861.

9. The ninth part is a report from the Secretary of the Coast and Geodetic Survey, dated January 1, 1861.

10. The tenth part is a report from the Secretary of the Smithsonian Institution, dated January 1, 1861.

11. The eleventh part is a report from the Secretary of the United States Mint, dated January 1, 1861.

12. The twelfth part is a report from the Secretary of the United States Land Office, dated January 1, 1861.

13. The thirteenth part is a report from the Secretary of the United States Patent Office, dated January 1, 1861.

14. The fourteenth part is a report from the Secretary of the United States Court of Claims, dated January 1, 1861.

15. The fifteenth part is a report from the Secretary of the United States Court of Appeals, dated January 1, 1861.

16. The sixteenth part is a report from the Secretary of the United States Supreme Court, dated January 1, 1861.

17. The seventeenth part is a report from the Secretary of the United States District Court, dated January 1, 1861.

18. The eighteenth part is a report from the Secretary of the United States Circuit Court, dated January 1, 1861.

19. The nineteenth part is a report from the Secretary of the United States Court of Customs and Excise, dated January 1, 1861.

20. The twentieth part is a report from the Secretary of the United States Court of Commerce, dated January 1, 1861.

21. The twenty-first part is a report from the Secretary of the United States Court of Admiralty, dated January 1, 1861.

22. The twenty-second part is a report from the Secretary of the United States Court of Appeals, dated January 1, 1861.

23. The twenty-third part is a report from the Secretary of the United States Court of Appeals, dated January 1, 1861.

24. The twenty-fourth part is a report from the Secretary of the United States Court of Appeals, dated January 1, 1861.

Appendix MCOMMENTS OF THE TEACHERS ON THE FINAL
TEACHER SURVEY*A. Evaluation of the manualItem Evaluated

1. The unit and reference materials were complete and accurate.
Comments:
2. The instructor has a great deal to do with the success or failure of the unit.
Comments:
 - 2.1. Very important (1) I
 - 2.2. Orientation is extremely important (1) I
3. Instructors need to be very familiar with the units before actual instruction begins.
Comments:
4. Upon completion of each lesson, the student should complete a teacher administered quiz which would be graded by the teacher for feedback.
Comments:
 - 4.1. Could be graded by the students for self-evaluation (1) I
 - 4.2. I'm not sure it's for feedback. It also depends on the method of teaching. (1) L-D
5. Teacher administered quizzes should be administered weekly.
Comments:
 - 5.1. Quizzes should be administered at the completion of a unit of instruction. (1) I
 - 5.2. Quizzes should be administered only at the end of a lesson. Students should keep a notebook of lessons completed to be checked. (1) I

* () = number indicating

I = Comments by teachers of the individualized instruction method

L-D = Comments by the teachers of the lecture-discussion method

6. The turfgrass unit can be used by individual students wishing to study turfgrass.
 Comments:
 - 6.1. The unit is real fine for a student interested in a turf career. (1) I
 - 6.2. The unit will work very well. (1) I
 - 6.3. The unit was complete enough for a student to follow. (1) L-D

7. Students felt lost without a standard with which they could compare themselves.
 Comments:
 - 7.1. Depends on the student. Many students felt lost. Those who had an interest had little trouble. (1) I

8. Students need to be motivated by the teacher in order to study the unit.
 Comments:
 - 8.1. Students need to be motivated by some laboratory work as a class. (1) I
 - 8.2. Students need to know "why"; not because the teacher feels it important. (1) I
 - 8.3. Generally true. (1) L-D
 - 8.4. There are some exceptions. (1) L-D
 - 8.5. Not always but usually. (1) L-D

9. The lesson behavioral objectives are complete, accurate, and appropriate.
 Comments:
 - 9.1. The objectives are too idealistic for high school students. (2) I
 - 9.2. Many students had difficulty relating to some of the behavioral objectives. (1) I
 - 9.3. Objectives are important in any occupational study. (1) L-D

10. The lessons are very appropriate.
 Comments:
 - 10.1. Most of them are appropriate. (1) L-D
 - 10.2. Varies for some students. (1) L-D

