AN EXPERIMENTAL STUDY TO EVALUATE THE EFFECTIVENESS OF AN INDIVIDUALIZED INSTRUCTIONAL METHOD AND THE LECTURE - DISCUSSION METHOD FOR TEACHING VOCATIONAL AGRICULTURE CLASSES

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ABSTRACT

AN EXPERIMENTAL STUDY TO EVALUATE THE EFFECTIVENESS OF AN INDIVIDUALIZED INSTRUCTIONAL METHOD AND THE LECTURE-DISCUSSION METHOD FOR TEACHING VOCATIONAL AGRICULTURE CLASSES

By

Walter William McCarley

Purpose. To evaluate the effectiveness of an individualized instruction-laboratory method as compared to the lecture-discussion-laboratory method of instruction as measured by: (1) student achievement, (2) student interest in agriculture and (3) student academic rank; (4) to construct a student personality profile and determine the extent of variation in the student personality profiles for the two methods of instruction.

Method. Four selected Michigan high schools with a total of 138 junior and senior vocational agriculture students participated in this study. Each teacher taught one class by the lecture-discussion method and one class by the individualized instructional method. The researcher prepared a forty-six page guidebook and assembled grain grading slides that were used by the individualized instructional group; lesson plans and grain grading specimens of equivalent materials were prepared by the researcher for the lecture-discussion group. Both groups used the same grain grading laboratory equipment and grain grading samples, and they took identical pretest and posttest (Part A - paper and pencil and Part B - laboratory performance).

Student agricultural interest was assessed with the Pennsylvania Vocational Agriculture Interest Inventory; student overall academic rank was secured from the local high school counselor, and student personality was assessed with the Guilford-Zimmerman Temperament Survey. Students in the individualized instructional group completed an evaluation form for the unit. One lesson for each method of instruction was tape recorded. A workshop for the cooperating teachers was held to provide teachers with mimeographed instructions and to answer any questions on the procedure to use.

Findings. The individualized instructional method was found to be significantly better than the lecture-discussion method of instruction. It was found that students acquired more knowledge and skills using a combination of psychomotor and cognitive skills than when using cognitive skills alone. Students in the individualized instructional group were more enthusiastic and tried harder, regardless of their academic rank. Student agricultural interest was related to student achievement when the assignment required the use of psychomotor and cognitive skills. Student academic rank was related only for cognitive skill requiring a mathematical calculation. The student personality profile revealed that there was no significant difference in the mean percentile rank of eight of the ten personality variables measured by the Guilford-Zimmerman Temperament Survey. The two personality variables, general activity and personal relations, were significantly greater, at the .05 level, for the lecture-discussion method of instruction. The student evaluation of the individualized instruction unit clustered toward the favorable end of the semantic differential scale. The tape recordings yielded no audio evidence that teachers deviated from the instructions presented at the workshop.

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By

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INTRODUCTION

This decade has been one of transition of vocational agriculture from the traditional preparation for farming to the preparation for farming and also the preparation for employment in agricultural business and industry. The Vocational Education Act of 1963 has broadened the vocational agricultural curriculum and has resulted in students with different vocational objectives being enrolled in the same classes. Some of the basic principles are needed by each of these groups of students, but the application from one occupation to another may be quite different.

The development, publication and evaluation of instructional materials have not kept pace with the broadened vocational agricultural curriculum. Thus, an important challenge to the agricultural educator today is the analyzing, rethinking and remolding of many facets of the vocational agricultural curriculum and instructional methods. Dr. J. Lloyd Trump states:

> The all-important key to continued growth ... will be the development of the experimental point of view--the constant seeking of better ways to teach. "Better products through research" might also be a useful slogan for education.[1]

Skinner states, "Education must play its part. It must accept the fact that a sweeping revision of educational practices is possible

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[1]J. Lloyd Trump and Dorsey Baynham, Guide to Better Schools: Focus on Change (Chicago: Rand, McNally and Company, 1961), p. 51.

and inevitable."[2]

New educational technology can help provide adequate occupational information. Dale urges careful planning.[3]

These statements emphasize the need for the development of a better and more efficient instruction. Glaser suggests, "Let us try to apply as much as we know; it might be enough to make a difference."[4]

This chapter will: (1) present information related to the need for the study, (2) state the problem in detail, (3) present definition of terms for a better understanding and interpretation and (4) state the assumptions on which this study is based.

A. Need for the Study

Traditionally the teacher of vocational agriculture surveyed the local community and identified the major and minor agricultural enterprises in the community and on this basis constructed a curriculum that would communicate the necessary knowledge, skills and attitudes needed by students preparing for farming. Clark indicates that the teacher of vocational agriculture has traditionally individualized instruction in several ways, namely:

1. Each student conducted on the home farm different kinds of projects in his Supervised Farming Program.

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[2]B. F. Skinner, "The Science of Learning and the Art of Teaching," Harvard Educational Review, XXIV (Spring, 1954), pp. 86-97.

[3]Edgar Dale, "The Teacher and Technology," The News Letter, XXIX (Winter, 1963), p. 1.

[4]Robert Glaser, "Christmas Past, Present, and Future," Contemporary Psychology, V (June, 1960), pp. 24-28.

2. The teacher made classroom study assignments so that students could apply the subject matter to the home farm situation.

3. The teacher may assign different references to students in relation to their interests or reading ability.

4. In some instances the teacher of vocational agriculture used different evaluation procedures for different students.[5]

An approach with more versatility is needed to meet the vocational objectives of students who are enrolled in vocational agriculture. American agriculture has changed rapidly. The size of farms is much larger, and a large amount of capital is required to become established in farming. Presently, farms are more specialized, i.e., crop farms, dairy farms or poultry farms. Thus, there is the occupational opportunity to employment as technical specialist on these farms.

Many activities once performed on the home farm are now being performed by agricultural businesses and usually performed more efficiently. Also, many new products and materials such as chemicals, fertilizers and insecticides are now handled by agricultural businesses. There is now a high degree of specialization in terms of farm supplies and processing of farm products.

Vocational agriculture has been expanded horizontally to include not only boys who are preparing for farming, but also boys and girls who are interested in a particular phase of technical agriculture or agriculture business. Also, vocational agriculture has been expanded vertically to include full-time, post-high and specialized out of school youth and adult programs.

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[5]Raymond Clark, "Individualizing Instruction in Vocational Agriculture" (paper presented to Teachers of Vocational Agriculture, Madison, Wisconsin, July 9, 1968).

Thus, the above mentioned conditions have resulted in students with different vocational objectives being enrolled in the same classes. There has been abundant research on presentation variables and response modes, and educators are now able to describe the characteristics of a quality programed instructional program with a high degree of confidence. Michigan State University has developed a pattern for individualized instruction for vocational agriculture. The question, how well do students learn from individualized instruction as compared to another method of instruction, can not be answered with any confidence. This study will investigate one method of solving this problem.

B. The Problem

The evaluation of a pattern for individualized instruction is the basis for this study. One of the results of students with different vocational objectives being enrolled in the same class is that the traditional lecture-discussion method is not versatile enough for instructional needs.

Succinctly stated, this study will seek probable answers as a solution to the following questions:

1. What is the effect of teaching by the individualized instruction-laboratory method as compared to the lecture-discussion-laboratory method on student achievement?

2. How does interest in agriculture affect student achievement when students are taught by the individualized instruction-laboratory method and the lecture-discussion method?

3. How does student academic rank in class affect student achievement when students are taught by the individualized instruction-laboratory method and the lecture-discussion-laboratory method?

4. How does student personality affect student achievement when students are taught by the individualized instruction-laboratory method and the lecture-discussion-laboratory method?

The major objective (Number One) and closely related additional objectives (Numbers Two, Three and Four) of this study are:

1. To evaluate the effectiveness of an individualized instruction-laboratory method as compared to the lecture-discussion-laboratory method of instruction, as measured by student achievement.

2. To evaluate the effectiveness of the individualized instruction-laboratory method as compared to the lecture-discussion-laboratory method of instruction, as measured by student interest in agriculture.

3. To evaluate the effectiveness of the individualized instruction-laboratory method as compared to the lecture-discussion-laboratory method of instruction, as measured by student academic rank in class.

4. To construct a student personality profile and to determine the extent of variation in student personality profile for the individualized instruction-laboratory and lecture-discussion-laboratory methods of instruction, based on student achievement on the posttest.

The major hypothesis (Number One) and closely related additional hypotheses (Numbers Two, Three and Four) tested are:

1. There will be no significant difference in teaching with the individualized instruction-laboratory method and teaching with the lecture-discussion-laboratory method, as measured by student achievement.

2. There will be no significant difference in teaching with the individualized instruction-laboratory method and teaching with the lecture-discussion-laboratory method, as measured by student interest in agriculture.

3. There will be no significant difference in teaching with the

individualized instruction-laboratory method and teaching with the lecture-discussion-laboratory method, as measured by student academic rank in class.

4. There will be no difference in student personality profile for students taught with the individualized instruction-laboratory method and students taught with the lecture-discussion-laboratory method, based on student high, medium and low achievement on the posttest.

C. Definition of Terms

The following definitions are given in order to clarify the terms which will be used frequently throughout this study. For the sake of brevity, certain contracted terms will be used throughout the remainder of the study. These are indicated in the definitions.

1. Agricultural business and industry. Refers to industry and businesses providing materials and services to farmers in the production of crops and livestock. Also included are those industries and businesses involved in marketing, processing and distributing agricultural products. Off-farm agricultural businesses and services are used synonymously in this study.

2. Agricultural production. Refers to an organization of subject matter and learning activities concerned with principles and practice in production of livestock, field crops, fruits and vegetables, fiber and other crops, on commercial and part-time farms.

3. Behavior. Refers to any visible or measurable activity displayed by the learner.

4. Cognitive. Refers to objectives which emphasize remembering or reproducing something which has presumably been learned, as well as objectives which involve the solving of some intellective task for which the individual has to determine the essential problem and then reorder

given material or combine it with ideas, methods or procedures previously learned.

5. Criterion. Refers to a test or stand by which terminal behavior may be measured and evaluated.

6. Criterion tests. Referred to in research are the standards of achievement by which the learner will be measured. Specifically, for this study these are tests of application of concepts of grain factors that determine the numerical grades.

7. Diagnostic or progress Examination. Refers to self-administered examination at the closure of a lesson and/or unit, used to determine how well the student has understood the concepts presented in the lesson.

8. Differentiated curriculum. Refers to a division of instruction within the classroom rather than dividing the total into selected groups.

9. Effectiveness. Refers to the effects a program produces, not for standards deciding how effective it ought to be in order to be regarded as of acceptable effectiveness.

10. Evaluation. Refers to an appraisal or ordinal ranking, i.e., in this study the comparison of two methods of instruction.

11. Individualized instruction. Refers to the steps taken to personalize the needs of students, each of whom is a unique individual. Personalization will sometimes involve the selection and organization of content, but it will include, as well, the creation of situations in which students will work and be considered both as individuals and as members of groups.

12. Instructional materials. Refers to any communication aids used to enhance the effects of teaching, i.e., chalkboard, flat pictures,

specimens, displays, tape recorder, still projection and programed instruction. For this study it will refer to a printed student guidebook, 2 x 2 grain slides, projector-viewer and the laboratory equipment needed to analyze grain, i.e., test weight per bushel tester, moisture tester, Gram scale and grain samples.

13. Independent study. Refers to the teaching and study procedure adapted to the differing interest, abilities and needs of individual students. This type of instruction is basic to such plans of classroom, shop and laboratory organization as a project method and the problem method. Steps in the individual study may be listed as: (1) the individual states the problem, (2) he lists questions, (3) he lists references, (4) he reviews with the teacher before consulting reference, and (5) finally he seeks answers to questions which form the basis for decisions.

14. Lecture-discussion. Refers to the traditional classroom instructional procedure utilized in vocational agriculture. Primarily verbal, it consists of problem-solving approach to instruction which relies heavily on interests and needs of student. Most vocational agriculture instruction utilizes resource materials and discussion.

15. Method of teaching. Method is a planned procedure to an end. It is the setting up of events, experiences or activities so as to get the desired behavioral objectives. Method per se does not exist, but is derived from the nature of the following raw materials: (1) the problem to be solved, (2) the group with whom the teacher will be working and (3) the behavioral objectives to be developed. It is standard procedure in the presentation on instructional materials and the content of activities. A method may, and frequently does, involve more than one instructional practice.

16. Psychomotor. Refers to objectives which emphasize some muscular or motor skill, some manipulation of material and objects, or some act which requires a neuromuscular coordination.

17. Reinforcement. Conotes a strengthening of the student's capability, readiness and disposition to behave in a certain way. The original use of the term came from Pavlov's experimentation with food and shock forms of reinforcement to animal behavior.

18. Self-instruction. Characterizes learning experiences designed to function relatively independent of the instructor. A prime consideration of this approach is maximum allowance for individual differences among students.

19. Semantic differential scale. A combination of controlled associations and scaling procedures. The student is provided with the concept to be differentiated and a bipolar set of adjectives on a scale against which to do it.

20. Supervised study. A type of study procedure in which the teacher is present and helps direct or guide the students in their quest for knowledge. It usually is recognized as one of the steps in the problem solving approach to teaching vocational agriculture. It also is considered as a phase of directed study.

21. Task analysis. Refers to a method of organizing the desired terminal behavioral objectives into logical sequence of small steps.

22. Teacher of vocational agriculture. One who is employed by a public school and who teaches one or more classes of vocational agriculture for which the local district is reimbursed by Vocational Funds.

23. Terminal behavior. Refers to the behavior you would like your learner to be able to demonstrate at the time your influence over him ends.

24. Traditional. As used in this study refers to the inherent pattern of thought and action, i.e., traditional vocational agriculture refers to the vocational agricultural curriculums prior to the Vocational Education Act of 1963.

25. Vocational education in agriculture. This term includes those educational activities relating to preparation for farming and for preparation for employment in the agricultural business and industry. The contracted term vocational agriculture has the same meaning.

26. Vocational objective. This term refers to the specific area of employment that students are preparing, i.e., preparation for farming or a specified area in agribusiness.

D. Basic Assumptions

Certain assumptions are listed below which were believed to be fundamental to the realization of the purposes of this study.

1. It is assumed that students are enrolled in the same classes with different vocational objectives. This study will be based on this assumption.

2. It is assumed that preparation for an occupation is enhanced by the teacher carrying instruction to the point of having the student make an application to the job for which he is preparing.

3. It is assumed that instructional materials as defined in this study aids in the development of the total curriculum program.

4. It is assumed that one role of teacher-training institutions

is preparing instructional materials for the teachers of vocational agriculture in the home-state.

5. It is assumed that the teachers of vocational agriculture use the instructional materials prepared by the home-state teacher-training department.

6. It is assumed that students enrolled in vocational agriculture classes are primarily farm youth.

7. It is assumed that the vocational objective of students enrolled in vocational agriculture classes is agricultural, i.e., production agriculture and/or agriculture business and service.

8. It is assumed that one of the educational responsibilities of public secondary education is to provide vocational training and vocational experiences for high school age students whose vocational objective is agricultural production and/or agricultural business and service.

CHAPTER II

REVIEW OF LITERATURE

This review of literature was conducted for the following major reasons: (1) to communicate to the reader an overview of the democratic concept of the individual and individualized instruction, (2) to acquire some knowledge of how individualized instruction has traditionally been structured for students of vocational agriculture and (3) to acquire some knowledge of related research that directly or indirectly affects this study.

In preparing this chapter, the literature has been classified into six divisions. These divisions are composed of literature which dealt with: (1) concept of individual differences not a twentieth century idea, (2) a plea for student centered education, (3) America's challenge for personalized educational experiences, (4) individualized instruction in agriculture, (5) related research and (6) conclusions.

A. Concept of Individual Differences Not a Twentieth Century Concept

Individualization of instruction is a century-old idea. Centuries ago Plato recognized the existence of human variability, specified its social implications, and proposed tests to measure traits important to the military: "... for it comes into my mind when you say it, that we are not born all exactly alike but different in nature, for all sorts of different jobs."[6]

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[6]W. H. D. Rouse (trans.), Great Dialogs on Plato (New York: The New American Library, 1956), p. 166.

Comenius, too, treated individual differences at length, admonishing teachers to consider their pupils' ages, intelligence and knowledge. He brought teachers to accept "nature", to adjust methods and materials accordingly and to start instruction at the pupil's level. Children, he observed, excel in memory and curiosity, adolescents in reasoning and adults in "the what and why."[7]

Rousseau, recognizing variation both among and within individuals, almost advanced a tutorial system. Harold Taylor, former president of Sarah Lawrence College, was led "... to insist upon some version of the tutorial system ... to assure that the student and teacher are known to each other, and that the student may thus benefit by the fact that his individuality is known, recognized, and respected."[8]

Rousseau agreed with Comenius in advocating the method of instructing through the senses, but he went further in thinking that true education consists less in knowledge than in doing. His proposed teaching methods took into account those inner senses or springs of actions known as feelings. The principle of interest was featured--the teacher's proper strategy lay in maneuvering the pupil into wanting to learn. So important to Rousseau were interest and inclination that he advocated a dependence upon them rather than upon constraint to sustain attention and perseverance in the face of difficulties and distractions.[9]

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[7]Jon Amos Komensky, The Analytical Didactic of Comenius (Chicago: University of Chicago Press, 1953), pp. 160-64, translated by V. Jelnick.

[8]Harold Taylor, "The Private Man with a Book," Saturday Review, XLIV (Jan. 7, 1961), pp. 17-19.

[9]Carroll Atkinson and Eugene Maleska, The Story of Education (New York: Bantam Books, 1962), p. 69.

Pestalozzi insisted that the natural instincts of a child should provide the motives for learning. He believed that free expression would allow the natural powers of the child to develop. Since it is nature that gives drive for life, he maintained the teacher's responsibility is to adapt instruction to each individual according to his particular changing, unfolding nature as required at the varying stages of his development.[10]

B. A Plea for Student Centered Education

1. The Colonial Schools and Academies. American educators tended to disregard the pleas of these early educational philosophers, and curriculums remained subject centered ignoring the individuality of the student.

The colonial "common schools" and later the Latin schools were established for the purpose of religious instruction. Their educational philosophy stressed reading skills as needed for an understanding of the Scriptures, and the Latin schools required students to study the Scriptures in the original tongues. These schools offered no opportunity for students to develop humanistic interests, i.e., attention to the world in which the student was living rather than the world-to-be.

Because of the lack of secular interests by the Latin schools, the prosperity of the population and the fact that most books were controlled by the church or government, the colonists began to crowd out religion. Their attention turned toward the scientific movement that was taking place in Europe. Consequently, private schools, known as academies, were established for the purpose of preparing young men to take part in the scientific movement. Although these academies served to unshackle

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[10]Ibid., p. 79.

secondary education from the religious domination by the church fathers who were responsible for operating and maintaining the Latin schools, it was not the final answer. A private school for the elite was not consistent with the ideals of a democracy, i.e., the worth and dignity of every individual.

2. Individual Instruction in Early Secondary Schools. American society was not displeased with the curriculum content of the academies. In fact, the secondary high schools were established for the purpose of duplicating the academies at public expense. Not only were the curriculums duplicated but also the methods of instruction. Many problems arose; and many are with us today: for example, college preparatory courses for a minority and terminal education for others and methods of instruction that makes allowance for individual differences.

The curriculums of many of the secondary schools were based on college preparatory courses; the college bound student and the terminal student were provided the same education. However, some educators were cognizant of the inadequacies of mass education that ignored individuality and resulted in equating equality of opportunity with identity of opportunity. Two educators that focused upon individual differences were Francis W. Parker and John Dewey.

3. Focusing on the Individual. Parker held that subjects were not ends in themselves, that they merely existed to promote the development of each pupil. The school should provide an environment where children enter into activities because they desire to do so rather than because they are forced by external incentives in the form of marks, awards and

prizes.[11]

Parker made the following observations regarding methods and curriculum:

> Reading meant the acquisition of meanings--not techniques of oral pronounciation. Memorizing of textbook facts received less emphasis because real things were being studied. Lessons on geography and science were largely based on first-hand information gathered outside the classroom.[12]

John Dewey also advocated the value of the individual:

> The individual is a democratic idea ... each one is equally an individual and entitled to equal opportunity of development of his own capacities, be they large or small in range. Moreover each has needs of his own, as significant to him as those of others are to him.[13]

Dewey writes on the value of the individual in society by saying:

> A society based on custom will utilize variation only up to a limit of conformity with useage; uniformity is the chief ideal within each class. A progressive society counts individual variation as precious since it finds in them the means of its own growth. Hence a democratic society is a must, in consistency with its ideals, allow for intellectual freedom and play of diverse gifts and interests in its educational measure.[14]

4. Mass Education for a Myriad of Adolescents. If we were to place the academic curriculum of most of the early high schools, as well as the academic curriculum of many of our present high schools, on a continuum from meaningless to meaningful, it becomes evident that much of our present day curriculum often seems meaningless to the non-college bound

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[11] Ibid., p. 87.

[12] Ibid.

[13] John Dewey, Problems of Man (New York: Philosophical Library, Inc., 1946), p. 25.

[14] John Dewey, Democracy and Education (New York: The Macmillan Company, 1961), p. 305.

student. Some educators still operate with the assumption that education exists for the sake of the curriculum; certain subjects are difficult and therefore are good for students because they "stretch the mind." Arthur Schlepp, commenting on pupil centered education, wrote:

> John Dewey's revolution from subject centered to child or pupil centered education ... is the single most important educational advance in a thousand years. As a result, education exists for the sake of the learner and not for the sake of subject matter.[15]

Even though secondary schools were based on democratic ideals and supported through public funds, equality of education has not become a reality. The democratic philosophy that each pupil shall be given an education that will enable him to develop to the fullest of his desires and capabilities has created many educational problems.

The clientele of our schools is composed of a myriad of individuals that come from various ethnic and socio-economic groups. These individuals vary; they vary between groups and within groups. They vary according to interests and vocational goals, age, age of puberty, physical health, intellectual adeptness, cognitive style (different approach to thinking by individuals), psychomotor style (different approach to physical movement by individuals), anxiety levels, achievement, motivation, self-concept, arousement and curiosity, attitudes and values, tolerance of ambiguity, reaction to complexity, empathy with other people and patterns of interests.

Thomas and Thomas state about individual differences:

> Children are not created equal, nor do they become more alike as they grow older. Rather, by the time they enter school, the

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[15]John P. Vergis, "Technology: Key to Individualized Instruction," Arizona Teacher, LV (September, 1966), pp. 12-3, quoting Arthur Schlepp, (ed.), Library of Living Philosophy.

> inequalities among them--intellectually, physically and in social behavior--have increased many fold. As they move upward through the grades, the differences increase even further.[16]

Yet, many educators attempt to provide curriculums that are uniform. Charles W. Elliot, chairman of the Committee of Ten, observed in 1892 that:

> Uniformity is a curse of American schools, that any school or college has a uniform product should be regarded as a demonstration of inferiority-impairity to meet the legitimate demands of a social order whose fundamental principle is that every career should be open to talent. Selection of studies for the individual instruction addressed to the individual, ... must come to the American school, if it is to answer the purposes of a democratic society.[17]

Also, theorists describe learning in terms of the average. However, the basic data reveal that the course of learning may differ from pupil to pupil. Consequently, by applying general rules, we may, and most often do, ignore the individual.

