Experimental evaluation of the effectiveness of projected transparencies on instruction in vocational agriculture

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OF PROJECTED TRANSPARENCIES ON INSTRUCTION
IN VOCATIONAL AGRICULTURE

by

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Experimental studies designed specifically to evaluate the effectiveness of instructional materials have not been common in agricultural education. The use of many types of audio-visual instructional materials in many of our public schools offering vocational education was virtually nonexistent prior to the enactment of the Vocational Education Act of 1963.

The purpose of the Vocational Education Act of 1963 was to strengthen and improve the quality of vocational education and to expand the vocational education opportunities in the nation. This act was the first major legislation which provided funds for public schools to purchase materials and equipment since the Smith-Hughes Act of 1917. As a result, a high percentage of the vocational agriculture departments in the state of Iowa have in their inventories recently purchased audio-visual materials and equipment.

Vocational agriculture day class instruction has been augmented in most Iowa departments by the equipment and materials purchased with federal monies. Young and adult farmer classes in the state have also been supplemented by the use of the newly acquired instructional materials.

During the 1968-69 school year vocational agriculture was offered in 234 departments in Iowa. These departments served 10,883 day class students, 535 young farmers and 14,911 adult farmers (10). A typical program of vocational agriculture in
Iowa consisted of four years of instruction at the secondary level, an adult farmer class, and/or a young farmer class.

The secondary level course structure in vocational agriculture included animal science and agricultural mechanics in the first year of instruction. Crops and soils science and agricultural mechanics were offered in the second year. The third year course of study consisted of farm management and agricultural mechanics. Agricultural occupations and employment experience comprised the fourth year of vocational agriculture instruction.

In addition to the preceding subject matter areas, instructional time was also given to orientation, farming programs and the Future Farmers of America organization.

Emphasis on the extension of vocational programs to expand the vocational education opportunities within the state of Iowa led to the development of 15 area vocational technical schools. Instructional material needs were enlarged by the establishment of these area schools.

Iowa's area community colleges and vocational technical schools in 1969 served over 100,000 persons in some course or program. Area vocational technical schools provided education in trades, industrial and distributive occupations, health occupations, business and office training, agriculture and homemaking. In 1969, there were 98 occupational offerings in the 15 Iowa area schools with 267 different programs available (1).
Agriculture curricula were available in 12 occupational areas in 12 of the area vocational technical schools. A high percentage of the schools listed two or more curricula in agriculture with agricultural power and equipment the program most frequently offered.

A new demand for supplying prepared instructional materials for educational purposes was created by the enactment of the Vocational Education Act of 1963. To meet this demand instructional service centers began making available prepared film strips, slides, transparencies, etc. Most universities and many Iowa public community schools have established some type of media center. The media centers facilitate the preparation and use of the instructional materials within a school system.

From the time of the Vocational Education Act of 1963 to the writing of this study, many developments have taken place in the area of audio-visual materials with little having been done on experimentation of the effectiveness of the instructional materials on student achievement.

In this study the author attempted to determine the effectiveness of projected transparencies on instruction in vocational agriculture. A secondary purpose of the study was to determine the effectiveness of color when used on transparencies. Of the six schools in this study, two tested black on clear transparencies; two tested black on colored
transparencies; and two tested an assortment of transparencies that included some new developments.

Using overhead projected transparencies to teach is not a new concept. The use of overhead projection dates back to World War II when the armed services employed overhead projectors for teaching service personnel. The overhead projector was used to a great extent during the Korean conflict, which was the time the universities began to use them in their educational programs.

It was not until the early 1960's that the public schools used the overhead projector to any extent. The Vocational Education Act of 1963 enabled many vocational agriculture departments to purchase the overhead projector for vocational agriculture class use. This was the beginning of any major use of the overhead projector in vocational education in agriculture.

A high percentage of Iowa vocational agriculture instructors have used overhead projected transparencies with varying degrees of success. Many specialists in agricultural education feel that overhead projected transparencies can be one of the most effective methods in communicating visually with a class. It is hoped that vocational agriculture instruction may benefit from the results of this study.

This study was a segment of an experimental project conducted cooperatively by the Iowa State University Department of Agricultural Education and the Iowa Department of Public
The title of the project was "An Experimental Evaluation of the Effectiveness of Selected Techniques and Resources on Instruction in Vocational Agriculture." Emphasis was placed on testing innovative methods and techniques that may lead to improving instruction in vocational agriculture. Seven instructional techniques were tested in the overall study. The techniques included: audio-tutorial, single concept films, video tape, prepared lesson plans, field trips, demonstrations and transparencies.

This study was financed in part from funds from the Iowa Agriculture and Home Economics Experiment Station, but largely from funds from the Research Coordinating Unit under a research grant from Vocational Education Branch (VEA-1963-1964 (a) ancillary funds) Iowa Department of Public Instruction.

