Experimental evaluation of an instructional unit on agriculture/agribusiness management

Robert James Birkenholz
Iowa State University
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EXPERIMENTAL EVALUATION OF AN INSTRUCTIONAL UNIT ON AGRICULTURE/AGRIBUSINESS MANAGEMENT

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Experimental evaluation of an instructional unit on agriculture/agribusiness management

by

Robert James Birkenholz

A Dissertation Submitted to the Graduate Faculty in Partial Fulfillment of the Requirements for the Degree of DOCTOR OF PHILOSOPHY

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INTRODUCTION

Instructional aids are as old as teaching itself. Aids used in one-room schools of the past may have included a slate, the Bible, and later, a McGuffy Reader. Educational materials have been transformed by incorporating technology currently available. Children in lower elementary grades have learned to operate mini and micro-computers. Use of hand-held calculators has reduced the need to commit multiplication tables to memory. Overhead projectors, movies, and television sets have been used to display images which several years ago could only have been described orally or roughly sketched on a chalkboard.

Recent advances in educational technology resulted in development of curriculum materials at a pace unequaled to date. Both public and private concerns have contributed to the volume of instructional materials currently available.

Vocational education curriculum material centers, located in many states, serve as clearinghouses for teaching aids in a variety of subject matter areas. Vocational teachers tend to rely heavily on such aids due to the highly technical nature of the subject matter with which they deal. Much of this material has been adopted and utilized in classroom teaching situations without first determining its usefulness.

Selection of high quality instructional materials for use in vocational agriculture classes has been a difficult problem. Excessive demands on vocational agriculture instructors have prevented many from identifying the most suitable materials available. Vocational agriculture
programs in secondary schools have been characterized by expanded content areas as a result of the Vocational Education Act of 1963 (41). Geesey (19) noted that as a result of mandated diversification of instruction in vocational agriculture, it has become more important that students and teachers have access to quality instructional materials in an era of rapid technological advancement. Vocational agriculture instructors depend on instructional materials as aids in teaching subject matter outside their areas of expertise, and in providing student learning experiences in a more interesting or efficient manner than may otherwise have been possible. Although many instructors have assumed the responsibility of developing their own instructional materials, this is a time-consuming task. Time devoted to developing such materials necessarily reduces the amount of time available to devote to other aspects of the vocational agriculture program.

Instructional materials have been developed in many content areas and serve a variety of purposes. Some materials involve "game-like" activities which tend to do little more than stimulate interest in a subject matter area. Materials such as movies, film strips, and slide sets are excellent tools to introduce new and highly technical information or procedures. Vocational agriculture teachers espouse an educational philosophy supporting experiential learning and have been eager users of materials requiring students to solve problems. Use of such materials, which incorporate real or simulated situations, results in students using their reasoning or judgmental abilities and making decisions to solve a problematic situation. An underlying objective related to
the use of such materials involves developing students' decision-making skills. These skills are generally believed to be more practical and useful than the acquisition of technical facts which may soon become obsolete.

Instructional materials vary considerably in the degree of sophistication which has accompanied their development. Unstructured materials have been prepared without regard to their utility in vocational agriculture programs. Other materials have incorporated an assortment of information into subject matter units from which instructors can develop lesson plans directly. Between these two extremes lies an assortment of materials which are used in vocational agriculture classes in a variety of ways.

Vocational agriculture instructors must be able to identify and select instructional materials which will serve as aids in the educational process by providing student experiences through which desired learning outcomes occur. Teachers are often unable to assess the quality of instructional materials accurately due to a variety of constraints, mainly time and money. However, evaluating instructional materials is an important responsibility which must not be overlooked.

Ridenour (44) suggested that evaluations be conducted to determine the effect of materials on the teaching-learning process. Materials which improve the efficiency and/or effectiveness of the educational process should replace materials which prove to be less efficient or effective. In such evaluations, consideration should be given not only to the effect on student learning, but also to the ways that such
materials contributed to a teacher's ability to provide quality learning experiences.

Gliem (20) suggested expanding the scope of curriculum material evaluation to include not only changes in student knowledge, but also changes in relevant attitudes and competencies. Knowledge alone was no longer the sole criterion for evaluation. Student growth and development resulting from the use of instructional materials was also a prime concern. This broadened view of instructional material evaluation indicated the need for structured, empirical evidence to support and direct development of quality curriculum materials in the future.

Past innovations have often been adopted in education without first determining the ultimate impact on student growth and development. Most educators will agree that using instructional materials has enhanced the educational process, but a question arises upon producing new materials. What is the impact of newly created materials on the teaching-learning process in relation to the materials presently being used?

Vocational agriculture instructors desiring to select suitable materials for use in their programs seek answers to this question. Resource constraints previously noted have not permitted instructors to evaluate materials as they become available. Authors must accept the responsibility of empirically testing the effectiveness of instructional materials and providing results of such evaluations to potential users. These evaluations should not only focus on how materials affect student growth and development (i.e., knowledge, attitudes, and skills), but also should determine the impact on teachers as they use the materials.
The central problem of concern for this investigation was to determine the effectiveness of an instructional unit in Agriculture/Agribusiness Management. Specifically, the research question was: How effective was the Agriculture/Agribusiness Management instructional unit?

The purpose of this research was to experimentally test the effectiveness of an instructional unit developed by the writer in the area of Agriculture/Agribusiness Management. Specific objectives for this investigation were identified as follows:

1. To determine the effectiveness of an Agriculture/Agribusiness Management instructional unit as evaluated by changes in:
   a. student knowledge in Agriculture/Agribusiness Management.
   b. student attitudes toward Agriculture/Agribusiness Management.

2. To determine the effectiveness of an Agriculture/Agribusiness Management instructional unit in relation to traditional materials.

3. To identify relationships which may exist between students' personal or school situational characteristics and achievement in or attitude toward Agriculture/Agribusiness Management.

4. To identify relationships which may exist between instructors' personal or school situational characteristics and student achievement in or attitude toward Agriculture/Agribusiness Management.

5. To identify vocational agriculture teacher concerns regarding the quality and value of an Agriculture/Agribusiness Management instructional unit.
This research was conducted as part of a project entitled "Strategies for Revision of Curriculum and Program Restructuring of Vocational Agriculture in Iowa." The project was funded by grants from the U.S. Office of Education and the Iowa Department of Public Instruction under Public Law 88-210, commonly referred to as the "Vocational Education Act of 1963." The project was conducted under the supervision of Iowa State University and administered through the College of Agriculture, the Iowa Agriculture and Home Economics Experiment Station, and the Department of Agricultural Education.
Presented in the following paragraphs is a review of literature and research which relates to this investigation. Authors and researchers have written extensively on development, evaluation, dissemination, and use of curriculum materials in teaching. This chapter should not be viewed as an encyclopedia of curriculum literature, but it will provide readers an overview of the "state-of-the-art" in curriculum evaluation. Results of experimental research will be emphasized as these studies are the most rigorous means of establishing true cause and effect relationships (33).

Ridenour identified the need for curriculum material development from a practical perspective when he wrote (44, p. 9):

Because of the limitations of time, teacher ability, and the infeasibility of one person becoming proficient in so many specialized subject matter areas, there has long been a recognized need for providing help to teachers in the form of instructional materials . . . (to) eliminate the wasted duplication of search time for instructional materials by teachers.

Both Ridenour (44) and Kotrlik (34) noted the impact of the Vocational Education Act of 1963 (41) which broadened the scope of vocational agriculture programs and served to strengthen the need for instructional aids. Programs supported by Federal monies were directed to expand opportunities for study in agriculture to include both production and agribusiness aspects. Provision for parttime employment was one area where expansion was specifically cited.

National emphasis on development of curriculum materials for use
in vocational agriculture programs was fostered as a result of the 1968 Vocational Education Amendments which stated (51, p. 5):

The commissioner is directed by the Act to promote the development and dissemination of curriculum materials for use in teaching occupational subjects; to develop standards for curriculum development in all fields, ... (and) to evaluate vocational-technical education curriculum materials and their uses. ...

Related Research

Instructional materials intended for use by teachers have been available in many forms. Textbooks are possibly the most widely-used form of instructional aid, but future students may not have access to written textbooks to the same degree as past students. Budgetary problems prohibit teachers from purchasing multiple copies of textbooks for use by individual students. Computerized or other technically enhanced media may replace textbook materials in the future.

Curriculum guides and core curricula are other forms of instructional materials which have been developed and used by vocational agriculture teachers in their instructional programs. Dillon and Blezek (15) determined that 98 percent of Nebraska vocational agriculture instructors used prepared teacher core curriculum materials, and 75 percent used student core materials to some extent in their programs. These observations suggest a relatively high demand for instructional materials by vocational agriculture teachers.

Research efforts have not yielded conclusive evidence regarding the form of curriculum materials most desired by teachers. A study conducted
by Householder et al. (26) in 1976 revealed that teachers preferred instructional materials from which to teach rather than curriculum guides for planning. However, in 1971 Drawbaugh reported (16, p. 65), "The heaviest demand was not for student resources such as job sheets, work-sheets, manuals, and workbooks; but rather for teachers' guides."

During 1976, Tillman (48) surveyed Virginia vocational agriculture teachers to determine their perceptions of 17 separate pieces of material which were developed and disseminated by the Agricultural Education Program Area at Virginia Polytechnic Institute and State University. Teachers surveyed rated each of the materials as "good." Tillman further determined that teachers desired materials containing transparency masters, student workbooks, tear-out pages, and teachers' keys.

Hilton (24) surveyed Pennsylvania vocational agriculture teachers in 1975 to identify their attitudes toward dissemination of selected instructional materials. He utilized a semantic differential technique as part of his instrument, which asked respondents to evaluate instructional material by reacting to ten pairs of bipolar adjectives. Although this research technique did not produce an attitude "measure," it did provide an indication of attitude direction. Hilton concluded that (1) teachers selected units based on the content and method of presentation, (2) teachers want complete units with teaching-learning activities, and (3) teachers desired dissemination on a direct, one-to-one basis or through a workshop setting.

Several research studies have focused on the effectiveness of various media used in the educational process. Warfel (54) experimented
with the use of a lecture-filmstrip method and a lecture-demonstration method in teaching parliamentary procedure to Greenhand FFA members at a state leadership camp. He concluded that the lecture-filmstrip method was no more effective than the lecture-demonstration method in that situation. Kahler (31) also conducted an experimental evaluation involving the use of eight instructional techniques in 48 vocational agriculture programs in Iowa. No differences in student achievement were detected that could be attributed solely to any of the instructional techniques used. However, the need for varying techniques in vocational agriculture instructional programs was identified by Kahler, who concluded (31, p. 32):

It was evident from both student and teacher evaluations of the techniques tested in their schools, that the student became more involved in the learning process and felt that they had benefited more from their instruction as a result of the use of these instructional techniques. It was further observed that in those treatment groups that encouraged independent study in addition to large group instruction, the students achieved at higher levels than did those who were subjected to the large group instruction approach only.

In yet another study, Zikmund (56) found no differences in the aspirations, understandings, or attitudes of Nebraska eighth graders when instruction consisted of viewing a slide-tape presentation describing mediated occupational information. Conclusions provided as a result of each of those media-related studies would appear to indicate that use of a single instructional technique or medium may be no more effective than any other, in a given situation. Teachers must be prepared to vary their techniques to provide the greatest opportunity for student learning to occur.
Curriculum research efforts have also focused on evaluating effectiveness of prepared units of instruction for both student and teacher use. These evaluations have differed greatly in the degree of formality and subjectivity which has accompanied the evaluation procedure. Warmbrod (55) suggested classroom teachers were in a unique position to evaluate new ideas (e.g., curriculum materials) in the situation for which they were intended. Teachers often visually appraise instructional material to determine its worth in the classroom. Other teachers will use new material in their classes and evaluate effectiveness in relation to instructional objectives.

Geesey emphasized the importance of evaluating curriculum materials in classrooms: "The impact of new instructional materials on the teaching-learning process should be quantified by classroom testing" (19, p. 17). Not only were evaluations to be conducted in classroom settings, but also results were to be measured or quantified. This observation supported the need to conduct "experimental" evaluations, as was noted in 1966 when it was reported in the Review and Synthesis of Research in Agricultural Education that "Experimental studies designed specifically to evaluate the effectiveness of instructional materials have not been common to agricultural education" (43, p. 57).

Prior to 1966, the majority of curriculum material evaluation efforts were subjective in nature. Since that time, many studies have utilized experimental designs to remove inherent bias. Many early experimental studies identified level of student knowledge as the most
important dependent variable. An achievement test was usually employed to determine the level of student achievement. Bloom et al. described the importance of this type of instrument in evaluating instructional materials (4, p. 54):

The achievement test is an attempt to quantify achievement of students and constitutes the principle instrument in measuring the extent to which learning has occurred, as well as being a means of facilitating learning.

Both Ridenour and Woodin (45) and Kaas (30) concurred that effect on student achievement should be a prime criterion for evaluating curriculum materials. Gliem (20) concluded in 1976 that evaluations should be conducted to determine the effect of instructional materials on student attitudes and abilities in addition to gain in student achievement. This broadened view of the scope of evaluations persists today. Many research efforts focusing on evaluating curriculum materials have examined more than the impact on student achievement. Bristol (6), Chall (9), Cromwell (10), Jacks (28), Phipps (40), and Wall (53) suggested that the following additional criteria be used for evaluating curriculum materials: (1) subject matter content, (2) readability, (3) organization, (4) up-to-dateness, (5) format, (6) usability, and (7) adaptability to teaching methods. Many of these criteria were suggested for specific curriculum material forms.

A study conducted in 1980 by Townsend (49) evaluated an instructional packet designed to teach leadership and provide information about the Future Farmers of America (FFA) organization to beginning vocational agriculture students. Sixty Iowa vocational agriculture departments were randomly selected and assigned to two experimental treatment groups and
one control treatment group in equal numbers (20 per group). One experimental group was provided with an instructional packet and inservice training concerning use of the materials. The second experimental group was provided the instructional packet without the benefit of inservice training. Finally, the control treatment group received neither the instructional packet nor inservice training. They were directed to teach leadership and FFA as they normally would to their beginning vocational agriculture students. A posttest only, control group design was the research model used for this investigation. Townsend concluded there was no significant difference in knowledge scores among students in the three groups, although students whose teachers had access to the instructional packet had a more positive attitude toward the FFA organization. There was no attempt made to evaluate effects of the instructional packet on student abilities.

Briers (5) conducted a similar study in 1978, evaluating a supervised occupational experience (SOE) instructional packet. Forty beginning vocational agriculture classes in Iowa were randomly selected to participate in the study. Half were assigned to an experimental treatment group and remaining classes were assigned to a control treatment group. Experimental group instructors received an SOE instructional packet and were also provided with inservice training concerning its use in the classroom. Control group instructors were asked to teach what they normally would teach their beginning students on supervised occupational experiment programs without having access to the instructional packet or inservice training. Briers used a pretest-posttest, control
group design as the research model for his experiment. Evaluative data collected as a part of this investigation included information concerning: (1) student knowledge of SOE programs, (2) student attitudes toward SOE programs, and (3) the degree to which students had planned their SOE programs by the end of the experiment. Briers concluded that experimental group students significantly improved their knowledge scores and performed better on an SOE Planning Inventory, but student attitudes were not appreciably affected by instruction utilizing the instructional packet.

Both Townsend and Briers provided inservice training for one group of instructors concerning suggested use of the materials. Both researchers recommended that future instructional material dissemination efforts include inservice training. Ehresman supported this recommendation (17, p. 2006a):

Maximum benefits from structured instructional materials may not be realized unless teachers are aware of the materials and are given assistance in utilizing the materials.

These researchers viewed inservice as a necessary dimension of curriculum material development and dissemination projects. Classroom teachers were felt to need additional training in order to utilize instructional materials to their fullest potential.

Joslin (29), on the other hand, conducted a meta analysis of 137 research reports on teacher inservice programs. She concluded that teachers' participation in inservice training programs was of questionable effectiveness in changing students' knowledge, attitudes, and skills.
She did concur that inservice was an effective means for changing knowledge, attitudes, and skills of participating instructors. Therefore, if the goal of curriculum material development projects is to effect changes in students, inservice training for teachers may not contribute to that end. Conversely, if teachers are expected to change their behavior in some manner, inservice training may provide a suitable avenue for the desired change. Most studies reviewed did not involve an inservice component in the research design.

Bettis (2) conducted an evaluation of the effect of using prepared study guides in teaching safe use of power tools. Experimental group students used study guides to supplement instruction involving demonstrations and other instructional methods, whereas control treatment group students did not have access to study guides. He concluded that students who had access to safety units scored no higher on a safety examination than students who did not use those materials.

In a similar study, Gliem (20) found that use of a student reference on ladder safety did not result in significantly increased knowledge gains. Students who did not use such a reference performed equally well.

Sixteen intact vocational horticulture classes in Ohio served as the sample for a posttest only, control group study conducted by Urbanic (52) in 1971. His research problem involved evaluating a student reference used in teaching ornamental horticulture to selected high school students. Urbanic concluded that although teachers responded favorably to the materials, posttest scores revealed no significant differences between experimental and control group students.
During 1979, Scanlon (46) used what he termed a "true experimental design" to evaluate effects of task instruction sheets on student performance. Students in the experimental group were provided with instruction sheets in the area of poinsettia production, whereas control students did not have access to such information. Scanlon found that experimental group students scored significantly higher on a posttest than did control group students. He further noted that reading aptitude, when used as a covariate variable, was not significant in relation to posttest scores.

Henry (22) reported on an agricultural careers game which he developed and evaluated in 1975. Selected ninth-grade agriculture students in Pennsylvania used the game in their classes and then completed an examination dealing with agricultural careers. Henry determined that students who had used the game achieved at the same rate as students who did not use the game, although he did conclude that cognitive achievement was highly correlated with a measure of student aptitude.

Pennsylvania was also the location of a study conducted in 1976 by Reimold (42). Fourteen classes in three high schools, totaling 386 students, participated in an evaluation of an instructional unit in nematology. Both biology and vocational agriculture classes were taught using a unit developed by Reimold. Conclusions offered as a result of the study were as follows: (1) girls scored higher than boys in biology, (2) biology boys scored higher than vocational agriculture boys, (3) I.Q. affected outcomes of both pre- and posttests, and (4) academically-inclined students scored higher on I.Q. tests than did vocational
agriculture students. Reimold ultimately suggested the nematode unit was successful in teaching nematology to high school students, although his data failed to support that claim.

Zurbrick (57) evaluated a teacher reference on marketing principles with Ohio vocational agriculture instructors in 1971. A pretest-posttest, control group design was used as the research model for this experiment. Criteria considered for evaluative purposes included student understanding, teaching time required, and teacher preparation time required. The instructional unit developed by Zurbrick was based on several economic principles and utilized an inductive mode. Six experimental group teachers were provided with the teacher reference, while six control group teachers received only the list of principles upon which they were to base their instruction. A fifty-five-item multiple choice examination was used to determine the level of student understanding for both the pretest and posttest measures.

Zurbrick found that experimental group students increased their level of understanding by 46 percent, whereas control group students produced a 25 percent gain in their level of understanding from pretest to posttest. He then concluded that the teacher reference was a successful aid for teaching economic principles, but did not reduce the amount of teacher preparation time required.

Students of vocational agriculture at Kane High School in Pennsylvania served as the sample for a curriculum material evaluation conducted by Fritz (18) in 1979. He developed a self-instruction manual for his students to use covering basic arc welding procedures. After 18 weeks
of instruction, Fritz determined that students produced a net gain of 20 points on a measure of welding achievement from pretest to posttest. This gain was attributed solely to the use of the self-instruction manual, although justification for this conclusion was not provided.