11. The introduction section of the manual provides the students with a good understanding of turfgrass sales and service.
 Comments:
 - 11.1. Only for urban areas. (1) I
 - 11.2. More needs to be added by the teacher. (1) L-D
 - 11.3. More background is needed. (1) L-D
 - 11.4. Field trips need to be added. (1) L-D
 - 11.5. The introductory section should be better. It should cover the broad field as well as specific fields. (1) L-D

12. The text section provides the students with a good idea of the things they need to learn in the lessons.
 Comments:
 12.1. Parts of the text needs to show areas of interrelationships. (1) I
13. The learning activities are very appropriate in developing understandings, knowledges and skills needed by a beginning employee in turfgrass sales and service.
 Comments:
 13.1. Only from a classroom situation. (1) I
 13.2. The learning activities are appropriate if the geographical area has the needed facilities to work with: (golf courses, garden centers, etc.). (1) L-D
14. The student self-evaluation questions are adequate in determining whether the students master the unit.
 Comments:
 14.1. They would be if all students were honest with themselves. (1) I
 14.2. Too hard for first time through students. (1) L-D
15. The audiovisual materials (slides, references, etc.) are very helpful and add to understanding of the unit.
 Comments:
 15.1. Students need the variation. It speeds up learning and makes the material more interesting to poor readers. (1) L-D
16. Other comments on evaluation of the manual:
 - 16.1. There was too much material to cover in one unit. (1) I
 - 16.2. The manual is too thick; many of the facts on fertilization, etc., are covered in other lessons. (1) I
 - 16.3. Provisions should be made for notes on some of the learning activities. (1) I
 - 16.4. The manual was put together very well. (1) L-D
 - 16.5. The manual was more complete than one on almost any other field. (1) L-D
 - 16.6. We used some demonstrations and work experience on school grounds. More slides could be added. (1) L-D

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B. Project Procedure

1. The study was too large.

Comments:

- 1.1. Yes, for individualized study. (1) I
- 1.2. Yes, for the length of time allowed (1) L-D
- 1.3. Depends on the interest of the student
(1) L-D
- 1.4. The unit should be divided up and studied
over a period of years. (1) L-D
- 1.5. It took too much time to cover in our classes.
(1) L-D

2. The manual should be studied throughout the year and on a seasonal nature such as much of the agriculture curriculum.

Comments:

- 2.1. I feel a student should be allowed to continue when he is really interested and wants to go ahead. (1) I
- 2.2. Spring or fall are okay. (1) L-D

3. Most high school students are capable of disciplining themselves to study on an individualized basis.

Comments:

- 3.1. Very few are. (1) I
- 3.2. Students need help at first to get used to this. (1) I
- 3.3. Many of the students said they should be made to study (students were not mentally prepared for self-control). (1) I
- 3.4. With some channeled guidance. (1) I
- 3.5. Students need much more work in this area.
(1) I
- 3.6. Many need help. (1) L-D
- 3.7. Maybe, if they are serious on college preparatory programs. (1) L-D

4. An entire class should not be given individualized material but rather selected individuals who are interested in the subject and who seek to become qualified for entry jobs and continued advancement should be given the materials.

Comments:

- 4.1. Depends on the class and the general class attitude (1) I
- 4.2. All should try; some will need help. (1) L-D
- 4.3. Even though I didn't use the individualized method, I know some of my students wouldn't be capable of doing it on their own. (1) L-D
- 4.4. Not until after one time through or until some sort of pre-study of some selected area is completed. (1) L-D

5. Poor readers do not react well to this unit.

Comments:

- 5.1. Very true; they became upset by it. (1) I
- 5.2. There is too much reading required for the poor reader. (1) I
- 5.3. Poor readers need more manual labor type jobs that they can learn by doing. (1) I
- 5.4. They liked visual materials and experiences best. (1) L-D

6. Other comments on project procedure:

- 6.1. Perhaps more audiovisual materials in all areas would help the poor reader. (1) I
- 6.2. The manual works better on an individual basis rather than as group work. (1) L-D

C. Project Evaluation Techniques

1. There were too many pre-tests.

Comments: (How many would you recommend?)