Very little research on instructional methods and techniques has been done other than frequency counts of the methods used and preferences for various methods. The review of literature that follows includes studies on the value of an instructional method, the construction of teaching devices and the measurements of instructional outcomes.
REVIEW OF LITERATURE

Effectiveness of teaching techniques has long been a concern of educators and it appears the problem is still far from being solved. For the purpose of this review, the investigator attempted to select studies which had direct bearing on the research of this dissertation.

One of the earlier studies of the effectiveness of different teaching methods was completed in 1950 by Stump (19). He made a study at Pennsylvania State College in which he compared different methods of presenting specially organized data relating to agricultural cooperatives. The compiled course of study was broken down into three forms: (a) a visual form, (b) a lesson-plan form, and (c) an activities procedure.

Fifty schools and 460 students participated in the testing program. Three groups of schools, numbering 10 each, tested the three forms of materials. Two groups of 10 schools each served as controls.

Results of this study indicated that an attempt should be made to produce and provide teaching media which can be used by teachers and students of vocational agriculture. Lesson plans and visual materials were found to be superior methods in presenting material concerning agricultural cooperatives.

Madison (13) conducted an investigation to determine which of two ways is better for visual teaching of certain farm management information to high school agriculture students.
Students in three schools were randomly divided into two equal-size groups. One section was presented a summary of farm management information using tables of numbers, and the other section received the same summary information using bar graphs. Both tables and graphs were prepared as overhead projector slides.

A written test constructed by Madison was used as a pre-test and again as a posttest, with a reliability coefficient of 0.88 for the test instrument obtained. The mean scores of both sections for each school were compared, and the mean gain in score from pretest to posttest was tested with a t-test. An analysis of variance was then run, followed by an analysis of covariance to compensate for the effects of the pretest.

A comparison of the differences in scores of the pretest and posttest showed that learning had taken place in all groups. Statistically, it was concluded that the tables of numbers did not contribute more to the achievement of students, nor did they contribute less to the learning, and that the achievements in all three schools were comparable when effects of the pretest were held constant.

An experiment that compared the effectiveness of programmed-instruction and lecture-discussion methods of teaching agricultural finance and credit to three grade levels of vocational agriculture students, using erasure-feedback and conventional multiple-choice answer sheets, was conducted by Legg (12).
Teaching method, grade level and answer sheet were the major variables. The multivariate design involved 480 high school and young adult farmer students in 20 schools in five states. Individual differences were controlled by a reading test and by a pretest of knowledge of agricultural finance. The criterion test was administered at the close of the instruction and two months later as a retest.

The difference in mean test scores of students taught by lecture-discussion over the programmed-instruction method was significant at the .01 level by multiple classification analysis of covariance. There was no change from posttest to retest. On all grade levels knowledge increased from pretest to posttest.

It was concluded that the programmed-instruction method may be of greatest aid to students desiring knowledge in areas of special interest in which learning experiences are not provided by other teaching procedures.

A study to determine the audio-visual instructional needs of 60 Negro teachers of vocational agriculture in Arkansas was conducted by Kirby (11) in 1963. He reviewed college transcripts of the teachers involved in the study to determine the audio-visual courses they had taken and found that 55 percent had had training in the preparation and use of audio-visual materials. Forty percent reported they had used projection equipment and prepared instructional materials while student teaching as undergraduates. The chalkboard ranked above all
other frequently used media, and the bulletin board ranked second. Handmade transparencies were used less frequently than other audio-visual materials.

The State Department of Education was the source of supply for audio-visual material for 75 percent of the teachers. Ninety-eight percent of the teachers indicated they would be interested in participating in audio-visual training programs.

Chance (4) conducted an experiment at the University of Texas concerning the adaption of the overhead projector utilizing colored transparencies and overlays in teaching engineering descriptive geometry. He observed that much of the formal lecture in the descriptive geometry area of the engineering curriculum was accomplished by using white chalk on the chalkboard. Five of his most serious objections to this methodology common to all areas of subject matter are:

1. An instructor cannot construct drawings on a chalkboard without turning his back to the class.

2. During actual construction time only a few students sitting on wide angled sides of the classroom can view the instructor's efforts.

3. Figures on the chalkboard may be too small to be seen by the increasing number of students in today's crowded classrooms.

4. Time required for constructing neat and accurate drawings limits the amount of material covered in each lecture.

5. Most instructors use only white chalk, thereby only one color is viewed.

Because of these major objections in formal lecture communication, he devised an experiment which involved an overhead
projector with colored transparencies in lieu of the chalkboard with white chalk.