Related Literature

Several authors have written extensively on the subject of evaluating and selecting instructional materials for use in vocational agriculture classes as Seeley wrote in 1973 (47, p. 3),

The problem today is not preparation of teaching methods and materials, but the intelligent selection of effective methods and appropriate materials for each learning situation.

Seeley noted materials were available in sufficient quantities, but the problem of identifying and selecting appropriate materials for each desired learning experience was of paramount importance. Teachers have evaluated the usefulness of instructional materials in relation to objectives identified for a course of study or specific learning experience. Reimold described the importance of continually evaluating curriculum materials when he stated: "Periodic re-evaluation and revision of teaching materials must be carried on to maintain the needs of today and the future" (42, p. 4).

Community and student needs change and educational programs must be adjusted to meet those needs. Curriculum materials likewise must be monitored and periodically modified to produce learning outcomes which are desired in students. Change through flexibility and continuity has been identified as a basic principle upon which agriculture and
agribusiness education programs in Iowa are founded (12). As programs change, instructional materials used in those programs must also change.

Agriculture has been characterized as an industry which undergoes constant change. Agricultural educators are charged with the responsibility of providing students information necessary to function effectively as consumers of agricultural products and/or as workers in agricultural industries. The problem of keeping abreast of changing technology in agriculture was noted by Jacks in 1971 (27, p. 55):

To effectively train today's agriculturists the vo-ag teacher must know the animal and plant sciences, the mechanical and economic aspects of farming, and the occupational requirements of non-farm ag-related pursuits.

Prepared curriculum materials which are carefully developed can help teachers by providing up-to-date information in this rapidly changing field. Curriculum materials must, however, reflect changes in more than technological information. Kelly identified other factors affecting education which change over time (32, p. 21):

Curriculum theory, therefore, must recognize that curriculum development must be a continuing process of evolution and change. Knowledge continues to develop; society evolves; people change; and the curriculum must keep pace with all these.

Bloom et al. (3) expanded this idea to accommodate change by reducing emphasis on minute details of a subject matter area. They contended that education should be more concerned with emphasizing basic ideas, structure, and methods of inquiry in student learning experiences.
Successful teaching would then prepare students for the deluge of new information which they will undoubtedly face throughout their lives.

Instructional aids should not be viewed as a cure-all for education's ills. Well-conceived materials will surely increase efficiency and/or effectiveness of the educational process, but may not produce a comparative advantage in student achievement. Bruce addressed this point of contention as follows: "...no amount of instructional materials will make a poor teacher of agriculture into a good teacher if his fundamental ideas about teaching are wrong" (7, p. 61).

Instructional materials should not be used as "crutches" to support the teaching-learning process. Rather, materials should be used as catalysts which enable students to learn more readily, or streamline the educational process. Without effective materials, student learning would likely have been hampered to some degree.

Evaluations have often focused on how materials affect student achievement. More emphasis should be placed on determining changes in teaching roles resulting from using instructional materials. Tillman (48) determined that younger teachers, with three or fewer years of experience, are the greatest users of instructional materials. Ehresman (17) noted that instructional units may save planning and preparation time for inexperienced teachers. More tenured instructors, however, tend to reduce their reliance on, or acceptance of new curriculum materials in lieu of materials which they have traditionally used in the past. Experienced teachers generally demand proof, or at least evidence, which substantiates the relative value of newly-created instructional
Evaluations have not accompanied development and dissemination of many instructional materials available to teachers of agriculture today. Drawbaugh described the scope of this problem: "... more instructional resources (were) being disseminated which were not tested than were tested for effectiveness in teaching and learning" (16, p. 65). Grobman (21), Kelly (32), and Tyler (50) have written about the importance of evaluating curricula in general, and teaching materials specifically. Each of these authors has also identified several criteria which should be used for evaluative purposes. Although student achievement was identified as most important, other criteria included: attitude changes, expanded abilities, reduced costs, increased student motivation, along with many others. Experimental designs were also recommended as optimum research models to insure that changes identified were a result of manipulation of the instructional material used and not uncontrolled factors.

Much has been written concerning evaluation of materials used in teaching. The majority of research studies have been unable to detect significant increases in student achievement when comparing one type of material with another. Each study reviewed did indicate that curriculum materials were generally successful in enhancing the learning process and contributed to student achievement. Studies have determined that teachers view some materials as more efficient than others relative to the planning and preparation time required to use such materials.

Younger teachers have been more dependent on instructional materials
in teaching than their more experienced colleagues. Future development of instructional materials should address the needs of beginning teachers as a primary focus. Reducing planning and preparation time required may encourage teachers to remain in the profession, when the dropout rate of teachers has been a problem facing vocational agriculture programs in Iowa.

Instructional materials have increased the effectiveness of quality teachers but have not transformed poor teachers into good ones. Changes in agriculture have made it necessary for teachers to use up-to-date materials in order to provide appropriate learning experiences for students. Future development of materials should be based on principles to accommodate the need for students to become more self-directed in their learning. Agriculture will continue to change in the future, as it has in the past, and students will need to master new information which will accompany those changes.

Teaching aids have and should continue to be developed in a variety of forms which can be adapted to a variety of teaching methods. Students learn at varying rates and in response to different stimuli. Teachers must be free to select appropriate instructional materials and methods for each learning experience.
METHOD OF PROCEDURE

The central problem for this investigation was to determine the effectiveness of an Agriculture/Agribusiness Management instructional unit. Specific research procedures were employed to fulfill this objective. These procedures are described in the following paragraphs under the headings: Definition of Terms, Development of Instructional Unit, Research Design, Instrumentation, Collection of Data, Analysis of Data, and Summary of Research Procedure.

Definition of Terms

Several terms found throughout the remaining text have meanings which were unique to this investigation. Definitions for these terms are presented to avoid ambiguity and prevent misunderstandings concerning how these terms were used and applied in this study.

Project 2000--a shortened title used for convenience in lieu of the full title for the project of which this research was a part.

Agriculture/Agribusiness Management--subject matter which has commonly been taught in Iowa vocational agriculture classes concerning general principles of management, business organization, business laws, contracts, liability, and governmental regulations affecting agriculture.

Instructional Unit--a collection of printed materials outlining subject matter and suggesting an approach to teaching.

School--Iowa high schools in which the experiment was conducted.
More specifically, in this context the term indicates vocational agriculture classes in which the experiment was conducted.

**Students**—Iowa vocational agriculture students participating in this experiment as a result of their membership in selected vocational agriculture classes.

**Avocational Agricultural Pursuit**—any agriculturally-related activity undertaken for pleasure and/or profit which may comprise up to 40 percent of an individual's income and require some knowledge of agriculture.

**Development of Instructional Unit**

The instructional unit which was evaluated as part of this investigation was developed by the researcher. Instructional materials were collected, adapted, developed, and arranged in ten problem areas. Agriculture/Agribusiness Management was selected as an appropriate title for the unit which provided an indication of the content.

Problem areas included in the unit were selected from those identified in the Farm Business Management section of the Iowa Curriculum Guide in Agribusiness and Natural Resource Education (14). Problem areas were identified by problem area questions as follows:

1. What is management?
2. How may agricultural businesses be organized?
3. What are the characteristics of a sole proprietorship?
4. What are the characteristics of a partnership?
5. What are the characteristics of a corporation?
6. What are the characteristics of a cooperative?

7. How do business laws affect agricultural businesses?

8. Why are contracts used in business?

9. What types of liability are of concern to agricultural businesses?

10. What governmental regulations affect the operation of an agricultural business?

Materials included in the unit were assembled in a problem-solving format. Each problem area was characterized by the following components: problem area question, situational statement, study questions, references and instructional materials, learner needs, suggested interest approach, learning activities, conclusion, evaluation criteria, and optional learning activities.

Problem area questions were intended to identify basic problems (or questions) students would need to solve (or answer) in each subject matter area. These questions were too broad to address in one lesson, but were intended to provide direction for instruction in the problem area for two to five 55-minute class periods.

Situational statements were included which directed instructors to identify "real-life" situations in the local community which characterized the problem at hand. Students' supervised occupational experience programs were suggested as excellent sources from which problematic situations could be derived.

Study questions were provided to identify specific questions to be answered. Three or more questions were developed in each problem area.
After answering all study questions, students should have been able to solve or answer the problem area question. Study questions were to be addressed during a single class period of instruction.

Teachers continuously search for a variety of instructional materials and references which could be used to supplement their teaching. References and instructional materials related to each problem area were identified throughout the unit. Addresses of publishers were also provided, enabling instructors to order materials if necessary.

Learner needs were identified as concepts instructors should stress in addition to subject matter. Tyler (50) described the importance of developing curriculum materials based on needs of learners, society, and the subject matter. Societal and subject matter needs are unique to each teaching environment and instructors must adapt their programs to meet those needs. Universal needs of learners were identified during an earlier phase of Project 2000. Learner needs which could be addressed were identified and keyed to specific learning activities in each problem area.

One activity included in each problem area was intended to arouse student interest. Interest approach activities were suggested to "set the stage" for further instruction, rather than provide in-depth instruction on a particular problem. Such activities assumed a variety of forms ranging from skits to films to educational games.

Several learning activities were suggested in each problem area. Activities were designed to encourage students to gather information needed to answer each study question. Transparency masters, student
activities, and information sheets were provided. Learning activities were described in detail providing teachers an indication of the intended use of the materials.

Conclusion sections were an important component of each problem area. Answers to study question were provided to aid teachers in summarizing each lesson and problem area. Conclusions also provided information necessary to answer the more general problem area questions as well.

Criteria for evaluating student achievement in each problem area were suggested. Although subject matter concepts were identified for evaluative purposes, instructors were encouraged to develop tests and quizzes for their own use. Teachers were asked to prepare evaluative instruments stressing concepts which they emphasized in their own programs. For the purpose of this study, however, instructors were asked to teach exactly as suggested in the instructional unit.

Optional learning activities were provided in several problem areas. These activities were identified as supplemental to instruction suggested in previous learning activities. Instructors wishing to provide more in-depth instruction or additional emphasis on a particular problem could consider these optional activities to serve that purpose.

The instructional unit contained an introductory section describing development and use of the unit. The instructional approach suggested throughout the unit was problem solving or decision-making. Format components were similar to those suggested by Lancelot (35), who advocated decision-making teaching.
The problem-solving approach incorporated an inductive learning mode through which instruction progressed from specific situations to more general principles. Students were encouraged to solve problems by acquiring and applying information relevant to each problem area. Learning activities also emphasized the importance of student experiences to enhance the learning process.

Research Design

A pretest-posttest, control group design as described by Campbell and Stanley (8) was selected as the research model to be used for this investigation. The specific design is diagrammed schematically below:

\[ S \quad R \quad O_1 \quad O_3 \quad X_1 \quad O_5 \quad O_7 \quad O_9 \quad O_{11} \]
\[ S \quad R \quad O_2 \quad O_4 \quad X_2 \quad O_6 \quad O_8 \quad O_{10} \quad O_{12} \quad O_{13} \]

where:

- **S** indicates nonrandom selection of the sample from the population.
- **R** indicates random assignment of selected teachers to either experimental or control treatment groups.
- **O_1**, **O_2** represent a pretest instrument designed to collect information from students indicating their level of knowledge of agriculture/agribusiness management.
- **O_3**, **O_4** represent a pretest instrument designed to collect information from students indicating their attitude toward agriculture/agribusiness management concepts.
- **X_1** indicates the control treatment which involved instructors teaching agriculture/agribusiness management using "traditional" instructional materials.
$X_2$ indicates the experimental treatment which involved instructors teaching agriculture/agribusiness management using an instructional unit provided by the researcher.

$O_5$, $O_6$ represent a posttest instrument designed to collect information from students indicating their level of knowledge of agriculture/agribusiness management.

$O_7$, $O_8$ represent a posttest instrument designed to collect information from students indicating their attitude toward agriculture/agribusiness management concepts.

$O_9$, $O_{10}$ represent an instrument designed to collect student personal and school situational information.

$O_{11}$, $O_{12}$ represent an instrument designed to collect teacher personal and school situational information.

$O_{13}$ represents an instrument designed to collect information from experimental teachers regarding their perceptions of the agriculture/agribusiness management instructional unit.

Because this investigation was concerned with determining the effect of using an agriculture/agribusiness management instructional unit on student achievement, both pretest and posttest measures of student achievement were needed. In addition, comparisons were desired between the level of student achievement resulting from instruction using traditional materials and the achievement levels of students taught by teachers using the instructional unit. The latter objective required inclusion of a control group in the design. Remaining objectives did not mandate additional design implications.

Seventy-two vocational agriculture teachers were selected from a list of 282 instructors employed in the State during the 1981-82 school term (13). Teachers selected were those who would most likely participate in the experiment by completing all responsibilities assigned them. This criterion was desired to insure that participating instructors would
teach the unit as directed by the researcher.

After 72 potential instructors were identified, the list was reviewed by Agricultural Education faculty members at Iowa State University. All teachers identified were approved for participation by these agricultural educators. Equal numbers of teachers were randomly assigned to experimental or control treatment groups by arranging teachers' last names in alphabetical order using a table of random numbers.

Hinkle, Wiersma, and Jurs described the usefulness of samples selected in such a manner (25, p. 201):

> Nonrandom samples can be used in research. If assignment to treatments is random, inferences based on statistical results can be made to the individuals included. Such inferences may be extended to other populations, but only on a logical, not on a statistical basis.

Teachers were initially contacted by letter (see Appendix A) to ask for their participation in the experiment. A self-addressed, postpaid postcard was enclosed with each letter asking teachers to hold a discussion with their building principal about participating in the study. Postcards were to be signed by both instructors and building principals before being returned to the researcher (see Appendix A). Forty-eight of the 72 teachers identified returned postcards and agreed to participate by teaching an agriculture/agribusiness management unit between November 1, 1981 and February 1, 1982 (see Appendix B). Twenty-six instructors assigned to the experimental group agreed to participate, whereas 22 control group instructors responded favorably. A majority of the instructors who did not agree to participate indicated their unwillingness to alter their curriculum during the time period.
identified.

Experimental treatment group instructors were asked to teach agriculture/agribusiness management using the approach suggested in the instructional unit. Control group instructors were provided a list of problem areas and study questions (see Appendix A) which were included in the instructional unit, and they were directed to focus their instruction on those areas using instructional materials currently available. It was assumed that both experimental and control group instructors focused their instruction on these same problem areas as directed. Neither group was provided inservice training regarding instruction in this subject matter area before or during the experiment.

Differences observed when comparing results of this experiment should be attributable to manipulation of the independent variable, i.e., the degree to which teachers had access to the agriculture/agribusiness management instructional unit. Although statistically-based conclusions must necessarily be limited to agricultural education programs included in the sample due to the nonrandomness of selection, generalizations drawn may logically have implications for other teachers utilizing such instructional units in the future.

Requirements for both internal and external validity appear to have been met for this experiment. Only a single independent variable was manipulated which fulfilled the requirement for internal validity. Vocational agriculture programs selected for this investigation were not so unique that findings could be replicated in other programs throughout the state of Iowa. Therefore, although the sample was not randomly
selected, external validity assumptions were not grossly violated.

Instrumentation

Several data collection instruments were developed and used as part of this investigation. Student achievement levels were ascertained through development and administration of a forty item, multiple choice examination. This examination was developed by the researcher consisting of four questions pertaining to each problem area included in the instructional unit. Individual items were developed in relation to study questions provided all participating teachers to avoid biasing the instrument. Information which may have been construed as specific to the instructional unit was not included in examination items. After initial development of the examination, it was presented to agricultural education faculty members at Iowa State University, who were asked to evaluate the instrument for content and face validity. These evaluators were asked to review each item's appropriateness for providing an indication of student achievement in agriculture/agribusiness management. Minor revisions were suggested for some items, but the examination was not significantly altered.

The student knowledge inventory (see Appendix D) was constructed by randomly arranging items using a table of random numbers. Responses for each item were also randomly arranged. The posttest form contained identical items although the order was rearranged in a random manner. Responses on the posttest form were not changed to avoid altering the degree of difficulty of the examination. Directions were provided at
the top of the first page of each examination booklet instructing students to complete the instrument and record their responses on IBM General Purpose Answer Sheets which were also provided.

Indications of student attitudes toward agriculture/agribusiness management concepts were collected through development and use of a student attitude inventory (see Appendix D). Six concepts related to agriculture/agribusiness management subject matter were evaluated by students who were asked to indicate their feelings or attitudes toward each concept presented. A semantic differential technique was employed requiring students to respond to each concept on a seven-unit scale with one member of a pair of bipolar adjectives at each extreme. Bipolar adjectives were exact opposites in meaning and respondents were directed to place a check mark (X) in one of seven positions on a scale between the two adjectives relative to their feelings toward each concept presented (36). Six pairs of bipolar adjectives were used for students to respond six different ways to each concept presented. More positive adjectives were generally positioned on the right-hand side of the scale to avoid confusing respondents. Values from 1 to 7 were assigned to each response position from left to right on the scale as illustrated below.

\[ \text{bad: 1 : 2 : 3 : 4 : 5 : 6 : 7 : good} \]

Student data collection instruments did not reveal these values. Identical instruments were used to collect student attitude responses during pretest and posttest measures.
Accompanying student posttest attitude inventories were student
data instruments (see Appendix D) used to collect personal and school
situational information. Information collected was used in data analysis
and interpretation to aid development of meaningful conclusions.

Information was also secured from participating instructors to pro­
vide additional insight into resulting findings. Teacher data instru­
ments (see Appendix D) were used to collect general information from
participating instructors. A second teacher data instrument was used
to collect more specific personal and school situational information from
instructors relative to the agriculture/agribusiness management unit.
Both experimental and control group teachers were requested to complete
each of the above instruments.

Experimental group teachers were also asked to complete an instru­
ment used to evaluate the agriculture/agribusiness management unit
(see Appendix D). A semantic differential technique was employed to
collect teacher responses concerning overall quality of the instruc­
tional unit. Format components were evaluated by participating in­
structors using a nine-point scale to rate the "value" of each format
component (i.e., problem area, study questions, learner needs, etc.).
Responses of "1" indicated the particular component was of no value,
"5" indicated the component was of average value, and "9" indicated the
component was of utmost value. Instructor perceptions of the value of
developing and disseminating additional instructional units were also
solicited.
Collection of Data

Experimental and control treatment group instructors were provided guidelines for collecting student information (see Appendix A). These instructions encouraged participating instructors to ask their building principal or guidance counselor to administer the student inventories. The researcher believed this strategy would emphasize the importance of responding in a conscientious manner.

Before any information was collected, students and parents were asked to read and sign an informed consent statement (see Appendix C). Instructors were asked to describe the extent of and need for participation before asking students for their cooperation. Iowa State University's Committee on the Use of Human Subjects in Research reviewed and approved each data collection instrument and informed consent form. Participating instructors were also asked to read and sign an informed consent form (see Appendix C) prior to submitting information to the researcher.

Pretest instruments were mailed to all participating instructors on October 26, 1981. Teachers were directed to collect student information prior to commencing instruction in agriculture/agribusiness management. Experimental group instructors were directed to review the unit and become familiar with the format of presentation. Control group teachers were asked to review the list of problem areas and study questions which they received and provide instruction in each of the areas identified. Instructional resources or materials were not identified
or suggested for use by control group teachers.

Participating instructors were asked to contact the researcher two weeks prior to concluding instruction in the unit. After notification from each instructor was received, posttest materials were mailed to them. Guidelines for collecting student information were again supplied and administration of student instruments by building principals or guidance counselors was encouraged. Information collected from teachers was obtained during the posttest collection period.