- 1.1. Recommend one pre-test. (2) I and L-D
- 1.2. School records should be used. (1) - I
- 1.3. Not more than two. (1) L-D
- 1.4. Some tests such as the Eysenck Personality Inventory only need to be administered once in high school. The rest are okay for at least a semester of time on turf. (1) L-D
- 1.5. Not sure. (1) L-D
- 1.6. My classes seemed to think there were too many pre-tests but I did not. (1) L-D

2. The type of pre-tests were adequate.

Comments: (Which ones would you recommend?)

- 2.1. Pre-study analysis. (1) I
- 2.2. Combination interest and knowledge test. (1) I
- 2.3. It depends on the information you are expecting to acquire from your unit. (1) I
- 2.4. Reading comprehension. (1) L-D
- 2.5. There were too many. (1) L-D
- 2.6. All of them. (1) L-D

3. The post-tests were comprehensive and adequate.

Comments:

- 3.1. The post-tests were too long. They were difficult to give with students absent. (1) I
- 3.2. The post-tests were very good. (1) I
- 3.3. Depends on the outcomes. (1) I

4. Other comments on project evaluation:

- 4.1. I think the technique is good if adapted to other subject areas for this type of student (rural-agriculture). (1) I
- 4.2. The pre-tests should all be given at the same time. (1) I
- 4.3. There should have been an oral examination for the students to see how well they can use the material at hand. (1) I
- 4.4. The length of time for doing some of the units needs to be expanded as much subject matter must be taught on a seasonal basis thus interrupting the study of turfgrass. (1) I
- 4.5. I believe group instruction would be better than the individualized approach. Many students are too immature to work on their own. (1) I
- 4.6. Due to my poor health, I failed to complete the study and consequently don't feel I am in a position to make an evaluation. I do feel that I learned as much as my students and it was fun working with you. (1) L-D
- 4.7. Evaluation was adequate. (1) L-D
- 4.8. The students should sometimes rate each other. (1) L-D
- 4.9. I did not take sufficient time. I tried to cover too much material in too little time. (1) L-D

D. Other specific comments concerning this study not covered elsewhere in this questionnaire:

- 1.1. I feel that block time rather than one hour would suit and benefit this unit material and manual. (two-three hour blocks of time). (1) I
- 1.2. Slow learners spent a lot of time reviewing A-V materials. (1) I
- 1.3. The students have to be mentally prepared and matured to work without somebody pushing them all the time. The students that I had participate in the program were not mentally prepared for the program. The class that will be juniors next year would be a class that I feel could benefit from the units on turfgrass. (1) I
- 1.4. The juniors and seniors are set in their ways. This study should have been aimed at freshmen and sophomores. I have been using the units with them and they are doing real well. (1) I

- 1.5. It would be better to piece-meal the units out, in the order desired by the instructor. The size scares most of the students, into a negative state of mind. (1) I
- 1.6. Thanks for the opportunity to participate in this study. (1) I
- 1.7. I would like to see a unit developed on animal science or plant science. (1) I
- 1.8. I wished resource material organized as you have done for this area was available for many other areas. Vo-Ag teachers simply don't have the time or are that put together in such a way as to do this on their own. (1) I
- 1.9. We have to have rather specific material and information such as your slides, tapes, and other material. Rather vague unit plans are quite useless. (1) I
- 1.10. Units need to be spelled out in detail. The furnishing of detailed references and audiovisual packets are a good idea. This unit is a big improvement over the other units developed by the Agricultural Education Department. (1) I
- 1.11. Very interesting project. Very well organized on your part. (1) L-D
- 1.12. We needed more time to go over the material and order visual aids before teaching the units. (1) L-D
- 1.13. Could use more ideas for motivation when all in a class cover it together. (1) L-D
- 1.14. The project was longer and took more time than I had planned on, which means that I didn't spend as much time as necessary to do a good job. I'm sure my students did a poor job on the post-test. It also came at the wrong season for me. (1) L-D
- 1.15. It was too advanced without more background material in other years of study. (1) L-D
- 1.16. I felt that the material was adequate; however, we didn't receive the material (units, etc.) early enough to order needed material, such as educational films, bulletins, etc. (1) L-D

- 1.17. I would like to do a follow-up again next year on an individual student basis, providing scheduling of time could be worked out. This was a very helpful experience for my classes and myself.
(1) L-D
- 1.18. My students would have preferred to study a different subject. A short unit without all the testing would have been much better. I should have known better than to participate in this project in a farming area. (1) L-D

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