An anthropologist writes, "Any human being, unless biologically defective or damaged, has the potential capacity to learn to a reasonably efficient degree any cultural tradition to which the individual concerned might be exposed."[18]

A psychologist states, "We begin with the hypothesis that any subject can be taught effectively in some intellectually honest form to any child at any age of development ... no evidence exists to the contrary."[19]

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[16]Robert M. Thomas and Shirley Thomas, Individual Differences in the Classroom (New York: McKay Co., 1965), p. 3.

[17]Charles W. Elliot, "Shortening and Enriching the Grammer School Course," in Charles Elliot and Popular Education (Ed.:Edward King, New York: Teachers College Press, 1961), pp. 50-55.

[18]Felix M. Kessing, Cultural Anthropology (New York: Rinehart and Company, 1958), p. 62.

[19]Jerome S. Bruner, The Process of Education (Cambridge: Harvard University Press, 1960), p. 33.

C. America's Challenge for Personalized Educational Experiences

American educators have assumed the tremendous challenge of providing educational experiences for this myriad of adolescents based on the democratic ideal. Numerous approaches have been made to provide for the individual differences of the school clientele, for example: accelerated programs, retardation programs, nongraded elementary, modular scheduling, multi-age grouping, departmentalization, remedial instruction, enrichment programs, programed instruction and individualized instruction. The remainder of this chapter will be devoted to literature regarding individualizing the instruction to make allowances for individual differences.

1. Individualized Instruction. Individualized instruction requires a great deal of self-direction and self-selection by the learner. It is intended to be pupil centered not teacher or content centered. The role of the teacher in this instructional approach is primarily a consultant to the learner and a manager and manipulator of the classroom environment. His role is to assist the students to learn to plan and evaluate, to provide stimulating experiences, to make the students aware of the many alternatives when making decisions and to provide a variety of appropriate material. Wolfson cited the basic assumptions for individualized instruction as follows:

> (1) For real learning to occur, the learner must see the purpose and meaning in the learning experience; (2) no best method exists for all teachers to use; (3) the way the teacher interacts with the children affects the amount they learn, their feelings about learning, and their feelings about themselves and (4) there is no best sequence in skill development.[20]

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[20]Bernice J. Wolfson, "Individualizing Instruction," National Education Journal, LV (November, 1966), pp. 31-40.

The reader is cognizant that the traditional lecture-discussion method is not applicable to individualized instruction in a classroom situation. The classroom procedure will vary due to the particular learning situation and the personal traits of the teacher. Wolfson observed on classroom procedure:

> (1) Individualized instruction provides opportunity for individuals to work alone and in small groups and (2) for individual and small group conferences with the teacher for pupil-teacher planning and evaluation and for teacher assistance as needed. In the final analysis the classroom teacher must translate his own values and goals into action.[21]

2. Two Successful Programs for Different Rates of Learning. Foth reports the use of a multi-media independent study program for teaching Soil Science 210, "Fundamentals of Soil Science," at Michigan State University. The class is structured with one discussion or quiz period and a three to four hour structured training program per week. The students complete a reading assignment, note the objectives and then begin the unit in the laboratory with an audio-tutorial system. The lesson is introduced, discussed and then the student is prepared to proceed with an investigation. The program is designed to be "self-instructional," but the instructor is always in the laboratory to answer questions and discuss materials.

Materials not suited for study in the carrel are exhibited on a display table. The display table permits students to observe a wide variety of scientific specimens as well as special equipment, photographs and models.[22]

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[21] Ibid.

[22] Henry Foth, Structured Learning and Training Environments in Soil Science, Project No. 204 (East Lansing, Michigan: Educational Development Programs, 1967), pp. 1-5.

Postlethwait reports the use of multi-media approach or Audio-Tutorial System for teaching a freshman botany course at Purdue University. The first phase of the program is the independent study session. The student is assigned to a study booth that is equipped with a tape player, an 8mm movie projector and other material appropriate for the week's work. The student listens to the tape, reads the text, examines specimens, manipulates the microscope, views film clips, or performs any other activity that relates to the week's objective. The tape and 8mm film can be stopped as often as necessary for repetition or to provide the student an opportunity to collect data, set up an experiment, or to perform some other related activity.

The second phase of the program is the general assembly session which is under the direction of the senior professor. These are considered as help sessions, and student attendance is not required. However, students are encouraged to attend special sessions involving guest lectures, tele-lectures, films and orientation sessions.

The third phase of the program is a rather unique form of student evaluation. The small assembly session involves no more than eight students and an instructor. These sessions are on a seminar nature. The instructor has on hand the various items included in the independent study program the preceding week. The instructor selects a student at random who is shown an item and is expected to respond to the item by identifying the item, relate it to the week's objective and then proceed to show his mastery of that objective. The instructor then records a grade for the student.[23]

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[23]Samuel N. Postlethwait, "The Use of Multi-Media in Science Education," Educational Media in Vocational Technical Education (Columbus, Ohio: The Center for Vocational Technical Education, 1967), pp. 100-106.

a) Provision for Rates of Learning Not Individual Learning. The results of these programs indicate that they have been extremely successful. They make allowances for variations in the rate of learning of individuals and allow students to complete the assignment at varying rates. However, the writer does not perceive the ideal individualized instruction as having each student proceed through the same subject matter, guidebook, view the same slides and listen to identical tapes.

Wolfson observed:

> The use of programed materials and textbooks with individual pacing is not truly individual learning. These materials provide for different rates of learning, but not responsible to other variations among pupils, such as, motivation, style of learning, energy level, attitudes and previous learning.[24]

D. Individualized Instruction in Vocational Agriculture

1. Social and Economic Demand for Personalized Education. Vocational agriculture in secondary schools is a direct result of nineteenth century American society rejecting the classical and theological education for the elite in favor of the practicality of the sciences and practical arts. The concept of social and economic mobility and the vision of the Western empires were assured by American democracy. Society favored Jefferson's equality: the right of every person to an equal opportunity to the worth and dignity of the individual as a human being and equal representation before the law as the cornerstone of America's ideal of democracy. Thus, societies rejection of education for the elite and support of the sciences and practical arts resulted in the passage of the Morrill Act of 1862.

The reader is cognizant that the Morrill Act was the keystone in

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[24]Bernice Wolfson, op. cit.

the development of our land grant institutions of higher learning. The Act also had several consequences for vocational technical education, namely: (1) a liberal and practical education was prescribed; (2) the doors of higher education were open to a wider public; (3) agriculture and mechanical arts were given important status and (4) the social efficiency of vocational education was proven to a "show me" people.[25] Thus, a major redirection in the pattern of American education resulted.

These land grant institutions led the way for vocational education and soon developed into the highly skilled and professional areas, thus, leaving a vacuum at the middle vocational level of preparation. The secondary schools were the logical place to develop these middle-level skills. However, this was not to be a reality for some time. Politics, pedagogy and the pressures of tradition prevented this from becoming a reality. The pressure for these middle-level skills continued to develop, and finally society demanded that it be filled by the secondary schools. The traditional thinking of the prevalent educators was again broken by Federal legislation that resulted in Congress enacting the Smith-Hughes Act of 1917.

a) Antecedent of the Project Method. The antecedent of the supervised farm training program of students enrolled in vocational agriculture that was provided for in the Smith-Hughes Act was an outgrowth of the early dormitory agriculture schools. The first school approved and supported by state funds was Smith's Agriculture School, established in 1908 at Northampton, Massachusetts. The trustees purchased a farm, equipped

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[25]Grant Venn, Man, Education and Work (Washington, D.C.: American Council on Education, 1964), p. 45.

it and put it into operation.

The concept of boys living in a dormitory and studying school-farm problems never materialized. The new director, Rufus W. Stimson, favored a home project method, and he succeeded in securing permission to dispose of school-owned livestock. Stimson had related to the trustees:

> Boys were coming in the morning from home farms bristling with dairy farm problems, and returning to those farms in the afternoon, and that he did not want them or their instructors to be thinking for a moment about school-owned cows.[26]

Stimson further alluded to the home-project as a means of personalizing instruction in vocational agriculture in the Eleventh Yearbook of the National Society for the Study of Education. Stimson observed that cooperative work between the school and the home farm is the most effective known means of trying out, under conditions of individual farms over widely scattered areas, methods which have proven profitable elsewhere. Stimson gave examples, such as: vegetable gardening, flower gardening, growing general farm crops, dairying, horse farming, etc. as the general fields in which numerous projects might be found.[27]

Mr. C. A. Prosser, Deputy Commissioner of Education in Massachusetts, and later secretary of the National Society for the Promotion of Industrial Education, strongly supported the project method of individualizing instruction and was instrumental in the principles being incorporated into the Smith-Hughes Act.

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[26]Rufus W. Stimson and Frank Lathrop, History of Agricultural Education of Less Than College Grade in the United States, U. S. Office of Education, Vocational Division, Bulletin 217, Agricultural Service No. 55 (Washington, D.C.: U. S. Govt. Printing Office, 1942), pp. 582-585.

[27]Rufus W. Stimson, "Special Emphasis on Part-Time Agriculture" (Chicago: Eleventh Yearbook of the NSSE, Part II, Agricultural Education, 1912), pp. 32-43.

2. Personalizing Instruction in Production Agriculture. Vocational educators rejected the learning theories of the classical and theological educators, i.e., that education comes from man, books and their lectures, thus, ignoring nature. Rousseau had declared, "Education comes to us from nature, from men, from things."[28] Therefore, vocational educators put nature, applied sciences and land use into curriculums; thus a revolution in teaching objectives and methods of instruction resulted. Therefore, the tool, the farm, the cattle-pen would hold equal place in the curriculum of other disciplines.

A teacher skilled in these disciplines would remain essential. As Aristotle had written:

> Men learn by doing and become builders by erecting houses, lyre players by practicing the lyre, and magistrates by making just and sagacious judgements. They must perform these functions as experienced builders, lyre players, and judges to do them, and should learn from the most proficient exemplars.[29]

"To fit for gainful employment" was the controlling purpose of the Smith-Hughes Act of 1917, and the establishment of graduates in farming was the principal criterion for evaluation. Phipps notes that the statement of purposes, periodically prepared by committees appointed by the Agricultural Education Division of the American Vocational Association in cooperation with the Agricultural Education Service, U. S. Office of Education, in publications issued in 1931, 1938, 1940 and 1955 differ mainly in description.[30] Consequently, the State Plans require that each student preparing to farm carry out a planned supervised farming program on the

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[28]Allan Nevins, The Origin of the Land-Grant Colleges and State Universities (Washington, D. C.: Civil War Commission, 1962), p. 16.

[29]Ibid., p. 17.

[30]Lloyd Phipps, Handbook on Agricultural Education in Public Schools (Dansville, Ill.: the Interstate Printers and Publishers, Inc., 1965), p. 13.

home farm.

The basic educational philosophy of vocational education is: learn by doing. This philosophy has resulted in teachers of vocational agriculture individualizing the curriculum, i.e., curriculums that are based on a cross-section of the knowledge and skills needed to efficiently produce the agricultural commodities and to perform related activities in the planned supervised farming programs of students in a particular class. Also, vocational agriculture teachers individualize instruction for each student, namely: (1) visiting prospective ninth grade students and parents, (2) planned supervised farming program, (3) supervised study programs during regular class periods, (4) teacher visits to the home farm and (5) conferences with individual students.

The teacher of vocational agriculture will visit prospective ninth grade students during the summer near the starting of school. The teacher will discuss the purposes and objectives of vocational agriculture in the local school, the planned supervised farming program and leadership development through the activities of the Future Farmers of America organization with the prospective student and his parents. The approval of the parents generally means that the family expects to help the student advance toward becoming established in farming. Thus, the foundation has been laid for the possibility of a four-year individualized instructional program for the student.

Individualized instruction is provided during regular class time through the supervised study periods. The students are encouraged to use the resources available within the vocational agriculture department to plan the supervised farming program, and the teacher of vocational agriculture is available to give counsel and/or advice if needed. The student

may study bulletins, books, farm magazines, father-son agreements, market reports, analyze soil from the home farm, adjust and/or repair a tool, perform a seed germination test and gather any information that will assist him in making a managerial decision relating to his individualized planned supervised farming program. This phase of instruction is of particular importance for students whose supervised farming program differs from the cross-section of agricultural enterprises within the community.

Periodically, the teacher of vocational agriculture further individualizes the instruction through teacher-student conferences during regular school hours or through home-farm visits to the student. The instruction will vary depending on the nature of the conference or farm visit. Examples of some purposes are: (1) discuss father-son agreements, (2) discuss securing capital to expand supervised farming program, (3) consulting on managerial decisions related to the supervised farming program, (4) a farm visit to observe a livestock or crop project or to keep parents informed of student progress ... (n) any problem pertaining to becoming established in farming.

Stevens illustrates the standard pattern of individual program planning as follows: (1) a small start in a major livestock or crop production enterprise is made the first year, and increases each succeeding year by means of natural livestock increase or reinvestment of earnings; (2) a wise selection of an additional enterprise each year broadens the scope of the student's program as justified by his advance in knowledge, skill and maturity; (3) acceptance of responsibility by the student for essential conservation, mechanization, automation, construction, record keeping, or reorganization activities on the farm and

(4) achievement of a status which involves an equity in the entire home farm family business (partnership agreement or corporation membership.[31]

Thus, teachers of vocational agriculture perfected one of the most effective methods of personalizing instruction in agriculture for students whose vocational objective was to become established in the business of farming. The financial statements and leadership accomplishments of the many State and American Farmer recipients substantiate the effectiveness of this method.

The declining rural population, decrease in the number of farms, increase in size of farms and the increased need for agribusiness and services indicated a need for broadening the agriculture curriculum.[32]

3. Individualized Instruction for Off-Farm Agricultural Occupations. The Vocational Education Act of 1963 expanded the purposes and objectives of vocational agriculture. In addition to developing competencies for persons preparing to engage in agriculture production, competencies needed by individuals engaged in or preparing to engage in (off-farm) agricultural occupations other than agricultural production have been added.[33] Consequently, we have a large number of high school students

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[31]Glenn Stevens, Agricultural Education (New York: The Center for Applied Research in Education, Inc., 1967), pp. 55-56.

[32]Manpower Report of the President, United States Department of Labor (Washington, D. C.: The United States Government Printing Office, 1966), pp. 119-140.

[33]Objectives for Vocational and Technical Education in Agriculture, U.S. Office of Education Bulletin 1966, No. 4 (Washington, D.C.: United States Government Printing Office, 1965), p. 4.

who do not live on farms and do not plan to engage in production agriculture. They do, however, plan to engage in one of the specialized business and services that furnish input to farms or perform some function in the processing or marketing of farm products. Thus, students may be enrolled in the same classes with different vocational objectives.

Individualized instruction is provided through planned occupational experiences through employment in an off-farm agricultural business. The employment is part-time and usually performed during some hours of the regular school day. The planned occupational experience may be performed on a farm other than a farm operated by the student's parents; the employment arrangement may be similar to the wage experience in off-farm agricultural business, or it may be quite similar to a home-farm planned supervised farming program. Stevens notes that teachers of agriculture have, over the past fifty years, developed highly effective procedures in cooperative education in situations where the farmer-parent is the "employer" in this instructional relationship.[34]

Although cooperative education is highly effective in providing individualized instruction in off-farm businesses. it is not an effective model in all situations, for example: (1) students with different vocational objectives enrolled within the same class, (2) if there is difficulty in securing an adequate number and/or kinds of training stations and (3) concepts or skills that require less than a semester to master.

Ohles succinctly summarized the situation when citing the principles of differentiated learning: the varying needs beg for attention; it is not possible to meet the needs in one group; the answer lies in a

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[34]Glenn Stevens, op. cit., p. 51.

method for selective instruction; and from differentiated instruction, needs will be more satisfactorily reconciled. Ohles concluded by indicating that if differentiated teaching is not the answer, we may turn to differentiated learning. This is a division of instruction within the classroom rather than mere division of the total instruction. Differentiated learning does not rule out or group separation of intellectuals--in fact, it is relatively unconcerned with the range within a class. The goal is separate learning experiences rather than separating pupils into groups. Implicitly, the process is for learning not for teaching, differentiated learning concealed by individual differences.[35]

There are probably many approaches that will provide adequate instruction for the situations mentioned above. One method is the development of individualized instructional units that are capable of allowing students develop the necessary skills and/or concepts. Todd and Stevens indicate that new patterns of individualized instruction, as well as course scheduling should be devised and tested.[36, 37]

The Manpower Report of the President indicates that one of the methods of strengthening education is to broaden the curriculum to increase appeal to students. Also to make a wider adoption of improved teaching techniques would strengthen education.[38]

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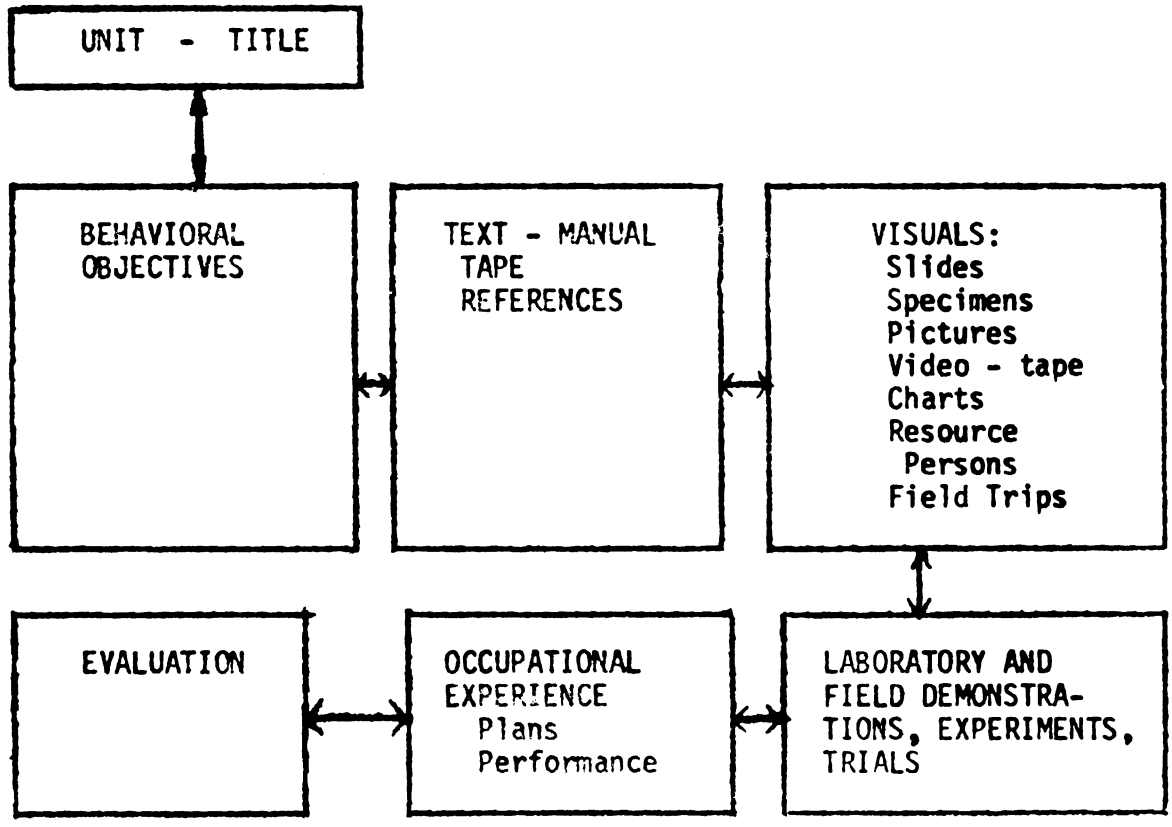
[35]John Ohles, "Differentiated Learning," Education, LXXII (March, 1962), pp. 396-398.

[36]John Todd, "A Course Combining Production and Industry Agriculture," Agricultural Education Magazine, XXXIX (Feb., 1967), pp. 186-87.

[37]Stevens, op. cit., p. 52.

[38]Manpower Report of the President, op. cit., p. 115.

a) Michigan State University Pattern for Individualized Instruction. Michigan State University provided the leadership in developing one of the early models for individualizing instruction for agribusiness and service occupations. The first of twelve units developed at Michigan State University was presented and distributed by Clark at the Central States Seminar held in Chicago during February 1968.[39] This is a manual for students. The paradigm is as follows:



This study is based on developing a similar individualized instructional unit and evaluating the effectiveness of the individualized instructional unit with the lecture-discussion method, as measured by student achievement.

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[39] Raymond Clark and Walter McCarley, A Pattern for Individualizing Instruction in Vocational Agriculture Classes: Grain Sampling and Grading (East Lansing, Michigan: College of Education, Michigan State University, February, 1968).

(1) The Role of the Teacher. The role of the teacher in this system is more critical than when he is in front of the classroom asking questions, judging answers for conformity to the text and leading discussion. The teacher becomes the leader, suggesting activities and procedures to help each student to learn. He is free to move about, helping individual student through difficult situations, stimulating others to greater achievement and suggesting areas for further study to others.

Thus, he becomes the facilitator and manipulator of the learning environment. He may make suggestions that students, individually or as a small group, make contacts in the community, arrange for resource persons to visit the class or arrange to participate in a learning activity outside of the classroom. The teacher must be actively involved in students' outside activities, making certain that the school-community relationships are maintained.

The teacher-pupil learning relationship, role of the teacher and objective of this unit was succinctly stated by Sedgwick when he observed that the student with the assistance of the instructor selects a particular instructional package in his individual learning program and takes a pretest based on behavioral objectives in the instructional package. If the pretest indicates that he is ready, he completes the materials in the instructional package. Next he administers a self-test to determine if he is ready for teacher evaluation. If a student's pretest indicates mastery of that unit, he can skip it in favor of another unit or proceed on to independent study where he defines the problem, sets his goals and carries out the study to achieve some level of solution to the problem. The instructor's role is monitoring each student's progress, diagnosing

learning problems and evaluating student's progress in achieving stated behavioral objectives.[40]

E. Related Research

1. General Education. In reviewing research it became quite evident that the boundaries of individual instruction, individual differences, programed instruction and instructional techniques are in need of clarification. Most of the research deals with either presentation variables, namely: prompting or conformation, branch pacing, size of step, machine vs. text, programed television, etc.; or it deals with response modes, namely: overt vs. convert, multiple choice vs. constructed response, etc. Others are concerned with individual differences, namely: the slow learner, accelerated learner, deaf, emotionally disturbed, etc. Among the remaining experiments are a considerable number of evaluative tests, that seek to compare the amount of learning from programs with the amount of learning from conventional classroom teaching of the same subject.

Educational psychologists have conducted a sufficient amount of research so that they are able to describe the characteristics of a quality program. They have proven that many kinds of students learn from such programs, namely: college, high school, junior high, primary, pre-school, adults, deaf, retarded, laborers, clerical, military, etc. Also, they have established that students learn such subjects as: math, science, English, spelling, electronics, psychology, statistics, reading, instrument flying rules, etc.