Code numbers were used to identify materials sent to and received from participating schools (see Appendix B). Each school was assigned a three-digit code number. Control schools were assigned numbers with "5" in the first position and experimental schools were assigned numbers with "6" in the first position (see Appendix B). The following two digits of each number were used to identify individual schools within treatment groups. Pretest and posttest information was returned to the researcher immediately after collection by participating instructors. Pretest knowledge inventory booklets were also returned following administration, whereas posttest examinations were retained by participating teachers. It was a major assumption that neither experimental or control group instructors retained copies of examination booklets, as this would have biased results of this experiment.
Analysis of Data

Data collected throughout this investigation were analyzed using Iowa State University Computation Center facilities. Statistical procedures employed were selected from the Statistical Package for the Social Sciences (SPSS) (37). Paragraphs which follow describe procedures used to analyze the data.

Student data were punched onto 80-column IBM computer cards by ISU Computation Center personnel. Only the total number of correct responses on the knowledge inventory was punched on student records. Values assigned to student attitude responses for each concept and scale were entered onto cards in raw form. Attitude responses could not be summed as the semantic differential scales employed for this investigation were not characterized by additivity. Personal and situational student data were punched on each student's record as well.

Teacher data were also punched onto 80-column IBM computer cards. Pretest and posttest class means for the knowledge inventory were entered on each teacher's record. Attitude inventory class means were computed for each of the 36 scales and entered onto teacher data cards because of the impropriety of summing attitude responses. Teacher and student data card decks were not co-mingled throughout the data analysis process.

Knowledge inventory instrument reliability was estimated by computing a Kuder-Richardson (KR-20) coefficient. This coefficient was computed for both pretest and posttest measures individually. Reliability
estimates were computed as part of the investigation. Experimental and control students were grouped together for the purpose of estimating reliability coefficients. Reliability estimates were computed during machine scoring of student answer sheets by the Iowa State University Test and Evaluation Service.

Reliability coefficients were to equal or exceed .80 for both pre-test and posttest knowledge instruments. Coefficients below that level would have been undesirable and would have necessitated steps to increase instrument reliability.

Attitude inventory instrument reliability was estimated using the SPSS subprogram RELIABILITY. This procedure produced an alpha coefficient of internal consistency. The reliability coefficient alpha was computed using a generalization of the KR-20 formula.

Student and teacher data which were missing or of questionable accuracy were not included in data analysis. Although rarely needed, such items were coded as "9s" through the use of the MISSING VALUES procedure.

The subprogram FREQUENCIES was employed to develop an understanding of how the data were distributed for several variables. These distributions were then visually inspected to determine the pertinency of the data. Knowledge inventory class means were computed using this subprogram.

Descriptive analysis was performed using two SPSS subprograms. CROSSTABS was employed to construct contingency tables for selected student and teacher variables measured on an ordinal scale. This analysis
produced joint frequency distributions, which were tested for independence through the calculation of a chi-square statistic to determine the success of the random assignment procedure.

The subprogram CONDESCRIPTIVE was used to compute descriptive statistics for data measured on an interval level. Means and standard deviations were computed for student attitude inventory items and experimental teacher evaluations of the instructional unit. Both measures employed the semantic differential technique. Experimental teacher responses to the value of format components in the instructional unit were also analyzed using the subprogram CONDESCRIPTIVE.

Inferential analyses were performed using a variety of procedures available in SPSS. Experimental and control group differences for both pretest and posttest measures were determined by the T-TEST procedure. Differences between treatment levels for knowledge gain (pretest-posttest differences) were determined through the use of the analysis of covariance procedure controlling for pretest differences.

Subprogram FACTOR was employed to analyze responses to the student attitude inventory. This procedure identified underlying constructs which existed for the 36 attitude scale items. Student attitude changes were analyzed by testing for significant differences between pretest and posttest responses using the T-TEST procedure.

Relationships between selected student or teacher variables and student achievement measures were identified using the PEARSON CORR subprogram. Significant correlations were inferred from the procedure. These relationships were used to interpret other findings of this
investigation.

Summary of Research Procedure

This study focused on determining the effectiveness of an Agriculture/Agribusiness Management instructional unit. Teachers were selected and randomly assigned to treatment levels. Control teachers were instructed to teach ten problem areas in the selected subject matter without having access to a prepared instructional unit. Experimental teachers were directed to teach the ten problem areas exactly as suggested the instructional unit provided.

Student knowledge and attitude measures were collected prior to and immediately following instruction in the subject matter area. Selected personal and situational information was solicited from participating students and teachers. Experimental teachers were also asked to evaluate several aspects of the instructional unit.

Data analysis procedures focused on fulfilling objectives identified for this investigation. Most importantly, knowledge gains from pretest to posttest measures were of primary concern.

Findings and conclusions drawn as a result of this investigation were necessarily limited to participants. Generalizations could not have been extended to all vocational agriculture teachers, students, or programs in Iowa on a statistical basis, although conclusions may have implications for those groups when interpreted with a degree of caution.
FINDINGS

Data collected as part of this experiment were coded and analyzed to fulfill the objectives stated in the introductory section of this manuscript. Student responses were grouped by class and means computed for each variable used in data analysis. Findings are presented under the following major headings: (1) Descriptive Analysis of Treatment Groups, (2) Evaluation of Data Collection Procedure and Instruments, (3) Effectiveness of Instruction, (4) Comparison of Treatment Groups, (5) Relationships Among Student Characteristics and Instructional Effectiveness, (6) Relationships Among Instructor Characteristics and Instructional Effectiveness, (7) Evaluation of Instructional Unit, and (8) Major Findings.

Descriptive Analysis of Treatment Groups

Twenty-eight of 47 Iowa Vocational Agriculture instructors contacted, participated in this experiment by providing pretest and posttest information interceded with instruction in Agriculture/Agribusiness Management. Students in sixteen classes provided responses for the experimental group, whereas, students in twelve classes provided responses for the control group. Data in Table B.1 (see Appendix B) reveal the number of students responding from each class. Nonparticipants (19 instructors or classes) indicated they were unwilling or unable to: (1) teach the unit during the time frame identified, (2) teach the problem areas identified, or (3) provide complete data due to adverse weather conditions causing
school cancellations and disrupted curricula. The majority of nonparticipants identified weather-related problems as the reason for their failure to participate or complete the experiment.

Teachers were selected by a nonrandom process from a list of all vocational agriculture instructors in the state of Iowa. Selected teachers were randomly assigned to treatment groups to avoid biasing experimental results. Selected teacher and student characteristics were examined to determine the extent to which the randomization process was successful. Data in Table 1 present the results of this evaluation.

The SPSS procedure T-TEST was employed to identify mean differences which existed between the experimental and control group class means for the characteristics studied. Results of these tests revealed that the randomization procedure was successful as treatment group mean differences were not found to be significant. This finding resulted in the assumption that comparisons could be made between the two treatment groups. Later analyses will adjust for certain characteristics which, although not statistically different, may have influenced student responses.

In the main, student respondents were classified as high school juniors or seniors. Students reported FFA membership of slightly over three years and the equivalent of six semesters of vocational agriculture completed. Students also reported having completed approximately one and one-half semesters of economics, four semesters of science, and four semesters of mathematics as part of their high school coursework.

Three student characteristics identified were not independently
Table 1. Selected student and teacher characteristic class means by treatment group

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Overall Mean (N=28)</th>
<th>Control Mean (N=12)</th>
<th>Experimental Mean (N=16)</th>
<th>t-value</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Years of FFA membership</td>
<td>3.15</td>
<td>3.37</td>
<td>3.01</td>
<td>1.40</td>
<td>0.173</td>
</tr>
<tr>
<td>Semesters of Vo. Ag.</td>
<td>5.88</td>
<td>6.19</td>
<td>5.63</td>
<td>1.31</td>
<td>0.203</td>
</tr>
<tr>
<td>Semesters of economics</td>
<td>1.69</td>
<td>1.47</td>
<td>1.91</td>
<td>-1.53</td>
<td>0.138</td>
</tr>
<tr>
<td>Semesters of science</td>
<td>4.18</td>
<td>4.69</td>
<td>4.13</td>
<td>1.06</td>
<td>0.298</td>
</tr>
<tr>
<td>Semesters of mathematics</td>
<td>4.10</td>
<td>4.31</td>
<td>4.19</td>
<td>0.41</td>
<td>0.683</td>
</tr>
<tr>
<td>Size of home farm</td>
<td>407.60</td>
<td>370.97</td>
<td>457.33</td>
<td>-1.32</td>
<td>0.199</td>
</tr>
<tr>
<td>Letter grades received&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.33</td>
<td>2.35</td>
<td>2.25</td>
<td>0.80</td>
<td>0.433</td>
</tr>
<tr>
<td>Teacher</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Years of teaching experience</td>
<td>9.75</td>
<td>9.17</td>
<td>10.19</td>
<td>-0.25</td>
<td>0.802</td>
</tr>
<tr>
<td>High school enrollment</td>
<td>266.07</td>
<td>268.00</td>
<td>264.63</td>
<td>0.06</td>
<td>0.955</td>
</tr>
<tr>
<td>Vocational agriculture enrollment</td>
<td>54.96</td>
<td>50.50</td>
<td>58.31</td>
<td>-0.76</td>
<td>0.457</td>
</tr>
<tr>
<td>Education level (years completed)</td>
<td>17.07</td>
<td>16.83</td>
<td>17.25</td>
<td>-1.00</td>
<td>0.324</td>
</tr>
<tr>
<td>Familiarity with agriculture/agribusiness management&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6.46</td>
<td>6.17</td>
<td>6.69</td>
<td>-1.08</td>
<td>0.288</td>
</tr>
<tr>
<td>Months of agribusiness experience</td>
<td>7.36</td>
<td>7.50</td>
<td>7.25</td>
<td>0.04</td>
<td>0.965</td>
</tr>
<tr>
<td>Class size</td>
<td>10.00</td>
<td>8.08</td>
<td>11.00</td>
<td>-1.65</td>
<td>0.112</td>
</tr>
<tr>
<td>Number of class periods</td>
<td>23.17</td>
<td>21.18</td>
<td>24.85</td>
<td>-0.75</td>
<td>0.464</td>
</tr>
</tbody>
</table>

<sup>a</sup> Values were coded: Mostly As = 4, Mostly Bs = 3, Mostly Cs = 2, Mostly Ds = 1.

<sup>b</sup> Values were coded: Totally unfamiliar = 1, Average familiarity = 5, Totally familiar = 9.
distributed between the experimental and control group. Students were asked to provide information identifying their plans following completion of their high school programs of study. Results of a test for independent frequency distributions revealed a significant chi-square statistic ($p = 0.011$), and are presented in Table 2. Most notably, 47.2% of experimental group students anticipated attending college following high school graduation, whereas, only 34% of the control group students indicated similar plans. The percentage of control students (21.6%) whose future plans were undecided was nearly double that of experimental students (12.5%).

Student grade level was another characteristic which did not appear to be independently distributed among treatment groups. Experimental group classes appeared to contain proportionally more seniors than did control classes. Similarly, control classes had an unexpectedly larger proportion of juniors. Results of the chi-square test for independence, presented in Table 3 revealed a significant chi-square value ($p = 0.013$).

Location of student residence was the third characteristic which did not appear to be independently distributed among treatment groups. Data in Table 4 present results of a chi-square test which revealed a significantly higher proportion (90.9%) of experimental students residing on farms. A greater proportion of control students reported living in a town or in a rural area. Two hundred and twenty-nine students reported living on a farm, whereas 266 students indicated their family was involved in a farming operation.

Each of these characteristics were examined to determine their
Table 2. Students' plans following graduation by treatment group

<table>
<thead>
<tr>
<th>Plans</th>
<th>Control</th>
<th>Experimental</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>College</td>
<td>33</td>
<td>34.0</td>
<td>83</td>
</tr>
<tr>
<td>Farm</td>
<td>30</td>
<td>30.9</td>
<td>47</td>
</tr>
<tr>
<td>Work in an agribusiness</td>
<td>9</td>
<td>9.3</td>
<td>6</td>
</tr>
<tr>
<td>Undecided</td>
<td>21</td>
<td>21.6</td>
<td>22</td>
</tr>
<tr>
<td>Other&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4</td>
<td>4.1</td>
<td>18</td>
</tr>
<tr>
<td>Total</td>
<td>97</td>
<td>35.5</td>
<td>176</td>
</tr>
</tbody>
</table>

Chi-square = 13.07
Probability = 0.011

<sup>a</sup>Other category included responses for "work but not in an agribusiness", "enter the military", and "other".

Table 3. Grade level by treatment groups

<table>
<thead>
<tr>
<th>Grade level</th>
<th>Control</th>
<th>Experimental</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>Junior</td>
<td>41</td>
<td>42.3</td>
<td>47</td>
</tr>
<tr>
<td>Senior</td>
<td>56</td>
<td>57.7</td>
<td>129</td>
</tr>
<tr>
<td>Total</td>
<td>97</td>
<td>100.0</td>
<td>176</td>
</tr>
</tbody>
</table>

Chi-square = 6.24
Probability = 0.013
impact on posttest knowledge and attitude scores. Regression analysis was employed using dummy variables to incorporate the above categorical variables into the predictor list. Results of this analysis are reported under the heading "Relationships Among Student Characteristics and Instructional Effectiveness".

Instructors reported an average of 9.75 years of teaching experience and had completed slightly over 17 years of formal education. The level of instructor education and experience ranged from first-year teachers having completed 16 years of formal education, to instructors with 34 years of experience and having completed 20 years of formal education. Instructors also reported an average of 7.36 months of experience in agribusiness (other than teaching vocational agriculture) and rated themselves as being moderately familiar with agriculture/agribusiness management subject matter (X = 6.46 on a nine-point scale). Class size

Table 4. Student residence by treatment group

<table>
<thead>
<tr>
<th>Place of residence</th>
<th>Control</th>
<th></th>
<th>Experimental</th>
<th></th>
<th>Total</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Town or city</td>
<td>15</td>
<td>15.5</td>
<td>11</td>
<td>6.3</td>
<td>26</td>
<td>9.5</td>
</tr>
<tr>
<td>Nonfarm rural</td>
<td>13</td>
<td>13.4</td>
<td>5</td>
<td>2.8</td>
<td>18</td>
<td>6.6</td>
</tr>
<tr>
<td>Farm</td>
<td>69</td>
<td>71.1</td>
<td>160</td>
<td>90.9</td>
<td>229</td>
<td>83.9</td>
</tr>
<tr>
<td>Total</td>
<td>97</td>
<td>100.0</td>
<td>176</td>
<td>100.0</td>
<td>273</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Chi-square = 19.07
Probability = 0.0000
averaged 10.00 students. High school enrollments averaged 266.07 students and vocational agriculture programs enrolled nearly 55 students ($\bar{X} = 54.96$). Vocational agriculture department enrollment varied from a low of 16 students to a high of 140 students.

Evaluation of Data Collection Procedure and Instruments

Data to satisfy the overall purpose of this investigation were provided by 280 students from 28 Iowa vocational agriculture classes in which a unit on agriculture/agribusiness management was taught. Both students and their respective instructors provided information. Students provided information relating to their level of understanding of the subject matter, their attitude toward six concepts representing the subject matter, and background information on their educational and personal experiences.

An agriculture/agribusiness management knowledge inventory was administered prior to initiating instruction as a pretest and immediately after concluding instruction as a posttest. This 40-item, multiple choice examination provided an indication of students' understanding of agriculture/agribusiness management at these two points in time. IBM General Purpose answer sheets were provided on which students were directed to record their responses. Answer sheets were coded with a school number and pretests were matched with posttests by pairing student names. Class means were computed for each participating class. These values constituted responses upon which tests for mean differences were conducted. The posttest knowledge inventory instrument was essentially
identical to the pretest form, although items were rearranged in a random fashion for the posttest. Response alternatives were not changed to avoid altering the degree of difficulty associated with the test.

Pretest and posttest knowledge inventory instruments were evaluated by computing a Kuder-Richardson 20 reliability coefficient. These coefficients are presented in Table 5 with other statistics useful for evaluating the knowledge inventory.

Pretest reliability was estimated to be .80 and the posttest estimate increased to .83. These estimates were considered adequate for a teacher-made test when used to provide an indication of the level of student understanding of the subject matter being studied. Mean item difficulty statistics are also presented for the pretest and posttest forms in Table 5. Item difficulty may be interpreted as the overall percentage of correct responses. In the main, test scores improved from pretest to posttest, variance diminished, and discriminating power increased. Individual item analyses for knowledge inventory are presented in Table E.1 (see Appendix D).

Table 5. Descriptive summary of agriculture/agribusiness management knowledge inventory

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Pretest</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean score</td>
<td>22.26</td>
<td>26.96</td>
</tr>
<tr>
<td>Standard error of measurement</td>
<td>2.74</td>
<td>2.53</td>
</tr>
<tr>
<td>KR-20 reliability coefficient</td>
<td>0.80</td>
<td>0.83</td>
</tr>
<tr>
<td>Mean item difficulty</td>
<td>0.557</td>
<td>0.674</td>
</tr>
<tr>
<td>Mean item discriminating power</td>
<td>0.347</td>
<td>0.372</td>
</tr>
</tbody>
</table>
Student attitudes toward six concepts representing agriculture/agribusiness management were examined through the use of a semantic differential technique. Six pairs of bipolar adjectives were positioned at opposite ends of a seven-point scale. Students were directed to place an "X" in the scale position which most accurately reflected their feelings toward each concept. Individual bipolar adjective scales were summed and a mean computed for each concept. Due to high interitem correlations, data analyses were conducted using the concept means rather than the individual subscale means. Pretest and posttest attitude inventory instruments were not altered.

Reliability estimates were also computed for the overall attitude inventory as well as each individual concept. As a result of this procedure, the bipolar adjective scale "complex-simple" was eliminated due to extremely low ($r < .05$) correlations with other scales in the same concept group. Two concept means, namely, "acquiring knowledge in agriculture" and "making decisions" were computed using responses from five remaining scales. Cronbach alpha reliability coefficients were computed using the SPSS subprogram RELIABILITY and are presented in Table 6.

Overall attitude inventory reliability was estimated at .905 for the pretest administration and .944 for the posttest. Individual concept reliabilities were also quite high and increased from pretest to posttest. Reliability coefficients of this magnitude were considered acceptable for the intended use of the instruments.

Students were asked to provide information concerning their current educational situation and past experiences. These data were visually
Table 6. Reliability coefficient alphas for each concept scale

<table>
<thead>
<tr>
<th>Concept</th>
<th>Pretest coefficient α</th>
<th>Posttest coefficient α</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooperation with others</td>
<td>0.839</td>
<td>0.903</td>
</tr>
<tr>
<td>Acquiring knowledge in agriculture a</td>
<td>0.874</td>
<td>0.901</td>
</tr>
<tr>
<td>Making decisions a</td>
<td>0.753</td>
<td>0.821</td>
</tr>
<tr>
<td>Corporate farming</td>
<td>0.885</td>
<td>0.894</td>
</tr>
<tr>
<td>Government regulations</td>
<td>0.916</td>
<td>0.935</td>
</tr>
<tr>
<td>Agriculture/agribusiness management</td>
<td>0.865</td>
<td>0.917</td>
</tr>
<tr>
<td>Overall a</td>
<td>0.905</td>
<td>0.944</td>
</tr>
</tbody>
</table>

aThe complex-simple response scale was deleted from reliability computation due to low interitem correlations.

inspected by the researcher and information not considered tenable was coded "9" and treated as missing data to avoid confounding results of this study.

Teachers were asked to provide information involving their educational background and school situation. Again, the data were inspected by the researcher and nontenable responses were eliminated from further analysis.

Instructors were also asked to supervise the collection of student data (although principals or guidance counselors were suggested to actually administer the test instruments). Written guidelines were provided for teachers to follow in collecting student data.