Chance used 200 transparencies and 800 overlays in teaching engineering descriptive geometry to freshmen engineering students, 104 of whom were divided between this method and the usual instruction with the chalkboard.

The transparency group did significantly better at the end of the course than the chalkboard group. Of the total number of students who earned an "A" in the course, 64 percent were in the transparency sections. Of the total number of students who received an "F" in the course, 75 percent were in the chalkboard sections. It was further determined that approximately 15 minutes of each 60-minute class lecture could be saved by use of the transparency medium. Student attentiveness was greater in the experimental group, and both students and instructors preferred this method.

Eight junior high schools participated in an experiment by Brooks (3) to ascertain the effects on learning and retention in beginning woodworking when conventional methods of testing were supplemented with overhead transparencies. Data were collected and analyzed from a total of 2,240 samples, involving 320 students. A factorial analysis of variance was used to analyze each of the selected unit tests and the pre- and post-experimental tests in order to test the hypotheses.

The addition of special overhead transparencies to the conventional methods of teaching resulted in significantly
greater achievement of the students in selected units of woodworking. The experimental group's over-all retention was significantly greater than that of the control group. The lower intelligence level groups of the experimental sections had on the average only .3 lower mean raw scores than the upper intelligence level groups of the control sections. Certain teachers and specific intelligence levels had highly significant effects upon student achievement. The teachers involved in the experiment favored overhead transparencies because of increased student interest and reduced lecture time.

Yeager (23) conducted an experimental study to determine the value of projectuals in presenting selected units of basic electricity in junior high school. Yeager's procedure was similar to that of Brooks (3), but his conclusion was somewhat different. He found that initial learning and over-all retention were equal in both methods. Teaching time, however, was reduced by one-third when projectuals were used.

The effectiveness of two methods of teaching selected areas in farm forestry and dairy products was measured by McMullen (15). One group of ninth grade classes in vocational agriculture departments in Indiana County, Pennsylvania, received instruction from their own vocational agriculture teacher. The other group of ninth grade classes of vocational agriculture students in the same county and state received instruction from subject matter team teaching specialists.
At the completion of 16 class hours of instructional time, tests on farm forestry and dairy products were administered. Individual differences of students were controlled by covariance analysis using scores from the sixth grade California Test of Mental Maturity, with final test scores as the criterion measure.

A significant difference between the test scores for the two methods of teaching selected areas of farm forestry and dairy products was found. Ninth grade vocational agriculture student achievement was greater for those students taught by the subject matter team teaching specialist method. Ninth grade vocational agriculture students indicated a strong desire for more team teaching in vocational agriculture.

A two-part study by Gallentine (6) attempted to evaluate the effectiveness of instruction utilizing overhead projection in collegiate undergraduate biological science courses in large lecture groups and in small laboratory groups as compared to conventional instruction in similar groups using the chalkboard.

The large lecture groups and the small laboratory groups were taught by the same instructor, in the same classroom, at approximately the same time, but on alternate days. The instructional period for both treatments was four weeks. In the experimental class, the instructor illustrated his lectures by using overhead projection instead of chalkboard drawings.
At the end of the large lecture group instructional period a factual botany examination was administered and the results were analyzed by a $2 \times 3$ factorial analysis of variance. From the results of the analysis it was concluded that there was no significant difference between the conventional and experimental groups.

A battery of three examinations was administered to both laboratory groups in joint session, and the test for homogeneity of variance and the t-test for significant differences between means were applied to the results. From the resulting analysis, it was concluded there was no significant difference between the conventional and experimental groups. The results, although not significant, indicated that instruction using overhead projection may increase the students' ability to think critically, as compared to chalkboard instruction, in the smaller classes.

In this study overhead projection compared as favorably as instruction using chalkboard drawings in both large lecture and the smaller laboratory groups.

Silverman (18) used two types of transparencies, static and animated, to teach facts about three kinds of firearms to 150 male college students. No differences in student attainment resulting from use of static and animated transparencies were observed with a written test, but significant differences did appear in favor of the animated transparencies with the
performance tests. The number of moving parts in the animated transparencies, however, did not make a difference.

It was found by Hull (9) that a higher IQ group outperformed a lower IQ group on an intellectual task regardless of the amount of practice each had had. He also found that on a manipulative task, practiced groups outperformed unpracticed groups regardless of IQ level. This indicates that performance is jointly a function of type of skill demanded by the task and ability.

The purpose of Hannemann's (7) study was to determine the type of instructional media to which teachers of agriculture have access, teachers' use of overhead transparencies and other teaching aids, and the sources of instructional materials used by teachers. A closed-end response questionnaire was used to collect information from the sample of 357 departments of vocational agriculture located in 47 states. This group represented a 4 percent unrestricted random sampling of all federally reimbursed departments of vocational agriculture in the continental United States in 1967.