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[40]Larry Sedgwick, "Teacher Education for the American Industry Project," Developing Innovative Vocational Technical Education Programs, (ed.) Mary Klaurens (Minneapolis: Research Coordinating Unit in Occupational Education, Univ. of Minn., 1968), pp. 55-60.

Research indicates that for almost any kind of subject and for almost any kind of student a considerable amount of learning can be derived from individualized instruction; this learning has been measured by pretest and posttest or time required or number of trials needed to reach a predetermined criterion of performance. But the question, how well do students learn from individualized instruction as compared to how well they learn from other kinds of instruction, can not be answered with any degree of confidence.[41]

Schramm tabulated thirty-six studies that compared the effectiveness of programed instruction with conventional classroom instruction. These studies were conducted in colleges, in secondary, in primary, with adults and with retarded children. The results indicated that eighteen showed no significant difference when the two groups were measured on the same criterion. Seventeen showed a significant difference in favor of students in the programed instructional group, and one indicated a superiority for students in the conventional classroom.[42]

2. Individualized Instruction in Agricultural Education. In reviewing related research in agricultural education, the following studies relate directly or indirectly to this study.

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[41]Walter Schramm, The Research on Programmed Instruction: An Annotated Bibliography, United States Office of Education, Bulletin 1964, No. 5 (Washington, D. C.: United States Government Printing Office, 1964), pp. 1-5.

[42]Ibid.

Studies by Legg[43] McClay and Hull[44] evaluated the effectiveness of lecture-discussion with programed instruction for teaching farm credit. Each reported a statistical significance for the lecture-discussion method. Student exposure to the two variables was not constant. The lecture-discussion group received twelve hours of classroom instruction, and the programed instruction group received only five hours of instruction. This writer wonders if there would have been any difference in the results if the instructional time had been constant for the two groups.

Hull[45] developed and tested a factor analysis procedure for self-sequencing instructional materials pertaining to concept attainment of human relations abilities. The first phase of the study involved student responses to self-instructional books that were randomly sequenced and then factor analyzed to generate a psychological sequence of concepts. The second phase of the study was the psychological sequence of concepts compared to random sequence. Hull's results indicated no significant difference in the resulting criterion scores.

Zarraga[46] developed two types of programed instructional material

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[43]Otto P. Legg, "Programmed-Instruction and Lecture-Discussion Methods Compared for Effectiveness in Teaching Agricultural Finance to Vocational Agriculture Students" (unpublished Doctor's dissertation, The Pennsylvania State University, University Park, 1962).

[44]David R. McClay and William Lee Hull, "A Comparison of Programmed and Lecture-Discussion Methods -- Teaching Farm Credit to High School Youth and Adults" (unpublished Staff Study, The Pennsylvania State University, University Park, 1964), ERIC, Spring, 1968.

[45]William Lee Hull, "A Procedure for Sequencing Self-Instructional Materials for Concept Attainment of Human Relations Abilities in Agricultural Business Occupations" (unpublished Doctor's dissertation, The Pennsylvania State University, University Park, 1965).

[46]Jose Cruz Zarraga, "The Development and Experimental Trials of

in farm business management. These programs were evaluated by comparing their effectiveness in five high schools. The instructional time was held constant, and Zarraga reported no significant difference in the programs. However, he reported the program with review examinations was slightly better but not significant.

Ehresman[47] evaluated the effectiveness of providing teachers in the experimental group a structured unit designed to assist teachers in organizing and teaching a unit on cooperatives, and teachers in the control group were denied the unit. The pretest and posttest scores resulted in no significant difference between the groups.

Hannemann[48] evaluated the effectiveness of a programed instructional booklet designed to teach parliamentary procedure. A posttest only design, with experimental and control groups, was used. A criterion examination was administered to both groups. The results indicated the programed instructional unit was significant at the .01 level.

Hull[49] and Zarraga[50] studies evaluated two methods of presenting concepts to students. Ehresman[51] and Hannemann[52] evaluated a method of

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Programmed Training Materials in Teaching Farm Business Management to Vocational Agriculture Students" (unpublished Doctor's dissertation, University of Minnesota, Minneapolis, 1963).

[47]Norman D. Ehresman, "An Experimental Study to Evaluate the Effectiveness of Certain Structured Teaching Materials" (unpublished Doctor's dissertation, University of Illinois, Urbana, 1966).

[48]James W. Hannemann, "The Effectiveness of Teaching Parliamentary Procedure through the Use of Programmed Instruction" (unpublished Master's thesis, Cornell University, Ithaca, New York, 1964).

[49]Hull, loc. cit. [50]Zarraga, loc. cit. [51]Ehresman, loc. cit.

[52]James W. Hannemann, "The Effect of Auditory and Visual Motion Picture Descriptive Modalities in Teaching Perceptual-Motor Skills Used in the Grading of Cereal Grain" (unpublished Doctor's dissertation,

presenting concepts or structuring a course that was withheld from the control group. Legg[53] and McClay and Hull[54] evaluated the lecture-discussion method with a programed book of equivalent materials.

Each of these studies focused on method of teaching, and no reference was made to vocational interest and/or objectives of students within each class. A statement by the Joint Project on the Individual and the School emphasized that conformity in individualized instruction may ignore special interests of students:

> Individualized instructional methods often provide for rates of speed appropriate to the individual. This is not unimportant; pace may be highly important. But speed should not be confused with other subtler aspects of individual differences. In fact, individualized instruction often forces all students through the same doors with a rigidity and an emphasis on conformity that ignore special aptitude and destroy uniqueness. This is not to say that various methods of individualized instruction are inherently restrictive. It is only to remind us "that a system" of such teaching does not guarantee respect and care for the individual and his particular capacities.[55]

F. Conclusions Drawn from Review of Literature

The concept of individual differences is a century old idea. America's secondary schools were established on Jefferson's democratic ideal of equality of education and the worth and dignity of each individual. Mass education tends to equate equality of education with identity of opportunity.

Michigan State University, East Lansing, 1968).

[53]Legg, loc. cit. [54]McClay and Hull, loc. cit.

[55]A Climate for Individuality, A Statement of the Joint Project on Individuality (Washington, D.C.: American Association of School Administrators, Association for Supervision and Curriculum Development, National Association of Secondary School Principals and NEA Department of Rural Education, 1965).

Vocational educators introduced and refined the highly effective home-project method of personalized instruction in situations where the farmer-parent is the "employer," and the student's vocational objective is to become established in farming.

The Vocational Education Act of 1963 broadened the curriculum horizontally to include not only girls but persons preparing for an off-farm occupation and vertically to include out of school youth and adults interested in off-farm occupations. The cooperative program personalizes the instruction in situations where agribusiness owners are the employer, and the student's vocational objective is an agricultural occupation other than production agriculture. However, there are numerous situations where cooperative education is not feasible or practical.

Most educational research labeled "Programed Instruction" deals with varying the stimulus-response. The number of studies that compare the effectiveness of programed or individualized instruction to another method of teaching is relatively few. In vocational agriculture, Legg[56] and McClay and Hull[57] evaluated the effectiveness of lecture-discussion with programed materials. Hull[58] and Zarraga[59] varied the stimulus, and Ehresman[60] and Hannemann[61] compared treatment to no treatment. Hamilton[62] identified students with special needs.

Varying the stimulus-response in programed units provides allowances for student variation due to rate of learning and reading compre-

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[56]Legg, loc. cit. [57]McClay and Hull, loc. cit. [58]Hull, loc. cit.

[59]Zarraga, loc. cit. [60]Ehresman, loc. cit. [61]Hannemann, loc. cit.

[62]James B. Hamilton, "Youth with Special Needs in Non-Metropolitan Ohio High Schools" (unpublished Doctor's dissertation, The Ohio State University, Columbus, 1967).

hension. It is not, however, personalized instruction adjusted to the student, which means it may sometimes be individualized or it may be in a group, sometimes including every student in class. It indicates that the individuality of the student is considered, without requiring him to adjust to the interest and rate of learning of other students within the class.

This study is based on evaluating an individualized instructional unit designed to personalize instruction in vocational agriculture classes.

CHAPTER III

RESEARCH DESIGN AND PROCEDURE

This chapter deals with research design, description and means by which data were obtained and methods of procedure that were used to analyze the data. The chapter is organized to include discussions on the following: (1) research design, (2) selection of teachers and departments of vocational agriculture, (3) instrumentation and equipment, (4) data gathering and procedure, (5) analysis of data and (6) limitations of the study.

A. Research Design

The researcher contacted professionals in the Educational Research Department, College of Education, Michigan State University, and explained the purposes and objectives of the study and that the study would be limited to four schools.

Based on the purposes, objectives and limitations of the study, research professionals recommended the research design shown in Table I. This design indicates that the sample size for each teaching method should be equal to or greater than thirty-two, thus, resulting in total sample size that is equal to or greater than sixty-four. Each teacher will teach one class using the lecture-discussion method and the remaining class using the individualized instructional method, thus distributing teacher variable equally between methods of instruction.

Table I. Research design for gathering data to compare the effectiveness of individualized instructional method with the lecture-discussion method

School	Individualized Instruction	Lecture-Discussion
A	Seniors	Juniors
B	Seniors	Juniors
C	Juniors	Seniors
D	Juniors	Seniors
	$n^1 \geq 32$	$n^2 \geq 32$
	$N \geq 64$	

Classes were randomly assigned to teaching method, i.e., the senior classes of the first two schools randomly selected, and the junior classes of the remaining two schools were assigned to the individualized instructional method, thus equally distributing student variation due to grade classification. This resulted in each instructional group being composed of two classes of senior and two classes of juniors. Students in each teaching method were administered a pretest and posttest, agricultural interest survey and personality inventory; also, student's academic rank in class was secured.

The pretest and posttest scores for schools in each teaching method were collapsed, thus pooling teacher variable and eliminating the comparison of teachers and/or schools. Consequently, variation in student achievement in each teaching method may be statistically treated. The variation in student achievement was analyzed for statistical significance for each teaching method as follows: (1) student achievement on gain scores for pretest and paper and pencil posttest, (2) student achievement

on paper and pencil posttest and (3) student achievement on assigning numerical grades posttest. Next, students in each teaching method were blocked on high, medium and low academic rank, based on total number of students in the grade classification for each school. Students' posttest scores for each teaching method were blocked into high, medium and low, based on the range of scores and total number of students; also, the mean personality percentile rank was calculated for each level.

The final phase of the research design was a workshop for cooperating teachers under the direction of the researcher. The workshop was held January 16, 1969, at Michigan State University. Three of the four cooperating teachers attended the workshop. Mimeographed instructions (see Appendix D) were distributed and discussed, and the dates that each school would have the laboratory equipment and teaching materials were finalized. The researcher visited the cooperating teacher who was unable to attend the workshop and discussed the mimeographed instructions.

B. Selection of Teachers and Departments

In order to secure data that would be relevant to the purposes and objectives of this study, the criteria for selecting teachers and departments were as follows: (1) type of grain farming in the community, (2) importance of agriculture in the community, (3) separate classes scheduled for juniors and seniors, (4) students had not been taught grain grading and (5) willingness of vocational agriculture teacher to participate in the study.

Through consulting the records in the Vocational Education Division of Michigan Department of Public Education and with the assistance from the doctoral committee chairman and others, a list of eleven schools in central

Michigan were selected. The researcher visited eight teachers in the home school, validated the accuracy of information researcher had gathered on schools in terms of selection criteria and presented the teacher with a brief overview of the study. The teacher responded indicating his interest in participating in the study and his willingness to attend the workshop.

The teachers in the schools visited were enthusiastic about participating in the study; however, the researcher possessed some invalid data on four schools in terms of the selection criteria. This procedure resulted in the selection of the following four Michigan high schools: Merrill, Ovid-Elsie, Lakewood and Maple Valley. Random assignment of classes to teaching method resulted in the following class and student distribution:

School	Individualized Instruction		Lecture-Discussion	
A	Seniors	11	Juniors	27
B	Seniors	26	Juniors	20
C	Juniors	15	Seniors	15
D	Juniors	10	Seniors	14
	Total	62	Total	76

C. Instrumentation and Equipment

In order to secure relevant data, several instruments and grain samples were prepared and laboratory equipment was assembled. Some of these items were used by both teaching methods, others for either the individualized instructional method or the lecture-discussion method.

1. Instruments and/or Equipment for Both Teaching Methods. A sixteen-question pretest (see Appendix A-1) with 216 total possible points that measures the student's knowledge of procedures used to determine test weight, moisture, broken corn and foreign material and damaged kernels

and to interpret the resulting information in terms of numerical grade to corn was prepared by the researcher.

A posttest (see Appendix B-1) with 451 total possible points with two parts: (A) paper and pencil test with 225 total possible points and (B) assigning numerical grades to two samples with 226 total possible points was prepared by the researcher. The paper and pencil pretest measures the same grade determining factors mentioned above. The performance posttest, assigning numerical grades to two samples of corn, measures the student's ability to perform grade determining factors in the laboratory and to interpret the results in terms of assigning numerical grades to corn.

The researcher prepared sixty two-quart samples of corn for students use during the instruction-laboratory exercise phase of the study. Number two yellow corn was purchased, and two quarts were measured and placed in cloth sample bags. Thirty bags were assigned Number One and thirty bags assigned Number Two. In each Number Two sample, forty-seven grams of damaged kernels were added. Another sixty 1 1/8 quart samples were prepared using grain samples secured from the Crop Science Department, Michigan State University. These samples were placed in cloth sample bags and assigned numbers 100-160.

A moisture test revealed that the percent moisture in both the practice-exercise samples (No.'s 1 and 2) and posttest samples (No.'s 100-160) was lower than desirable for moisture test instructional purposes. Consequently, an additional unnumbered sixty practice samples of 350 grams each were prepared from the current season corn crop. These samples were placed in moisture-proof bags to prevent the moisture content from changing while being stored in the heated classrooms.

The laboratory equipment assembled and made available for each school is as follows: one test weight per bushel tester, one Boerner divider, one moisture tester, four gram scales, four 12/64 inch corn sieves and one Steinlite moisture tester.

2. Instruments and/or Equipment for Individualized Instructional Method. Using the Pattern for Individualized Instruction in Vocational Agriculture Classes: Grain Sampling and Grading, developed by Clark and McCarley,[63] the researcher wrote a forty-six page student guidebook, An Individualized Instruction Unit for Assigning Numerical Grades to Corn.[64] The unit is composed of four lessons and a review exercise:

Lesson One - Determining Test Weight Per Bushel
Lesson Two - Making the Moisture Test
Lesson Three - Analyzing for Broken Corn and Foreign Material
Lesson Four - Damaged Kernels
Review Exercise - Interpreting and Applying Grain Grading Factors

Each lesson is divided into six steps, as follows:

A. Importance of the Grain Grading Factor
B. What You Will Learn from This Lesson
C. Text Material
D. Visuals
E. Review and Application
F. Laboratory Exercise

Dr. Lawrence Copeland, Crop Science Department, Michigan State University, read the unit for technical accuracy. Then corrections were made as recommended, and the unit was typed on stencils and mimeographed. Next, it was assembled in booklet form.

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[63]Raymond Clark and Walter McCarley, A Pattern for Individualized Instruction in Vocational Agriculture Classes: Grain Sampling and Grading (East Lansing, Michigan: College of Education, Michigan State University), February, 1968.

[64]Raymond Clark and Walter McCarley, An Individualized Instruction Unit for Assigning Numerical Grades to Corn (East Lansing, Michigan: College of Education, Michigan State University), June, 1969.

The guidebook contains a student evaluation form based on Osgood's semantic differential scale.[65] If you want to find out what something means to a person, you ask him. A verbally fluent student could adequately express his feelings. A less fluent student would encounter difficulty. In either case, recording and reporting responses would be an insurmountable task. In preparing a semantic differential scale, Osgood cites the following principles: (a) a carefully devised sample of alternative verbal responses which can be standard across subjects, (b) these alternatives should be drawn from the subject rather than emitted so that the verbal fluency is eliminated as a variable and (c) these alternatives are to be representative of the major ways in which meanings vary. The selection of successive alternatives gradually eliminates the uncertainty as to the concept being thought about. To increase the sensitivity of the instrument, we may insert a scale between each pair of terms so that the subject can indicate both the direction and the intensity of each judgment.[66] (See Appendix E)

The individualized instructional unit required thirty-five 2 x 2 grain grading slides for student viewing. The slides were assembled from several sources, namely: Michigan State University, Kansas State University and slides prepared by the researcher. Four Sawyer projector-viewers were purchased for students use.

3. Instruments and/or Equipment for Lecture-Discussion Method. In order to structure the lecture-discussion presentation with equivalent

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[65]Charles Osgood, George Suci and Percy Tannenbaum, The Measurement of Meaning (Urbana: Univ. of Ill. Press, 1957), pp. 76-125.

[66]Ibid., pp. 19-20.

materials, the researcher prepared lesson plans and transparencies (see Appendix C) of the technical information and review and application exercises included in the individualized instructional unit.

Corn kernel damage specimens were secured from the Crop Science Department, Michigan State University. They were as follows: Blue-eyed mold damage, cob-rot damage, mold damage, heat-damaged kernels, discoloration not heat damage, drier damage, ground and weather damage, sprout damage, insect damage and cracked corn and foreign material.

One hundred copies of Official Grain Standards of the United States[67] were secured from the United States Government Printing Office, Washington, D. C. Each student in the lecture-discussion method was given a personal copy.

D. Data Gathering and Procedure

Thirteen days per school were required to gather the data, namely: one day for pretest, eight days for instruction, two days for posttest, one day to administer Pennsylvania Vocational Agriculture Interest Inventory[68] and one day to administer Guilford-Zimmerman Temperament Survey.[69]

The researcher delivered the laboratory, instructional materials and instruments to be administered (except pretest which was distributed at the cooperating teachers' workshop, January 16, 1969) to the first school on January 24, 1969 and returned two weeks later to retrieve the

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[67]Official Grain Standards of the United States (Washington, D.C.: U. S. Govt. Printing Office, 1964.

[68]R. H. Walker, G. Z. Stevens and N. K. Hoover, Pennsylvania Vocational Agriculture Interest Inventory (University Park, Penn.: Teacher Education Series, Dept. of Agriculture Education, 1963).

[69]The Guilford-Zimmerman Temperament Survey (Beverly Hills, Calif.: The Sheridan Supply Company, 1949).

unit. This procedure was repeated three times.

The pretest was administered prior to the start of class instruction. Each class received eight hours of instructional time, and each class was permitted two hours to complete the posttest. The pretest and paper and pencil posttest papers were graded by the researcher, and the resulting scores and student responses to the semantic differential scale recorded.

To determine the student's academic rank in class, based on total number in the school for the grade classification, the cooperating teacher presented the counselor with a prepared list of students in each class. The counselor calculated the students' academic rank and rated them as follows: (1) High - top one-third of the class, (2) Medium - middle one-third of the class and (3) Low - bottom one-third of the class. This information was forwarded to the researcher and recorded.

To measure the student's interest in agriculture, the Pennsylvania Vocational Agriculture Interest Inventory was administered by the cooperating teacher. This test is composed of seventy-five forced choice answers. Students recorded responses on an IBM-type answer sheet. The descriptive manual accompanying the test indicates that the test measures interest in agriculture for farm and non-farm students.[70] The answer sheets were forwarded to the researcher, hand scored and raw scores recorded. Students were then rated as follows: (1) High interest - raw scores of 66 and above, (2) Medium interest - raw scores of 43 to 65 and (3) Low interest - raw scores of 42 and below; raw score conversion table was developed by Pennsylvania State University.

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[70]Walker, Stevens and Hoover, loc. cit.

Student's personality was assessed with the Guilford-Zimmerman Temperament Survey which has ten scores, namely: (1) inactive to general activity, (2) impulsiveness to restraint, (3) submissiveness to ascendance, (4) shyness to social interest, (5) emotional instability to emotional stability, (6) subjectiveness to objectiveness, (7) hostility to friendliness, (8) unreflective to reflective, (9) intolerance to cooperativeness and (10) femininity to masculinity. Students recorded responses to the 273 forced choice questions on an IBM-type answer sheet. The researcher hand scored the answer sheets, converted raw scores to percentile rank and recorded the resulting information.

An attempt was made to determine teacher consistency in following the directions given by the researcher at the workshop. One lecture-discussion lesson and one individualized instruction lesson was to be tape recorded. The cooperating teachers selected the moisture lesson for each method of instruction to tape record. The researcher listened to the recordings in an attempt to identify variation in presentation of the lecture-discussion lesson and in an attempt to determine the extent of teacher-pupil and pupil-pupil interaction in the individualized instructional method.

At the conclusion of the instructional phase of the study, numerical grades were assigned to the sixty posttest grain samples by Dr. Herbert Pettigrove, Crop Science Department, Michigan State University. Student achievement in analyzing grade determining factor and assigning numerical grades on posttest papers were scored and recorded. The maximum number of points for each grade determining factor and points for assigning numerical grade on the assigning numerical grade posttest were determined

(see Appendix B-3) as recommended by Dr. Lawrence Copeland, Crop Science Department, Michigan State University.

E. Analysis of Data

The resulting data, i.e., pretest and posttest scores, agriculture interest scores, academic rank in class, student personality scores and student responses to the semantic differential scale, were recorded on Michigan State University Computer Laboratory-Data Coding Form. These data were key punched on IBM cards and verified by Michigan State University Computer Center.

The researcher retained the services of research specialists in the Educational Research Department, College of Education, Michigan State University, to write the computer program to analyze the data. The Michigan State University Agricultural Experiment Station analysis of variance program was used for statistical treatment of data.

The IBM cards were run through the 3600 computer at Michigan State University, and a computer program was written to analyze the data as follows. A one way analysis of variance was used to test the difference in the mean scores of student achievement between each method of teaching,[71] namely: (1) difference in the mean gain scores between the pretest and paper and pencil posttest (2) difference in the mean scores between paper and pencil posttest, i.e., by total, test weight, moisture, broken corn and foreign material, damaged kernels and interpretation scores, (3) difference in the mean scores between assigning numerical grade posttest and (4) difference in the mean scores between total posttest.

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[71]Allen Edwards, Experimental Design in Psychological Research, (New York: Holt, Rinehart and Winston, 1965), pp. 117-136.

A two by three analysis of variance test was used to test the difference in the mean scores of student posttest achievement between each method of teaching,[72] student academic rank and student interest in agriculture.

To construct a student personality profile, the total posttest scores were tabulated into high, medium and low based on range for each method of instruction and total number of scores for each method of instruction. This resulted in a distribution as follows:

Posttest Score	Individualized Instruction	Lecture-Discussion
High	311 - 420	220 - 380
Medium	251 - 310	166 - 219
Low	86 - 250	36 - 165

The mean percentile rank of each of the ten personality variables was calculated, and a personality profile for students ranked as high-medium-low on the posttest for each method of instruction was compiled and presented in tabular form (see Appendix F-1 for profile chart). The resulting six mean percentile scores were analyzed by the analysis of variance test. This analysis revealed that the mean percentile scores of two of the personality variables were statistically different. The overall mean percentile of these two variables was calculated for each method of instruction and tested for significance at the .05 level using Scheffe's test.[73]

To further analyze student achievement variation, the mean scores

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[72] Ibid., pp. 175-201.