Experimental group instructors were also asked to evaluate the
instructional unit provided them using two measures. First, an eleven-scale semantic differential evaluation format (see Appendix D) allowed teachers to indicate their feelings toward the instructional unit in general terms. Instrument reliability was estimated by computing a Cronbach's alpha coefficient. The up-to-dateness scale was eliminated prior to the computation as a result of a low correlation with other scales. The coefficient alpha computed using the ten remaining scales was .82.

The second method used to evaluate the instructional unit employed a nine-point Likert scale to determine the "value" of specific components or aspects of the unit. A scale value of "1" was used for a response of "no value", a scale value of "5" indicated "average value", and a scale value of "9" was used to indicate "utmost value". Respondents were encouraged to use any number from 1 to 9 to indicate the value of each component or aspect of the instructional unit. Blanks were provided on the instrument and teachers encouraged to record their suggestions for improving the unit for use by other instructors.

Effectiveness of Instruction

The degree of learning which occurred during the course of this investigation was examined by comparing class means for pretest and posttest knowledge inventories. Class means were compared statistically by employing the SPSS T-TEST procedure.

Data in Table 7 present results of the pretest-posttest class mean comparisons for the control group. Twelve classes provided data for this
comparison and scores were matched by class allowing a paired t-test. Results of this test indicated students in the control group increased their understanding of agriculture/agribusiness management by approximately 8% (3.2 test points on the 40-item knowledge inventory). Calculation of a t-statistic of -2.95 revealed that the pre-posttest class mean difference for the control group was significant beyond the .05 level.

Results of a similar paired t-test are presented in Table 8 for the experimental group class means. The average level of student knowledge increased by 5.93 points (14.83%) on the posttest. This gain in knowledge resulted in the calculation of a significant t-statistic of -7.33 (p = 0.00).

Both experimental and control group students had increased their level of understanding of the subject matter. It was also observed that control group student knowledge scores increased in variability (i.e., pretest standard deviation = 3.93, posttest standard deviation = 5.02) from pretest to posttest, whereas experimental group student knowledge

Table 7. Pre-posttest knowledge score mean difference for the control treatment group

<table>
<thead>
<tr>
<th>Time of administration</th>
<th>( \bar{X} )</th>
<th>S.D.</th>
<th>t-value</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>21.31</td>
<td>3.93</td>
<td>-2.95</td>
<td>0.013</td>
</tr>
<tr>
<td>Posttest</td>
<td>24.51</td>
<td>5.02</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*aDegrees of freedom for this test were 11.*
Table 8. Pre-posttest knowledge score mean difference for the experimental treatment group

<table>
<thead>
<tr>
<th>Time of administration</th>
<th>$\bar{X}$</th>
<th>S.D.</th>
<th>$t$-value</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>16</td>
<td>22.63</td>
<td>3.09</td>
<td>-7.33</td>
</tr>
<tr>
<td>Posttest</td>
<td>16</td>
<td>28.56</td>
<td>1.94</td>
<td>-7.33</td>
</tr>
</tbody>
</table>

$^a$Degrees of freedom for this test were 15.

scores decreased in variability during that time (i.e., pretest standard deviation = 3.09, posttest standard deviation = 1.94). Later analyses will reveal pretest variances to approximate equality, whereas posttest variances were significantly different ($p < .05$) for experimental and control group knowledge inventory class means.

Null hypotheses for these analyses assumed no difference between pretest and posttest knowledge inventory scores for either treatment group. Significant $t$-values computed in both tests resulted in rejection of the null hypotheses in favor of the assumed alternatives that mean differences did exist (i.e., learning did occur). This finding revealed that the level of student knowledge increased significantly in the area of agriculture/agribusiness management during the experiment.

Changes in students' attitudes toward selected concepts related to agriculture/agribusiness management were also examined. Pretest and posttest comparisons were again conducted for control and experimental groups individually. Results of the control treatment group attitude comparisons are presented in Table 9. Data were analyzed by computing
Table 9. Pretest and posttest attitude concept class means for the control group

<table>
<thead>
<tr>
<th>Concept</th>
<th>Pretest</th>
<th>Posttest</th>
<th>t-value&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooperation with others</td>
<td>M&lt;sup&gt;b&lt;/sup&gt;</td>
<td>N=12</td>
<td>5.74</td>
<td>5.76</td>
</tr>
<tr>
<td></td>
<td>SD&lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
<td>0.35</td>
<td>0.46</td>
</tr>
<tr>
<td>Acquiring knowledge in agriculture</td>
<td>M</td>
<td></td>
<td>6.00</td>
<td>6.01</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td></td>
<td>0.31</td>
<td>0.49</td>
</tr>
<tr>
<td>Making decisions</td>
<td>M</td>
<td></td>
<td>5.89</td>
<td>5.92</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td></td>
<td>0.28</td>
<td>0.51</td>
</tr>
<tr>
<td>Corporate farming</td>
<td>M</td>
<td></td>
<td>4.66</td>
<td>5.06</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td></td>
<td>0.44</td>
<td>0.55</td>
</tr>
<tr>
<td>Government regulations</td>
<td>M</td>
<td></td>
<td>4.39</td>
<td>4.72</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td></td>
<td>0.80</td>
<td>0.57</td>
</tr>
<tr>
<td>Agriculture/agribusiness management</td>
<td>M</td>
<td></td>
<td>5.88</td>
<td>5.95</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td></td>
<td>0.45</td>
<td>0.44</td>
</tr>
<tr>
<td>Overall</td>
<td>M</td>
<td></td>
<td>5.43</td>
<td>5.57</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td></td>
<td>0.26</td>
<td>0.41</td>
</tr>
</tbody>
</table>

<sup>a</sup>Degrees of freedom were 11.

<sup>b</sup>M = group means.

<sup>c</sup>SD = group standard deviations.

t-statistics to determine pretest-posttest group mean differences. Only the concept "corporate farming" was found to produce a posttest mean significantly different (p = 0.017) than the corresponding pretest group mean. The null hypothesis, which assumed equality of pretest and posttest means among concepts was not rejected for the five remaining concepts. The null hypothesis was rejected for the corporate farming...
concept in favor of the assumed alternative involving statistically
different pretest and posttest group means.

Results of pretest and posttest attitude concept comparisons for the
experimental group are revealed in Table 10. The researcher failed to
reject the assumed null hypothesis of nonsignificant pretest and post-
test mean differences for each of the six concepts studied. Attitudes

Table 10. Pretest and posttest attitude concept class means for the
experimental group

<table>
<thead>
<tr>
<th>Concept</th>
<th>Pretest</th>
<th>Posttest</th>
<th>t-value&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooperation with others</td>
<td>M&lt;sup&gt;b&lt;/sup&gt;</td>
<td>N=16</td>
<td>5.69</td>
<td>5.71</td>
</tr>
<tr>
<td></td>
<td>SD&lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
<td>0.35</td>
<td>0.44</td>
</tr>
<tr>
<td>Acquiring knowledge in agriculture</td>
<td>M</td>
<td>N=16</td>
<td>5.88</td>
<td>5.90</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td></td>
<td>0.48</td>
<td>0.54</td>
</tr>
<tr>
<td>Making decisions</td>
<td>M</td>
<td>N=16</td>
<td>5.93</td>
<td>5.94</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td></td>
<td>0.28</td>
<td>0.37</td>
</tr>
<tr>
<td>Corporate farming</td>
<td>M</td>
<td>N=16</td>
<td>4.92</td>
<td>5.07</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td></td>
<td>0.33</td>
<td>0.35</td>
</tr>
<tr>
<td>Government regulations</td>
<td>M</td>
<td>N=16</td>
<td>4.71</td>
<td>4.73</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td></td>
<td>0.45</td>
<td>0.44</td>
</tr>
<tr>
<td>Agriculture/agribusiness manage-</td>
<td>M</td>
<td>N=16</td>
<td>5.92</td>
<td>5.87</td>
</tr>
<tr>
<td>ment</td>
<td>SD</td>
<td></td>
<td>0.36</td>
<td>0.50</td>
</tr>
<tr>
<td>Overall</td>
<td>M</td>
<td>N=16</td>
<td>5.51</td>
<td>5.54</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td></td>
<td>0.25</td>
<td>0.41</td>
</tr>
</tbody>
</table>

<sup>a</sup>Degrees of freedom were 15.

<sup>b</sup>M = group means.

<sup>c</sup>SD = group standard deviations.
were generally unaffected throughout the course of this experiment. Negative t-values computed for nearly all comparisons revealed that students responded in a more positive manner (i.e., higher posttest mean scores) toward the concepts presented on the posttest instrument, although only one comparison revealed a significant change in attitude as described earlier.

Both control and experimental students increased their level of knowledge of agriculture/agribusiness management as revealed by higher posttest knowledge inventory class means. Conversely, student attitudes did not appear to change as pre-posttest attitude inventory class means did not differ significantly for the majority of concepts studied.

Comparison of Treatment Groups

A major objective of this research involved determining the effectiveness of the instructional approach suggested through the agriculture/agribusiness management instructional unit in relation to traditional materials. Instructors were randomly assigned to treatment groups. Experimental teachers were provided the instructional unit describing the subject matter to be taught and the approach to be used in teaching. Control teachers were provided with problem area questions, study questions, and directed to focus their instruction on those questions using materials currently available.

Class means were used to compare the relative effectiveness of instruction provided through the approach suggested in the instructional unit with the approach used by control group instructors. Covariate
analysis was employed to equalize classes in each treatment group on pretest measures. The researcher desired to eliminate posttest knowledge inventory variance attributable to pretest knowledge scores. Table 11 presents results of the analysis of covariance test using pretest scores as a covariate variable. Significant F-statistics were produced for the pretest and treatment effects associated with the examination.

Table 11. Pretest knowledge score covariate analysis of agriculture/agribusiness management knowledge scores

<table>
<thead>
<tr>
<th>Source</th>
<th>Degrees of freedom</th>
<th>Sum of squares</th>
<th>Mean square</th>
<th>F-value</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covariate (Pretest knowledge score)</td>
<td>1</td>
<td>127.28</td>
<td>127.28</td>
<td>13.02</td>
<td>0.001</td>
</tr>
<tr>
<td>Main effect (Treatment)</td>
<td>1</td>
<td>73.54</td>
<td>73.54</td>
<td>7.52</td>
<td>0.011</td>
</tr>
<tr>
<td>Error</td>
<td>25</td>
<td>244.47</td>
<td>9.78</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>445.28</td>
<td>16.49</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This finding revealed that both pretest and treatment significantly affected posttest knowledge scores. More specifically, after equalizing treatment groups' pretest knowledge scores, adjusted posttest means were found to be significantly different \( (p = 0.011) \) for the two treatment groups. Pretest and treatment group variables were correlated \( (r = .672) \) with posttest knowledge scores and accounted for approximately 45% of the variance associated with the posttest knowledge scores.
The assumed null hypothesis underlying this test of mean differences involved equal overall posttest attitude means after adjusting for pretest differences. Significant F-values were computed resulting in rejection of the null hypothesis in favor of the assumed alternative hypothesis that treatment group class means were not equal following adjustment for pretest differences. More specifically, this finding revealed that experimental group classes produced significantly higher posttest knowledge inventory means than did control group classes after equalizing all groups for their pretest measure.

Analysis of covariance was also employed to test for posttest attitude inventory class mean differences controlling for pretest effects. Overall attitude means were computed by summing each of the bipolar adjective scale responses and dividing by the number of responses. Reliability coefficients reported earlier (pretest = .91, posttest = .94) indicated a high degree of instrument unidimensionality, thus allowing the researcher to compute an overall grand mean attitude score for each student and ultimately each class. Data in Table 12 present results of the covariate analysis for overall attitude class means. A significant F-value was computed for the covariate variable (pretest F = 19.03, p = 0.000), whereas the effect of treatment group did not significantly influence overall posttest attitude scores.

Individual attitude concepts are not reported due to the failure to identify overall posttest attitude mean differences. Although individual concept analysis of covariance tests were made; results only substantiated the above finding and were therefore not reported. Each
Table 12. Pretest attitude score covariate analysis of agriculture/agribusiness management posttest attitude scores

<table>
<thead>
<tr>
<th>Source</th>
<th>Degrees of freedom</th>
<th>Sum of squares</th>
<th>Mean square</th>
<th>F-value</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covariate (Pretest attitude score)</td>
<td>1</td>
<td>1.82</td>
<td>1.82</td>
<td>19.03</td>
<td>0.000</td>
</tr>
<tr>
<td>Main effect (Treatment)</td>
<td>1</td>
<td>0.10</td>
<td>0.10</td>
<td>0.99</td>
<td>0.327</td>
</tr>
<tr>
<td>Error</td>
<td>25</td>
<td>2.39</td>
<td>0.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>4.31</td>
<td>0.16</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

analysis revealed significant pretest effects accompanied by nonsignificant treatment group effects. Posttest attitude response variance appeared to be a function of the pretest response and was generally unaffected by treatment group.

Relationships Among Student Characteristics and Instructional Effectiveness

Students were asked to provide information about their background and experiences which may have influenced their responses on the knowledge or attitude inventories. Pearson correlation coefficients computed for variables measured on an interval scale with posttest knowledge scores are presented in Table 13. Measures of relationship were estimated using student data rather than class means as the intent was to identify relationships on an individual student basis. Probability levels for each
Table 13. Correlations of selected student posttest knowledge scores and characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>N</th>
<th>r</th>
<th>$r^2$</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest knowledge score</td>
<td>273</td>
<td>0.54</td>
<td>0.29</td>
<td>0.000</td>
</tr>
<tr>
<td>Pretest attitude score</td>
<td>274</td>
<td>0.08</td>
<td>0.01</td>
<td>0.216</td>
</tr>
<tr>
<td>Posttest attitude score</td>
<td>274</td>
<td>0.13</td>
<td>0.02</td>
<td>0.038</td>
</tr>
<tr>
<td>Years of FFA membership</td>
<td>272</td>
<td>0.17</td>
<td>0.03</td>
<td>0.004</td>
</tr>
<tr>
<td>Semesters of vocational agriculture</td>
<td>272</td>
<td>0.11</td>
<td>0.01</td>
<td>0.059</td>
</tr>
<tr>
<td>Semesters of economics</td>
<td>272</td>
<td>0.18</td>
<td>0.03</td>
<td>0.003</td>
</tr>
<tr>
<td>Semesters of science</td>
<td>272</td>
<td>0.07</td>
<td>0.00</td>
<td>0.247</td>
</tr>
<tr>
<td>Semesters of mathematics</td>
<td>271</td>
<td>0.17</td>
<td>0.03</td>
<td>0.004</td>
</tr>
<tr>
<td>Farm size</td>
<td>266</td>
<td>0.22</td>
<td>0.05</td>
<td>0.000</td>
</tr>
<tr>
<td>Grade level(^a)</td>
<td>272</td>
<td>0.16</td>
<td>0.03</td>
<td>0.008</td>
</tr>
<tr>
<td>Grades received(^b)</td>
<td>272</td>
<td>0.57</td>
<td>0.32</td>
<td>0.000</td>
</tr>
</tbody>
</table>

\(^a\) Responses were coded: Freshman = 1, Sophomore = 2, Junior = 3, Senior = 4.

\(^b\) Responses were coded: Mostly As = 1, Mostly Bs = 2, Mostly Cs = 3, Mostly Ds = 4.

Several of the coefficients computed revealed a significant relationship between certain characteristics and posttest knowledge scores. Further investigation revealed only two variables which had correlation coefficients in excess of .50, namely, pretest knowledge scores and letter
grades received in school. Remaining variables, although many were signifi­cantly related to posttest scores, explained no more than 5 percent of the variance associated with posttest knowledge scores as estimated by coefficients of determination \( R^2 \), which are also presented in Table 13.

Letter grades received by students and pretest knowledge scores had the highest coefficients of correlation with posttest knowledge scores. Those students who received higher grades in school tended to score higher on the posttest knowledge inventory.

Neither pretest nor posttest attitude scores were highly correlated with posttest knowledge scores, although the coefficient for the posttest attitude score was significant \( (p = 0.038) \). The number of semesters of vocational agriculture and science completed by students did not reveal significant coefficients of correlation. This observation revealed no apparent relationship between the extent of study in vocational agriculture or science classes and student scores on the agriculture/agribusiness management knowledge inventory. Also, attitude responses were, for all practical purposes, unrelated to posttest knowledge scores.

A stepwise regression procedure was employed to predict student posttest knowledge scores. Results of this procedure are presented in Table 14. Categorical variables which were not independently distributed between treatment groups were introduced into the regression analysis as dummy variables: namely, place of residence, grade level in school, and plans after high school graduation.

Four student characteristics entered the prediction equation which
Table 14. Stepwise regression analysis of student characteristics on posttest knowledge scores

<table>
<thead>
<tr>
<th>Step</th>
<th>Variable entered</th>
<th>$B^a$</th>
<th>Multiple $r$</th>
<th>F-value$^b$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Letter grades received</td>
<td>3.46</td>
<td>0.581</td>
<td>133.78</td>
</tr>
<tr>
<td>2</td>
<td>Pretest knowledge score</td>
<td>0.35</td>
<td>0.673</td>
<td>55.25</td>
</tr>
<tr>
<td>3</td>
<td>Experimental treatment (Dummy variable)</td>
<td>3.58</td>
<td>0.734</td>
<td>48.32</td>
</tr>
<tr>
<td>4</td>
<td>Plan to work in agribusiness upon graduation</td>
<td>-4.19</td>
<td>0.749</td>
<td>13.83</td>
</tr>
</tbody>
</table>

Constant = 25.03

Multiple $R^2 = 0.5614$

$^a$Regression coefficients for the final prediction equation.

$^b$F$_{1, 260, .05} = 3.84$.

accounted for 56.14 percent of posttest variance. Grades received by students was the first variable to be entered into the equation, followed by pretest knowledge scores, an experimental treatment dummy variable, and a dummy variable representing student plans to work in an agribusiness upon graduation from high school. F-values reported were for the step in which each variable entered the prediction equation. Although the four variables included were significant beyond the .05 level, the resulting equation accounted for only slightly more than half of the variance associated with posttest knowledge scores. Other variables did not add significantly to the prediction equation ($p > .05$) and were, therefore, not included.
Student grades accounted for approximately 34 percent of the posttest variance. Pretest knowledge scores added 11 percent, experimental treatment 8 percent, and planning to work in an agribusiness 2 percent, to the total variance explained by the prediction equation. Residual variance could not be explained by remaining student variables at the established level of significance.

Data in Table 15 present coefficients of correlation for student characteristics with posttest attitude inventory scores. Four variables had significant coefficients beyond the .05 level: namely, pretest attitude score, posttest knowledge score, years of FFA membership, and semesters of science completed.

Pretest attitude scores were most closely related with posttest attitude scores and explained approximately 29 percent of the latter's variance. Other variables, although significant, had relatively low coefficients of correlation and each explained less than 5 percent of the posttest attitude variance.