It was found the 16mm picture projector was the predominant item of instructional media available to teachers of agriculture. It was also found that the overhead projector, a relatively new item, was becoming a common item in many departments of vocational agriculture as nearly one-fifth of the agriculture teachers had unlimited access to such projectors and over one-half of the agriculture teachers had
shared access to an overhead projector. They indicated a demand for overhead transparencies. Fifty-three percent of vocational agriculture teachers purchased instructional media and/or materials from their State Department of Education during the past two years.

Matteson and Thompson (14) sent questionnaires to the 275 vocational agricultural teachers in Wisconsin to determine their instructional material needs. Ninety-four percent of the teachers responded, with a majority noting they had changed their high school vocational agriculture curriculum in the past three years. Careers in agriculture, farm power, agricultural economics, horticulture and landscaping, farm machinery and farm management were most frequently listed as the subject areas in which the instructor had the greatest need for instructional materials. Woodlot management, F.F.A., cooperatives, sheep and poultry were most frequently listed as the five subject areas in which the instructor had the least need for instructional materials. Ninety-four percent of the responding instructors stated they would benefit from an instructional materials center, and would be willing to attend workshops for the purpose of discussion, demonstrating and dissemination of new instructional materials.

An agricultural education media consultant at California State Polytechnic College, San Luis Obispo, California, Dr. Heaney (8), writes that the overhead projector is not new, but has just recently been discovered by educators. He points
out that the overhead projector was used extensively by the armed forces during World War II.

Dr. Heaney explains the overhead projector as a versatile machine, adaptable to almost any situation arising in a classroom. He points to the relative inexpensive cost as compared to video tape and 16mm colored film. He also calls attention to the ease of preparing acetate transparencies with the numerous translucent pens, pencils and tapes available, as well as the ready availability of commercially prepared masters and transparencies. The overhead projector is referred to as an extension of the chalkboard, but that it has many advantages over the chalkboard, including the fact that the classroom is faced at all times.

Pautz (16) relates that research shows 85 percent of what we know comes through sight and that it seems only logical to direct teaching toward the sense of sight. He states that the overhead projector is a must in every classroom with its use limited only by ingenuity.

Since it is known that people learn faster and better when they are able to see subject matter as well as hear it, the overhead projector is a visual aids tool according to Pautz. Modern projectors are easy to use, light in weight and can be used in fully lighted classrooms. Overhead projection saves the teacher much time by eliminating lengthy chalkboard writing and hours spent reproducing material for a class of students by another process.
A transparency is defined by Schultz (17) as being a sheet of transparent film on which a reproduction of an original is made. A transparency should be neat, clean, simple, attractive and informative. Once a transparency is made, it is permanent. It will not fade with usage or time. It is not affected by moisture or light, nor can it be accidentally erased as can a lesson on a chalkboard. Transparencies are easily stored in a file cabinet, desk drawer or brief case according to Schultz (17).

The teacher can supplement the transparency with several devices and techniques to further enhance interest in a lesson and maintain attention. Some of these devices and techniques outlined are:

1. The pointing method.
2. Using a transparency as a chalkboard.
3. Placing an opaque sheet of paper over all or part of a transparency, and revealing projected material to a class bit by bit.
4. Projecting shadow pictures such as triangles, squares, outlines, circles, etc., in silhouette fashion.
5. Transparent tools and devices, such as slide rules, can clearly be projected.
6. Colored plastic sheets provide a full-color background to a transparency.
7. Transparent pressure-sensitive tapes supplement transparencies and are available in a wide variety of colors and widths.
8. Overlays provide an effective technique for presentation of material in a step-by-step fashion.
In an educational bulletin published by the Visual Products Division, 3M Company of St. Paul, Minnesota (5), it is stated that the simplicity in making transparencies is probably most responsible for the near-universal acceptance of the overhead projector. The company points out that the overhead projector is the only visual aid which keeps the teacher "in the picture," controlling class progress, controlling emphasis, and teaching the subject in the way the teacher wants it presented. For these reasons, the use of the overhead projector has been described as a teacher-oriented system.

Overhead projection enables the instructor to observe student facial expressions that denote misunderstanding or lack of attention. Students who are slow or who for any reason fall behind in their work can be helped by repeated showing of the transparencies. Transparencies can be used in the checking of homework. Cartooning and humor aid students in retention. Words have a way of evaporating in mid-air between the teacher's mouth and the student's ear, while pictures make an imprint on the eye, followed by an impression on the mind.