[73] William Hays, Statistics for Psychologists (New York: Holt, Rinehart and Winston, Inc., 1963), p. 484.

of paper and pencil posttest questions relating to each grade determining factor previously calculated are presented in a table and bar graph for each method of instruction.

An analysis of student response on assigning numerical grade posttest was made by coding student response for method of instruction and for each grade determining factor analyzed. The coding system developed is:

1. No response for either sample
2. No response for one sample, incorrect response for one sample
3. No response for one sample, correct response for one sample
4. Two correct responses for both samples
5. One correct response one sample, incorrect response one sample
6. Two incorrect responses for both samples.

The total responses for each grade determining factor were recorded for method of instruction, and the percentile for each response was calculated.

Student responses to the semantic differential scale were recorded and the mean calculated for each response. The resulting information was presented in tabular form.

The researcher listened to the tape recordings of the moisture lesson in order to identify any auditory variation from the directions given at the workshop.

F. Limitations of the Study

1. The scope of this study will be limited to the students of the junior and senior classes in the four schools participating in this study.

2. The findings of this study may be generalized to the one hundred twenty-eight students and four teachers of vocational agriculture who participated in this study.

3. This study will also be limited to the extent to which the methodology of this unit adheres to the theoretical construct for individualized instruction.

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

The data collected and analyzed by the procedures described in Chapter III are presented in this chapter. Each objective stated in Chapter I is presented along with the data gathered to test it.

A. Description of Sample by Methods of Instruction

Teachers of vocational agriculture who cooperated in this study taught in rural high schools. It was assumed that students enrolled in these vocational agriculture classes were primarily farm youth and that their vocational objective was agricultural, i.e., production agriculture and/or agriculture business or service. Also, it was assumed that students with different vocational objectives are enrolled in the same classes.

To gather data relevant to these assumptions and relevant to size and types of farms, students completed an information form (see Appendix A-3). This information is presented in Tables II, III, IV and V.

Table II shows that students in this study are primarily farm youth. Note that 33.3 percent of the parents are full-time farmers and 44.9 percent of the parents are part-time farmers. This results in 78.2 percent of the parents being full or part-time farmers. The table shows that 14.5 percent of the parents are non-farmers. Thus Table II validates the assumption that students enrolled in the vocational agriculture classes participating in this study are primarily farm youth.

Table II. Occupation of students' parents by individualized instructional and lecture-discussion methods of instruction and percent reporting

Category	Individualized Instruction	Lecture-Discussion	Total	Percent
No Response	6	4	10	7.3
Full-time Farmer	25	21	46	33.3
Part-time Farmer	28	34	62	44.9
Non-farmer	3	17	20	14.5
Total	62	76	138	100.0

Table III shows that 55.9 percent of the students' parents operate either a general farm or a grain farm, 10.1 percent operate a dairy farm and 9.4 percent operate a livestock farm. This results in 76.8 percent of the students' parents operating farms that are either producing grain or purchasing grain for feeding purposes. A knowledge of grain grading will contribute to student ability in making managerial decisions on marketing and/or purchasing grain.

Table III. Type of farm operated by students' parents by individualized instructional and lecture-discussion methods of instruction and percent reporting

Category	Individualized Instruction	Lecture-Discussion	Total	Percent
No Response	5	7	12	8.7
Grain	25	17	42	30.5
Livestock	8	5	13	9.4
Fruit	0	2	2	1.4
General	14	21	35	25.4
Dairy	6	8	14	10.1
None	4	16	20	14.5
Total	62	76	138	100.0

Table IV shows that 43.6 percent of the students reside on farms 160 acres or larger, 32.5 percent reside on farms 160 acres or less and .7 percent reside in town but farm. The reader is cognizant that the size of farms is increasing and the number of farms is declining. Large commercial farms have been growing in number and accounting for ever-larger proportion of the agricultural output. As farms increase in size and as more farm operations become mechanized, the cost of buying or operating an economically productive farm becomes increasingly prohibitive for rural farm youth.

Table IV. Size of farm on which student resides by individualized instructional and lecture-discussion methods of instruction and percent reporting

Category	Individualized Instruction	Lecture-Discussion	Total	Percent
No Response	5	7	12	8.7
Lives on Farm:				
10 - 60 Acres	4	8	12	8.7
61 - 80 Acres	7	7	14	10.1
81 - 159 Acres	9	10	19	13.7
160 Acres or More	34	26	60	43.6
Rural Non-farms	2	13	15	10.7
City or Town	1	4	5	3.8
Town and Farms	0	1	1	.7
Total	62	76	138	100.0

A study of Table V shows that 31.9 percent of the students plan to enter production agriculture and that 35.6 percent plan to enter an agriculture business occupation. Thus, 67.5 percent of the students did have a vocational objective that was agricultural. This validates the assumption

that student vocational objective in this study was agricultural. Due to the trend in size and number of farms, it is not likely that 31.9 percent of these students will become established in farming. This suggests that a greater percentage of these students may focus their vocational objective on an agriculture service or business.

Table V. Student occupational goal by individualized instructional and lecture-discussion methods of instruction and percent reporting

Category	Individualized Instruction	Lecture-Discussion	Total	Percent
No Response	5	8	13	9.4
Plans to Farm	21	23	44	31.9
Plans to enter an Agri. Occupation	20	29	49	35.6
No Agri. Plans	16	16	32	23.1
Total	62	76	138	100.0

B. Analysis of Data for Objective Number One

The results of the analysis of variance test are presented in Tables VI, VII, VIII and IX. Each table shows the mean scores for the two methods of instruction. At the bottom of each table the total number of student scores, the F statistic and the level of significance are reported. For example, Table VI should be read as follows: the mean score of the individualized instructional method is 153.61; the mean score of the lecture-discussion method is 12[illegible].81; the F/122 is the number of student scores in the statistical analysis; the /F 11.40 is the F statistic calculated from the variance, and by referring the F statistic number to a point of distribution table and using the appropriate degrees

of freedom, F 11.40 is significant at the .001 level.

Objective Number One was: to evaluate the effectiveness of an individualized instruction-laboratory method as compared to the lecture-discussion-laboratory method of instruction as measured by student achievement. One way analysis of variance was used to test the hypotheses relating to Objective Number One. A statement of each null hypothesis and the results of the analysis of variance test used, are as follows.

Null Hypothesis Number One used to test Objective Number One was: there will be no significant difference in student achievement on gain scores of the pretest and paper and pencil posttest of the two methods of instruction. Table VI shows the results of the analysis of variance test of the mean gain scores for the two methods of instruction. One hundred twenty-two students took both pretest and paper and pencil posttest. The comparison of the means shows that the individualized instructional method was better than the lecture-discussion method at the .001 level of significance.

Table VI. Comparison of student gain scores of pretest and paper and pencil posttest (Part A only) by individualized instructional and lecture-discussion methods of instruction

	Individualized Instruction		Lecture Discussion
Means	153.61		122.81
F/ 122	/F 11.40	Significance Level .001	

Null Hypothesis Number Two used to test Objective Number One was: there will be no significant difference in student achievement on total

posttest scores of the two methods of instruction. Table VII shows the results of the analysis of variance test of the posttest mean scores of the two methods of instruction. The comparison of the means shows that the individualized instructional method was better than the lecture-discussion method at the .0005 level of significance.

Table VII. Comparison of student achievement on total posttest score (Part A plus Part B) by individualized instructional and lecture-discussion methods of instruction

	Individualized Instruction	Lecture-Discussion
Means	263.09	198.91
F/ 122	/F 21.60	Significance Level .0005

Null Hypothesis Number Three used to test Objective Number One was: there will be no significant difference in student achievement on paper and pencil posttest scores of the two methods of instruction. Table VIII shows the results of the analysis of variance test of the mean scores of the two methods of instruction. The six additional students previously accounted for were exposed to the respective methods of instruction and did take the paper and pencil posttest and are included in this analysis. The comparison of the means shows that the individualized instructional method was better than the lecture-discussion method at the .049 level of significance.

Table VIII. Comparison of student achievement on paper and pencil posttest (Part A only) by individualized instructional and lecture-discussion methods of instruction

	Individualized Instruction	Lecture-Discussion
Means	171.56	153.01
F/ 128	/F 3.96	Significance Level .049

Null Hypothesis Number Four used to test Objective Number One was: there will be no significant difference in student achievement in assigning numerical grades posttest of the two methods of instruction. Table IX shows the results of the analysis of variance test of the mean scores of the two methods of instruction. There are one hundred twenty-two students with a numerical score for both the paper and pencil and assigning numerical grade posttest. The comparison of the means shows that the individualized instructional method was better than the lecture-discussion method at the .0005 level of significance.

Table IX. Comparison of student achievement on assigning numerical grades posttest (Part B only) by individualized instructional and lecture-discussion methods of instruction

	Individualized Instruction	Lecture-Discussion
Means	89.25	44.79
F/ 122	/F 29.87	Significance Level .0005

To analyze variation in student achievement by the two methods of instruction other than by statistical analysis, student total numerical score for test questions relating to each grade determining factor on the paper and pencil posttest (see Appendix B-2) was recorded and mean scores calculated. Table X shows the mean scores for each grain grading factor, the methods of instruction and the total points assigned for questions relating to the specific grain grading factor. This table is based on student scores previously analyzed and reported in Table VII.

Figure 1 shows the mean scores for student achievement for each method of instruction. Note that the greatest apparent variation is in analyzing broken corn and foreign material. The next greatest apparent variation is in interpretation of grade determining factors in relation to assigning numerical grade. The least amount of apparent variation is in determining test weight and moisture. These variations are analyzed statistically later in this chapter and presented with the data for testing objectives two and three.

Table X. Student mean scores for paper and pencil posttest questions related to grade determining factors and total possible points by individualized instructional and lecture-discussion methods of instruction

Major Areas of Posttest	Method of Instruction*	Possible Points	Mean	Major Areas of Posttest	Method of Instruction*	Possible Points	Mean
Test Weight	T:1	20	13.4	Damaged Kernels	T:1	20	14.9
	T:2	20	12.8		T:2	20	10.8
Moisture	T:1	35	26.0	Heat Damaged	T:1	20	14.2
	T:2	35	25.4		T:2	20	11.2
Broken Corn & F. Mat.	T:1	26	21.2	Inter-pretation	T:1	100	69.5
	T:2	26	16.1		T:2	100	64.7
Total Damage	T:1	2	1.[illegible]				
	T:2	2	1.5				

*T:1 = Individualized Instruction T:2 = Lecture Discussion

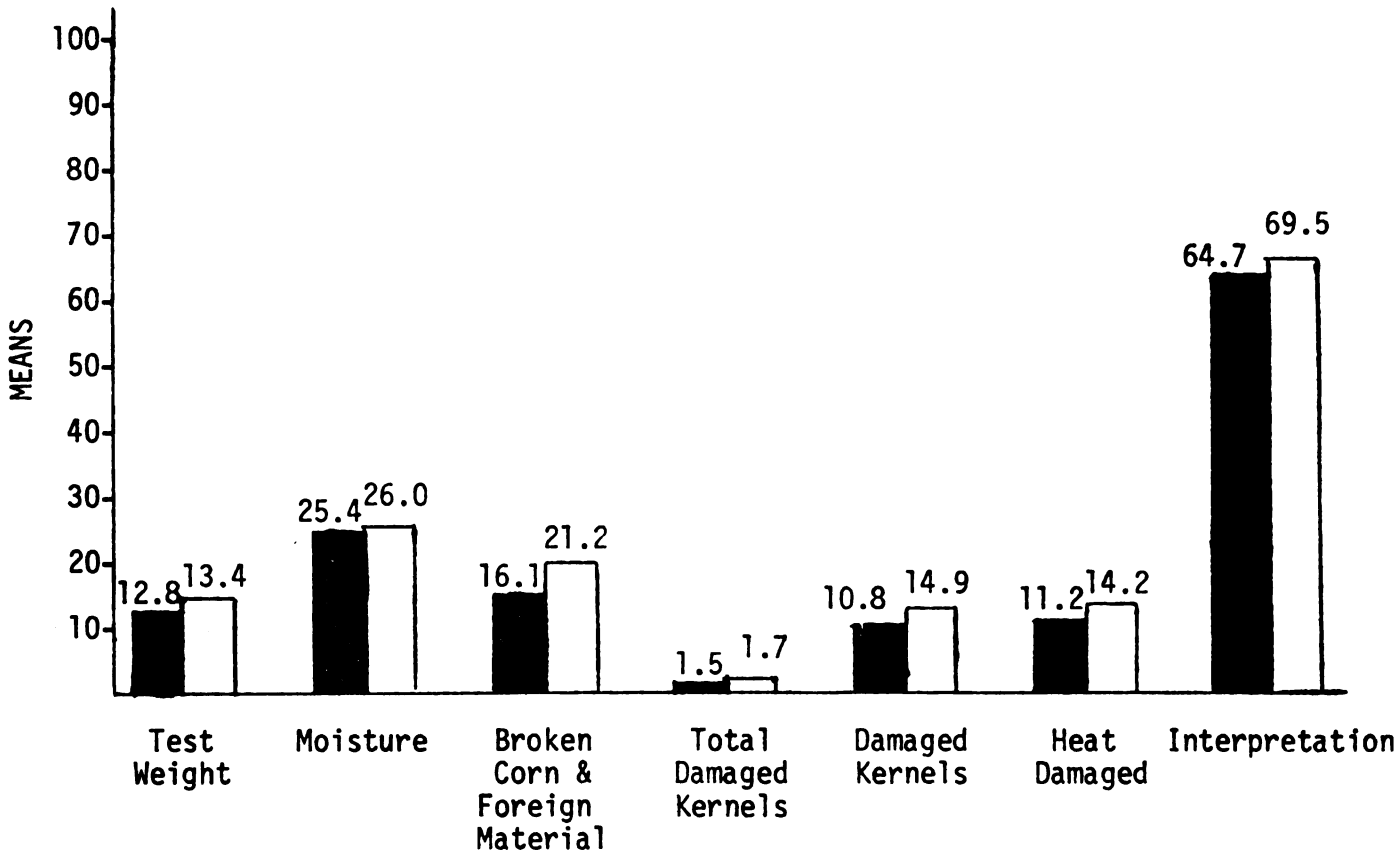

Figure 1. Student mean scores for paper and pencil posttest questions related to grade determining factors by individualized instructional and lecture-discussion methods of instruction

To further analyze differences in the two methods of instruction in student achievement, student responses were coded and recorded as indicated in Chapter III for student achievement on performing the laboratory analysis for each grade determining factor and for the assigning of numerical grades part of the posttest.

Table XI shows the tabulated results and percentile for each factor based on student responses previously analyzed in Table VIII. Table XI should be read as follows: for the grade determining factor, moisture, and for the lecture-discussion method, represented by T:2, five students (Column 1) gave no response for making the moisture determining analysis for either sample. These five students represent 6.9 percent of the seventy-one students in the lecture-discussion method of instruction.

Student variation on achievement becomes more apparent by carefully studying Columns 4, 5 and 6; these columns represent students who recorded two responses for each factor. Adding the moisture responses and percentages for these three columns results in the following: forty-seven students or 63.9 percent of the students in the individualized instructional method and forty-six or 53.9 percent of the students in the lecture-discussion method recorded two responses for determining moisture.

The number of student responses and the percentile for each method of instruction have been tabulated for Columns 4, 5 and 6. Figure 2 shows these results. Note that the least apparent variation is for determining test weight, moisture and analyzing for broken corn and foreign material. The greatest apparent variation is for determining heat damaged and damaged kernels. Table XI and Figure 2 show that the individualized instructional group tried harder than the lecture-discussion group on performing the laboratory analysis for each grade determining factor and for the assigning of numerical grades part of the posttest.

Table XI: Number of itemized student responses and percentile for assigning numerical grade and laboratory analysis for grade determining factors on assigning numerical grade posttest by individualized instructional and lecture-discussion methods of instruction

Grade Determining Factor	Method of Instruction*	(1) No Response for Two Samples		(2) No Response and One Wrong Response		(3) No Response and One Correct Response		(4) Two Correct Responses		(5) One Correct & One Wrong Response		(6) Two Wrong Responses	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Determining Test Weight	T:1	3	5.2	8	13.8	0	0.0	43	74.1	3	5.2	1	1.7
	T:2	5	6.9	20	27.8	1	1.4	38	52.8	6	8.3	2	2.8
Determining Moisture	T:1	2	3.4	9	15.5	1	1.7	36	62.1	9	15.5	1	1.7
	T:2	5	6.9	16	22.2	5	6.9	39	54.2	5	6.9	2	2.8
Analyzing Bkn. Corn & Foreign Material	T:1	2	3.4	11	19.0	4	6.9	27	46.6	10	17.2	4	6.9
	T:2	7	9.7	3	4.2	23	31.9	17	23.6	12	16.7	10	13.9
Determining Heat Damaged	T:1	5	8.6	6	10.3	11	19.0	5	8.6	15	25.9	16	27.6
	T:2	20	27.8	1	1.4	25	34.7	0	0.0	5	6.9	21	29.2
Determining Damaged Kernels	T:1	6	10.3	5	8.6	12	20.7	1	1.7	9	15.5	25	43.1
	T:2	22	30.6	1	1.4	24	33.3	1	1.4	3	4.2	21	29.2
Determining Total Damaged	T:1	9	15.5	6	10.3	8	13.8	13	22.4	19	32.8	3	5.2
	T:2	22	30.6	3	4.2	20	27.8	4	5.6	12	16.7	11	15.3
Assigning Numerical Grades	T:1	8	13.8	10	17.2	7	12.1	8	13.8	18	31.0	7	12.1
	T:2	21	29.2	5	6.9	20	27.8	2	2.8	12	16.7	12	16.7

*T:1 = Individualized Instruction T:2 = Lecture-Discussion

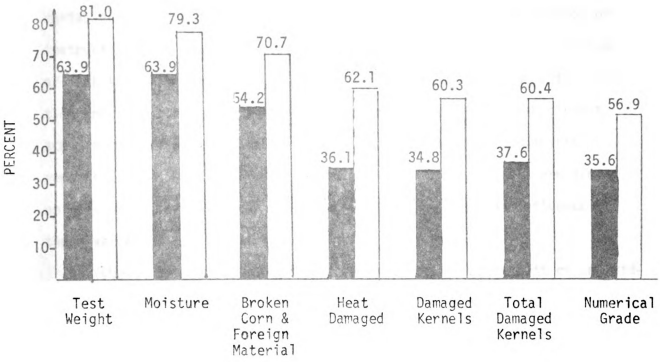

Figure 2. Percent of students with two responses (sum of Columns 4, 5 and 6, Table XI) for assigning numerical grade and laboratory analysis of grade determining factors on assigning numerical grade posttest by individualized instructional and lecture-discussion methods of instruction

Lecture-Discussion

Individualized Instruction

C. Analysis of Data for Objective Number Two

The results of the two by three analysis of variance test used to test Objectives Two and Three are presented in two by three tables. Each table shows the mean scores for the methods of instruction and for the variables ranked high-medium-low; also, (1) the group mean for the variables ranked high-medium-low, (2) the group mean for the methods of instruction and (3) ($\bar{X}t$) the total group mean are shown. At the bottom of each table the significance levels of the effect of methods of instruction and the effect of the variables ranked high-medium-low on student achievement are given. Next, the interaction of these variables is reported, i.e., no significance is interpreted to mean that there are no generalizations that may be made regarding the combined influence of these variables on student achievement.

Objective Number Two was: to evaluate the effectiveness of individualized-instruction-laboratory method as compared to the lecture-discussion-laboratory method of instruction as measured by student interest in agriculture.

Null hypothesis Number One used to test Objective Two was: there will be no significant difference in student achievement on paper and pencil posttest of the two methods of instruction, as measured by student interest in agriculture. Table XII shows the results of two by three analysis of variance test. Conclusions from Table XII are as follows: (1) there is no significant difference in student achievement due to high, medium and low interest in agriculture; (2) there is a significant difference in student achievement due to methods of instruction; the individualized instructional method is better than the lecture-discussion method at the .079 level of significance and (3) there is no significant interaction

between student agricultural interest and methods of instruction.

Table XII. Effect of student agricultural interest, effect of individualized instructional and lecture-discussion methods of instruction and effect of interaction of these two variables on student achievement on paper and pencil posttest (Part A)

Agricultural Interest	Mean Scores: Individualized Instruction	Lecture-Discussion	Means
High	146.20	151.30	148.75
Medium	161.75	141.37	151.56
Low	179.71	133.12	156.41
Means	162.88	141.93	$\bar{X}t$ 152.24

Variable	Sum of Squares	df	Mean Square	F	Significance
Agricultural Interest	1164.61	2	582.31	0.1349	0.874
Methods of Instruction	13524.56	1	13524.56	3.1323	0.079
Interaction	13137.25	2	6568.62	1.523	0.222

A pattern emerges in Table XII that may be observed, also, in some of the following tables in this chapter. Note that the student mean score in the individualized instructional method increases as student interest in agriculture decreases. Conversely, the student mean score of the lecture-discussion method decreases as student interest in agriculture decreases.

The data gathered provides no basis for concluding reasons for this pattern. However, there are some factors that may be related, for example: (1) the unequal distribution of junior and senior students within each method of instruction, i.e., the lecture-discussion group contained five more juniors and ten more seniors than the individualized

instructional group, (2) the Pennsylvania Vocational Agriculture Interest Inventory was administered before the units on grain grading were taught in two schools and after the units on grain grading were taught in two schools, (3) the lecture-discussion group contained one more rural non-farm student and three more city or town students than the individualized instructional group and (4) the Pennsylvania Vocational Agriculture Interest Inventory used may not have been valid for this population.

Null Hypothesis Number Two used to test Objective Two was: there will be no significant difference in student achievement on assigning numerical grade posttest for the two methods of instruction, as measured by student interest in agriculture. Table XIII shows the results of the two by three analysis of variance test. Conclusions from Table XIII are as follows: (1) there is a significant difference on student achievement due to high, medium and low agricultural interest; students with low interest doing better than students with high interest at .032 level of significance; (2) there is a significant difference in student achievement due to method of instruction; the individualized instructional method is better at the .0005 level of significance, and (3) there is no significant interaction between student agricultural interest and methods of instruction.

Table XIII. Effect of student agricultural interest, effect of individualized instructional and lecture-discussion methods of instruction and effect of interaction of these two variables on student achievement on assigning numerical grade posttest (Part B)

Agricultural Interest	Mean Scores: Individualized Instruction	Lecture-Discussion	Means
High	68.04	33.00	50.52
Medium	72.29	33.74	56.02
Low	104.00	51.00	77.50
Means	83.44	39.25	$\bar{X}t$ 61.31

Variable	Sum of Squares	df	Mean Square	F	Significance
Agricultural Interest	15581.14	2	7790.57	3.56	0.032
Methods of Instruction	62151.32	1	62151.32	28.34	0.0005
Interaction	1595.64	2	797.81	0.3637	0.69

Null Hypothesis Number Three used to test Objective Number Two was: there will be no significant difference in student achievement on total posttest score for the two methods of instruction, as measured by student interest in agriculture. Table XIV shows the results of the two by three analysis of variance test. Conclusions from Table XIV are as follows: (1) there is no significant difference in student achievement due to high, medium and low agricultural interest; (2) there is a significant difference in student achievement due to methods of instruction; the individualized instructional method is better than the lecture-discussion method at the .0005 level of significance, and (3) there is no significant interaction between student agricultural interest and methods of instruction.