Multiple regression analysis was again employed to identify variables which could be useful in predicting posttest attitude scores. Results of this procedure are presented in Table 16. Three student characteristics entered into the prediction equation as significant predictors (p < .05) of student posttest attitude scores. Most notably, pretest attitude score was the first variable to enter the equation and explained approximately 41 percent of the posttest attitude score variance. Semesters of science and length of FFA membership accounted for approximately 1.6 and 1.3 percent, respectively.
Table 15. Correlation of posttest attitude scores and selected student characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>N</th>
<th>r</th>
<th>$R^2$</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest knowledge score</td>
<td>279</td>
<td>0.10</td>
<td>0.01</td>
<td>0.094</td>
</tr>
<tr>
<td>Pretest attitude score</td>
<td>280</td>
<td>0.54</td>
<td>0.29</td>
<td>0.000</td>
</tr>
<tr>
<td>Posttest knowledge score</td>
<td>274</td>
<td>0.13</td>
<td>0.02</td>
<td>0.038</td>
</tr>
<tr>
<td>Years of FFA membership</td>
<td>273</td>
<td>0.19</td>
<td>0.04</td>
<td>0.002</td>
</tr>
<tr>
<td>Semesters of vocational agriculture</td>
<td>273</td>
<td>0.05</td>
<td>0.00</td>
<td>0.395</td>
</tr>
<tr>
<td>Semesters of economics</td>
<td>273</td>
<td>0.03</td>
<td>0.00</td>
<td>0.598</td>
</tr>
<tr>
<td>Semesters of science</td>
<td>273</td>
<td>-0.13</td>
<td>0.02</td>
<td>0.035</td>
</tr>
<tr>
<td>Semesters of mathematics</td>
<td>272</td>
<td>0.01</td>
<td>0.00</td>
<td>0.924</td>
</tr>
<tr>
<td>Farm size</td>
<td>267</td>
<td>0.06</td>
<td>0.00</td>
<td>0.326</td>
</tr>
<tr>
<td>Grade level$^a$</td>
<td>273</td>
<td>0.01</td>
<td>0.00</td>
<td>0.924</td>
</tr>
<tr>
<td>Grades received$^b$</td>
<td>273</td>
<td>0.11</td>
<td>0.01</td>
<td>0.064</td>
</tr>
</tbody>
</table>

$^a$Responses were coded: Freshman = 1, Sophomore = 2, Junior = 3, Senior = 4.

$^b$Responses were coded: Mostly As = 1, Mostly Bs = 2, Mostly Cs = 3, Mostly Ds = 4.

The full prediction model was able to explain nearly 45 percent of the variance associated with the posttest attitude inventory. Residual variance could not be attributed to remaining student characteristics on a statistical basis.

Categorical variables which did not enter the prediction equations
Table 16. Stepwise regression analysis of student characteristics on posttest attitude scores

<table>
<thead>
<tr>
<th>Step</th>
<th>Variable entered</th>
<th>$B^a$</th>
<th>Multiple r</th>
<th>$F$-value $^b$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pretest attitude score</td>
<td>0.73</td>
<td>0.643</td>
<td>190.69</td>
</tr>
<tr>
<td>2</td>
<td>Semesters of science</td>
<td>-0.58</td>
<td>0.656</td>
<td>7.71</td>
</tr>
<tr>
<td>3</td>
<td>Years in FFA</td>
<td>0.78</td>
<td>0.667</td>
<td>6.90</td>
</tr>
<tr>
<td></td>
<td>Constant = 1.50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Multiple $R^2$ = 0.4446</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$^a$ Regression coefficients for the final prediction equation.

$^b$ $F_{1, 268, .05} = 3.84$.

were assumed to have only limited influence over responses in favor of either treatment group. Although these characteristics were not independently distributed among treatment groups, it appeared that posttest scores were generally unaffected by that disparity.

Relationships Among Instructor Characteristics and Instructional Effectiveness

Teachers were asked to provide information about their background and current teaching situation which may have influenced student responses. Correlation coefficients were computed for teacher characteristics with posttest knowledge inventory class means. Data in Table 17 present correlation coefficients, coefficients of determination ($R^2$), and the level of significance associated with each characteristic. Class means were used as the basis upon which measures of relationship
Table 17. Correlation of posttest knowledge class means and selected instructor situational characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>r</th>
<th>$R^2$</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years of teaching experience</td>
<td>0.07</td>
<td>0.00</td>
<td>0.728</td>
</tr>
<tr>
<td>High school enrollments</td>
<td>0.11</td>
<td>0.01</td>
<td>0.568</td>
</tr>
<tr>
<td>Vocational agriculture enrollment</td>
<td>0.16</td>
<td>0.03</td>
<td>0.407</td>
</tr>
<tr>
<td>Number of classes taught per day</td>
<td>-0.17</td>
<td>0.03</td>
<td>0.380</td>
</tr>
<tr>
<td>Number of vocational agriculture classes taught per day</td>
<td>-0.06</td>
<td>0.00</td>
<td>0.774</td>
</tr>
<tr>
<td>Education level&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.22</td>
<td>0.05</td>
<td>0.259</td>
</tr>
<tr>
<td>Months of agribusiness experience</td>
<td>-0.40</td>
<td>0.16</td>
<td>0.036</td>
</tr>
<tr>
<td>Number of class periods in which unit was taught</td>
<td>0.05</td>
<td>0.00</td>
<td>0.824</td>
</tr>
<tr>
<td>Familiarity with agriculture/agribusiness management</td>
<td>0.08</td>
<td>0.01</td>
<td>0.672</td>
</tr>
<tr>
<td>Population of largest community in school district</td>
<td>-0.14</td>
<td>0.02</td>
<td>0.484</td>
</tr>
<tr>
<td>Number of students employed in an agribusiness</td>
<td>0.17</td>
<td>0.03</td>
<td>0.393</td>
</tr>
<tr>
<td>Number of visits per semester to employed students</td>
<td>0.27</td>
<td>0.07</td>
<td>0.178</td>
</tr>
<tr>
<td>Size of class</td>
<td>0.08</td>
<td>0.01</td>
<td>0.682</td>
</tr>
</tbody>
</table>

<sup>a</sup>Years of formal education.
were computed.

Only the number of months of agribusiness work experience reported by instructors was significantly related to posttest knowledge class means. This observation revealed that instructors with fewer months of agribusiness experience tended to be associated with classes having higher posttest knowledge means. Although the relationship was significant, instructor agribusiness experience accounted for only 16 percent of the posttest variance.

Other characteristics examined did not reveal significant relationships with posttest knowledge class means. Most notably, years of teaching experience, the number of class periods required to teach the unit, class size, and the number of vocational agriculture classes taught per day were not related to posttest knowledge class means.

Regression analysis was again employed to identify variables which significantly influence the predictability of posttest knowledge class means. Results of this analysis are presented in Table 18. Dummy variables were created to allow the researcher to enter categorical information. Variables entered as dummies included: treatment group, instructor coursework in agriculture/agribusiness management, college degree in agriculture/agribusiness management, and the person who administered the posttest (i.e., principal, guidance counselor, self, etc.).

The first variable to enter the prediction equation was the dummy variable for the experimental treatment effect. Experimental treatment accounted for nearly 22 percent of the variance associated with posttest knowledge inventory class means.
Table 18. Stepwise regression analysis of instructor characteristics on posttest knowledge class means

<table>
<thead>
<tr>
<th>Step</th>
<th>Variable entered</th>
<th>B&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Multiple r</th>
<th>F-value&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Experimental treatment (Dummy variable)</td>
<td>3.58</td>
<td>0.468</td>
<td>7.01</td>
</tr>
<tr>
<td>2</td>
<td>Months of agribusiness experience</td>
<td>-0.16</td>
<td>0.639</td>
<td>7.71</td>
</tr>
<tr>
<td>3</td>
<td>Number of vocational agriculture classes taught per day</td>
<td>-1.98</td>
<td>0.714</td>
<td>4.77</td>
</tr>
</tbody>
</table>

Constant = 35.12

Multiple R² = 0.5104

<sup>a</sup> Regression coefficients for the final prediction equation.

<sup>b</sup> F₁, 24, .05 = 4.26.

Two other variables had significant f-values and entered the prediction equation in subsequent iterations. The number of months of instructor experience and the number of vocational agriculture classes taught per day entered in steps two and three, respectively. After each significant predictor variable was entered, the full equation (with all significant variables entered) was able to account for 51.04 percent of the posttest knowledge variance.

Pearson correlation coefficients were also computed for instructor characteristics and posttest attitude inventory class means. These coefficients, the R² values, and significance levels are reported in Table 19.
Table 19. Correlation of posttest attitude class means and selected instructor situational characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>r</th>
<th>$r^2$</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years of teaching experience</td>
<td>0.38</td>
<td>0.14</td>
<td>0.046</td>
</tr>
<tr>
<td>High school enrollment</td>
<td>0.45</td>
<td>0.20</td>
<td>0.024</td>
</tr>
<tr>
<td>Vocational agriculture enrollment</td>
<td>0.44</td>
<td>0.19</td>
<td>0.019</td>
</tr>
<tr>
<td>Number of classes taught per day</td>
<td>-0.13</td>
<td>0.02</td>
<td>0.499</td>
</tr>
<tr>
<td>Number of vocational agriculture classes taught per day</td>
<td>-0.06</td>
<td>0.00</td>
<td>0.757</td>
</tr>
<tr>
<td>Education level&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.35</td>
<td>0.12</td>
<td>0.066</td>
</tr>
<tr>
<td>Months of agribusiness experience</td>
<td>-0.18</td>
<td>0.03</td>
<td>0.362</td>
</tr>
<tr>
<td>Number of class periods in which unit was taught</td>
<td>0.25</td>
<td>0.06</td>
<td>0.246</td>
</tr>
<tr>
<td>Familiarity with agriculture/agribusiness management</td>
<td>-0.09</td>
<td>0.01</td>
<td>0.650</td>
</tr>
<tr>
<td>Population of largest community in school district</td>
<td>0.42</td>
<td>0.18</td>
<td>0.029</td>
</tr>
<tr>
<td>Number of students employed in an agribusiness</td>
<td>-0.13</td>
<td>0.02</td>
<td>0.535</td>
</tr>
<tr>
<td>Number of visits per semester to employed students</td>
<td>0.12</td>
<td>0.01</td>
<td>0.548</td>
</tr>
<tr>
<td>Size of class</td>
<td>0.29</td>
<td>0.08</td>
<td>0.131</td>
</tr>
</tbody>
</table>

<sup>a</sup>Years of formal education.
Four characteristics had correlations which were statistically significant beyond the .05 level: namely, years of teaching experience, high school enrollment, vocational agriculture enrollment, and the population of the largest community in the school district. Coefficients of correlation did not exceed .50 for any characteristic.

Regression analysis revealed only one significant predictor variable for posttest attitude class means. Data in Table 20 reveal the results of this analysis. High school enrollment accounted for approximately 20 percent of posttest attitude variance. Other variables, including categorical dummy variables, did not significantly add to the predictability of the equation.

Table 20. Stepwise regression analysis of instructor characteristics on posttest attitude scores

<table>
<thead>
<tr>
<th>Step</th>
<th>Variable entered</th>
<th>B</th>
<th>Multiple r</th>
<th>F-value^a</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>High school enrollment</td>
<td>0.67</td>
<td>0.448</td>
<td>5.71</td>
</tr>
<tr>
<td></td>
<td>Constant = 5.17</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*^aF_1, 26, .05 = 4.22.*

In the main, attitude class means from larger schools tended to be higher than similar means from smaller schools. Although most teacher characteristics did not appear to be significantly related to attitude class means, population-related variables (i.e., high school enrollment, vocational agriculture enrollment, and size of the largest community
in school district) were significantly related to posttest attitude class means. Further investigation revealed higher attitude class means tended to be associated with larger schools, vocational agriculture programs, and communities.

**Evaluation of Instructional Unit**

Experimental group instructors were asked to provide information regarding the quality and value of the agriculture/agribusiness management instructional unit. A semantic differential technique was employed to evaluate the overall quality of the unit. Eleven bipolar adjective scales were provided and instructors were asked to indicate their feelings toward the quality of the unit in regard to each adjective pair. Seven response positions were provided and coded 1 through 7 with more positive responses receiving higher coded values.

Means, standard deviations and response ranges for each of the bipolar adjective scales are presented in Table 21. Adjectives used to identify each scale in the table were considered to be the more positive adjective of the bipolar pair.

Each scale response mean was found to exceed the midpoint of the scale (4.0) revealing the tendency of positive feelings toward the instructional unit. The highest scale mean was computed for the "technically accurate" characteristic and the "simplicity" scale had the lowest mean. The "up-to-date" scale was discarded due to low correlation with other scales (r < .05).

Dividing the seven-point response scale into three regions, namely,
Table 21. Evaluation of instructional unit characteristics by experimental group instructors

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>$\bar{X}$</th>
<th>S.D.</th>
<th>Response range</th>
</tr>
</thead>
<tbody>
<tr>
<td>N=16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effectiveness</td>
<td>5.19</td>
<td>0.83</td>
<td>3.00-6.00</td>
</tr>
<tr>
<td>Usefulness</td>
<td>5.38</td>
<td>0.96</td>
<td>3.00-7.00</td>
</tr>
<tr>
<td>Appropriateness</td>
<td>5.38</td>
<td>1.03</td>
<td>3.00-7.00</td>
</tr>
<tr>
<td>Accuracy</td>
<td>5.81</td>
<td>0.83</td>
<td>4.00-7.00</td>
</tr>
<tr>
<td>Simplicity</td>
<td>4.50</td>
<td>1.37</td>
<td>1.00-6.00</td>
</tr>
<tr>
<td>Readability</td>
<td>5.44</td>
<td>1.09</td>
<td>2.00-7.00</td>
</tr>
<tr>
<td>Visual appeal</td>
<td>4.75</td>
<td>1.44</td>
<td>2.00-7.00</td>
</tr>
<tr>
<td>Need</td>
<td>5.44</td>
<td>1.03</td>
<td>4.00-7.00</td>
</tr>
<tr>
<td>Worth</td>
<td>5.56</td>
<td>0.73</td>
<td>4.00-7.00</td>
</tr>
<tr>
<td>Complete</td>
<td>4.63</td>
<td>1.26</td>
<td>2.00-7.00</td>
</tr>
</tbody>
</table>

- **a** "Up-to-date" subscale was not included due to low correlation with remaining items.
- **b** Range of scale values provided by experimental teacher group respondents.
- **c** Characteristics identified were considered to be the more positive adjective of each bipolar scale.

Negative responses (below 3.00), neutral responses (3.00 to 5.00) and positive responses (above 5.00) allowed the researcher to categorize each response accordingly. Seven of ten characteristics studied produced mean responses in the positive category. Three characteristic means, namely, simplicity, completeness, and visual appeal were computed in the neutral
category. No means were computed in the negative category.

Visual inspection revealed characteristics with lower value means tended to have higher standard deviations. Whereas, characteristics having higher means tended to have lower standard deviations. More variance was associated with responses for lower-value characteristics, while more highly-valued characteristics also tended to have more uniform responses.

Three characteristics had response values of no less than the scale midpoint as was indicated by the response ranges (i.e., range = 4.00 to 7.00) provided in Table 21. This finding revealed that instructors viewed the three respective characteristics (i.e., technically accurate, need, and worth) in a more uniformly positive manner than other characteristics examined, as no teacher responded in the lower half of the bipolar scale.

A nine-point "value" scale was utilized to collect instructor responses concerning their perceptions of the value of each component in the instructional unit. Means, standard deviations, and response ranges are provided for each component in Table 22. Highest response means were computed for items concerning the value of: (a) the unit in reducing teacher preparation time (\( \bar{X} = 7.69 \)), (b) developing units in other subject matter areas (\( \bar{X} = 7.44 \)), and (c) distributing units to other vocational agriculture teachers (\( \bar{X} = 7.19 \)).

When dividing the value scale into three regions, namely, least value (less than 3.67), average value (3.67 to 6.33), and greatest value (above 6.33), five components, plus the three characteristics described
Table 22. Value of instructional unit components as perceived by experimental group instructors

<table>
<thead>
<tr>
<th>Components</th>
<th>( \bar{X} )</th>
<th>S.D.</th>
<th>Response range&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem area</td>
<td>6.38</td>
<td>1.09</td>
<td>5.00-8.00</td>
</tr>
<tr>
<td>Study questions</td>
<td>6.56</td>
<td>1.03</td>
<td>5.00-8.00</td>
</tr>
<tr>
<td>Learner needs</td>
<td>5.75</td>
<td>1.65</td>
<td>1.00-7.00</td>
</tr>
<tr>
<td>Interest approach</td>
<td>6.88</td>
<td>1.41</td>
<td>3.00-8.00</td>
</tr>
<tr>
<td>Learning activities</td>
<td>7.00</td>
<td>0.97</td>
<td>5.00-8.00</td>
</tr>
<tr>
<td>Conclusions</td>
<td>6.81</td>
<td>1.22</td>
<td>5.00-9.00</td>
</tr>
<tr>
<td>Evaluation criteria</td>
<td>6.19</td>
<td>1.38</td>
<td>3.00-8.00</td>
</tr>
<tr>
<td>Optional learning activities</td>
<td>5.88</td>
<td>1.59</td>
<td>2.00-8.00</td>
</tr>
<tr>
<td>Reducing preparation time</td>
<td>7.69</td>
<td>1.20</td>
<td>5.00-9.00</td>
</tr>
<tr>
<td>Developing units in other areas</td>
<td>7.44</td>
<td>1.09</td>
<td>5.00-9.00</td>
</tr>
<tr>
<td>Distributing units to other</td>
<td>7.19</td>
<td>1.05</td>
<td>5.00-9.00</td>
</tr>
<tr>
<td>Iowa Vo. Ag. teachers</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup> Values were coded: No value = 1, average value = 5, utmost value = 9.

<sup>b</sup> Range of scale values provided by experimental teacher group respondents.

Above produced response means in the greatest value category. Components included problem area, study questions, interest approach, learning activities, and conclusions. These components were considered to be of greatest value to experimental group instructors. Remaining component response means were classified in the "average value" category and no means were computed in the least value category.
Several instructors provided additional comments concerning the quality of the instructional unit both verbally and in writing. Many suggestions focused on extending the scope of the unit to include additional problem areas. Other comments were directed at specific components of the unit. Learner needs appeared to be the least valuable component and teacher comments tended to substantiate that observation.

Learning activities appeared to be the component which was most highly valued by the experimental group instructors. Further investigation revealed the lowest standard deviation was computed for this component. This observation indicated instructor responses were the most homogeneous for the value of learning activities provided in the unit.

Learner needs, on the other hand, had the lowest value mean ($\bar{X} = 5.75$) and the highest standard deviation ($SD = 1.65$). In the main, experimental group instructors placed less value on the learner needs identified in the instructional unit and responses were the most variable for that component. This latter component was the only one to receive responses from the negative extreme of the scale, (i.e., response $= 1 = no$ value).

In the main, experimental group instructors appeared quite satisfied with the agriculture/agribusiness management instructional unit. The need for instructional materials was repeatedly expressed by experimental and control group instructors. The most valued aspect of the instructional unit was the reduced amount of preparation time required to teach the unit. Other aspects, although considered important, did not approach the value of the unit in reducing teacher preparation time.
Major Findings

The following statements summarize the major findings important to this investigation.

1. Both experimental and control group classes produced significantly higher posttest knowledge inventory scores than pretest scores.

2. Experimental classes produced significantly higher knowledge class means than control classes after equalizing groups for their pretest score differences.

3. Experimental and control group attitude class means were generally unchanged from pretest to posttest.

4. Student grades, their pretest knowledge score, the experimental treatment, and plans to work in an agribusiness after graduation from high school explained a majority of the variance associated with individual student posttest knowledge scores.

5. The experimental treatment, extent of instructor agribusiness experience, and the number of classes taught by the instructor per day explained a majority of the variance associated with posttest knowledge inventory class means.

6. Experimental instructors provided favorable responses regarding the value and quality of the agriculture/agribusiness management instructional unit.

7. Teacher and school situational characteristics were of limited value in predicting posttest knowledge or attitude class means.
8. Attitude scores tended to move in a positive direction from pretest to posttest, although the change was not statistically significant.

9. Knowledge score variance was approximately equal between treatment groups for the pretest. However, posttest variance increased for the control group, while experimental group knowledge score variance decreased.

10. Experimental group instructors rated the decreased amount of preparation time required as the most valued aspect of the agriculture/agribusiness management instructional unit.