The cardinal rule for any teacher using overhead projection is that there is no substitute for simplicity in visual projection. A cluttered projection which only tends to confuse is as useless as no projection at all. A simple projection—six or seven words per line and not more than ten, easy-to-read lines—is regarded as the best support to the teacher's lecture.
Tindall (20) conducted a companion study to the one conducted by the author as a part of the larger project entitled "An Experimental Evaluation of the Effectiveness of Selected Techniques and Resources on Instruction in Vocational Agriculture." The purpose of his study was to determine the relationship of class size and department enrollment to the achievement of students in high school vocational agriculture in Iowa when certain selected instructional media are used.

From the high school vocational agriculture departments that met certain criteria, a random selection was made to select six schools each for seven instructional media treatments: audio-tutorial, demonstration, field trip, prepared lesson plan, single concept film, transparency and video-tape media. Instructional materials for each of the seven media were prepared cooperatively by the members of the project staff for each of four subject matter areas. The subject matter areas were animal health for the ninth grade students, commercial fertilizers for the tenth grade students, small gasoline engines for the eleventh grade students and farm credit for the twelfth grade students. All students in the 42 Iowa vocational agriculture departments cooperating in this study were given a pretest prior to the beginning of the instruction, and a posttest upon completion of 14 days of instruction. The 42 vocational agriculture departments were divided into enrollments of 36 to 53 and 54 to 72 students.
When comparing the gain in achievement of students in animal health, commercial fertilizers and farm credit subject matter, it was revealed that students in the transparency media group in small departments scored higher than did the students in large departments. However, students in the large departments scored higher than the students in the small departments when transparencies were used in the small gas engine instruction. Highly significant correlations between student gain and class size were found in the transparency (.36) media treatment group for the small gas engine subject matter.

Tindall's study revealed that the mean gain of students in the small departments was higher when demonstration, field trip, prepared lesson plan and transparency media were used. The mean gain of students in the large departments was higher when audio-tutorial, single concept film and video-tape media were used. Students in the large departments achieved slightly higher than those in the small departments, but this difference was not verified as statistically significant.

Another study, as part of the previously mentioned larger project, was made by Beane (2) to determine the relationship between the instructors' knowledge of subject matter and their students' level of academic achievement. Beane's procedure was similar to that of Tindall's (20) with the addition of a 45-item test which was given to the vocational agriculture instructors prior to their receipt of the instructional media treatments in the four subject matter areas. The vocational
agriculture instructors were then given a posttest at the conclusion of the instruction period. On the basis of their pretest scores and differences between the pretest and posttest scores, the instructors were placed in three equal-sized groups: high, medium and low. The analysis of variance and t-test techniques were used to evaluate the relationships between instructors' knowledge of the subject matter and student achievement.

Significant differences at the .05 level of confidence were revealed among the mean posttest scores of students grouped according to their instructors' knowledge of the subject matter. No significant differences were found in mean scores of students grouped according to their instructors' knowledge of the subject matter and the form of instructional media used to teach the unit. A highly significant difference was found between the instructors' pretest and posttest mean scores.

Research reviewed appears to indicate that no teaching method yet devised has replaced the teacher's personality and his way of delivering the material sought by the student. An aid to this delivery, and perhaps the best yet conceived, may be the overhead projector. While little research has been done in vocational agriculture in relation to the effectiveness of projected transparencies on instruction, the review of literature indicates that overhead projection enables the teacher
to present more technical information in a more meaningful manner, in less time and with greater thoroughness.
METHOD OF PROCEDURE

This study was conducted as a part of a project which investigated experimentally the effectiveness of selected resources and techniques on instruction in vocational agriculture.

The primary purpose of this investigation was to determine the effectiveness of overhead projected transparencies on instruction in vocational agriculture. A secondary purpose was to determine the effectiveness of color when used on overhead projected transparencies.

The specific objectives of the study were:

(1) To determine the effectiveness of projected transparencies on instruction in vocational agriculture.

(2) To determine the effectiveness of projected transparencies on instruction in specific units in each of the four curriculum areas in vocational agriculture: animal science, agronomy, agricultural mechanics and farm management.

(3) To determine the effectiveness of various types of transparencies on instruction in vocational agriculture.

(4) To determine the factors related to student achievement in vocational agriculture when overhead projected transparencies were used.
Collection of Data

This study included 12 Iowa high school vocational agriculture departments selected randomly from a list of Iowa high schools offering an approved four-year program of vocational agriculture. Selection requirements were (1) that the enrollment of the department must be at least 39 students and (2) class size must be not less than seven nor more than 22 students. It was further required that all instructors have had at least one year of teaching experience.

The 12 schools in this study were randomly divided into two groups of six each. One group of schools was used as the control group while the other group tested the effectiveness of transparencies.

Each school was contacted by the researcher who explained the purpose of the study and who collected basic information from the school to be used in the study. Information on class enrollments, course outlines, and reference materials available in the school was obtained. Figure 1 reveals the geographic location of the two groups of schools participating in this study. Class enrollment and size of the vocational agriculture departments may be found in Table 1.