Table XIV. Effect of student agricultural interest, effect of individualized instructional and lecture-discussion methods of instruction and effect of these two variables on student achievement on total posttest score (Part A + Part B)

Agricultural Interest	Mean Scores: Individualized Instruction	Lecture-Discussion	Means
High	214.24	184.30	199.27
Medium	240.00	175.11	207.55
Low	203.79	184.12	233.96
Means	246.00	181.18	$\bar{X}t$ 213.59

Variable	Sum of Squares	df	Mean Square	F	Significance
Agricultural Interest	25116.53	2	12583.27	1.3795	0.255
Methods of Instruction	133701.93	1	133701.93	14.6576	0.0005
Interaction	23924.74	2	11962.37	1.3114	0.273

Null Hypothesis Number Four used to test Objective Two was: there will be no significant difference in student achievement on paper and pencil posttest test weight questions for the two methods of instruction, as measured by student interest in agriculture. Table XV shows the results of the two by three analysis of variance test. Conclusions from Table XV are as follows: (1) there is no significant difference in student achievement due to high, medium and low agricultural interest; (2) there is no significant difference in student achievement due to methods of instruction, and (3) there is no interaction between student agricultural interest and methods of instruction.

Table XV. Effect of student agricultural interest, effect of individualized instructional and lecture-discussion methods of instruction and effect of these two variables on student achievement on test weight questions (No.'s 3, 4 and 5) on paper and pencil posttest (Part A)

Agricultural Interest	Mean Scores Individualized Instruction	Lecture-Discussion	Means
High	12.71	12.34	12.53
Medium	13.12	13.85	13.49
Low	14.35	12.20	13.28
Means	13.40	12.80	$\bar{X}_t$ 13.01

Variable	Sum of Squares	df	Mean Square	F	Significance
Agricultural Interest	23.05	2	11.52	0.4528	0.637
Methods of Instruction	11.31	1	11.31	0.4442	0.506
Interaction	43.17	2	21.59	0.8480	0.431

Null Hypothesis Number Five used to test Objective Two was: there will be no significant difference in student achievement on paper and pencil posttest moisture questions for the two methods of instruction, as measured by student interest in agriculture. Table XVI shows the results of the two by three analysis of variance test. Conclusions from Table XVI are as follows: (1) there is no significant difference in student achievement due to high, medium and low agricultural interest; (2) there is no significant difference in student achievement due to methods of instruction, and (3) there is no significant interaction between student agricultural interest and methods of instruction.

Table XVI. Effect of student agricultural interest, effect of individualized instructional and lecture-discussion methods of instruction and effect of interaction of these two variables on student achievement on moisture questions (No.'s 6, 7, 8 and 9) on paper and pencil posttest (Part A)

Agricultural Interest	Mean Scores Individualized Instruction	Lecture-Discussion	Means
High	24.86	24.22	24.54
Medium	24.62	25.88	25.25
Low	28.64	26.29	27.47
Means	26.00	25.47	$\bar{X}t$ 25.75

Variable	Sums of Squares	df	Mean Square	F	Significance
Agricultural Interest	178.86	2	89.43	0.7225	0.487
Methods of Instruction	10.54	1	10.54	0.0852	0.771
Interaction	69.42	2	34.71	0.2804	0.756

Null Hypothesis Number Six used to test Objective Two was: there will be no significant difference in student achievement on paper and pencil posttest broken corn and foreign material questions for the two methods of instruction, as measured by student interest in agriculture. Table XVII shows the results of the two by three analysis of variance test. Conclusions from Table XVII are as follows: (1) there is no significant difference in student achievement due to high, medium and low agricultural interest; (2) there is a significant difference in student achievement due to methods of instruction; the individualized instructional method is better than the lecture-discussion method at the .005 level of significance, and (3) there is no significant interaction between student agricultural interest and methods of instruction.

Table XVII. Effect of student agricultural interest, effect of individualized instructional and lecture-discussion methods of instruction and effect of interaction of these two variables on student achievement on broken corn and foreign material questions (No.'s 10, 11 and 12) on paper and pencil posttest (Part A)

Agricultural Interest	Mean Scores Individualized Instruction	Lecture-Discussion	Means
High	18.57	18.00	18.28
Medium	21.50	12.55	17.03
Low	23.56	17.71	20.64
Means	21.56	16.09	$\bar{X}t$ 18.65

Variable	Sums of Squares	df	Mean Square	F	Significance
Agricultural Interest	273.57	2	13.78	1.3338	0.267
Methods of Instruction	836.04	1	836.04	8.1523	0.005
Interaction	417.00	2	208.50	2.0331	0.135

Null Hypothesis Number Seven used to test Objective Two was: there will be no significant difference in student achievement on paper and pencil posttest total damage questions for the two methods of instruction, as measured by student interest in agriculture. Table XVIII shows the results of the two by three analysis of variance test. Conclusions from Table XVIII are as follows: (1) there is no significant difference in student achievement due to high, medium and low agricultural interest; (2) there is a slight significant difference in student achievement due to methods of instruction; the individualized instructional method is better than the lecture-discussion method at the .064 level of significance, and (3) there is no significant interaction between student agricultural interest and methods of instruction.

Table XVIII. Effect of student agricultural interest, effect of individualized instructional and lecture-discussion methods of instruction and effect of interaction of these two variables on student achievement on total damage questions (No.'s 13 and 14) on paper and pencil posttest (Part A)

Agricultural Interest	Mean Scores Individualized Instruction	Lecture-Discussion	Means
High	1.58	1.35	1.46
Medium	1.58	1.62	1.60
Low	1.85	1.37	1.61
Means	1.67	1.45	$\bar{X}t$ 1.56

Variable	Sums of Squares	df	Mean Square	F	Significance
Agricultural Interest	0.66	2	0.33	0.75	0.472
Methods of Instruction	1.54	1	1.54	3.49	0.064
Interaction	1.48	2	0.74	1.68	0.191

Null Hypothesis Number Eight used to test Objective Two was: there will be no significant difference in student achievement on paper and pencil posttest damaged kernels questions for the two methods of instruction, as measured by student interest in agriculture. Table XIX shows the results of the two by three analysis of variance test. Conclusions from Table XIX are as follows: (1) there is no significant difference in student achievement due to high, medium and low agricultural interest; (2) there is a significant difference in student achievement due to methods of instruction; the individualized instructional method is better than the lecture-discussion method at the .009 level of significance, and (3) there is no significant interaction between student agricultural interest and methods of instruction.

Table XIX. Effect of student agricultural interest, effect of individualized instructional and lecture-discussion methods of instruction and effect of interaction of these two variables on student achievement on damaged kernels questions (No. 15) on paper and pencil posttest (Part A)

Agricultural Interest	Mean Scores: Individualized Instruction	Lecture-Discussion	Means
High	12.57	11.91	12.24
Medium	15.21	11.26	13.23
Low	17.00	9.42	13.21
Means	14.92	10.86	$\bar{X}t$ 12.89

Variable	Sums of Squares	df	Mean Square	F	Significance
Agricultural Interest	28.01	2	14.00	0.1894	0.828
Methods of Instruction	525.34	1	525.34	7.1037	0.009
Interaction	235.16	2	117.58	1.5900	0.208

Null Hypothesis Number Nine used to test Objective Two was: there will be no significant difference in student achievement on paper and pencil posttest heat damage questions for the two methods of instruction, as measured by student interest in agriculture. Table XX shows the results of the two by three analysis of variance test. Conclusions from Table XX are as follows: (1) there is no significant difference in student achievement due to high, medium and low agricultural interest; (2) there is a significant difference in student achievement due to methods of instruction; the individualized instructional method is better than the lecture-discussion method at the .058 level of significance, and (3) there is no significant interaction between student agricultural interest and methods of instruction.

Table XX. Effect of student agricultural interest, effect of individualized instructional and lecture-discussion methods of instruction and effect of interaction of these two variables on student achievement on heat damage question (No. 16) on paper and pencil posttest (Part A)

Agricultural Interest	Mean Scores: Individualized Instruction	Lecture-Discussion	Means
High	12.67	11.95	12.31
Medium	15.67	11.37	13.51
Low	14.36	10.29	12.32
Means	14.23	11.20	$\bar{X}t$ 12.71

Variable	Sum of Squares	df	Mean Square	F	Significance
Agricultural Interest	44.69	2	22.34	0.28	0.756
Methods of Instruction	290.92	1	290.92	3.6489	0.058
Interaction	88.93	2	44.46	0.5577	0.574

Null Hypothesis Number Ten used to test Objective Two was: there will be no significant difference in student achievement on paper and pencil posttest interpretation question for the two methods of instruction, as measured by student interest in agriculture. Table XXI shows the results of the two by three analysis of variance test. Conclusions from Table XXI are as follows: (1) there is no significant difference in student achievement due to high, medium and low agricultural interest; (2) there is no significant difference in student achievement due to methods of instruction, and (3) there is no significant interaction between student agricultural interest and methods of instruction.

Table XXI. Effect of student agricultural interest, effect of individualized instructional and lecture-discussion methods of instruction and effect of interaction of these two variables on student achievement on interpretation question (No. 17) on paper and pencil posttest (Part A)

Agricultural Interest	Mean Scores: Individualized Instruction	Lecture-Discussion	Means
High	63.19	73.00	68.09
Medium	67.00	63.70	65.35
Low	73.29	57.37	67.83
Means	69.48	64.69	$\bar{X}t$ 67.09

Variable	Sum of Squares	df	Mean Square	F	Significance
Agricultural Interest	214.81	2	107.40	0.0839	0.920
Methods of Instruction	732.73	1	732.73	0.5722	0.451
Interaction	4624.56	2	2312.28	1.8058	0.169

D. Analysis of Data for Objective Number Three

Objective Number Three was: to evaluate the effectiveness of individualized instruction-laboratory method as compared to the lecture-discussion-laboratory method of instruction, as measured by student academic rank.

Null Hypothesis Number One used to test Objective Three was: there will be no significant difference in student achievement on paper and pencil posttest for the two methods of instruction, as measured by student academic rank. Table XXII shows the results of the two by three analysis of variance test. Conclusions from Table XXII are as follows: (1) there is no significant difference in student achievement due to high, medium and low academic rank; (2) there is a significant difference in student achievement due to methods of instruction; the individualized instructional

method is better than the lecture-discussion method at the .051 level of significance, and (3) there is no significant interaction between student academic rank and methods of instruction.

Table XXII. Effect of student academic rank, effect of individualized instructional and lecture-discussion methods of instruction and effect of interaction of these two variables on student achievement on paper and pencil posttest (Part A)

Academic Rank	Mean Scores Individualized Instruction	Lecture-Discussion	Means
High	178.12	145.06	161.59
Medium	161.75	150.89	156.33
Low	150.21	118.31	134.26
Means	163.37	138.01	$\bar{X}t$ 150.73

Variable	Sum of Squares	df	Mean Square	F	Significance
Academic Rank	15706.97	2	7853.49	1.8531	0.161
Methods of Instruction	16404.08	1	16404.08	3.8707	0.051
Interaction	3389.62	2	1694.81	0.3999	0.671

Null Hypothesis Number Two used to test Objective Three was: there will be no significant difference in student achievement on assigning numerical grade posttest for the two methods of instruction, as measured by student academic rank. Table XXIII shows the results of the two by three analysis of variance test. Conclusions from Table XXIII are as follows: (1) there is no significant difference in student achievement due to high, medium and low academic rank; (2) there is a high level of significant difference due to the methods of instruction; the individualized instructional method is better than the lecture-discussion method at the .0005 level of significance, and (3) there is no significant interaction between student academic rank and methods of instruction.

Table XXIII. Effect of student academic rank, effect of individualized instructional and lecture-discussion methods of instruction and effect of interaction of these two variables on student achievement on assigning numerical grade posttest (Part B)

Academic Rank	Mean Scores Individualized Instruction	Lecture-Discussion	Means
High	79.25	36.82	58.04
Medium	81.76	42.81	62.28
Low	77.51	37.06	57.29
Means	79.50	38.90	$\bar{X}t$ 59.20

Variable	Sum of Squares	df	Mean Square	F	Significance
Academic Rank	673.38	2	336.69	0.1418	0.868
Methods of Instruction	42336.06	1	42336.06	17.8338	0.0005
Interaction	48.77	2	24.38	0.0103	0.990

Null Hypothesis Number Three used to test Objective Three was: there will be no significant difference in student achievement on total posttest for the two methods of instruction, as measured by student academic rank. Table XXIV shows the results of the two by three analysis of variance test. Conclusions from Table XXIV are as follows: (1) there is no significant difference in student achievement due to high, medium and low academic rank; (2) there is a significant difference due to methods of instruction; the individualized instructional method is better than the lecture-discussion method at the .001 level of significance, and (3) there is no significant interaction between student academic rank and methods of instruction.

Table XXIV. Effect of student academic rank, effect of individualized instructional and lecture-discussion methods of instruction and effect of interaction of these two variables on student achievement on total posttest (Part A + Part B)

Academic Rank	Mean Scores Individualized Instruction	Lecture-Discussion	Means
High	257.37	181.88	219.63
Medium	243.57	193.71	218.64
Low	227.70	155.37	191.54
Means	242.88	176.99	$\bar{X}t$ 209.93

Variable	Sum of Squares	df	Mean Square	F	Significance
Academic Rank	20632.64	2	10316.32	1.1183	0.330
Methods of Instruction	111465.81	1	111465.81	12.0826	0.001
Interaction	4117.44	2	2058.72	0.2232	0.800

Null Hypothesis Number Four used to test Objective Three was: there will be no significant difference in student achievement on paper and pencil posttest test weight questions for the two methods of instruction, as measured by student academic rank. Table XXV shows the results of the two by three analysis of variance test. Conclusions from Table XXV are as follows: (1) there is no significant difference in student achievement due to high, medium and low academic rank; (2) there is no significant difference in student achievement due to methods of instruction, and (3) there is no significant interaction between student academic rank and methods of instruction.

Table XXV. Effect of student academic rank, effect of individualized instructional and lecture-discussion methods of instruction and effect of interaction of these two variables on student achievement on test weight questions (No.'s 3, 4 and 5) on paper and pencil posttest (Part A)

Academic Rank	Mean Scores Individualized Instruction	Lecture-Discussion	Means
High	15.00	13.25	14.18
Medium	13.09	13.00	13.04
Low	12.64	13.06	12.85
Means	13.57	13.01	$\bar{X}t$ 13.34

Variable	Sum of Squares	df	Mean Square	F	Significance
Academic Rank	24.78	2	12.39	0.4943	0.611
Methods of Instruction	5.86	1	5.86	0.2340	0.629
Interaction	17.69	2	8.84	0.3528	0.703

Null Hypothesis Number Five used to test Objective Three was: there will be no significant difference in student achievement on paper and pencil posttest moisture questions for the two methods of instruction, as measured by student academic rank. Table XXVI shows the results of the two by three analysis of variance test. Conclusions from Table XXVI are as follows: (1) there is no significant difference in student achievement due to high, medium and low academic rank; (2) there is no significant difference in student achievement due to methods of instruction, and (3) there is no significant interaction between student academic rank and methods of instruction.

Table XXVI. Effect of student academic rank, effect of individualized instructional and lecture-discussion methods of instruction and effect of interaction of these two variables on student achievement on moisture questions (No.'s 6, 7, 8 and 9) on paper and pencil posttest (Part A)

Academic Rank	Mean Scores Individualized Instruction	Lecture-Discussion	Means
High	29.75	23.58	26.67
Medium	25.38	27.65	26.52
Low	23.51	22.68	23.01
Means	26.22	24.64	$\bar{X}t$ 25.43

Variable	Sum of Squares	df	Mean Square	F	Significance
Academic Rank	329.59	2	164.79	1.3847	0.254
Methods of Instruction	63.35	1	63.35	0.5323	0.467
Interaction	279.49	2	139.74	1.1742	0.312

Null Hypothesis Number Six used to test Objective Three was: there will be no significant difference in student achievement on paper and pencil posttest broken corn and foreign material questions for the two methods of instruction, as measured by student academic rank. Table XXVII shows the results of the two by three analysis of variance test. Conclusions from Table XXVII are as follows: (1) there is no significant difference in student achievement due to high, medium and low academic rank; (2) there is a significant difference due to methods of instruction; the individualized instructional method is better than the lecture-discussion method at the .003 level of significance, and (3) there is no significant interaction between student academic rank and methods of instruction.

Table XXVII. Effect of student academic rank, effect of individualized instructional and lecture-discussion methods of instruction and effect of interaction of these two variables on student achievement on broken corn and foreign material questions (No.'s 10, 11 and 12) on paper and pencil posttest (Part A)

Academic Rank	Mean Scores Individualized Instruction	Lecture-Discussion	Means
High	22.62	14.17	18.40
Medium	21.52	17.21	19.36
Low	19.57	14.00	16.79
Means	21.24	15.13	$\bar{X}t$ 18.19

Variable	Sum of Squares	df	Mean Square	F	Significance
Academic Rank	160.16	2	80.08	0.7540	0.473
Methods of Instruction	959.22	1	959.22	9.0319	0.003
Interaction	66.38	2	33.19	0.3125	0.732

Null Hypothesis Number Seven used to test Objective Three was: there will be no significant difference in student achievement on paper and pencil posttest total damage questions for the two methods of instruction, as measured by student academic rank. Table XXVIII shows the results of the two by three analysis of variance test. Conclusions from Table XXVIII are as follows: (1) there is no significant difference in student achievement due to high, medium and low academic rank; (2) there is no significant difference in student achievement due to methods of instruction, and (3) there is no significant interaction between student academic rank and methods of instruction.

Table XXVIII. Effect of student academic rank, effect of individualized instructional and lecture-discussion methods of instruction and effect of interaction of these two variables on student achievement on total damage questions (No.'s 13 and 14) on paper and pencil posttest (Part A)

Academic Rank	Mean Scores Individualized Instruction	Lecture-Discussion	Means
High	1.62	1.47	1.54
Medium	1.67	1.52	1.60
Low	1.67	1.44	1.55
Means	1.65	1.47	$\bar{X}t$ 1.56

Variable	Sum of Squares	df	Mean Square	F	Significance
Academic Rank	0.06	2	0.03	0.07	0.931
Methods of Instruction	0.78	1	0.78	1.79	0.183
Interaction	0.05	2	0.0025	0.05	0.944

Null Hypothesis Number Eight used to test Objective Three was: there will be no significant difference in student achievement on paper and pencil posttest damaged kernels question for the two methods of instruction, as measured by student academic rank. Table XXIX shows the results of the two by three analysis of variance test. Conclusions from Table XXIX are as follows: (1) there is a significant difference in student achievement due to high, medium and low academic rank; high academic rank is superior to low academic rank at the .036 level of significance; (2) there is a significant difference in student achievement due to methods of instruction; the individualized instructional method is better than the lecture-discussion method at the .010 level of significance and (3) there is no significant interaction between student academic rank and methods of instruction.

Table XXIX. Effect of student academic rank, effect of individualized instructional and lecture-discussion methods of instruction and effect of interaction of these two variables on student achievement on damaged kernels question (No.15) on paper and pencil posttest (Part A)

Academic Rank	Mean Scores Individualized Instruction	Lecture-Discussion	Means
High	15.62	12.88	14.25
Medium	15.05	12.37	13.70
Low	13.51	5.81	9.66
Means	14.33	10.35	$\bar{X}t$ 12.54

Variable	Sum of Squares	df	Mean Square	F	Significance
Academic Rank	489.63	2	244.81	3.39	0.036
Methods of Instruction	491.36	1	491.36	6.82	0.010
Interaction	172.16	2	86.08	1.1950	0.306

Null Hypothesis Number Nine used to test Objective Three was: there will be no significant difference in student achievement on paper and pencil posttest heat damage question for the two methods of instruction, as measured by student academic rank. Table XXX shows the results of the two by three analysis of variance test. Conclusions from Table XXX are as follows: (1) there is no significant difference in student achievement due to high, medium and low academic rank; (2) there is a significant difference in student achievement due to methods of instruction; the individualized instructional method is better than the lecture-discussion method at the .053 level of significance, and (3) there is no significant interaction between student academic rank and methods of instruction.

Table XXX. Effect of student academic rank, effect of individualized instructional and lecture-discussion methods of instruction and effect of interaction of these two variables on student achievement on heat damage question (No. 16) on paper and pencil posttest (Part A)

Academic Rank	Mean Scores Individualized Instruction	Lecture-Discussion	Means
High	15.62	12.82	14.24
Medium	13.76	12.39	13.08
Low	13.60	7.50	10.55
Means	14.33	10.90	$\bar{X}t$ 12.62

Variable	Sum of Squares	df	Mean Square	F	Significance
Academic Rank	244.26	2	122.13	1.5481	0.217
Methods of Instruction	301.14	1	301.14	3.8172	0.053
Interaction	135.66	2	68.33	0.8662	0.423

Null Hypothesis Number Ten used to test Objective Three was: there will be no significant difference in student achievement on paper and pencil posttest interpretation question for the two methods of instruction, as measured by student academic rank. Table XXXI shows the results of the analysis of variance test. Conclusions from Table XXXI are as follows: (1) there is no significant difference in student achievement due to high, medium and low academic rank; (2) there is no significant difference in student achievement due to methods of instruction, and (3) there is no significant interaction between student academic rank and methods of instruction.

Table XXXI. Effect of student academic rank, effect of individualized instructional and lecture-discussion methods of instruction and effect of interaction of these two variables on student achievement on interpretation question (No. 17) on paper and pencil posttest (Part A)

Academic Rank	Mean Scores Individualized Instruction	Lecture-Discussion	Means
High	76.62	66.64	71.63
Medium	68.09	67.26	67.68
Low	64.30	55.87	60.09
Means	69.67	63.26	$\bar{X}t$ 66.47

Variable	Sum of Squares	df	Mean Square	F	Significance
Academic Rank	2335.40	2	1167.70	0.9064	0.407
Methods of Instruction	1055.74	1	1055.74	0.8195	0.367
Interaction	494.42	2	247.21	0.1919	0.826

E. Analysis of Data for Objective Number Four

Objective Number Four was: to construct a student personality profile and to determine the extent of variation in student personality profile for the individualized instructional and lecture-discussion methods of instruction, based on student achievement on the posttest.

The null hypothesis to test Objective Four was: there will be no difference in student personality profile for the two methods of instruction, based on student high, medium and low rank on the posttest. To construct the student personality profile for each method of instruction, student posttest scores were ranked into high, medium and low based on the range and total number of scores as described in Chapter III; the mean percentile of each of the ten personality scores was calculated. The results are presented in Table XXXII.

The ten columns for Table XXXII represent a descending to ascending scale as follows: (1) G - inactive to general activity, (2) R - impulsiveness to restraint, (3) A - submissiveness to social boldness, (4) S - shyness to social interest, (5) E - emotional instability to emotional stability, (6) O - subjectivity to objectivity, (7) F - hostility to friendliness, (8) T - unreflectiveness to thoughtfulness, (9) P - intolerance to cooperativeness and (10) M - femininity to masculinity.