11. Experimental instructors responded positively to seven quality characteristics for the instructional unit.

12. Experimental instructors identified five components and three aspects of the instructional unit as being of greatest value.
DISCUSSION

The central purpose of this investigation was to evaluate the effectiveness of an agriculture/agribusiness management instructional unit. Data collected from Iowa vocational agriculture classes were analyzed to accomplish that purpose.

This investigation was planned and conducted using a pretest-posttest, control group design. Participating instructors were handpicked rather than selected on a random basis. The intent was to identify teachers who would cooperate by providing the researcher an unbiased test of the materials. Although generalizations may not be extended to all Iowa vocational agriculture classes, this study was designed to test an instructional approach and determine its effectiveness in classroom situations. This study was not designed to provide conclusions to be generalized to a broad population.

Random selection of teachers may not have yielded instructors who were willing to cooperate and teach the unit as directed. Internal validity was enhanced by requiring each participating instructor to teach exactly as directed. Control group teachers were instructed to address each problem area and study question provided, whereas experimental teachers were asked to follow the teaching procedure exactly as suggested in the instructional unit.

These requirements limited the external validity of the experiment. Teachers would not be expected to blindly follow the approach suggested in the instructional unit under nonexperimental conditions. The
researcher opted to control as many extraneous variables as possible which required experimental teachers to utilize the approach suggested in the unit. Generalizations resulting from this investigation were necessarily limited to participating classes. Conclusions drawn may have implications for other groups if interpreted with a certain degree of caution.

Future researchers would be well-advised to consider the use of non-random samples in research. Discretion in the sampling procedure, random assignment to treatments, and cautious interpretation of results may enable researchers to conduct quality investigations when random sampling may prove counterproductive.

The design of this study was adequate in providing the conditions necessary to accomplish the desired purpose. Pretests administered to all classes enabled the researcher to equalize treatment groups for initial differences in student knowledge level. Inclusion of a control group also enabled the researcher to control historical and maturation effects as these threats to internal validity were assumed to affect both treatment groups equally.

Inservice training was not included in this study to insure that observed changes were attributed to use of the instructional unit and not inservice training. Review of past research revealed that inservice generally affects only teacher knowledge and attitudes, with no measurable effect on students (29). Teacher inservice training was included as part of the experimental treatment in research conducted by Briers (5) and Townsend (49) but did not exhibit a significant effect. Due to the
results of previous studies, the researcher chose not to include an in-service component in an effort to conserve time and budgetary resources. Further research is needed to determine the impact of teacher inservice programs and how students are affected.

Communication between participating instructors and the researcher was accomplished by letter and telephone. Instructor visits were considered by the researcher, but time and budgetary constraints prevented including teacher visits in the design of this research. Although such visits may have provided additional insights, such action may have also violated internal validity assumptions.

Both experimental and control group classes had significantly higher posttest knowledge means than pretest means. This finding led the researcher to conclude that instruction provided in both treatment groups was effective. Learning that occurred and was measured by pre-posttest differences was believed to have been the result of efforts by teachers to enhance student understanding of the subject matter.

Teaching style, methodology, and interpersonal factors affecting instructional effectiveness were assumed to have varied in a random fashion among treatment groups. This assumption enabled the researcher to conclude that higher posttest knowledge scores were not the result of a single approach to instruction as the level of student understanding increased for both treatment groups. Effective teaching was assumed to have resulted from various methods and approaches used in both groups. This conclusion substantiates similar conclusions drawn from previous research efforts. Student learning occurs in various instructional
settings, at different rates, and in response to different stimuli.

Student attitudes were examined as part of this study to evaluate instructional effectiveness. Bloom et al. (4) identified three educational domains which may be affected by instruction. Psychomotor skills had only limited applicability to the relevant subject matter and were not directly examined. Knowledge and attitudes were studied to determine instructional effectiveness as these domains may have been significantly affected by instruction in this subject matter area.

Learner needs were identified and keyed to specific learning activities through which they were to be addressed. Needs such as, "to develop a sense of citizenship" formed the basis of many learning activities. Instructors were directed to focus their teaching on those needs in addition to subject matter needs as suggested by Tyler (50).

Agriculture/agribusiness management attitude means did not change appreciably throughout the experiment. The general trend was toward more positive responses from pretest to posttest, although this change was not found to be statistically significant.

One factor which may have influenced the relatively minor shift in student attitudes involved the process through which attitudes develop. Initially, a person identifies or is exposed to a thought or concept (possibly through formal instruction) and establishes a belief or truth in that regard. Over time, that belief or truth becomes ingrained into the person's thought processes to the point where an attitude or feeling toward the concept or thought begins to emerge. These attitudes or feelings are continuously scrutinized and evaluated in terms of other
beliefs, attitudes, and values presently held by the individual. Eventually, the person begins to mentally weigh these attitudes which have been formed and places a measure of worth on each. Values are formed by internalizing the worth or "value" of certain beliefs and exhibiting them in the way a person lives. Although this is an oversimplified description of values development, attitudes are viewed as an intermediate step in the valuing process.

Attitudes, unlike beliefs, do not change frequently. Many recurring events are usually necessary to permanently alter one's attitude, whereas beliefs can change drastically as a result of a single event, experience being the most prevalent.

Although attitudes generally moved in a positive direction, the researcher contends there was insufficient time or opportunity to significantly alter student attitudes toward the concepts presented.

Attitudes are free to change in either positive or negative directions. Knowledge, on the other hand, generally will only increase as a result of instruction. Knowledge changes would be expected to be more unidirectional than would changes in attitudes. This factor may help to support the finding that significant knowledge changes were observed, whereas attitude changes were not apparent.

Techniques employed to provide an indication of respondent attitudes are less refined than instruments used to estimate the level of student knowledge. The inability to detect significant attitude changes may have been due to the lack of precision associated with the technique used in this research. Further refinement may be necessary to construct an
instrument which will "measure" attitude changes with a greater degree of precision.

Student attitudes toward agriculture/agribusiness management were examined through the use of a semantic differential technique. The researcher selected this technique to avoid requiring respondents to select a numerical value from a Likert-type scale. Respondents were felt to provide more realistic and meaningful responses using a seven-step response range between two bipolar adjectives. The use of numerical rating scales has been of questionable value in research (38). Respondents in this study were not exposed to numerical value labels on the instruments provided. Response values were numerically coded by the researcher after completion by each respondent. The researcher contends that responses were more meaningful as respondents were not influenced by numerical values on the response scale.

Further research is needed to evaluate the usefulness of this technique in research settings. Construction of the bipolar scales was also an area of concern to the researcher. Although more positive adjectives were positioned on the right-hand side of each scale, some researchers advocate alternating or randomly assigning the position of adjectives. Instruments developed and used in this study attempted to facilitate responding and coding scale responses in such a manner to minimize confusion.

Historical effects may also have influenced student attitudes in a direction opposite that which was promoted through formal instruction. This situation may have produced the observation of insignificant net
changes in student attitudes from pretest to posttest. Inservice training designed to more fully explain the intention and use of the learner needs component may be necessary to encourage teachers to address those needs identified, many of which were values-oriented.

Experimental and control groups were compared to identify differences in instructional effectiveness. Although random assignment was included as part of the research procedure, posttest group means were equalized for pretest differences before comparisons were made. This covariate analysis procedure allowed the researcher to examine posttest differences using adjusted group means. Knowledge inventory class means were found to be significantly higher for the experimental group than for the control group.

Students in the experimental group scored nearly nine percent higher on the posttest knowledge inventory than did control students on the average. Regression analysis revealed that the experimental treatment effect explained over 20 percent of the posttest variance. Although the explained variance may appear to be insignificant, the experimental treatment accounted for nearly half the explained variance. Other factors which appeared to influence individual posttest knowledge scores were: grades received by students, pretest knowledge scores, and plans after high school graduation involving work in an agribusiness.

In the main, students with higher letter grades and higher pretest knowledge scores, also scored higher on the posttest. Students planning to work in an agribusiness after graduation generally scored lower on the posttest knowledge inventory. Academically successful students
tended to score higher on the posttest as indicated by the significant relationship between grades received and posttest scores. Students indicating they planned to work in an agribusiness after graduation generally scored lower on the posttest knowledge inventory. This may be explained by the theory that students entering the work force directly from high school are less academically-oriented which may have prevented them from achieving higher posttest scores. These students may also have been entering manual labor positions and did not feel the need to study agricultural/agribusiness management at that point in time.

Treatment group variances for the knowledge inventory also shifted during the experiment. Although pretest variances were essentially equal for both groups, posttest variances revealed a shift in opposite directions. Control group variance increased from pretest to posttest, whereas experimental group variance decreased during the experiment. This observation may have been the result of the level of planning which accompanied experimental group instruction which was based on a central plan, whereas control classes received instruction which was essentially planned by each individual instructor.

The agriculture/agribusiness management unit was developed using a problem-solving format. Instruction was to address the problem areas and study questions identified by the researcher. Students in the experimental treatment group, who were exposed to problem-solving instruction, appear to have increased their posttest knowledge scores in a more uniform manner than control students. Some students in the control group appear to have responded well to the instructional approach which they
experienced, whereas others were less able to learn in the same environment. The researcher therefore concluded that the problem-solving approach used in experimental classes provided an environment through which students learned more uniformly. This conclusion should not be interpreted as the result of a stifling effect by limiting some students' potential while enhancing others. Experimental students scored higher on the posttest which would not be indicative of limiting student potential. Poorer students may have been assisted in reaching their potential by applying knowledge to realistic situations. This conclusion may lend support to the hypothesis that some students learn as a result of the teacher's efforts, while others learn in spite of the teacher's efforts.

The test used to provide an indication of the level of student knowledge was prepared by the researcher. Items were developed which focused on problem area and study questions contained in the unit and provided to all participating instructors. Although the potential for biasing the test in favor of one treatment group is evident, precautions were taken which reduced that threat.

All teachers were directed to focus their instruction on the problem areas and study questions provided by the researcher. Test questions based on those problem areas and study questions were developed and assumed to be valid for students from either treatment group. Agricultural education staff members at Iowa State University were asked to evaluate each test question in regard to the propriety of its use in testing high school students. The wording of some items was revised
to improve clarity, but the content was not altered. The researcher contends that as a result of the efforts made in test construction and validation, the instrument did not intentionally or unintentially bias the results of this study.

Based on the results of this investigation, the researcher concluded that student achievement was influenced to a greater degree by the quality, not the quantity of instruction. Support for this conclusion arose from the fact that a correlation coefficient of $r = .05$ was computed for the relationship between the number of class periods used in teaching the unit and posttest knowledge class means. Longer units may tend to bore students, whereas shorter, well-planned instruction may be equally effective.

The extent of instructor agribusiness experience was examined to determine the relationship with posttest knowledge class means. In general, teachers reporting more experience in agribusiness tended to be associated with classes having lower knowledge means. Explanations for this observation were not immediately apparent. Teachers who have more experience in the business community may be more task-oriented than people-oriented. Assuming this hypothesis to be true, teachers reporting more agribusiness experience may also be more concerned with quantity, and less concerned with the quality of their instruction. Lower student test scores may have been the result of an instructor's task-oriented style of teaching. Instructors with less business experience may be more personable, more concerned with the quality of their teaching. This hypothesis should be regarded as such as results of this research
have not provided a substantial base from which to draw definitive con-
clusions in this area.

The number of semesters of vocational agriculture did not appear to be related to posttest knowledge or attitude scores. This observation may be potentially disturbing to some vocational agriculture educators. The researcher contends that this observation should be expected. Past experiences in vocational agriculture, although providing a base from which to build, should not be expected to directly overlap with the agriculture/agribusiness management unit. This situation may help to explain the observation of no relationship between knowledge scores and extent of vocational agriculture instruction. Alternative explanations for this observation would involve the academic caliber of vocational agriculture students. Students in these programs may represent the entire range of academic ability, whereas mathematics and economics courses may enroll more academically-oriented students. Test scores, which were shown to be correlated with higher grades, would then also be related to the extent of instruction in academic courses and not vocational agriculture. This hypothesis was documented as a result of this study.

Attempts were made to predict posttest knowledge and attitude scores and class means using student and teacher predictor variables. Equations produced as a result of regression analysis explained less than 60 percent of the variance associated with the dependent variable. Prediction equations did identify significant predictor variables, but other factors not identified also appeared to influence posttest scores.

Prediction of knowledge scores was more successful than attempting
to predict student or class attitude scores. The conclusion drawn by the researcher was based on the number of variables assumed to influence each dependent variable (i.e., knowledge and attitude levels). Although more predictor variables were identified that contributed to knowledge scores than attitude scores, the researcher contends that in actuality more factors influence attitudes. More variables accounting for the total variance may result in fewer variables being identified as significant predictors. Each variable would be assumed to have a more limited marginal affect on attitude scores.

Teacher and school situational information was generally less valuable in predicting knowledge and attitude class means than was student information to predict individual scores. Class attitude means were especially difficult to predict using the information collected in this study. Additional information and characteristics should be identified and collected as part of future research efforts and their impact on student learning analyzed.

In the main, experimental teachers responded favorably to the quality and value of the instructional unit. The characteristic receiving the highest rating for the unit was technical accuracy. Simplicity was the lowest rated characteristic which revealed a degree of instructor concern for the complexity of the unit. These observations tend to support one another in that for the unit to be technically accurate may require added complexity. Each of the characteristics examined through the use of the semantic differential technique had means in excess of the scale midpoint. The researcher concluded that the unit was of
acceptable quality as judged by experimental instructors.

Individual components were evaluated by experimental instructors using a one to nine point "value" scale. Each component and aspect addressed had value means in excess of the scale midpoint. Based on this finding the researcher concluded that all components were of greater-than-average value to experimental group instructors.

The most valued aspect of the instructional unit was the reduced amount of preparation time necessary to teach the unit. It was also noted that the components most frequently used by experimental teachers (i.e., interest approach, learning activities, conclusions, etc.) received high value ratings relative to less frequently used components (i.e., learner needs and optional learning activities).

Written comments by teachers generally focused on expanding the scope of the unit. Although these comments were well-received, the intent of the study was to evaluate the intact unit. Future curriculum development efforts may be well-advised to provide a broad focus for materials to be developed. Many comments centered on the need for this and other subject matter units. The researcher did not receive any comments indicating the unit was of less-than-average value or that the unit would not be used in the future. Some instructors indicated they would modify the approach to some degree for future use.

Based on the findings of this investigation, the following major conclusions were drawn.

Student learning was affected by various teaching approaches, styles, and methods.
Use of the agriculture/agribusiness management instructional unit produced greater increases in student knowledge than did the use of traditional instructional materials.

Student attitudes shifted in a positive direction although the change was not significant.

The agriculture/agribusiness management instructional unit was effective in increasing the level of student knowledge of the subject matter.

Students exposed to the problem-solving approach suggested through the agriculture/agribusiness management unit had less variable posttest knowledge scores than did control students.

Instructional effectiveness appeared to be a function of quality rather than quantity of teaching.

Academically-oriented students scored higher on the posttest knowledge inventory.

Teacher characteristics had relatively little effect on student achievement or attitudes toward agriculture/agribusiness management.

The extent of previous instruction in vocational agriculture was not related to the level of student knowledge of agriculture/agribusiness management.

Several more minor factors appear to affect student attitudes, whereas fewer, more significant factors appear to influence the level of student knowledge of the subject matter.

Attitudes did not appear to change as readily as the level of student knowledge.

Use of the agriculture/agribusiness management instructional unit was successful in reducing the amount of preparation time required to teach the unit without sacrificing instructional effectiveness.

Teachers highly valued the "most-used" components of the instructional unit.

Learner needs were the least understood and the least valuable component in the instructional unit. Inservice training should be provided to explain the intent and use of the learner needs component.

Based on the findings and conclusions identified in this study
several recommendations were made which may impact on vocational agriculture teachers, teacher educators, state supervisors, and curriculum development personnel. These recommendations were suggested in an attempt to improve the quality of curriculum materials and instruction in Iowa vocational agriculture classes. Although these recommendations may not be directly generalized to all vocational agriculture classes in Iowa, program administrators should examine the potential benefits which may be derived by implementing these suggestions in the programs which they supervise.

Curriculum materials should be developed which incorporate a wide variety of teaching methods and techniques. Students learn in a variety of settings and in response to various stimuli. Attempting to maximize student learning requires learning experiences using a variety of techniques. Instructional materials arranged in broad subject matter units enables the author to vary the suggested methods in a logical, sequential manner. Materials developed with a more limited scope, often do not incorporate varying instructional techniques, if suggested at all.

Instructional materials should be developed using a problem-solving format. Many materials developed in the past have focused on subject matter without considering the learner. Future materials should provide opportunities to apply information to realistic problems. Consideration should be given to the role of students in the learning process.

Instructor inservice should be provided to describe the intended use of instructional materials. The purpose and need for addressing specified learner needs should be discussed at these inservice sessions.
Quality teaching should be stressed rather than quantity as it relates to instructional effectiveness.

Vocational agriculture teachers have asked for, and even demanded, high quality curriculum materials. The usefulness of specific instructional materials will diminish as rapidly as the technology upon which they are based changes. Development of quality instructional materials is not an isolated activity. Quality materials can be maintained only through a continuous, well-planned revision process. Materials currently in use are likely to become outdated in a short time and revised materials must become available to allow the vocational agriculture instructional program to keep pace with current technology. Materials should also be developed which utilize the educational technology which is currently available (i.e., micro-computers, television, transparencies, etc.).

Materials developed in the future should be subjected to rigorous evaluations to determine their effectiveness. Low-quality materials should be eliminated and more effective materials used in their place.

Personnel in charge of developing curriculum materials also have the unenviable task of identifying new subject matter areas on which to develop materials. More specialized instructional programs of the future will make that task more difficult. The researcher recommends that future curriculum development efforts focus more on future needs rather than current needs which may change before materials can be developed to fulfill them. Special efforts should be made to identify needs of the population which future vocational agriculture programs will be
serving.

Several implications would be expected as a result of implementation of the above suggestions. Most importantly, vocational agriculture instructional programs would expectedly be more effective. The level of student knowledge should increase more uniformly as students are better able to apply information to problematic situations.

Vocational agriculture instructors should have more time to attend to other duties as a result of decreased preparation time required to meet class expectations. Ultimately, this may increase teacher retention as time demands are reduced for such positions.

Instruction in vocational agriculture would be more beneficial to future students, assuming instructional materials were continually revised and updated. Instructors would be able to provide more current and technically accurate information as a result. Educational costs would undoubtedly rise in the event that recommendations resulting from this study were fully implemented. The latter observation alone appears to be the greatest limitation to the development and revision of future instructional materials.

Teachers of the future who have access to a wide variety of instructional materials would be better able to meet the educational needs of a widely divergent clientele. More instructors may be trained as "professional educators" and specialists in educational technology, relying more heavily on instructional materials and subject matter specialists to provide the technical information. This scenario, although futuristic, has become more apparent as we examine the changes which have occurred in education in recent years.
SUMMARY

This investigation was directed toward evaluation of an agriculture/agribusiness management instructional unit. Objectives for this study were identified as follows: 1) to determine the effectiveness of an agriculture/agribusiness management instructional unit as evaluated by changes in student knowledge and attitudes, 2) to determine the effectiveness of the unit in relation to traditionally-used instructional materials, 3) to examine relationships which existed between selected student characteristics and their knowledge level or attitude toward agriculture/agribusiness management, 4) to examine relationships which existed between selected instructor and school characteristics and knowledge or attitude class means, and 5) to identify experimental teacher concerns regarding the quality and value of the instructional unit.

This investigation was planned and conducted using a pretest-post-test, control group design. Data were collected from 280 students in 28 Iowa vocational agriculture classes and analyzed to fulfill the objectives identified above. Sixteen classes enrolling 180 students provided information for the experimental treatment group, whereas twelve classes enrolling 100 students provided control treatment group data.