The instructional materials for the total project were prepared cooperatively by the members of the project staff and by the Department of Agricultural Education staff members. Four units of instruction in agriculture were selected for
Figure 1. Geographical location of participating schools

Key:
0 - indicates location of control schools
X - indicates location of treatment schools
Table 1. Schools and the number of students participating in the experiment

<table>
<thead>
<tr>
<th>Schools</th>
<th>Animal health</th>
<th>Commercial fertilizer</th>
<th>Small gas engines</th>
<th>Farm credit</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alden</td>
<td>12</td>
<td>10</td>
<td>11</td>
<td>11</td>
<td>44</td>
</tr>
<tr>
<td>Anamosa</td>
<td>19</td>
<td>12</td>
<td>15</td>
<td>14</td>
<td>60</td>
</tr>
<tr>
<td>Guthrie Center</td>
<td>21</td>
<td>17</td>
<td>9</td>
<td>14</td>
<td>61</td>
</tr>
<tr>
<td>Maurice-Orange City</td>
<td>10</td>
<td>10</td>
<td>11</td>
<td>11</td>
<td>42</td>
</tr>
<tr>
<td>Pleasantville</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>15</td>
<td>47</td>
</tr>
<tr>
<td>Sigourney</td>
<td>8</td>
<td>17</td>
<td>12</td>
<td>13</td>
<td>50</td>
</tr>
<tr>
<td>Total</td>
<td>79</td>
<td>77</td>
<td>70</td>
<td>78</td>
<td>304</td>
</tr>
<tr>
<td>Control:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alta</td>
<td>12</td>
<td>7</td>
<td>8</td>
<td>8</td>
<td>35</td>
</tr>
<tr>
<td>Everly</td>
<td>7</td>
<td>9</td>
<td>9</td>
<td>11</td>
<td>36</td>
</tr>
<tr>
<td>Hartley</td>
<td>12</td>
<td>8</td>
<td>10</td>
<td>9</td>
<td>39</td>
</tr>
<tr>
<td>Rock Valley</td>
<td>10</td>
<td>9</td>
<td>8</td>
<td>10</td>
<td>37</td>
</tr>
<tr>
<td>Sac City</td>
<td>10</td>
<td>8</td>
<td>14</td>
<td>8</td>
<td>40</td>
</tr>
<tr>
<td>West Liberty</td>
<td>16</td>
<td>10</td>
<td>10</td>
<td>9</td>
<td>45</td>
</tr>
<tr>
<td>Total</td>
<td>67</td>
<td>51</td>
<td>59</td>
<td>55</td>
<td>232</td>
</tr>
</tbody>
</table>
study during the experimental period. The four units selected and a description thereof follows:

(1) Animal health - The identification, causes, prevention and control of major swine, sheep and cattle diseases.

(2) Commercial fertilizer - Essential plant food elements, crop hunger signs, soil sampling, liming, fertilizer application rates and selection of fertilizers.

(3) Small gasoline engines - Principles of operation of two- and four-stroke cycle engines, functions of the engine parts, measuring devices and preventive maintenance on small gasoline engines.

(4) Farm credit - Budgeting principles, types of loans, sources of credit, interest rates, collateral, credit instruments and the use of farm credit.

A written test of 60 points for each subject matter area was constructed by members of the project team. This test was used as a pretest and again as a posttest. The test stressed major objectives in each of the four subject matter areas. All students in the 12 Iowa vocational agriculture departments cooperating in this study were given a pretest prior to the beginning of the 14-day period of instruction, and a posttest upon completion of the instruction period. The pretest and posttest were administered under the direction of the guidance counselors in the respective schools.
Additional data were obtained from the following standardized tests for each student cooperating in this study:

1. Otis IQ Score
2. Differential Aptitude Test
3. Kuder Preference Record

Social-economic information pertaining to the background of the student was also obtained.

Preparation of Materials

Teaching plans were prepared in the areas of animal health for the ninth grade students, commercial fertilizers for the tenth grade students, small gasoline engines for the eleventh graders, and farm credit for the twelfth grade students.

Before the actual statistical study of the effectiveness of overhead projected transparencies was undertaken, 738 transparency masters were constructed and assembled into transparencies. These transparencies were hand-mounted in cardboard frames.

The six schools in this study using transparencies were subdivided into three groups of two schools each. One group was supplied black on clear transparencies, one group received black on colored background transparencies, while the third group received a mixed variety of transparencies. The mixed-variety group of transparencies contained transparencies with motion to be shown with a polarized adapter on the overhead projector.
Training of Project Instructors

The training of instructors involved in the project was performed at three different periods of time. The first meeting was a one-half day briefing given in district meetings to familiarize the vocational agriculture instructors and school guidance personnel with the project. Student testing materials were discussed and distributed to the guidance personnel at this first meeting.