In reading Table XXXII, the reader should always be cognizant that the socially accepted mean percentile rank for each of the ten personality variables would lie on the fiftieth percentile. A careful study of Table XXXII reveals that the mean percentile rank for the lecture-discussion group is consistently higher for each personality variable, except masculinity. The greatest amount of overall personality variance based on student achievement between the instructional groups is found within the low student achievement. A further study of the percentile rank of the two methods of instruction shows that the greatest personality variances are found in general activity, Column 1, and personal relations, Column 9; the least amount of personality variance is found in masculinity, Column 10. These percentile rank mean scores were used to construct the personality profile for the two methods of instruction and are analyzed statistically later in this chapter (see Appendix F-1 for a profile chart of the two methods of instruction).

Conclusions from Table XXXII are as follows: (1) the greatest amount of personality variance is found in the personality variables general activity and personal relations; the least amount of personality variance is found in the personality variable masculinity, (2) the

Table XXXII. Mean percentile rank for the Guilford-Zimmerman Temperament Survey for (1) individualized instruction and lecture-discussion overall group percentile mean scores and (2) high, medium and low student achievment on posttest (Part A plus Part B) by individualized instructional and lecture-discussion methods of instruction

	Methods of Instruction*	(1) G	(2) R	(3) A	(4) S	(5) E	(6) O	(7) F	(8) T	(9) P	(10) M
		Personality Variables**									
		Mean Percentile Rank									
Percentile Rank Overall Group Mean	T:1	33	30	32	23	26	23	31	29	21	41
	T:2	53	36	37	33	30	27	39	38	33	41
		46	33	35	29	30	25	35	34	28	41
Posttest Rank											
High	T:1	39	37	28	23	25	21	40	33	23	43
	T:2	50	44	38	30	34	33	43	40	33	40
Medium	T:1	43	24	29	23	25	26	32	25	24	39
	T:2	47	30	34	32	26	21	36	36	33	44
Low	T:1	33	30	40	23	28	21	21	29	15	40
	T:2	61	33	38	37	40	27	37	38	33	38

*T:1 = Individualized Instruction T:2 = Lecture-Discussion
**Personality variables defined in preceding text

lecture-discussion group personality scores were consistently higher for all personality variables except masculinity, and (3) the greatest amount of personality variation is in the low achievement group; the second greatest personality variation is found in the high achievement group, and the least amount of personality variance is found in the medium achievement group.

To further analyze student personality variation, the mean percentile rank for high-medium-low student achievement for each method of instruction was analyzed with the analysis of variance. The overall group mean percentile rank for each method of instruction was tested for significance with Scheffe's test (see Appendix F-2). The analysis of variance test revealed that the mean percentile scores of eight of the personality variables were not statistically different. However, student mean percentile rank of general activity and personal relations based on student achievement was found to be statistically different.

The results of the analysis of variance test and Scheffe's test of the group means for general activity and personal relations are presented in Table XXXIII and Table XXXIV. Each table shows the mean personality score for the personality variable indicated in the table heading for each method of instruction. At the bottom of each table, the total number of student personality scores, the F statistic, the level of significance and the range of scores for Scheffe's test are presented.

Table XXXIII should be read as follows: student mean personality rank for general activity, for low achievement on the posttest and for the lecture-discussion method is 61. The overall group mean percentile rank for the lecture-discussion method is 53 and for the individualized instructional method is 38. There were 122 students in the observation; the F statistic is 2.35; it is statistically significant at the .004 level, and Scheffe's test of the two group means results in a range of -40.5 to -7.5.

Conclusions from Table XXXIII are as follows: (1) there is a significant difference in personality variable, general activity, based on high-medium-low student achievement on the posttest; this difference is significant at the .004 level; (2) Scheffe's test shows that there is a significant difference between the group percentile means; the general activity variable percentile mean for the lecture-discussion group is statistically greater than the percentile mean for the individualized instructional group at the .05 level of significance.

Table XXXIII. The relationship of the Guilford-Zimmerman personality variable General Activity, methods of instruction, student achievement on posttest (Part A + Part B) and the results of a test of difference between group mean percentile rank

Achievement on Posttest	Mean Percentile Rank Individualized Instruction	Lecture-Discussion
High	39	50
Medium	43	47
Low	33	61
Group Mean	38	53
F/122	/F 2.35	Significance .004
Scheffe's Test	-40.5 to -7.5	Significance .05

The results of the analysis of variance test for the personality variable, personal relations, is presented in Table XXXIV. Conclusions from Table XXXIV are as follows: (1) there is a significant difference in the personality variable, personal relations, based on high-medium-low student achievement on the posttest; this difference is significant

at the .003 level; (2) Scheffe's test shows that there is a significant difference between the group percentile means; the variable, personal relations, percentile mean for the lecture-discussion group is statistically greater than the percentile mean for the individualized instructional group at the .05 level of significance.

Table XXXIV. The relationship of the Guilford-Zimmerman personality variable Personal Relations, methods of instruction, student achievement on posttest (Part A + Part B) and the results of a test of difference between group mean percentile rank

Achievement on Posttest	Mean Percentile Rank Individualized Instruction	Lecture-Discussion
High	23	33
Medium	24	33
Low	15	33
Group Mean	21	33
F/122	/F 2.54	Significance .003
Scheffe's Test	-49.84 to -25.16	Significance .05

The data gathered provides no basis for concluding reasons for the statistical higher percentile mean scores for the lecture-discussion group on the personality variables general activity and personal relations. However, there are some factors that may be related, for example: (1) intuitively, a person achieving a high score on personal relations would be expected to perform better in a highly structured situation as the lecture-discussion method. Conversely, a person achieving a lower score on the personal relations variable would be expected to be more independent and perform better in a situation where

he had more freedom, such as the individualized instructional method. (2) Again, intuition would indicate a person achieving a high score on general activity would be expected to do better in the individualized instructional method. However, these data show this to be a false assumption; therefore, general activity may not be related to student achievement in the individualized instructional method. (3) The directions given the students for taking the test may have varied extensively from school to school. (4) The personality test was administered after the completion of the instructional unit. Consequently, the students that had just completed the individualized instructional unit may have felt freer to honestly answer the questions. The lecture-discussion group may have attempted to give the expected answers.

F. Analysis for Semantic Differential Scale

A semantic differential scale to be used for student evaluation was constructed by the researcher as described in Chapter III (see Appendix E). This graphic scale was included in the student guidebook, and students in the individualized instructional method were asked to respond to the graphic scale items after completing the unit on grain grading. Responses are interpreted as follows: (1) if the student felt the question was *very closely* related, he placed a check-mark in either Column 1 or Column 7; if the student felt that the question was *quite closely* related, he placed a check-mark in either Column 2 or Column 6; if the student felt that the question was *slightly related*, he placed a check-mark in Column 3 or Column 5, and a check-mark in Column 4 was

Table XXXV. Student mean response to the seven point semantic differential scale in student guidebook completed by students in the individualized instructional method of instruction

Guidebook Division	Graphic Rating Scale Items	Mean
Lessons	a. difficult-easy	4.1
	b. clear-confusing	3.8
	c. meaningful-meaningless	2.9
	d. good-bad	2.6
2 X 2 Slides	a. clear-confusing	2.1
	b. necessary-unnecessary	3.2
	c. meaningful-meaningless	3.1
	d. important-unimportant	3.3
	e. valuable-worthless	3.2
Text	a. difficult-easy	4.1
	b. clear-confusing	3.1
	c. meaningful-meaningless	3.1
	d. good-bad	2.8
	e. complete-incomplete	2.4
Review Questions	a. fair-unfair	2.2
	b. difficult-easy	4.2
	c. clear-confusing	2.4
	d. meaningful-meaningless	2.9
Review Questions (Continued)	e. valuable - worthless	2.8
	f. important-unimportant	3.0
	g. complete-incomplete	2.4
Laboratory Assignment	a. difficult-easy	4.7
	b. clear-confusing	2.5
	c. meaningful-meaningless	2.5
	d. good-bad	2.4
	e. valuable-worthless	2.5
	f. important-unimportant	2.6
	g. complete-incomplete	2.4
Individ. Approach	a. complete-incomplete	2.8
	b. pleasurable-painful	2.7
	c. interesting-boring	2.7
	d. fair-unfair	2.5
	e. valuable-worthless	2.9
	f. successful-unsuccessful	2.8
	g. complex-simple	3.8
	h. liked-not liked	3.1

interpreted as *neutral* or *completely irrelevant* (unrelated to the question). The mean scores for student responses were calculated and are presented in Table XXXV.

A careful study of Table XXXV shows that the individualized instructional unit was well liked by the students who used it. Note the mean scores for the difficult-easy scale for the lessons, the text, the review questions and laboratory assignments clustered toward the easy end of the scale. The mean for remaining graphic scales lies below four; the lower the number, the better the student felt about the unit. Therefore, the researcher concluded that the unit on assigning numerical grades to corn was well liked and well received by the high school students.

G. Related Information

1. Taped Recordings for Moisture Lesson. The moisture lessons were tape recorded for both the individualized instructional and lecture-discussion methods of instruction. The cooperating teachers presented the moisture lesson using the lesson plans and transparencies written and prepared by the researcher (see Appendix C) for the lecture-discussion method. The researcher listened to the tape recordings very carefully and was not able to identify any deviation from the directions given at the workshop; granted, each teacher incorporates his own personality into the classroom, i.e., classroom management, teacher-pupil rapport and teacher expectations of student achievement. The teachers presented the transparencies to the class; the moisture problems were worked as a class project, and then students were given the laboratory assignment.

The tape recordings for the individualized instructional group sounded like utter chaos within the classroom. Students were talking to other students, i.e., helping each other read and interpret the guidebook and discussing the proper procedure for making the moisture test. Also, the microphone was placed by the Boerner divider which amplified the sound of the grain being divided, thus adding to the impression of confusion. The teachers of vocational agriculture answered questions directed to them. The teachers answered the questions in a direct manner and refrained from orally quizzing the students on what they were doing and how they were progressing.

2. Teacher Comments on the Unit, Assigning Numerical Grades to Corn.

Upon completion of the unit in the school, the researcher returned to the school to retrieve the unit. The teacher had used the instructional unit in his classroom for two weeks, and the researcher was interested in the comments and observations of the teacher regarding the individualized instructional unit. Each teacher reported that ten days was not long enough to adequately teach the unit; they indicated that fifteen days of classroom instruction would be needed to adequately teach the unit on assigning numerical grades to corn.

One teacher reported that he had had a discipline problem with some of the students in the individualized instruction group from the time they enrolled as freshmen. He reported that these students became very actively involved in the individualized instruction unit, and he had absolutely no discipline problems when using this instructional unit. He remarked that this was the longest period of time that these students had gone without causing some type of discipline problem within the classroom.

Another teacher reported that he liked the individualized instructional approach; however, he emphasized that he would not like to teach all of his classes this way. He said that he did not think that he was teaching and this fact bothered him. Also, his students were very upset over taking the pretest. In fact, they were very hostile for several days over the fact that they were being quizzed over material that had not been previously taught in class. They believed that this was very unfair and not the way that school was supposed to be. The teacher believed that this affected their performance on the individualized instructional method; however, in a couple of days the students settled down to the task at hand.

The remaining two teachers reported that they believed the individualized instructional method was very practical and said that they would like to see more of these units developed for vocational agriculture classes.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The major items to be considered in this chapter are: (1) the problem, (2) methods of procedure, (3) analysis of data, (4) major findings, (5) implications of this study, (6) conclusions and (7) recommendations for further study.

A. The Problem

The evaluation of a pattern for individualized instruction was the basis for this study. One of the results of students with different vocational objectives being enrolled in the same class is that the traditional lecture-discussion method is not versatile enough to adequately meet student instructional needs.

1. Purposes. Specifically, the purposes for which this study was conducted were as follows. The major objective (a) and closely related additional objectives (b, c and d) of this study were:

a) To evaluate the effectiveness of an individualized instruction-laboratory method as compared to the lecture-discussion-laboratory method of instruction, as measured by student achievement.

b) To evaluate the effectiveness of an individualized instruction-laboratory method as compared to the lecture-discussion-laboratory method of instruction, as measured by student interest in agriculture.

c) To evaluate the effectiveness of an individualized instruction-laboratory method as compared to the lecture-discussion-laboratory method

of instruction, as measured by student academic rank.

d) To construct a student personality profile and to determine the extent of student variation in student personality profile for the individualized instruction-laboratory method and the lecture-discussion-laboratory method of teaching, based on student achievement on the post-test.

B. Methods and Procedures

Four high schools were selected to participate in this study. A workshop, to discuss the various phases of the study and to provide all cooperating teachers the benefit of questions directed to the researcher, was held at Michigan State University. The following materials were prepared and/or assembled by the researcher to gather data or for instructional purposes. The materials are as follows: (1) a forty-six page student guidebook, including a student semantic differential scale, (2) 2 X 2 colored grain grading slides for use with the student guidebook, (3) one hundred eighty grain samples were prepared, (4) lesson plans and transparencies were prepared, (5) corn kernel damaged samples were secured, (6) grain grading laboratory equipment was assembled, (7) projector-viewers were purchased, (8) pretest and posttest instruments prepared, (9) Official Grain Standards Manuals secured, (10) student academic rank secured from school counselors, (11) Pennsylvania Vocational Agriculture Interest Inventory instruments secured, (12) Guilford-Zimmerman Temperament Survey instruments secured and (13) a tape recorder provided for each school's use.

Each cooperating teacher taught one class by the individualized instructional method and one class by the lecture-discussion method. Each

method of instruction provided students with 8 one-hour periods of instruction. Students were administered a pretest and a two-day posttest; the posttest consisted of two parts, namely: Part A - the paper and pencil test and Part B - the laboratory performance of assigning numerical grades to two samples of corn. One period each was allowed to administer the Pennsylvania Vocational Agriculture Interest Inventory and the Guilford-Zimmerman Temperament Survey. Student academic rank was secured through the local high school counselor.

C. Analysis of Data

The data were analyzed with the 3600 computer at Michigan State University. Student achievement on the pretest and posttest was analyzed four ways: (1) the mean scores of the pretest and posttest (Part A) of the two methods of instruction, (2) the mean scores of the posttest (Part A + B) of the two methods of instruction, (3) the mean scores of the posttest (Part A) of the two methods of instruction and (4) the mean scores of the posttest (Part B) of the two methods of instruction.

Students were blocked into high-medium-low on the Pennsylvania Vocational Agriculture Interest Inventory and their academic rank in class; these two variables and student achievement on the posttest were analyzed twenty ways using the two by three analysis of variance, namely: (1) the mean scores of high-medium-low student academic rank and agriculture interest of posttest (Part A) of the two methods of instruction, (2) the mean scores of high-medium-low student academic rank and agriculture interest on posttest (Part B) of the two methods of instruction, (3) the mean scores of high-medium-low student academic rank and agriculture interest on posttest (Part A + B) of the two methods of instruction, (4)

the mean scores of student high-medium-low academic rank and agriculture interest on posttest (Part A) questions relating to test weight of the two methods of instruction, (5) the mean scores of student high-medium-low academic rank and agriculture interest on posttest (Part A) questions relating to moisture of the two methods of instruction, (6) the mean scores of student high-medium-low academic rank and agriculture interest on posttest (Part A) questions relating to broken corn and foreign material of the two methods of instruction, (7) the mean scores of student high-medium-low academic rank and agriculture interest on posttest (Part A) questions relating to total damage of the two methods of instruction, (8) the mean scores of student high-medium-low academic rank and agriculture interest on posttest (Part A) questions relating to damaged kernels of the two methods of instruction, (9) the mean scores of student high-medium-low academic rank and agriculture interest on posttest (Part A) questions relating to heat damaged kernels of the two methods of instruction and (10) the mean scores of student high-medium-low academic rank and agriculture interest on posttest (Part A) questions relating to interpretation and application by the two methods of instruction

Student posttest (Part A + B) scores were blocked into high-medium-low for both methods of instruction. A personality profile was constructed for high, medium and low level of student achievement for each method of instruction.

Student posttest (Part B) responses for each grain grading factor were coded on the basis of no response, a correct response, an incorrect response or any two combinations of these responses. The coded responses were recorded for each method of instruction, and the percentile for each

response total was calculated and presented in tabular form. The coded responses indicating two attempts, right or wrong, were added and the resulting numerical figure for each grain grading factor and for each method of instruction was presented as a bar graph.

The mean scores for student responses on the semantic differential scale were calculated and reported in tabular form.

D. Major Findings

The major findings of this study are as follows:

1. The Effect of Teaching by the Individualized Instructional Method as Compared to the Lecture-Discussion Method of Instruction as Measured by Student Achievement Indicated That:

a) student gain scores on pretest and posttest (Part A) were better for the individualized instructional method over the lecture-discussion method at the .001 level of significance

b) the mean scores on the posttest (Part A) were better for the individualized instructional method over the lecture-discussion method at the .049 level of significance

c) the mean scores on the posttest (Part B) were better for the individualized instructional method over the lecture-discussion method at the .0005 level of significance

d) the mean scores on the posttest (Part A + B) were better for the individualized instructional method over the lecture-discussion method at the .0005 level of significance

e) the mean scores for questions relating to each grain grading factor on posttest (Part A) were higher for the individualized instructional method than for the lecture-discussion questions

f) the percent of students with two responses for laboratory analysis part of posttest (Part B) were higher for the individualized instructional method than for the lecture-discussion method.

2. The Effect of Agriculture Interest and Student Academic Rank on Student Achievement when Students are Taught by the Individualized Instructional Method and Lecture-Discussion Method Indicated That:

a) an analysis of the two methods of instruction on posttest (Part A) and blocking student agricultural interest and academic rank revealed that the individualized instructional method was significantly better than the lecture-discussion method at the .079 level and .051 level respectively. Agricultural interest and academic rank indicated no significant influence on student achievement, and there was no interaction between academic rank, agricultural interest and methods of instruction.

b) An analysis of the two methods of instruction on posttest (Part B) and blocking student agricultural interest and academic rank revealed that the individualized instructional method was significantly better than the lecture-discussion method at the .0005 level in both instances. Agricultural interest was slightly significant on student achievement for the individualized instructional method at the .032 level; academic rank was not significant, and there was no interaction between methods of instruction and academic rank or interest in agriculture.

c) An analysis of the two methods of instruction on posttest (Part A + B) and blocking student agricultural interest and academic rank revealed that the individualized instructional method was significantly better than the lecture-discussion method at the .0005 level and .001 level respectively. Agricultural interest and academic rank had no significant influence on

student achievement; and there was no interaction between agricultural interest, academic rank and methods of instruction.

d) An analysis of the two methods of instruction on posttest (Part A) questions related to test weight and moisture and the blocking of student agricultural interest and academic rank revealed that there was no significant influence on student achievement due to methods of instruction, agricultural interest and academic rank, nor was there any interaction of these variables.

e) An analysis of the two methods of instruction on posttest (Part A) questions related to broken corn and foreign material and blocking student agricultural interest and academic rank revealed that the individualized instructional method was significantly better than the lecture-discussion method at the .005 level and .003 level respectively. There was no significant influence on student achievement due to agricultural interest and academic rank, nor was there any interaction of these variables.

f) An analysis of the two methods of instruction on posttest (Part A) questions related to total damage and blocking student agricultural interest and academic rank revealed that the individualized instructional method was better (.064 level) than the lecture-discussion method for agricultural interest, but there was no significant difference on student achievement between the two methods of instruction when blocking scores on academic rank. There was no significant influence on student achievement due to agricultural interest and academic rank, nor was there any interaction between these variables.

g) An analysis of the two methods of instruction on posttest (Part A)

questions relating to damaged kernels and blocking student agricultural interest and academic rank revealed that the individualized instructional method was better than the lecture-discussion method at the .009 level and .010 level respectively. Agricultural interest did not influence student achievement, but academic rank was significant at the .036 level of significance. There was no interaction between agricultural interest, academic rank and methods of instruction on student achievement.

h) An analysis of the two methods of instruction on posttest (Part A) questions relating to heat damaged kernels and blocking student agricultural interest and academic rank revealed that the individualized instructional method was better than the lecture-discussion method at the .058 level and the .053 level respectively. There was no significant influence on student achievement due to agricultural interest and academic rank, nor was there any interaction between these variables.

i) An analysis of the two methods of instruction on posttest (Part A) questions relating to interpretation and application and the blocking of student agricultural interest and academic rank revealed that there was no significant difference in student achievement due to methods of instruction, agricultural interest and academic rank, nor was there any interaction between these variables.

Students' scores on the posttest (Part A + B) for both methods of instruction were blocked into high, medium and low based on the range of scores and total number of scores. Students' mean percentile rank for the ten personality variables on the Guilford-Zimmerman Temperament Survey was used to construct a personality profile for each method of instruction and each level of achievement. The personality profile revealed

that students' mean percentile rank for the lecture-discussion group was consistently higher for all personality variables except masculinity. An analysis of variance test of high-medium-low achievement mean percentile scores for the two methods of instruction revealed that only the personality variables general activity and personal relations were significantly different. Also, Scheffe's test revealed that the group percentile means for these two variables were statistically greater for the lecture-discussion group than for the individualized instructional group.

The semantic differential scale responses by students in the individualized instructional group revealed that the individualized instructional unit was well received and well liked by the students. Also, the tape recordings of the moisture lessons for both methods of instruction and for each of the four schools revealed no audio diversion from the instructional guidelines set forth by the researcher at the cooperating teachers' workshop.

E. Implications of This Study

This study was confined to four teachers of vocational agriculture in four rural high schools in Michigan and to one hundred twenty-eight junior and senior students of vocational agriculture within these schools who completed the pretest and/or posttest. If application of the findings is to be made to other situations, detailed consideration should be given to these limitations. Conditions in schools and among teachers vary according to location, facilities, teacher competencies and teacher attitude toward individualized instruction. Likewise, the availability of instructional units that lies within the theoretical construct of this model are limited. Therefore, it is possible that findings of this study

may differ with similar evaluation studies using a different theoretical model to prepare the instructional units which are conducted at a different time, covering a different geographical location, with a different group of vocational agriculture teachers and for different classes of vocational agriculture students. Yet, most departments of vocational agriculture are located in rural areas, students enrolled in vocational agricultural classes usually have an agricultural occupational goal and considering the wide range in the number of years of teaching experience of the cooperating teachers would seem to indicate the possibility of applying these findings to similar vocational agriculture teachers, students of vocational agriculture and similar rural areas.

With the above limitations in mind, the following implications were drawn from the various facets of this study.

1. The findings of this study which dealt with student gain scores on the pretest and posttest (Part A), which dealt with student achievement on posttest (Part A + B), student achievement on posttest (Part A) and student achievement on posttest (Part B) implies that students who were taught by the individualized instructional method acquired more knowledge and skills than the students taught by the lecture-discussion method.

However, these findings imply that knowledge and skills were developed to a higher degree of proficiency on the laboratory performance assignment. It may be implied that students may acquire more knowledge and skill with the individualized instructional method and that students develop to a higher degree using a combination of psychomotor and cognitive skills (laboratory assignment) than they do by using only cognitive skills (paper and pencil posttest).