Participating instructors were selected from a list of all Iowa vocational agriculture teachers and randomly assigned to treatment groups. Random selection procedures were not employed as the researcher desired to select teachers who would provide an unbiased test of the materials. The intent of the study was to focus on testing the
instructional approach suggested in the unit, and was less concerned with the ability to generalize results to any population.

Knowledge levels were estimated by the total number of correct responses provided by each student on a 40-item multiple choice test. The test used in this study was developed by the researcher. Precautions were taken to ensure the test would not favor either treatment group.

Student attitudes were examined by employing a semantic differential technique. Six agriculture/agribusiness management concepts were presented and students were asked to respond to each of six bipolar adjective scales provided for each concept. Responses were numerically coded and summed to obtain an overall attitude score.

Knowledge and attitude inventories differed only in form from pretest to posttest. Items were randomly arranged, as were alternatives, for the pretest knowledge inventory form. The posttest knowledge inventory had items rearranged in a random fashion, but the alternatives were not changed. Attitude instruments were not changed from pretest to posttest. Reliability coefficients of .80 or higher were computed for the data collection instruments used in this study.

Experimental treatment group instructors were directed to teach the agriculture/agribusiness management unit using the approach exactly as directed. Control group teachers were asked to focus their instruction on problem areas and study questions provided, which were addressed in the instructional unit.

Data analysis revealed significantly higher posttest scores than pretest scores for both treatment groups. Students in experimental
classes revealed larger gains in knowledge scores than did students in control classes. Use of the agriculture/agribusiness management instructional unit appeared to increase the effectiveness of instruction in relation to traditionally-used materials.

Student attitudes appeared to shift in a positive direction during the course of the experiment. The instrument used to provide an indication of student attitudes toward the six concepts presented was unable to detect significant attitude changes.

Students in the experimental treatment group were found to have more homogeneous knowledge inventory scores than control students. This observation was attributed to the central planning involved in the development of the instructional unit, whereas control group classes received instruction planned mainly by individual instructors.

The number of class periods used to teach the subject matter did not appear to be related with posttest knowledge class means. This finding led the researcher to conclude that the quantity of instruction was not as important as quality in determining instructional effectiveness.

In the main, experimental teachers were quite satisfied with the quality and value of the agriculture/agribusiness management instructional unit. Technical accuracy was rated highest of all quality characteristics examined, whereas the simplicity associated with use of the unit received the lowest ratings. Components used most often by the experimental teachers received high value ratings. The value of learner needs identified in the unit was of least value.

Experimental group teachers revealed that the instructional unit
was of the most value in reducing the amount of preparation time necessary to teach the unit. Teaching effectiveness was not diminished as a result of decreased preparation time.

Plans for continued revision of curriculum materials were recommended by the researcher. Materials should also be developed which incorporate current educational technology and a variety of instructional methods.

Future vocational agriculture programs will be required to meet the educational needs of students with more diverse interests. Instructional materials should be prepared and made available in specialized subject matter areas to assist teachers in meeting those needs. Materials in these areas should incorporate an approach to teaching through suggested learning activities.

Use of high-quality instructional materials was shown to increase the effectiveness of teaching in Iowa vocational agriculture programs. Teacher inservice programs should be directed toward the intended use of instructional materials in the classroom. Further research may be necessary to identify methods and techniques which may be employed to influence student attitudes in favorable directions.

Evaluations of newly-developed materials should be conducted to examine their impact on instructional effectiveness before dissemination to teachers. New materials should be adopted only when they exceed the quality, value, or overall effectiveness of materials currently in use.
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ACKNOWLEDGMENTS

The writer wishes to publicly express his sincere appreciation to many people who provided support, assistance, guidance, and encouragement throughout my graduate program.

To Dr. Alan Kahler and his wife, Helen—who provided much needed support and encouragement to my family as well as myself. Dr. Kahler is also to be commended for the skillful guidance and direction provided as my major professor.

To Dr. Harold Crawford—for allowing me to study in the department by providing opportunities to gain practical experience in teacher education and for serving on my committee.

To Professor Clarence Bundy—for agreeing to serve on my committee during his retirement and for providing insights into agricultural education from his unique perspective.

To Dr. Anton Netusil—for his valuable instruction in the use of statistics in educational research and for serving on my committee.

To Drs. Earl Heady and Duane Harris—for agreeing to serve on my committee as representatives of my minor field.

To the staff and students in the Department of Agricultural Education who provided a cordial environment in which to learn.

And most importantly, to my wife, Pam, and my children, Todd and Reed, for the many sacrifices they made to enable me to complete my degree program. The debt of gratitude which I owe to these and many other people too numerous to mention, can never be fully repaid.
APPENDIX A: CORRESPONDENCE

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Teacher Response Postcard 110
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Agriculture/Agribusiness Management--Problem Areas and Study Questions 115
Guidelines for Collecting Student Information 117
Summary Letter to Participating Instructors 118
I hope that your school year has gotten off to a smooth start and that you have set some high goals for your program for the year. We here at ISU are beginning to get settled after the transition from a quarter to the semester system. Many courses have undergone drastic revisions in the process, but students seem to be adjusting rather well.

The purpose for this letter is to solicit your participation in a field test of curriculum materials developed by Project 2000 staff members. We are asking a number of vocational agriculture teachers throughout the state to use materials in the area of Soybean Production, Soil Fertility and Fertilizers, and Agricultural Business Management as a part of this field test. These materials consist of learning activities and instructional materials dealing with problems in each of those areas of study. Materials will be provided to each school without charge.

Participation on your part would involve the use of these materials as they are written and administration of a pre-post test to determine their effects on student achievement. Our goal is to ultimately determine the effectiveness of these materials on teaching vocational agriculture in Iowa. Other schools have been selected to serve as a control group which will utilize traditional instructional materials in these areas. Pre-test and post-test scores for both groups will be compared to determine the effectiveness of Project 2000 materials in relation to traditional materials presently being used.

Evaluation of instructional materials is an important aspect of curriculum material development. It is important that teachers who wish to cooperate in this effort do so with the goal of increasing their own teaching effectiveness as well as that of future teachers.
It is our hope that cooperating departments will agree to teach these units during the period from November 1, 1981, to February 1, 1982. Each unit will require approximately six weeks of class time.

I am asking for your cooperation and assistance in field testing these materials and request that you discuss your interest in participating with your principal and return the enclosed response postcard at your earliest convenience. Further information concerning your responsibility in that regard will be provided, if you are interested, by contacting me at (515) 294-5872 or a member of the Project 2000 staff at (515) 294-8454.

I thank you for your cooperation and will look forward to hearing from you.

Sincerely,

Alan A. Kahler
Professor, Agricultural Education
Director, Project 2000

AAK/mt

Enc. (postcard)
I hope that your school year has gotten off to a smooth start and that you have set some high goals for your program for the year. We here at ISU are beginning to get settled after the transition from a quarter to the semester system. Many courses have undergone drastic revisions in the process, but students appear to be adjusting rather well.

The purpose of this letter is to identify vocational agriculture teachers who would be willing to participate in a study of vocational agriculture curriculums in the state of Iowa as a part of Project 2000. I am asking participating instructors to meet the following qualifications:

1. Teach units on Soybean Production, Soil Fertility and Fertilizers, and Agricultural Business Management during the period from November 1, 1981, to February 1, 1982 (approximately six weeks for each unit).

2. Administer pre-test and post-test instruments to students in the relevant classes.

Vocational agriculture departments who wish to cooperate in this effort will incur no additional expense in their programs. Pre-test and post-test instruments will be provided along with further instructions.
The results of your input will be useful in a determination of the need for development of instructional materials in these areas. I would ask that you discuss your interest in participating in this study with your principal and return the enclosed postcard at your earliest convenience.

I thank you in advance for your cooperation and look forward to hearing from you.

Sincerely,

Alan A. Kahler
Professor, Agricultural Education
Director, Project 2000

AAK/mt
Enc. (postcard)

P. S. If you have questions, please feel free to contact me at (515) 294-5872.
Teacher Response Postcard

(School)

I ___ am ___ am not interested in participating in Project 2000's curriculum study.

I plan to teach:
___ Soybean Production to ___ students.
___ Soil Fertility & Fertilizers to ___ students.
___ Agricultural Business Management to ___ students.

____________________________  ____________________
Principal                   Vo Ag Teacher
Dear Vo Ag Instructor,

Thank you for agreeing to participate in Project 2000's evaluation of curriculum materials. Enclosed you will find an assortment of materials which will help us evaluate the Agriculture/Agribusiness Management unit.

Please review the contents of this envelope which contains:

1. One instructional unit in Agriculture/Agribusiness Management
2. Informed Consent Forms (one for each student in Agriculture/Agribusiness Management)
3. Agriculture/Agribusiness Management Knowledge Inventory (one for each student in Agriculture/Agribusiness Management)
4. General Purpose-NCS-Answer Sheets (one for each student in Agriculture/Agribusiness Management)
5. Agriculture/Agribusiness Management Attitude Inventory (one for each student in Agriculture/Agribusiness Management)
6. Guidelines for Collecting Student Information

If you find that you have not received any of the above items in the proper quantities, please contact us immediately at (515) 294-8454.

Before beginning instruction in this subject matter unit, it is important to review the materials needed throughout the unit and to order that information which is not currently on hand. We are asking that each instructor proceed through each problem area and utilize each learning activity provided. Learner needs are identified in several of the activities provided. These are areas which can be emphasized to improve the quality of education without diluting the subject matter being taught.

Prior to initiating the instructional phase of this evaluation, we would encourage you to ask your building principal or guidance counselor to administer the Agriculture/Agribusiness Knowledge Inventory and Agriculture/Agribusiness Attitude Inventory to students in the class. There are several reasons for this request. By utilizing these administrative personnel, the vocational agriculture program can publicize
its attempt to provide the highest quality instruction to students in the district. Also, students may be encouraged to put forth a more honest effort if administrators participate in this fashion. The final decision regarding who administers these instruments will be left with you.

Both the Knowledge Inventory and Attitude Inventory must be completed and returned to us before beginning instruction in this unit. Please review each Knowledge Inventory Answer Sheet and Attitude Inventory to check that the students have provided their names as requested. Failure to supply names will unable us to match pre-test scores with post-test scores for evaluation purposes. It is important to stress that individual scores and the scores of students in your program will be combined with other students and programs, and no comparisons will be made between individual students or programs.

We are asking that all copies of the inventory forms and answer sheets be returned to our office immediately after completion, and we will respect your honesty and integrity not to duplicate these materials.

Informed Consent Forms should be distributed to students for their own and their parents' signatures. These forms, required of all projects of this nature, must be completed and returned to our office before we can utilize information provided by students in your program.

Approximately two weeks prior to concluding instruction in this unit, please contact our office so that we may send out materials needed for the post-test phase of the evaluation process.

The evaluation of instructional materials is of extreme importance. We sincerely appreciate your cooperation in this attempt and welcome any suggestions you may have which will improve the materials provided or the evaluation process.

Again, thank you for your cooperation.

Sincerely,

Alan A. Kahler
Professor, Agricultural Education
Director, Project 2000

AAK/mt
Enclosures
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Again, thank you for your cooperation.

Sincerely,

Alan A. Kahler
Professor, Agricultural Education
Director, Project 2000

AAK/mt
Enclosures
AGRICULTURE/AGRIBUSINESS MANAGEMENT

Problem Areas and Study Questions

I. What is Management?

Study Questions:

1. How is management defined?
2. What is the purpose of management?
3. What kinds of resources require management?
4. Who is involved in management?
5. How can "Management by Objectives" be used in agricultural businesses?

II. How May Agricultural Businesses be Organized?

Study Questions:

1. How are business organizational structures classified?
2. How do organizational structures differ?
3. Why do businesses organize in different ways?

III. What are the Characteristics of a Sole Proprietorship?

Study Questions:

1. What are some examples of a sole proprietorship in our community?
2. Who makes decisions in sole proprietorships?
3. Who assumes financial risks in a sole proprietorship?
4. How are profits distributed in sole proprietorships?

IV. What are the Characteristics of a Partnership?

Study Questions:

1. What are some examples of partnerships?
2. How are business decisions made?
3. Who assumes financial risks in a partnership?
4. How are profits distributed in a partnership?
5. How does a limited partnership differ from a general partnership?

V. What are the Characteristics of a Corporation?

Study Questions:

1. What are some examples of corporations in our community?
2. How are corporate business decisions made?
3. Who assumes financial risk of corporate business?
4. How are corporate profits distributed?
5. How do Sub-Chapter S corporations differ from regularly-taxed corporations?
VI. What are the Characteristics of a Cooperative?

Study Questions:

1. What are the responsibilities of various people involved in a cooperative?
2. How do cooperatives differ from other types of businesses?
3. How are cooperative profits distributed?
4. Who assumes financial risks in a cooperative?

VII. How do Business Laws Affect Agricultural Businesses?

Study Questions:

1. How is the judicial system organized?
2. What are the different kinds of laws?
3. Who has the ability to establish laws?
4. Which kinds of laws are of greatest concern to agricultural businesses?
5. How are laws enforced?

VIII. Why are Contracts Used in Businesses?

Study Questions:

1. What is the purpose of a contract?
2. Which elements of a contract should be specified?
3. What are some common remedies for "breach of contract"?
4. When and why should contracts be in writing?
5. Are advertisements considered contracts?
6. Do negotiable instruments meet the criteria of a contract?

IX. What Types of Liability are of Concern to Agricultural Businesses?

Study Questions:

1. What is meant by the term "liability"?
2. How does liability vary with the different types of business organizations?
3. How does tort, negligence, and product liability affect agricultural businesses?

X. What Governmental Regulations Affect the Operation of an Agricultural Business?

Study Questions:

1. Who authors governmental regulations?
2. Why are regulations important?
3. How are regulations enforced?
4. Which agencies are involved in regulating agricultural businesses?
GUIDELINES FOR COLLECTING STUDENT INFORMATION

Purpose of Evaluation:

The purpose of this project is to collect information necessary to evaluate instructional materials in Vocational Agriculture which were developed by Iowa State University.

Directions:

1. Have principal or guidance counselor administer the Knowledge Inventory to students. Make sure each student uses a No. 2 (soft-lead) pencil to record answers on the answer sheet provided.

2. Administer the Attitude Inventory to students. The instructions should be self-explanatory. Please emphasize to them that they should respond to each and every item.

3. Distribute Informed Consent Forms to students and explain that it is essential these forms be completed and returned.

4. Mail all four items for each student (i.e. Knowledge Inventory, Answer Sheet, Attitude Inventory, and Informed Consent Form) to:

   Dr. Alan A. Kahler  
   Department of Agricultural Education  
   219 Curtiss Hall  
   Iowa State University  
   Ames, Iowa 50011

Thanks again for your help and cooperation. If you have questions, please call (515) 294-8454.
Dear

Enclosed you will find the materials needed to complete the data collection process involved with the evaluation of curriculum materials developed through Project 2000. Please have your students complete the Knowledge Inventories and the Attitude Inventories as they did for the pre-test. We would also ask that you complete the Informed Consent Form and the Teacher Data Instrument which are also enclosed. After completing all of the enclosed materials, we would ask that you return them to us as quickly as possible. Feel free to keep the Knowledge Inventory (tests) if you so desire.

We hope that you have enjoyed participating in this evaluation and it has not created an undue hardship on your teaching load. Results should be available in time to be presented at the Vo-Ag Teachers Conference in Des Moines next summer.

Again, thank you for your help in making this evaluation possible and we look forward to receiving the materials from you.

Sincerely,

Alan A. Kahler

encl.
APPENDIX B: IDENTIFICATION OF PARTICIPANTS
Table B.1. Code number, school, instructor, and size of classes by treatment group

<table>
<thead>
<tr>
<th>Code</th>
<th>School</th>
<th>Instructor</th>
<th>Class size</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Control</strong></td>
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<td></td>
</tr>
<tr>
<td>503</td>
<td>New Market</td>
<td>David Linke</td>
<td>7</td>
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<tr>
<td>504</td>
<td>Sac City</td>
<td>Mitch Hoyer</td>
<td>9</td>
</tr>
<tr>
<td>505</td>
<td>West Marshall</td>
<td>Norm Wagoner</td>
<td>9</td>
</tr>
<tr>
<td>509</td>
<td>Marengo</td>
<td>Andy Rowe</td>
<td>6</td>
</tr>
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<td>510</td>
<td>Aurelia</td>
<td>Brian Maddy</td>
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</tr>
<tr>
<td>511</td>
<td>Pocahontas</td>
<td>Jerry Chizek</td>
<td>3</td>
</tr>
<tr>
<td>512</td>
<td>Forest City</td>
<td>Larry Vold</td>
<td>6</td>
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<tr>
<td>515</td>
<td>Grundy Center</td>
<td>Larry Lockwood</td>
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<td>517</td>
<td>Hartley</td>
<td>Harold Woodard</td>
<td>8</td>
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<td>518</td>
<td>Montezuma</td>
<td>Ron Sheetz</td>
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<td>519</td>
<td>West Delaware</td>
<td>Bob Wendt</td>
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<td>522</td>
<td>Graettinger</td>
<td>Dale Nelson</td>
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<tr>
<td><strong>Experimental</strong></td>
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<td>601</td>
<td>Ackley-Geneva</td>
<td>Dave Holm</td>
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<td>603</td>
<td>Clarion</td>
<td>Wes Johnson</td>
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<td>604</td>
<td>Lake Mills</td>
<td>Phil Bax</td>
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<tr>
<td>607</td>
<td>Monona (M-F-L)</td>
<td>Todd McDonough</td>
<td>25</td>
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<tr>
<td>608</td>
<td>Nashua</td>
<td>Diane Rickels</td>
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<td>Rolfe</td>
<td>Dennis Adkisson</td>
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<td>612</td>
<td>Wapsie Valley</td>
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<td>Garnavillo</td>
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<td>Rockwell-Swaledale</td>
<td>Dean Webber</td>
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<td>North Kossuth</td>
<td>Cliff Van Berkum</td>
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<td>621</td>
<td>North Linn</td>
<td>Joe Yedlik</td>
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<td>622</td>
<td>Osage</td>
<td>Lewis Lauterbach</td>
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<td>623</td>
<td>Davis County</td>
<td>DeWitt Shelton</td>
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<tr>
<td>624</td>
<td>Wellman</td>
<td>Paul Swank</td>
<td>15</td>
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<tr>
<td>625</td>
<td>Delmar</td>
<td>Mahlon Peterson</td>
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</tbody>
</table>

| Total |                     |                     | 180        |
APPENDIX C: INFORMED CONSENT FORMS

Informed Consent Form—Informed Consent of Students 122
Informed Consent Statement (Teacher) 123
INFORMED CONSENT FORM

Informed Consent of Student

I voluntarily agree to participate in the activities associated with the study of Agriculture/Agribusiness Management in my vocational agriculture class. I further understand that the information which I provide will be held in strict confidence and that my responses will be combined with other responses and used only in the interest of improving instruction in vocational agriculture. The information that I provide through my participation in these activities will be used, along with that provided by other students, as a basis for developing instructional materials on agricultural subjects that will be shared with all vocational agriculture programs in the state of Iowa.

_________________________  ________________________________
(Date)  (Print Name of Student)

______________________________
(Signature of Student)

______________________________
(Box Number or Route Number)

_________________  ____________  ____________
(Town)  (State)  (Zip)

______________________________
(Name of School)

Informed Consent of Parent/Guardian

My son/daughter, __________________________, has my permission to participate in the activities described above.