The second meeting of the instructors was a two-day training period just prior to the beginning of the instructional testing period. During this session the instructors received training on the subject matter areas and the limitations of the instructional methods they could use. Both control and the treatment schools used the following instructional techniques or aids in providing instruction:

(1) individual study
(2) cut-of-class assignments
(3) discussion
(4) lectures
(5) chalkboard
(6) charts
(7) handouts
(8) pictures
(9) utilized small groups, as panels, role playing, etc.

The only major difference in instructional methods between the control and the treatment schools was the use of prepared
transparencies at specified times in the treatment schools. (See Table 2.)

Each teacher in the treatment group was instructed on the proper use of overhead projected transparencies. All instructional materials and visual aids were presented to the instructors during the two-day training period.

The author visited the transparency treatment schools while the instructional period was in progress to supervise the use of the instructional techniques and resources and to evaluate the progress of the project. Beane (2) and Tindall (20) visited and observed the six control schools in this study.

Treatment of Data

Data were collected, coded and transferred to 80-column IBM cards for analysis by the Iowa State University Computation Center. Analysis of variance and analysis of co-variance were used to evaluate the relationships between the control and the transparency treatment schools.
Table 2. Schedule for use of transparencies

<table>
<thead>
<tr>
<th>Subject unit</th>
<th>Day</th>
<th>Transparency number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animal health</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2-3</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>4-14</td>
</tr>
<tr>
<td></td>
<td>9-10</td>
<td>15-23</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>24-25</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>26</td>
</tr>
<tr>
<td>Commercial fertilizers</td>
<td>1</td>
<td>1-7</td>
</tr>
<tr>
<td></td>
<td>2-3</td>
<td>8-11</td>
</tr>
<tr>
<td></td>
<td>5-6</td>
<td>12-13</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>14-15</td>
</tr>
<tr>
<td></td>
<td>8-9</td>
<td>16-19</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>20-21</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>12-13</td>
<td>23-24</td>
</tr>
<tr>
<td></td>
<td>Misc.</td>
<td>25-28</td>
</tr>
<tr>
<td>Small gas engines</td>
<td>1</td>
<td>1-6</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>7-8</td>
</tr>
<tr>
<td></td>
<td>3-4</td>
<td>9-12</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>13-14</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>15-18</td>
</tr>
<tr>
<td></td>
<td>7-9</td>
<td>19-24</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>11-12</td>
<td>26-34</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>35-41</td>
</tr>
<tr>
<td>Farm credit</td>
<td>1-2</td>
<td>1-6</td>
</tr>
<tr>
<td></td>
<td>3-5</td>
<td>7-8</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>9-11</td>
</tr>
<tr>
<td></td>
<td>7-8</td>
<td>12-14</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>15-20</td>
</tr>
<tr>
<td></td>
<td>10-11</td>
<td>21-22</td>
</tr>
<tr>
<td></td>
<td>12-13</td>
<td>23-28</td>
</tr>
</tbody>
</table>
FINDINGS

Findings revealed in this chapter are presented to support the acceptance or rejection of null hypotheses. The hypotheses were stated so as to provide evidence that would satisfy the objectives of the study as stated in the Method of Procedure chapter.

Preliminary Tests

$H_{01}$ — There was no difference between the treatment and control groups of schools in students' academic achievement in animal health at pretest time by specific objectives.

Values of $F$ at the five and one percent levels of significance were obtained from Wert et al. (21, p. 419).

The mean pretest scores by objectives are shown in Table 3 for the treatment and control schools.

<table>
<thead>
<tr>
<th>Schools</th>
<th>Mean pretest scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>36.77</td>
</tr>
<tr>
<td>Control</td>
<td>34.71</td>
</tr>
<tr>
<td>Difference</td>
<td>2.06</td>
</tr>
</tbody>
</table>
The mean score for the treatment schools was 2.06 higher than the mean score for the control schools. An analysis of variance test was conducted on the mean pretest scores to determine if the two groups of schools were significantly different.

Table 4. Analysis of variance on mean pretest scores for animal health by specific objectives

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degree of freedom</th>
<th>Sum of squares</th>
<th>Mean square</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>1</td>
<td>12.69</td>
<td>12.69</td>
<td>0.29</td>
</tr>
<tr>
<td>Error</td>
<td>10</td>
<td>431.58</td>
<td>43.16</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>11</td>
<td>444.27</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ .05 = 4.96 \]
\[ .01 = 10.04 \]

The analysis of variance test provided a nonsignificant F-value revealing that the mean pretest scores of the two groups of schools were essentially the same. The null hypothesis was not rejected that there was no difference between the two groups of schools in students' academic achievement in animal health at pretest time by specific objectives.
$H_{02} -$ There was no difference between the treatment and control groups of schools in students' academic achievement in commercial fertilizer at pretest time by specific objectives.