2. The findings of this study which dealt with student attempt to complete the laboratory assignment (posttest Part B) implied that students in the individualized instruction group consistently gave more responses to each of the grade determining factors than students in the lecture-discussion group. It may be implied that students in the individualized instruction group were more enthusiastic and tried harder, regardless of their ability rank.

3. The findings of this study which dealt with student achievement on posttest (Part A + B), achievement on posttest (Part A), achievement on posttest (Part B) and student agricultural interest implies that when student interest in agriculture is ranked, student achievement on cognitive skills (posttest Part A) and a combination of psychomotor and cognitive skills (posttest Part B) is developed to a higher degree using the individualized instructional method. However, these findings indicate that the combination of cognitive and psychomotor skills (posttest B) are developed to a higher level of proficiency than when cognititve skills (posttest Part A) are developed exclusively.

These findings also indicate that student agricultural interest is related to student achievement when the assignment requires the use of both psychomotor and cognitive skills. However, no interaction or no generalization may be made regarding the combined effects of methods of instruction and student agricultural interest. It may be implied that students who are taught by the individualized instructional method developed a higher degree of proficiency than students taught by the lecture-discussion method and that students develop to a higher degree of proficiency by using a combination of psychomotor and cognitive skills

than when using only cognitive skills. Also, it is implied that agricultural interest is related to developing skills and knowledge requiring psychomotor and cognitive skills but not related to developing only cognitive skills. However, there was no interaction or generalizations that can be made regarding the combined effect of agricultural interest and methods of instruction.

4. The findings of this study which dealt with student achievement on posttest (Part A + B), achievement on posttest (Part A), achievement on posttest (Part B) and student academic rank in class indicate that when student academic rank is considered as a variable, student achievement on the cognitive skills (posttest Part A) and a combination of psychomotor and cognitive skills (posttest Part B) is developed to a higher degree using the individualized instructional method. However, these findings indicate that students develop a higher degree of competency using a combination of psychomotor and cognitive skills. The findings also indicate that student academic rank was an important factor in making mathematical calculations. It may be implied that students who are taught by the individualized instructional method developed a higher degree of proficiency than students who were taught by the lecture-discussion method and that students developed a higher degree of competence by using a combination of psychomotor and cognitive skills than when using cognitive skills only. Also, it is implied that academic rank is related to the cognitive skill, making mathematical calculations; but it is not related to the other cognitive and psychomotor skills developed by the individualized instructional unit used in this study. Also, it may be implied that no interaction or no generalization can be made regarding the combined

effect of academic rank and methods of instruction.

5. The findings of this study which dealt with student personality profile and student achievement indicated that eight of the ten personality variables were not statistically different for the two methods of instruction. The mean scores for the personality variables general activity and personal relations were significantly greater for students in the lecture-discussion group than for students in the individualized instructional group.

6. The findings of this study which dealt with student evaluation of the individualized instructional unit indicated that the mean scores of the student responses clustered toward the favorable end of the semantic differential scale. It may be implied that the individualized instructional unit on assigning numerical grades to corn was well received, well liked and thought of as being valuable and worthwhile by the students who used the individualized instructional unit.

F. Conclusions

1. The information from this study may be used by persons at the local, state and college levels who are responsible for the development of instructional materials, as a basis for the development of additional individualized units. These persons should be encouraged to develop units that would help students develop vocational competencies to meet the training needs of students who are enrolled in the same vocational agriculture classes and who have different vocational objectives.

2. The teacher trainers at Michigan State University should develop appropriate ways and means for training student teachers,

beginning teachers and experienced teachers of vocational agriculture in the use of individualized instructional materials. This may be accomplished in several ways, namely: (1) in-service workshops should be conducted by Michigan State University instructional material specialist in Agricultural Education; (2) student teachers could be clustered in a student teaching center, and a portion of the weekly seminars should be devoted to training student teachers in the use of individualized instructional materials and (3) teacher training institutions, such as Michigan State University, that do not issue permanent teaching certificate upon completion of the baccalaureate degree and require post-baccalaureate credits for permanent certification, should develop and make available a course in the use of individualized instructional materials that would be taken during this interim period.

3. Teachers of vocational agriculture who are going to use individualized instructional units to develop vocational competencies need to have individualized instructional units that would encompass all subject matter areas that would be taught.

4. The information from this study may be used to develop a pilot program based on students completing a predetermined number of individualized instructional units during a semester. Students completing all of these units would earn one-half credit; students completing additional units would earn extra credit and students completing fewer units would earn less credit. This would eliminate failing a student for completing less than the required number of instructional units. For example: children of migrant workers could move from school to school and earn credit for work completed.

5. It may be concluded from this study that teachers of vocational agriculture should put less reliance on student academic ability for students who are working on individualized instructional units.

G. Recommendations for Further Study

Based on the findings of this study and from the experiences received while conducting it, the following recommendations are made for use in future research studies related to individualized instruction.

1. There is a need for further study to identify the combinations of cognitive and psychomotor skills that may be taught effectively by the individualized instructional method. Such a study would be beneficial in identifying the technical information that could be taught effectively to students by the individualized instructional method. Students enrolled in the same vocational agriculture classes with different vocational objectives could pursue a course of study that would contribute to each student's vocational objective. This could result in a differentiated curriculum within the same class and provide a means for "truly" individualized instruction.

2. A study should be made that identifies the cognitive skills that may be effectively taught by individualized instruction. This study would be beneficial in determining the technical information related to production agriculture and agricultural business and service that could be presented to students in individualized units. Individualized units that are representative of the kinds of technical information needed for production agriculture and agricultural business and

service would need to be developed and evaluated. This implies a cluster of studies focusing on this problem.

3. A study that identifies the psychomotor skills that may be taught effectively by individualized instruction would be beneficial. This study would be worthwhile in determining the psychomotor skills related to production agriculture and agricultural business and service that could be presented to students in individualized instructional units. Individualized units that are representative of the psychomotor skills needed for production agriculture and agricultural business and service would need to be developed and evaluated. This implies a cluster of studies focusing on this problem.

4. In agriculture many problems are diagnosed through sound, for example: a tractor engine that has malfunctioned. A study needs to be made that would evaluate individualized instructional units utilizing auditory stimulus as a means of diagnosing problems.

5. In agriculture many problems are diagnosed visually, for example: determining the cause of tire wear. A study needs to be made that would evaluate individualized instructional units utilizing the visual stimulus as a means of diagnosing problems.

6. A study needs to be made in detail on the cognitive and psychomotor skills that may be taught successfully to students with an agricultural objective whose I.Q. scores are ninety-five or lower. There are routine tasks that require a limited amount of technical information that could be performed adequately by such students.

7. Further study needs to be conducted in detail with individualized instructional units that have auxiliary individualized

instructional units for the basic skills needed for successful completion of the major unit. A pretest could identify students that lacked the basic skills required for a unit. The group should be randomly divided, and one group would advance through the unit while the other group would first complete an individualized instructional unit designed to develop the basic skill required for successful completion of the major unit. The results could be analyzed to determine the benefit of the auxiliary units for teaching the basic skills needed to successfully complete a unit. This would be valuable in evaluating the effectiveness of an individualized instructional unit on basic skills for a specific application.

8. A study needs to be made in detail to identify and catalog the individualized instructional materials that are available in vocational agriculture and other vocational disciplines. This study should focus on identifying the individualized instructional materials that are oriented toward student behavior. Such a study would assist teachers of vocational agriculture in identifying sources of instructional materials and in securing individualized instructional materials that would be oriented toward the specific student behavioral objectives.

9. A study needs to be made in detail to determine what percentage of the total vocational agriculture curriculum could be taught by the individualized instructional method. Teachers cooperating in this study indicated that they liked the individualized instruction unit but also indicated that they would not like to teach every class, every day using the individualized instructional method. Also, the cooperating teachers indicated that they felt that students would not like all of

their vocational agriculture classes taught in this manner. Therefore, a detailed study should identify the ideal combination of individualized instruction with other methods of instruction.

10. A study needs to be made to determine what psychological adjustments that teachers and students need to make when using the individualized instructional units. Students and teachers have traditionally been accustomed to the lecture-discussion and problem-solving methods of teaching. This study would be beneficial in setting guidelines for an in-service training program for teachers preparing to use the individualized instructional method; it could identify guidelines that these teachers could use in preparing their students for this method of teaching.

11. Further study needs to be conducted in detail on the role of the teacher when using the individualized instructional method. The variation due to teacher differences was pooled in this study. Such a study should be of sufficient size to identify teachers who have been successful with individualized instruction and to identify teachers who were not successful with individualized instruction. An instrument should then be developed to identify and describe the teacher activities of the successful teachers; the results could then be used to develop a theoretical model of the teacher role in individualized instruction.

12. A study needs to be made in detail of the personality profile of teachers of vocational agriculture who have been successful and those who have been unsuccessful in using the individualized instructional method. Such a study would be valuable in identifying prospective teachers who would be likely to be successful using the

individualized instructional method.

13. A study that would identify the criteria students use in evaluating themselves should be made. Are students more critical in evaluating themselves or fellow students than parents and teachers? This study should identify the peer influence, parental influence and teacher influence related to student personal evaluation.

14. A study that would identify how students establish behavioral objectives for themselves should be made. This study should try to determine the peer influence, parental influence and teacher influence on behavioral objectives and the decision making processes that students experience when they determine their personal behavioral objectives.

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APPENDICES

APPENDIX A

APPENDIX A-1

GRADING CORN

(PRETEST)

Student's Name_____ Class_____

School_____ Date_____

NUMERICAL GRADES, SAMPLE GRADE AND GRADE REQUIREMENTS FOR CORN

Grade No.	Minimum Test Weight Per Bushel	Moisture	Broken Corn & Foreign Material	Damaged Kernels	
				Total	Heat-Damaged Kernels
	Pounds	Percent	Percent	Percent	Percent
1	56	14.0	2.0	3.0	0.1
2	54	15.5	3.0	5.0	0.2
3	52	17.5	4.0	7.0	0.5
4	49	20.0	5.0	10.0	1.0
5	46	23.0	7.0	15.0	3.0
Sample grade	Sample grade shall be corn which does not meet the requirements for any grades from No. 1 to No. 5, inclusive.				

Directions: Read the questions and/or problems carefully and then select or figure the best possible answer based on the information given. Place the answers in the space provided.

EXAMPLE: Numerical grades of corn are determined by__a__.

a. quality and condition
b. shape of the kernel
c. class of corn
d. none of these

Appendix A-1 Continued....

1. List four factors that determine the numerical grades of corn.

   (1)_____ (3)_____

   (2)_____ (4)_____

2. Complete the following table.

Test Weight Per Bushel	Best Numerical Grade Based on Test Weight
Pounds	
51	
42	
54	
44	

3. List the critical factors in making the test weight per bushel test.

   a._____

   b._____

   c._____

   d._____

   e._____

   f._____

   g._____

   h._____

   i._____

4. To determine the test weight per bushel _____.

   a. 2 quarts are needed
   b. 4 quarts are needed
   c. 1 pint is needed
   d. 1 1/8 quart is needed

Appendix A-1 Continued....

5. The beam arm on the test weight per bushel tester weighs directly in _____.

   a. pounds
   b. grams
   c. pounds per bushel
   d. none of these

6. The funrel is placed _____inches above the kettle.

   a. 2 inches
   b. 3 inches
   c. 4 inches
   d. 6 inches

7. True or False_____.

   Moisture in a sample of corn relates to the future quality of the grain.

8. List critical steps in determining percent moisture.

   a. _____

   b. _____

   c. _____

   d. _____

   e. _____

9. What numerical grade would you assign the following samples based on moisture?

Sample No.	Percent Moisture	Best Possible Grade Based on Moisture
1	24	
2	12	
3	20	
4	16	
5	14.5	
6	18	

Appendix A-1 Continued....

10. Determine the percent moisture in the following sample and assign numerical grade to each sample.

Sample No.	M-Reading	Percent	Temperature	Correction Factor	Percent Moisture	Best Possible Grade
1	100	20.38	65	+.75		
2	130	24.58	70	+.50		
3	30	10.74	74	+.30		
4	85	18.54	69	+.55		
5	100	20.38	68	+.60		
6	40	12.34	70	+.50		

11. How much corn is needed to determine the percent broken corn and foreign material?_____

12. Calculate the percent of broken corn and foreign material in the following problems and then assign numerical grade.

Sample No.	Original Weight	Grams of Broken Corn & Foreign Material	Percent of Broken Corn & Foreign Material in Sample	Best Possible Grade Based on Broken Corn and Foreign Material
1	800 grams	16		
2	800 "	24		
3	800 "	32		
4	800 "	40		
5	800 "	56		

13. To determine the percent of broken corn and foreign material, a sample size of_____is needed.

Appendix A-1 Continued....

14. Calculate the percent of damaged kernels in the following problems and assign best numerical grade.

Sample No.	Grams of Damaged Kernels	Percent of Damaged Kernels	Best Possible Numerical Grade Based on Damaged Kernels
1	10 grams		
2	15 "		
3	18 "		
4	25 "		
5	50 "		

15. Calculate the percent of heat-damaged kernels in the following problems and assign the best numerical grade.

Sample No.	Heat-damaged Kernels	Percent Heat-damaged Kernels	Best Possible Grade Based on Heat-damaged
1	.26 grams		
2	.4 "		
3	1.20 "		
4	3.0 "		
5	8.0 "		

Appendix A-1 Continued....

16. **Complete the following chart by (1) determining the best possible grade for each of the four factors given for each sample and (2) determine the numerical grade for the sample.**

Sample No.	Test Weight	Moisture	Broken Corn & Foreign Material	Damaged Kernels		Grade for Sample	Best Possible Grade Based on -				
				Total	Heat-damaged		Test Weight	Percent Moisture	Broken Corn & Foreign Materials	Damaged Kernels	
										Total	Heat-damaged
	Pounds	Percent	Percent	Percent	Percent						
1	54	14.1	2.1	3.1	.1						
2	56	14.0	2.0	2.9	.1						
3	44	14.0	2.0	3.0	.1						
4	40	23.0	7.0	15.0	3.0						
5	60	15.0	2.1	3.0	1.0						
6	52	15.0	3.5	6.0	.4						
7	50	17.6	4.5	9.0	.8						
8	49	23.5	2.0	3.0	.1						
9	51	20.0	4.9	9.0	.8						
10	57	12.0	2.0	1.0	4.0						

APPENDIX A-2

POSSIBLE POINTS FOR EACH QUESTION ON PRETEST

Question		Possible Points
1		4
2		4
3		8
4		1
5		1
6		1
7		1
8		10
9		6
10	Moisture	12
	Grade	6
11		1
12	Percent Broken Corn and Foreign Material	15
	Grade	5
13		1
14	Percent Damaged Kernels	15
	Grade	5
15	Percent Heat-damaged	15
	Grade	5

Question		Possible Points
16	Sample Grade (5 points each)	50
	Test Weight (1 point each)	10
	Moisture (1 point each)	10
	Broken Corn (1 point each)	10
	Total Damaged (1 point each)	10
	Heat-damaged (1 point each)	10
Total Possible Points		216

APPENDIX A-3

STUDENT INFORMATION FORM

1. Name_____ School_____

2. Age_____ Date of birth_____

   Sex M_____ F_____ Grade_____ Jr. or Sr.___

3. Father or guardian is: (indicate one)

   a. full-time farmer_____
   b. part-time farmer_____
   c. non-farmer _____

4. Type of farm: (indicate one)

   a. grain_____
   b. livestock_____
   c. fruit or vegetable_____
   d. general_____
   e. none_____
   f. dairy_____

5. Type of soil:_____

6. Your place or residence: (indicate one)

   a. on a farm_____ (Size, acres)___
   b. in a rural area but not on farm_____
   c. in town or city_____

7. Do you plan to farm?_____ Enter an agricultural occupation?_____ On-the-farm?_____ Off the farm?_____--after graduation from high school.

APPENDIX B

APPENDIX B-1

EXAM ON GRADING CORN

Student's Name_____ Class_____

School_____ Date_____

NUMERICAL GRADES, SAMPLE GRADE AND GRADE REQUIREMENTS FOR CORN

Grade No.	Minimum Test Weight Per Bushel	Moisture	Broken Corn & Foreign Material	Damaged Kernels	
				Total	Heat-damaged Kernels
	Pounds	Percent	Percent	Percent	Percent
1	56	14.0	2.0	3.0	0.1
2	54	15.5	3.0	5.0	.2
3	52	17.5	4.0	7.0	.5
4	49	20.0	5.0	10.0	1.0
5	46	23.0	7.0	15.0	3.0
Sample grade	Sample grade shall be corn which does not meet the requirements for any grades from No. 1 to No. 5, inclusive.				

Directions: Read the questions and/or problems carefully and then select or figure the best possible answer based on the information given. Place the answers in the space provided.

EXAMPLE: Numerical grades of corn are determined by__a__.

a. quality and condition
b. shape of the kernel
c. class of corn
d. none of these

Appendix B-1 Continued....

1. Quality and condition are determined by the following factor or factors_____.

   a. test weight per bushel
   b. percent of moisture
   c. percent of broken corn and foreign material
   d. all of the above: a, b & c

2. The grades of corn shall be_____.

   a. numerical grade
   b. sample grade
   c. special grade
   d. all of the above: a, b and c

3. Complete the following table:

Test Weight Per Bushel	Best Numerical Grade Based on Test Weight
Pounds	
48	
45	
55	
56	
50	

4. Complete the following table:

Grade	Minimum Test Weight Per Bushel
1	
2	
3	
4	
5	

Appendix B-1 Continued....

5. List the critical steps in: (a) dividing the sample and (b) making the test weight per bushel test.

a. Cutting Sample	b. Making Test Weight Per Bushel Test
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	

6. List the key steps in determining percent moisture.

a. _____

b. _____

c. _____

d. _____

e. _____

7. What numerical grade would you assign the following samples, based on percent moisture?

Sample No.	Percent Moisture	Best Possible Grade Based on Moisture
1	16.0	
2	13.0	
3	24.0	
4	20.0	
5	18.0	
6	14.5	

Appendix B-1 Continued....

8. What are the maximum limits of percent moisture for the following numerical grades of corn?

Grade	Maximum Limits of Moisture
1	
2	
3	
4	
5	
Sample	

9. Determine the percent moisture in the following samples and then assign numerical grade for each sample.

Sample No.	M-Reading	Per-cent	Temper-ature	Correction Factor	Percent Moisture	Best Possible Grade Based on Moisture
1	119	23.04	70	+.50		
2	40	12.34	65	+.75		
3	51	14.10	71	+.45		
4	61	15.6	74	+.30		
5	77	17.58	69	+.55		
6	125	23.88	100	-1.00		

Appendix B-1 Continued....

10. The amount of corn needed to determine the percent of broken corn and foreign material_____.

    a. one pint
    b. one quart
    c. one one-eighth quart
    d. two quarts

11. Figure the percentage of broken corn and foreign material in the following samples and assign best numerical grade possible based on broken corn and foreign material.

Sample No.	Weight of Original 1 1/3 Quart	Grams of Broken Corn & Foreign Material	Percent of Broken Corn & Foreign Material in Sample	Best Possible Grade Based on Broken Corn & Foreign Material
1	1000 grams	70 grams		
2	1000 "	100 "		
3	1000 "	150 "		
4	1000 "	50 "		
5	1000 "	20 "		

12. Complete the following table.

Grade	Maximum Limits for Broken Corn and Foreign Material
1	
2	
3	
4	
5	

Appendix B-1 Continued....

13. To determine the percent of total damage in a sample of corn, weigh _____grams of cleaned corn.

    a. 1000 grams
    b. 500 grams
    c. 250 grams
    d. 10 grams

14. The total damage in a sample of corn is determined by adding the total grams of damaged kernels and_____.

    a. heat-damaged kernels
    b. broken corn and foreign material
    c. weight in grams of 1 1/8 quart sample
    d. none of these

15. Figure the percent of damaged kernels in the following samples and assign the best possible numerical grade based on damaged kernels.

Sample No.	Grams of Damaged Kernels	Percent of Damaged Kernels in Sample	Best Possible Grade Based on Damaged Kernels
1	7.5 grams		
2	12.5 "		
3	17.5 "		
4	25.0 "		
5	37.5 "		

16. Figure the percent of heat-damaged kernels in the following sample and assign the best possible grade based on heat-damaged kernels.

Sample No.	Heat-damaged Kernels	Percent Heat-Damaged Kernels	Best Possible Grade Based on Heat-damage
1	.25 gram or (¼) g.		
2	.5 gram or (½) g.		
3	1.25 gram		
4	2.5 gram		
5	7.5 gram		

Appendix B-1 Continued....

17. Complete the following chart by (1) determining the best possible grade for each of the four factors given for each sample and (2) determine the numerical grade for the sample.

Sample No.	Test Weight	Moisture	Broken Corn & Foreign Material	Damaged Kernels		Grade for Sample	Best Possible Grade Based on -				
				Total	Heat-damaged		Test Weight	Percent Moisture	Broken Corn & Foreign Material	Damaged Kernels: Total	Damaged Kernels: Heat-Damaged
	Pounds	Percent	Percent	Percent	Percent						
1	56	12.5	1.8	3.1	.1						
2	44	12.5	2.0	2.9	.1						
3	55	14.0	2.5	3.1	.2						
4	46	20.1	5.1	10.1	1.5						
5	49	17.6	4.1	7.1	.8						
6	56	23.0	2.0	3.0	.1						
7	56	12.5	2.0	2.0	.1						
8	52	15.6	3.5	6.0	.5						
9	56	14.0	2.0	6.0	.5						
10	56	14.0	2.0	2.5	3.4						

Appendix B-1 Continued....

18. From your instructor secure a 1 1/8 quart sample of grain and determine the (1) test weight, (2) percent moisture, (3) percent broken corn and foreign material and (4) damaged kernels. Record the sample number, your figures and answers in the spaces provided in the accompanying table. After you have determined the four factors, assign numerical grade based on your analysis. (Upon completing the analysis of this sample, return the sample to your instructor and pick up the next sample to analyze.)*

GRAIN RECORDING TABLE

EXAMPLE:

Sample No. X

Assignment Factor		
Test Weight	56	pounds
Moisture	14.5	percent
Broken Corn and Foreign Material a. weight of original 1 1/8 quarts 1,000 grams. b. weight of broken corn and foreign material 20 grams. c. percent of broken corn and foreign material 20/1000= .02 or 2	2	percent
a. heat-damage .25 grams b. percent heat-damage in sample .25/250 = 0.1 c. damaged kernels 6.5 grams d. percent damaged kernels in sample 6.5/250 = 2.0 Total Damage (b + d) 2.1	2.1	percent
Grade for Sample	1	

*Note: It is very important that you return every piece of material back into the sample container. These samples have not yet been graded. The samples will be assigned grades under the supervision of Dr. Lawrence Copeland, Agronomy Department, Michigan State University. To secure an accurate grade, all material must be returned.

Appendix B-1 Continued....