_________________________  ________________________________
(Date)  (Print Name of Parent)

______________________________
(Signature of Parent)
Vocational Agriculture Instructors:

Please read and sign the following INFORMED CONSENT STATEMENT which indicates your willingness to provide information necessary to complete the evaluation of curriculum materials developed and tested as a part of Project 2000.

INFORMED CONSENT STATEMENT

I voluntarily agree to provide the information as requested below as a part of my involvement with Project 2000's evaluation of curriculum materials. I understand that the information which I provide will be held in confidence and that my responses will be combined with other responses and used only in the interest of improving instruction in vocational agriculture.

(Date) (Signature)

Directions: Please respond to each of the following items as each relates to you or your teaching situation.

___ 1. How many years have you taught vocational agriculture? (Including this year)
___ 2. How many students are enrolled in your high school? (9-12)
___ 3. How many students are enrolled in your Vo-Ag Department?
___ 4. How many day-classes do you teach per day?
___ 5. How many vo-ag day-classes do you teach per day?
___ 6. Write the number which indicates the highest level of your education.

9, 10, 11, 12 13, 14, 15, 16 17, 18, 19, 20
(High School) (College) (Graduate)
APPENDIX D: DATA COLLECTION INSTRUMENTS

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture/Agribusiness Management Knowledge Inventory</td>
<td>125</td>
</tr>
<tr>
<td>Agriculture/Agribusiness Management Attitude Inventory</td>
<td>131</td>
</tr>
<tr>
<td>Student Data Instrument</td>
<td>134</td>
</tr>
<tr>
<td>Teacher Data Instrument</td>
<td>135</td>
</tr>
<tr>
<td>Instructor Evaluation of Agriculture/Agribusiness Management</td>
<td>136</td>
</tr>
<tr>
<td>Instructional Unit</td>
<td></td>
</tr>
</tbody>
</table>
Directions:

The purpose of this test is to determine your present level of knowledge of Agriculture/Agribusiness Management. Using a soft lead (No. 2) pencil, please enter your name in the space provided on the upper left portion of the answer sheet. Above your name, please write the letters "ABM" in the blank area.

Read each question and response carefully. After deciding on the correct or best response, darken the circle on the answer sheet corresponding to your choice. Please answer all questions.

After completing this test, please return both the answer sheet and test to your instructor.

1. Which of the following best describes secondary sources of law?

   A. Someone's interpretation of primary law
   B. A law that is based on another law
   C. Laws developed by state legislatures rather than the U.S. Congress
   D. All of the above

2. Resources that require management in a business may include:

   A. Time
   B. Money
   C. Equipment
   D. All of the above

3. How are corporate profits distributed?

   A. Equally among all investors
   B. Equally among the Board of Directors
   C. Equally among the shares of stock issued
   D. None of the above

4. Why are contracts used in agricultural businesses?

   A. To indicate that an agreement has taken place between two parties
   B. To avoid misunderstandings about an agreement at a later date
   C. To encourage lawyers to participate in business procedures
   D. None of the above

5. Which term is used to describe a "civil wrong" which causes damage to another person or their property?

   A. Warranty liability
   B. Assault liability
   C. Tort liability
   D. Negligent liability

NOTE: TURN TO THE BACK SIDE OF THIS PAGE FOR ITEM NUMBER 6.
6. Why should liability aspects be considered before forming a partnership?
   A. Business losses may be collected from a partner's personal assets
   B. Partnerships are taxed at a higher rate than sole proprietorships
   C. Only one partner makes management decisions
   D. All of the above

7. Who makes management decisions in a corporation?
   A. Board of Directors
   B. Member patrons
   C. Government agencies regulating corporate activities
   D. Shareholders

8. Which of the following is responsible for establishing laws affecting agricultural businesses in Iowa?
   A. Governor
   B. Secretary of Agriculture
   C. Legislature
   D. U.S. District Attorney

9. Which of the following types of liability are of concern to agricultural businesses?
   A. Civil liability
   B. Contract liability
   C. Business loss liability
   D. All of the above

10. Which one of the following is a unique feature of sole proprietorships?
    A. Profits are taxed twice
    B. One person is responsible for management decisions
    C. Shareholders receive quarterly dividends
    D. Liability is limited to owner's investment in business assets

11. Who receives the profits from a sole proprietorship?
    A. Shareholders
    B. Member patrons
    C. Owner
    D. Limited partner

12. Which of the following best describes the term "Breach of Contract"?
    A. Failure to properly sign the contractual agreement
    B. Failure to date the contractual agreement
    C. Failure to fulfill the terms of the contractual agreement
    D. All of the above

13. Where do cooperatives obtain operating money?
    A. Member patrons
    B. Lending institutions
    C. Retained patronage dividends
    D. All of the above.
14. Which person(s) should be responsible for management?
   A. Hired hand
   B. Land owner
   C. Tenant who is farming ground
   D. All of the above.

15. Which of the following is NOT a recognized form of business organization?
   A. Sole partnership
   B. Corporation
   C. Limited partnership
   D. Sole proprietorship

16. Which form of business automatically dissolves with the death of one of the owners?
   A. Cooperative
   B. General partnership
   C. Corporation
   D. Subchapter S corporation

17. Which one of the following types of business organizations pose the greatest liability for owners?
   A. General partnership
   B. Limited partnership
   C. Cooperative
   D. Corporation

18. Which one of the following is NOT true of partnerships?
   A. Written agreements are preferred to oral agreements
   B. Any number of persons can form a partnership
   C. Partners must be "blood relatives"
   D. Partners may include children under "legal age"

19. What is the role of the judicial system in regard to laws affecting agricultural businesses?
   A. Interpreting the meaning of laws
   B. Enforcing laws
   C. Debating and establishing new laws
   D. All of the above

20. What happens when a shareholder in a corporation dies?
   A. Business is reorganized
   B. Assets invested by the deceased are confiscated by the business
   C. Business purchases the deceased's stock
   D. There is no effect on the business

NOTE: TURN TO THE BACK SIDE OF THIS PAGE FOR ITEM NUMBER 21.
21. Corporate business losses can be collected from which of the following sources?
   A. Personal assets owned by stockholders
   B. Stockholders money invested in the business
   C. Estates of deceased stockholders
   D. None of the above

22. How are cooperative profits distributed?
   A. Equally among member patrons
   B. Equally among the Board of Directors
   C. Equally among customers of the cooperative
   D. None of the above

23. Which governmental agency regulates the federal grain reserves program?
   A. Department of Environmental Quality
   B. Inter-state Commerce Commission
   C. Federal Trade Commission
   D. Agricultural Stabilization and Conservation Service

24. What is the major factor differentiating the forms of business organizations?
   A. Size of the business
   B. Number of owners
   C. Goal of the business
   D. Profitability of the business

25. Which agency issues permits for livestock producers to build an animal waste lagoon?
   A. Food and Drug Administration
   B. Department of Public Safety
   C. Department of Environmental Quality
   D. Packers and Stockyards Administration

26. Which of the following situations may result in termination of a contract?
   A. When agreement is reached through dishonesty
   B. When agreement is reached through threat of physical violence
   C. When agreement requires illegal activity
   D. All of the above

27. Which of the following penalties may be used to enforce governmental regulations?
   A. Issue "cease and desist" orders by a District court judge
   B. Fine the guilty party
   C. Sue the guilty party
   D. All of the above
28. What do the letters O.S.H.A. stand for?
   A. Over Seas Hereford Association
   B. Occupational Safety and Health Administration
   C. Occupants Safe Housing Authority
   D. None of the above

29. Agricultural cooperatives may be involved in which of the following businesses?
   A. Providing services to farmers (insurance, credit)
   B. Marketing agricultural products (grains, livestock)
   C. Supplying agricultural materials to farmers (fertilizer, fuel)
   D. All of the above

30. How should business profits be distributed among partners?
   A. In the same proportion as each partner invests money
   B. According to the terms of the partnership agreement
   C. Equal amounts going to each partner
   D. Passing to partners as they need money for living expenses

31. Which form of business organization has the least number of investors?
   A. Cooperative
   B. General partnership
   C. Subchapter S corporation
   D. Sole proprietorship

32. Which of the following must be proven in order to sue another person for negligence?
   A. Damages were suffered
   B. Damages were caused by other person's actions
   C. Other person's actions were not reasonable
   D. All of the above

33. How are cooperative profits regulated?
   A. Limited to 20% of invested capital
   B. Limited to $500.00 per year per member patron
   C. Limited to 8% of invested capital
   D. No limit on profits

34. Which one of the following is the most common form of farm business?
   A. Subchapter S corporation
   B. Sole proprietorship
   C. General partnership
   D. Cooperative

35. Management can best be defined as:
   A. The supervision of employees in a business
   B. The allocation of limited resources to accomplish certain goals
   C. The process involved in marketing agricultural products
   D. Those persons who serve on the Board of Directors of an agricultural business.

NOTE: TURN TO THE BACK SIDE OF THIS PAGE FOR ITEM NUMBER 36.
36. Which of the following is an essential element of a contract?
   A. Agreement
   B. Competent parties
   C. Legal purpose
   D. All of the above

37. Which of the following is a unique feature of a "limited partnership"?
   A. Liability is limited to the amount invested in the business
   B. "Limited" partner has no role in management decisions
   C. Profits are distributed according to terms of the partnership agreement
   D. All of the above

38. Which of the following is NOT considered a primary source of laws affecting agricultural businesses?
   A. Case law
   B. Statutory law
   C. Regulatory law
   D. Criminal law

39. Who makes management decisions in a sole proprietorship?
   A. Board of Directors
   B. A farm manager hired by the Board of Directors
   C. Individual owner
   D. A panel of experts

40. Which of the following is NOT a characteristic of good management?
   A. A continuous process
   B. Requires both short-term and long-term planning
   C. It is a simple procedure
   D. Involves making decisions

NOTE: Have you entered your name and the letters "ABM" on the answer sheet as requested?
AGRICULTURE/AGRIBUSINESS MANAGEMENT ATTITUDE INVENTORY

Directions: Please evaluate each of the following concepts listed in BOLD PRINT placing an "X" on each line in relation to your feelings toward the concept presented. BE HONEST! Please place only one mark on each and every row provided.

Example: I FEEL THAT PARTICIPATION IN FFA ACTIVITIES IS:

If you felt participation in FFA activities was important, you might mark the following:

If you felt participation in FFA activities was totally meaningless, you would mark the following:

I FEEL THAT COOPERATION WITH OTHERS IS:
1. BORING: INTERESTING
2. UNIMPORTANT: IMPORTANT
3. UNPLEASANT: PLEASANT
4. BAD: GOOD
5. DISCOURTEOUS: COURTEOUS
6. FOOLISH: WISE

I FEEL THAT ACQUIRING KNOWLEDGE IN AGRICULTURE IS:
1. COMPLEX: SIMPLE
2. FOOLISH: WISE
3. BAD: GOOD
4. BORING: INTERESTING
5. UNPLEASANT: PLEASANT
6. UNIMPORTANT: IMPORTANT

NOTE: TURN TO THE BACK SIDE OF THIS PAGE TO CONTINUE
I FEEL THAT MAKING DECISIONS IS:
1. BORING:__:__:__:__:__:__:__:__:__:__ INTERESTING
2. FOOLISH:__:__:__:__:__:__:__:__:__:__:WISE
3. ROUTINE:__:__:__:__:__:__:__:__:__:__:CREATIVE
4. UNIMPORTANT:__:__:__:__:__:__:__:__:__:__:IMPORTANT
5. BAD:__:__:__:__:__:__:__:__:__:__:GOOD
6. COMPLEX:__:__:__:__:__:__:__:__:__:__:SIMPLE

I FEEL THAT CORPORATE FARMING IS:
1. UNIMPORTANT:__:__:__:__:__:__:__:__:__:__:IMPORTANT
2. BAD:__:__:__:__:__:__:__:__:__:__:GOOD
3. UNSUCCESSFUL:__:__:__:__:__:__:__:__:__:__:SUCCESSFUL
4. UNFAIR:__:__:__:__:__:__:__:__:__:__:FAIR
5. ROUTINE:__:__:__:__:__:__:__:__:__:__:CREATIVE
6. UNORGANIZED:__:__:__:__:__:__:__:__:__:__:ORGANIZED

I FEEL THAT GOVERNMENT REGULATIONS ARE:
1. UNIMPORTANT:__:__:__:__:__:__:__:__:__:__:IMPORTANT
2. BAD:__:__:__:__:__:__:__:__:__:__:GOOD
3. ERRATIC:__:__:__:__:__:__:__:__:__:__:SYSTEMATIC
4. UNFAIR:__:__:__:__:__:__:__:__:__:__:FAIR
5. MEANINGLESS:__:__:__:__:__:__:__:__:__:__:MEANINGFUL
6. UNNECESSARY:__:__:__:__:__:__:__:__:__:__:NECESSARY
I feel that agriculture/agribusiness management is:

1. Unimportant: _______: _______: _______: _______: _______: IMPORTANT
2. Passive: _______: _______: _______: _______: _______: ACTIVE
3. Bad: _______: _______: _______: _______: _______: GOOD
4. Routine: _______: _______: _______: _______: _______: CREATIVE
5. Boring: _______: _______: _______: _______: _______: INTERESTING
6. Meaningless: _______: _______: _______: _______: _______: MEANINGFUL

Note: Have you made an "X" on each row for each concept and written your name on the front? THANK YOU!
Directions: Please respond to each of the following items in the blank provided before each question. Round your answers to the nearest whole number if necessary.

1. How many years have you been an FFA member? (0, 1, 2, 3, 4)
2. How many semesters of Vo-Ag classes have you completed?
3. How many semesters of Economics or Business classes have you completed?
4. How many semesters of Science classes have you completed?
5. How many semesters of Mathematics classes have you completed?
6. Where do you live?
   1. In a town or city
   2. In a rural area, not on a farm
   3. On a farm
7. How many total acres does your family farm? (Both own or rent)
8. What is your grade classification in school?
   1. Freshman (9th)
   2. Sophomore (10th)
   3. Junior (11th)
   4. Senior (12th)
9. What grades do you normally receive in your high school courses?
   1. Mostly A's
   2. Mostly B's
   3. Mostly C's
   4. Mostly D's
10. What do you plan to do after high school graduation?
    1. Go to college
    2. Farm
    3. Work in agribusiness
    4. Work but not in an agribusiness
    5. Enter the military
    6. Undecided
    7. Other (specify)
Directions: Please respond to each of the following items which corresponds with the unit you have taught as a part of Project 2000's curriculum material evaluation.

**Agriculture/Agribusiness Management**

1. How many months have you been employed in an agribusiness? (If none, then answer "0")
2. Do you have a degree (major or declared minor) in an agribusiness-related curriculum? (Yes/No)
3. Have you ever been enrolled in a college course which focused on the subject matter covered in this unit? (Yes/No)
4. How many class periods did you devote to the Agriculture/Agribusiness Management unit?
5. Rate your familiarity with the material covered in the Agriculture/Agribusiness Management unit according to the scale provided below.

   1 2 3 4 5 6 7 8 9
   / / / / / / / / /

   Totally unfamiliar Average familiarity Totally familiar

6. What is the population of the largest community in your school district?
7. How many vocational agriculture students are currently employed in an agribusiness as a part of their supervised occupational experience program?
8. How many visits (approximately) do you make to students identified in question #7 above per semester? (Please respond on a per student basis)
9. Who administered the pre-test?
   A. Principal
   B. Guidance Counselor
   C. Vo-Ag Instructor (self)
   D. Other
10. Who administered the post-test?
    A. Principal
    B. Guidance Counselor
    C. Vo-Ag Instructor (self)
    D. Other
INSTRUCTOR EVALUATION OF AGRICULTURE/AGRICULTURAL MANAGEMENT INSTRUCTIONAL UNIT

Directions: Please evaluate the above instructional unit developed by Project 2000 using the following scale. Place an "X" on each line below in relation to your feelings about the unit in general.

1. ineffective:________: effective
2. useless:________: useful
3. inappropriate:________: appropriate
4. technically inaccurate:________: technically accurate
5. complex:________: simple
6. difficult to read:________: easy to read
7. technically out-of-date:________: technically up-to-date
8. visually unappealing:________: visually appealing
9. not needed:________: needed
10. worthless:________: worthwhile
11. incomplete:________: complete

Using the following scale, rate each of the statements below as they pertain to the instructional unit identified above. Enter your response on the blank provided before each of the statements.

No Little Some Much Utmost
value value value value value

12. Problem area questions in identifying important components to be studied in the subject matter area?
13. Study questions in focusing the direction of the problem area?
14. Learner needs statements in identifying opportunities to emphasize learning beyond the subject matter level?
15. Interest approach activities in stimulating student interest in the problem area?
16. Learning activities in providing realistic experiences for students to acquire knowledge and understanding in each problem area?
17. Conclusions in providing accurate responses to the problem statement?
18. Evaluation criteria in identifying important components of student achievement to be assessed?
19. Optional learning activities in providing additional strategies for teaching in each problem area?
20. Problem area outlines in decreasing the preparation time required to teach the unit?
21. Developing instructional units in other subject matter areas for future use?
22. Distributing this instructional unit for use by vocational agriculture instructors throughout Iowa?
23. Additional comments or suggestions for changing future units.

_________________________________________________________________
_________________________________________________________________
APPENDIX E: RESULTS OF KNOWLEDGE INVENTORY ANALYSES
Table E.1. Item analysis of the agriculture/agribusiness management knowledge inventory

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<th>Item number</th>
<th>Difficulty</th>
<th>Discriminating power</th>
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a Item number on pretest form of knowledge inventory.

b Identical items were used on both the pretest and posttest forms, however, the order was randomly arranged on both.

c Item number on posttest form of knowledge inventory.
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**Correlation coefficients below .05 or negative.
APPENDIX F: USE OF HUMAN SUBJECTS CLEARANCE
INFORMATION ON THE USE OF HUMAN SUBJECTS IN RESEARCH
IOWA STATE UNIVERSITY
(Please follow the accompanying instructions for completing this form.)

1. Title of project (please type): Evaluation of the Effectiveness of Strategies for Structuring Agriculture and Agribusiness Education Programs in Iowa

2. I agree to provide the proper surveillance of this project to insure that the rights and welfare of the human subjects are properly protected. Additions to or changes in procedures affecting the subjects after the project has been approved will be submitted to the committee for review.

   Alan A. Kahler 11/16/81
   Typed Name of Principal Investigator
   219 Curtiss Hall Campus Address
   294-5872 Campus Telephone

3. Signatures of others (if any) Date Relationship to Principal Investigator

4. ATTACH an additional page(s) (A) describing your proposed research and (B) the subjects to be used, (C) indicating any risks or discomforts to the subjects, and (D) covering any topics checked below. CHECK all boxes applicable.

   □ Medical clearance necessary before subjects can participate
   □ Samples (blood, tissue, etc.) from subjects
   □ Administration of substances (foods, drugs, etc.) to subjects
   □ Physical exercise or conditioning for subjects
   □ Deception of subjects
   □ Subjects under 14 years of age and(or) Subjects 14-17 years of age
   □ Subjects in institutions
   □ Research must be approved by another institution or agency

5. ATTACH an example of the material to be used to obtain informed consent and CHECK which type will be used.

   □ Signed informed consent will be obtained.
   □ Modified informed consent will be obtained.

6. Anticipated date on which subjects will be first contacted: Month Day Year

7. If Applicable: Anticipated date on which audio or visual tapes will be erased and(or) identifiers will be removed from completed survey instruments: Month Day Year

   The period of the contract has been extended to 5/31/82.

8. Signature of Head or Chairperson Date Department or Administrative Unit

   Agricultural Education

9. Decision of the University Committee on the Use of Human Subjects in Research:

   □ Project Approved □ Project not approved □ No action required

   George G. Karas
   Name of Committee Chairperson Date Signature of Committee Chairperson