GRAIN RECORDING TABLE

Sample No. _____

Assignment Factor	
Test Weight	pounds
Moisture	percent
Broken Corn and Foreign Material a. weight of original 1 1/8 quarts _____ grams. b. weight of broken corn and foreign material _____ grams. c. percent of broken corn and foreign material _____	percent
a. heat-damage _____ grams b. percent heat-damage in sample _____ c. damaged kernels _____ grams d. percent damaged kernels in sample _____ Total Damage (b + d)	percent
Grade for Sample	

APPENDIX B-2

POSSIBLE POINTS FOR EACH QUESTION ON EXAM

Question		Possible Points	
1	General	1	
2		1	... 2
3	Test Weight	5	
4		5	
5		10	... 20
6	Moisture	5	
7		6	
8		6	
9	Percent Moisture Grade	12 6	... 35
10	Broken Corn & Foreign Material	1	
11	% Broken Corn & Foreign Material Grade	15 5	
12		5	...26
13	Total Damage	1	
14		1	... 2
15	% Damaged Kernels Grade	15 5	...20
16	% Heat-damage Grade	15 5	...20

Question	Possible Points	
16 Interpretation		
Sample Grade	50	
Test Weight	10	
Percent Moisture	10	
Broken Corn & Foreign Material	10	
Total Damage	10	
Heat Damage	10	...100
Total Possible Points	225	

APPENDIX B-3

ASSIGNING NUMERICAL GRADES

Factor	Points Allowed
Test Weight	4.0
Moisture	4.0
Broken Corn and Foreign Material	10.0
Heat Damage	10.0
Damaged Kernels	10.0
Total Damage	20.0
Grade for Sample	55.0
Total Points Per Sample	113.0

APPENDIX C

APPENDIX C

LESSON PLAN

Job-Problem Layout

Enterprise: Grain Month: January Periods: Two
Problem: Grading Grain Job: Determining Test Weight Per Bushel

Motivation: Would you buy a 50 bushel size wagon of shelled corn without knowing the test weight per bushel? Obviously you would prefer a test weight of 54 pounds per bushel to a test weight of 49 pounds per bushel, assuming that the moisture in each sample was the same. It is easy to figure how much more dry matter, i.e., nutrients available for livestock, the grain with a test weight of 54 pounds has over a sample with a test weight of 49 pounds.

For Example: 50 bu. X 54 lbs. test weight = 2700 total lbs.
50 " X 49 " " " = 2450
250 lbs. more dry matter

Behavioral Objectives: At the conclusion of this lesson the students will be able to: (1) properly cut a sample of known size into a 1 1/8 quart sample, (2) determine the test weight per bushel and (3) interpret the test weight in terms of assigning numerical grade.

Pivotal Points:

1. Explain the parts of the Boerner divider and demonstrate the proper use and function of the divider.
2. Explain the parts of the test weight per bushel tester and demonstrate the proper use of the tester.
3. As class project, make interpretation of how test weight per bushel affects the numerical grade of corn (use transparency No. 1).
4. As class exercise, determine the minimum test weight per bushel of grades No. 1, 2, 3, 4 and 5 (use transparency No. 1).
5. Students will go to laboratory area and determine test weight per bushel of samples of corn.

Teaching Methods: Lecture, Discussion, Demonstration and Laboratory Exercises

References:

1. U.S.D.A., Grain Grading Primer, Miscellaneous Publication No. 740, Washington, D.C.: U.S. Govt. Printing Office, 1957.
2. U.S.D.A., Official Grain Standards of the United States, Washington, D.C.: U.S. Govt. Printing Office, 1964.
3. U.S.D.A., Test Weight Per Bushel of Grain: Methods of Use and Calibration of the Apparatus, Circular 921, Washington, D.C.: U.S. Govt. Printing Office, 1953.

Appendix C Continued....

TRANSPARENCY NO. 1

1. Complete the following table:

TEST WEIGHT	BEST NUMERICAL GRADE POSSIBLE BASED ON TEST WEIGHT
54 lbs.	
55 lbs.	
44 lbs.	
51 lbs.	
48 lbs.	
50 lbs	
56 lbs.	

2. What is the minimum test weight per bushel for the following grades of corn:

GRADE	MINIMUM TEST WEIGHT PER BUSHEL
1	
2	
3	
4	
5	
Sample Grade	

Appendix C Continued....

LESSON PLAN

Job-Problem Layout

Enterprise: Grain Month: January Periods: Two
Problem: Grading Grain Job: Determining Moisture

Motivation: Dryness is a must to maintain quality in corn that is to be stored or mixed into feed that will be stored. Corn that contains moisture in the excess of this normal air dry condition is nearly always unsafe for storage. The reader is well aware that corn with a high moisture content will soon mold or rot. This results in ruining the feeding value for the farmer, and the grain elevator operator will have to mechanically dry the corn before it can be stored with other dry grain or mixed into feed. Obviously, if you were buying 50 bushel of grain, you would prefer a moisture content of 15.5 percent to a moisture content of 20 percent, assuming that the test weight per bushel for each sample was the same. It is easy to figure how much more moisture you would have in the sample with 20 percent moisture. Let us assume that each sample has a test weight of 54 pounds per bushel.

Sample One	Sample Two
15.5% moisture	20% moisture
54 lbs. test weight	54 lbs. test weight
8.37 lbs. of water	10.80 pounds of water

By subtracting 10.8 - 8.37 equals 2.43 more pounds of water per bushel in Sample Two. Considering the 50 bushel that we are purchasing, we would multiply 50 bushel X 2.43 pounds would equal 121½ pounds more water in the 50 bushel of corn with 20% moisture. Since water weighs 8 lbs. per gallon, it is easy to figure that 121½ pounds of water divided by 8 lbs. per gallon would equal over 15 gallons more water in the 50 bushel of corn testing 20 percent moisture.

Behavioral Objectives: At the conclusion of this lesson the students will be able to: (1) determine the percent of moisture in a sample of corn and (2) interpret the percent of moisture in terms of numerical grade.

Pivotal Points:

1. Lecture demonstration on how to use Steinlite Moisture Tester.
2. As a class exercise determine the percent of moisture in several samples of grain (use transparency No. 2).
3. Students will go to the laboratory and analyze several samples for moisture and interpret results in terms of grade.

Teaching Methods: Lecture, Discussion, Demonstration and Laboratory Exercise.

References:

1. Operating Instructions for Steinlite Moisture Tester, Model RCT.
2. U.S.D.A., Official Grain Standards of the United States, Washington, D.C.: U.S. Govt. Printing Office, 1964.

Appendix C Continued....

TRANSPARENCY NO. 2

1. Figure the percent of moisture in the following problems:

Sample No.	M Reading	Per-cent	Temper-ature	Correc-tion Factor	Percent Moisture	Best Possible Grade Based on Moisture
1	120	23.18	30°	+2.50%		
2	140	26.92	60	+1.00		
3	81	18.06	71	+ .45		
4	74	17.22	80	+ .00		
5	30	10.74	75	+ .25		
6	22	9.05	86	- .30		
7	33	11.22	100	-1.00		
8	40	12.34	70	+ .50		
9	45	13.14	74	+ .30		
10	70	16.74	70	+ .50		
11	58	15.15	80	+ .00		

2. Complete the following table:

GRADE	MAXIMUM LIMITS OF MOISTURE
1	
2	
3	
4	
5	
Sample Grade	

Appendix C Continued....

LESSON PLAN

Job-Problem Layout

Enterprise: Grain Month: January Periods: Two
Problem: Grading Grain Job: Analyzing for Broken Corn and Foreign Material

Motivation: Broken corn and foreign material is important in corn because: (1) an excess amount of broken corn and foreign material affects test weight per bushel, (2) lowers the total amount of food value in a bushel of corn, (3) takes up valuable storage space and (4) foreign material is almost worthless for feeding purposes and broken corn will encourage insect infestation, such as: granary weevil, rice weevil, grain borer and Angoumois grain moth. It is obvious to see that a bushel of corn with a test weight of 52 pounds per bushel and containing 4 percent broken corn and foreign material would result in approximately two pounds per bushel of broken corn and foreign material.

For Example: 52 pounds test weight
4 percent broken corn and foreign material
2.08 pounds of broken corn and foreign material

Behavioral Objectives: At the conclusion of this lesson the students will be able to (1) hand sort broken corn and foreign material, (2) weigh the broken corn and foreign material, (3) figure the percentage of broken corn & foreign material and (4) interpret the results in terms of numerical grades.

Pivotal Points:

1. Explain the proper procedure for weighing 1 1/8 quart sample.
2. Demonstrate proper sieving procedure and hand picking foreign material that does not pass through 12/64 inch sieve.
3. Demonstrate weighing broken corn and foreign material.
4. Show students how to determine percentage of broken corn and foreign material in sample.
5. As a class exercise, determine the percentage of broken corn and foreign material in several samples (use transparency No. 3).
6. Students will go to the laboratory and analyze samples for broken corn and foreign material in several samples of corn and determine the percentage of broken corn and foreign material in samples.

Teaching Methods: Lecture, Discussion, Demonstration and Laboratory Exercises.

References: 1. U.S.D.A., Grain Grading Primer, Miscellaneous Publication No. 740, Washington, D.C.: U.S. Govt. Printing Office, 1957.

Appendix C Continued....

TRANSPARENCY NO. 3

1. Calculate the percent of broken corn and foreign material in the following problems:

Sample No.	Weight of 1 1/8 quart	Weight of Broken Corn and Foreign Material	Percent Broken Corn and Foreign Material	Best Numerical Grade Based on Broken Corn and Foreign Material
1	1000 grams	20 grams		
2	800 grams	56 grams		
3	900 grams	45 grams		
4	950 grams	38 grams		
5	980 grams	29.5 grams		
6	1000 grams	100 grams		

2. Complete the following table:

GRADE	MAXIMUM LIMITS OF BROKEN CORN AND FOREIGN MATERIAL
1	
2	
3	
4	
5	
Sample Grade	

Appendix C Continued....

LESSON PLAN

Job-Problem Layout

Enterprise: Grain Month: January Periods: Two
Problem: Grading Grain Job: Determining Damaged Kernels and Heat-damaged Kernels

Motivation: Damaged kernels affect the present or future quality of grain as well as the palatability, i.e., how the grain tastes to the livestock. Soundness is a quality of considerable importance in assigning grade to corn. Field damage such as frost damage and fungus damage such as cobrot are practically beyond the control of the operator. Only a very small percent of damaged kernels will result in a lower grade.

Behavioral Objectives: At the conclusion of this lesson the students will be able to: (1) properly weigh a 250 gram sample of cleaned corn, hand sort for damaged and heat-damaged kernels, (2) calculate the percent damaged and heat-damaged kernels in the sample and (3) interpret this information in terms of grade.

Pivotal Points:
1. Demonstrate and explain how to determine the heat-damaged and damaged kernels.
2. Show students damaged and heat-damaged kernels.
3. Show students how to determine the percentage of damaged kernels in a sample.
4. As a class exercise, determine the percent of damaged kernels in several samples of corn (use transparency No. 4).
5. Students will go to the laboratory and analyze samples of corn for total damage and determine percent of damage in the sample.

Teaching Methods: Lecture, Discussion, Demonstration and Laboratory Exercises.

References:
1. U.S.D.A., Grain Grading Primer, Miscellaneous Publication No. 740, Washington, D.C.: U.S. Government Printing Office, 1957.
2. Corn Kernel Damage, Leaflet E-692, Oklahoma State University, Stillwater, Oklahoma.

Appendix C Continued....

TRANSPARENCY NO. 4

1. Assign numerical grade to the following, based on damaged kernels:

Sample No.	Total Percent Damaged Kernels	Best Possible Grade Based on Damaged Kernels
1	10	
2	15	
3	5	
4	3	
5	7	
6	16	

2. Figure the total grams of total damaged kernels that would be in the following samples:

GRADE	PERCENT TOTAL DAMAGED KERNELS	TOTAL GRAMS OF DAMAGED KERNELS IN SAMPLE
1	3.0	
2	5.0	
3	7.0	
4	10.0	
5	15.0	

APPENDIX D

APPENDIX D

ORIENTATION MEETING FOR COOPERATING TEACHERS

Thursday, January 16, 1969

1. Design of the Study

T:1 = Individualized instruction
T:2 = Lecture discussion

	T:1	T:2
Maple Valley	Juniors - 10	Seniors - 14
Ovid-Elsie	Juniors - 15	Seniors - 16
Lake Odessa	Seniors - 26	Juniors - 20
Merrill	Seniors - 12	Juniors - 27
	63	77

2. Directions for T:1 (Individualized instruction)

Each student will have a guidebook, Individualized Instruction Unit for Assigning Numerical Grades to Corn. The unit contains four lessons, namely:

1. Determining Test Weight Per Bushel
2. Determining Moisture
3. Analyzing for Broken Corn and Foreign Material
4. Analyzing for Damaged Kernels

The students are to read the text material, look at 2 x 2 colored slides, work the review exercises (answers in appendices) and then perform the laboratory exercises. At the conclusion of Lessons One through Four, a review exercise based on the combined effects of test weight, moisture, broken corn and foreign material and damaged kernels has been provided.

The teacher is to be in the classroom to answer any student questions.

Four Sawyer projector-viewers and 2 x 2 colored slides will be provided for the individualized instructional unit. Divide your class assigned to the individualized instructional unit into four groups. One group will begin on Lesson One, another group on Lesson Two, one group on Lesson Three and the last group on Lesson Four; after two periods, rotate the groups. Repeat this procedure until all students have studied all four lessons.

For Example: 26 students

Test Weight	Moisture	Broken Corn and Foreign Material	Damaged Kernels
1 projector	1 projector	1 projector	1 projector
6 students	6 students	7 students	7 students

Appendix D Continued....

On pages 36 and 37 of the individualized instructional guidebook, there is a student evaluation form. Please see that each student assigned to the individualized instructional group completes this form.

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.

3. Directions for T: 2 (Lecture-discussion)

The students in lecture-discussion are not to see the 2 x 2 colored slides or the guidebook used for individualized instruction.

Lesson plans on Test Weight, Moisture, Broken Corn and Foreign Material and Damaged Kernels are provided, also, transparencies with exercises for interpreting these factors in terms of numerical grade. The teacher is to "lecture" and answer only student initiated questions; also, work the answers to the transparency exercises as a class exercise, not individually.

Damaged kernel samples will be provided for the students to examine.

Please do not ask the students leading questions, and answer or give examples only to the questions initiated by the students.

After the lecture-discussion period, the lecture-discussion group will perform laboratory exercises.

4. Laboratory

The same samples will be used by all four schools and for students in individualized instruction and in lecture-discussion. It is very important that the samples are not mixed and that all material be replaced in the original sample bags. This will assure that the next student and the next school will have the opportunity to work with equivalent material.

Samples marked 1 and 2 are for the laboratory exercises. Each student in the two methods of instruction is to determine: test weight, moisture, broken corn and foreign material and damaged kernels on these samples. A moisture-proof container with over 250 grams of corn harvested this season is provided for determining moisture; use the resulting moisture percentage reading for Sample Two.

The two final exam samples numbered 100-160 were secured from the Agronomy Department of Michigan State University. Each sample is different and has not been assigned a numerical grade. All material must be returned to the sample bag so that the next class and/or the next school will be working with equivalent materials. At the conclusion of the study, Dr. Lawrence Copeland of the Agronomy Department of M.S.U. will supervise assigning official numerical grades to these samples.

Appendix D Continued....

5. Contributory Information Needed

1. Students in individualized instructional method and lecture-discussion method complete the pretest prior to studying the unit.

2. Students in individualized instructional method and lecture-discussion method complete the student information sheet and interest inventory exam.

3. Students in both methods take the Guilford-Zimmerman Personality Inventory exam.

4. A list of the junior and senior students and their rank in academic courses (academic rank is based on total number of students in each grade classification.

5. Teach a lesson determining percentage and a lesson on gram weight prior to instruction by both methods.

6. Tape Recording of One Lesson

One individualized instructional lesson and one lecture-discussion lesson will be tape recorded in each school. For example, if the moisture lesson is to be taped, then moisture lessons for individualized instruction and for lecture-discussion in each school will be taped for comparison by the researcher.

7. Equipment Provided:

One test weight per bushel tester
One Boerner divider
One Steinlite moisture tester
Four gram scales
Four 12/64 inch sieves and bottom pans
Four Sawyer projector-viewers
Thirty-five 2 x 2 colored slides
Tape and tape recorder
Twelve grain pans
Grain samples (180)

8. Have students make the following corrections in the guidebook:

Page 13 - Under A. The word "multiple" to "multiply"

Page 35 - Sample No. 4, Test Weight = 56 pounds.

APPENDIX E

APPENDIX E

SEMANTIC DIFFERENTIAL SCALE

STUDENT EVALUATION FORM

The writer would like to know what you think and how you feel about this unit. You can help by completing the graphic rating scale presented below. Please make your judgments on the basis of what these things mean to you. You are to rate the opposing adjectives on each of the scales as follows:

If you feel that the question is very closely related to one end of the scale, you should place your check-mark as follows:

fair X : : : : : : unfair

or

fair : : : : : : X unfair

If you feel that the question is quite closely related to one or the other end of the scale (but not extremely), you should place your check-mark as follows:

fair : X : : : : : unfair

or

fair : : : : : X : unfair

If you feel that the question is only slightly related to one side as opposed to the other side (but not really neutral), you should then place your check-mark as follows:

fair : : X : : : : unfair

or

fair : : : : X : : unfair

The direction toward which you check, of course, depends upon which of the two ends of the scale seem most characteristic to you of the question that you are evaluating.

If you consider the question to be neutral on the scale, both sides of the scale equally associated with the question, or if the question is completely irrelevant (unrelated to the question), then you should place your check-mark in the middle of the space as follows:

fair : : : X : : : unfair

Appendix E Continued....

IMPORTANT: a. Place your check-marks in the middle of the spaces provided, not on the boundaries.

THIS NOT THIS

____:____:_X_:____:___X__:____

b. Be sure to mark every scale for every question--do not omit any.

c. Never put more than one check-mark on a single scale.

1. The lessons were:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
a. difficult								easy
b. clear								confusing
c. meaningful								meaningless
d. good								bad

2. The 2 x 2 slides were:

a. clear								confusing
b. necessary								unnecessary
c. meaningful								meaningless
d. important								unimportant
e. valuable								worthless

3. The text was:

a. difficult								easy
b. clear								confusing
c. meaningful								meaningless
d. good								bad
e. complete								incomplete

4. The review questions were:

a. fair								unfair
b. difficult								easy
c. clear								confusing
d. meaningful								meaningless
e. valuable								worthless
f. important								unimportant
g. complete								incomplete

5. The laboratory assignments were:

a. difficult								easy
b. clear								confusing
c. meaningful								meaningless
d. good								bad
e. valuable								worthless
f. important								unimportant
g. complete								incomplete

Appendix E Continued....

6. The individualized approach was:

a.	complete	____	____	____	____	____	____	incomplete
b.	pleasurable	____	____	____	____	____	____	painful
c.	interesting	____	____	____	____	____	____	boring
d.	fair	____	____	____	____	____	____	unfair
e.	valuable	____	____	____	____	____	____	worthless
f.	successful	____	____	____	____	____	____	unsuccessful
g.	complex	____	____	____	____	____	____	simple
h.	liked	____	____	____	____	____	____	did not like

APPENDIX F

PROFILE CHART FOR THE GUILFORD-ZIMMERMAN TEMPERAMENT SURVEY

Appendix F-1

For high-school, college, and adult ages

C SCORE	G General Activity Energy	R Restraint Seriousness	A Ascendance Social Boldness M F	S Social Interest Sociability	E Emotional Stability	O Objectivity	F Friendliness Agreeableness M F	T Thoughtfulness Reflectiveness	P Personal Relations Cooperativeness	M Masculinity Femininity M F	CENTILE RANK	NEAREST T SCORE
10	30 29 28	30 29 28 27	30 30 29 29 28 28 27	30	30 29	30 29	30 30 28 29 26 28	30 29 28	30 29	30 0 29 1	99	75
9	27 26	26 25	27 26 25 26 24	29	28 27	28 27	25 27 24 26	27 26	28 27	28 2 27 3		70
8	25 24	24 23	25 23 22 24 21	28 27	26 25	26 25	23 25 22 21 24	25 24	26 25	26 4 25 5	95 90	65
7	23 22	22 21	23 20 22 21 19	26 25	24 23	24 23	20 23 22 19 21	23 22	24 23	6 24 7	80	60
6	21 20	20 19 18	20 18 19 17 18 16	24 23 22	22 21 20	22 21 20	18 20 17 19 16 18	21 20	22 21 20	23 8 22 9	70	55
5	19 18 17	17 16 15	17 15 16 14 15 13	21 20 19	19 18 17	19 18 17	15 17 14 16 13 15	19 18 17	19 18 17	21 10 20 11	60 50	50
4	16 15 14	14 13 12	14 12 13 12 11	18 17 16 15	16 15 14 13	16 15 14	12 14 11 13 10 12	16 15 14	16 15 14	19 12 18 13	40 30	45
3	13 12 11	11 10	11 10 9 10 8	14 13 12 11	12 11 10 9	13 12 11 10	9 11 8 10 7 9	13 12 11	13 12	17 14 16 15 15	20	40
2	10 9 8	9 8 7	9 7 8 7 6	10 9 8 7	8 7 6	9 8 7	6 8 5 7	10 9 8	11 10 9	14 16 13 17 12 18	10 5	35
1	7 6	6 5	6 5 4 5 3	6 5 4	5 4	6 5	4 6 3 5	7 6 5	8 7 6	11 19 10 9 20		30
0	5 3 2 1	4 3 2 1	4 2 3 2 1 1 0	3 2 1 0	3 2 1	4 3 2 1	2 4 1 3 1 2 0 1	4 3 2 1	5 3 1	8 21 5 23 2 25	1	25
	Inactivity Slowness	Impulsiveness Rhathymia	M F Submissiveness	Shyness Seclusiveness	Emotional Instability Depression	Subjectivity Hypersensitiveness	M F Hostility Belligerence	Unreflectiveness	Criticalness Intolerance	M F Femininity Masculinity		

Ind. Instruction ——— Lecture-Discussion ---

APPENDIX F-2

Explanation of Scheffe's test[74] of the difference between any pairs of means after an analysis of variance has been calculated. The figures substituted in the formula are for the personality variable, personal relations, found in Table XXXIV. The test is statistically significant at the .05 level if the resulting two numbers both have the same sign.

$$\hat{\Psi} = \pm \sqrt{(t-1)\ F\ .05\ (MSw) \sum \frac{CT^2}{nT}}$$

$$\hat{\Psi} = (23 + 24 + 15) - (33 + 33 + 33) = -37$$

(the mean percentile ranks from Table XXXIV)

$(t-1) = .5$

F .05 for 5 and 116 degrees of freedom = 2.30

$MSw = 484$

$\sum \frac{CT^2}{nT} = 1/17 + 1/19 + 1/22 + 1/23 + 1/22 = .2974$

Substituting

$$-37 = \pm \sqrt{(.5)\ (2.30)\ (484)\ (.2974)}$$

$$= \sqrt{(1.15)\ (484)\ (.2974)}$$

$$= \sqrt{(556)\ (.2974)}$$

$$= \sqrt{165}$$

$$= 12.84$$

$-37 \pm 12.84 = -49.84$ to -24.16

---

[74] William Hays, Statistics for Psychologists (New York: Holt, Rinehart and Winston, Inc., 1963), p. 484.