The data in Table 5 reveal the mean pretest scores by objectives for the treatment and control schools.

Table 5. Mean pretest scores in commercial fertilizer by objectives for treatment and control schools

<table>
<thead>
<tr>
<th>Schools</th>
<th>Mean pretest scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>36.38</td>
</tr>
<tr>
<td>Treatment</td>
<td>32.16</td>
</tr>
<tr>
<td>Difference</td>
<td>4.22</td>
</tr>
</tbody>
</table>

An analysis of mean pretest scores revealed a 4.22 higher pretest score for the control group as compared to the transparency group. However, when an analysis of variance test was performed, no significant difference was found as is indicated in Table 6.

The null hypothesis that there was no difference between the two groups of schools in student academic achievement in commercial fertilizer at pretest time by specific objectives was not rejected.
Table 6. Analysis of variance on mean pretest scores for commercial fertilizer by specific objectives

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degree of freedom</th>
<th>Sum of squares</th>
<th>Mean square</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>1</td>
<td>53.59</td>
<td>53.59</td>
<td>1.39</td>
</tr>
<tr>
<td>Error</td>
<td>10</td>
<td>385.11</td>
<td>38.51</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>11</td>
<td>438.70</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

.05 = 4.96
.01 = 10.04

**H_{03} --** There was no difference between the treatment and control groups of schools in students' academic achievement in small gasoline engines at pretest time by specific objectives.

Table 7 contains the mean pretest scores by objectives for the treatment and control schools.

Table 7. Mean pretest scores for small gasoline engines by objectives for treatment and control schools

<table>
<thead>
<tr>
<th>Schools</th>
<th>Mean pretest scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>39.01</td>
</tr>
<tr>
<td>Control</td>
<td>36.15</td>
</tr>
<tr>
<td>Difference</td>
<td>2.86</td>
</tr>
</tbody>
</table>
Schools in the treatment group had a mean pretest score of 39.01 as compared to 36.15 for the schools in the control group.

Table 8 compares the mean pretest scores of the two groups of schools in an analysis of variance.

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degree of freedom</th>
<th>Sum of squares</th>
<th>Mean square</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>1</td>
<td>24.51</td>
<td>24.51</td>
<td>0.25</td>
</tr>
<tr>
<td>Error</td>
<td>10</td>
<td>995.99</td>
<td>99.60</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>11</td>
<td>1020.50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ .05 = 4.96 \]
\[ .01 = 10.04 \]

No significant difference was found with the 0.25 F-value which supports the null hypothesis that there was no difference between the media and control groups of schools in students' academic achievement in small gasoline engines at pretest time by specific objectives.
$H_0$: There was no difference between the two groups of schools in students' academic achievement in farm credit at pretest time by specific objectives.

Farm credit mean pretest scores are presented in Table 9.

Table 9. Mean pretest scores for farm credit by objectives for treatment and control schools

<table>
<thead>
<tr>
<th>Schools</th>
<th>Mean pretest scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>51.61</td>
</tr>
<tr>
<td>Treatment</td>
<td>44.20</td>
</tr>
<tr>
<td>Difference</td>
<td>7.41</td>
</tr>
</tbody>
</table>

The mean pretest score of 51.61 for the control schools was 7.41 higher than the transparency treatment schools which had a 44.2 mean pretest score. A test of analysis of variance was conducted with the results presented in Table 10.

Table 10. Analysis of variance on mean pretest scores for farm credit by specific objectives

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degree of freedom</th>
<th>Sum of squares</th>
<th>Mean square</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>1</td>
<td>164.65</td>
<td>164.65</td>
<td>1.68</td>
</tr>
<tr>
<td>Error</td>
<td>10</td>
<td>978.06</td>
<td>97.81</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>11</td>
<td>1142.71</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$0.05 = 4.96$

$0.01 = 10.04$
The null hypothesis was not rejected that there was no difference between the two groups of schools in students' academic achievement in farm credit at pretest time by specific objectives.

Parallel analysis of variance tests were calculated for the mean pretest overall to determine if a difference existed between groups. No difference was found between the transparency treatment group and the control group in the four subject matter areas.

All tests revealed that there were no differences between groups in the mean pretest scores by subject matter units. All additional tests will be based on the assumption that no differences existed between the two groups at pretest time.

Composite Analysis

The first specific objective of the study was to determine the effectiveness of projected transparencies on instruction in vocational agriculture. The four instructional subject matter areas of animal health, commercial fertilizer, small gasoline engines and farm credit composed a typical program in vocational agriculture for the purpose of this study. This program was conducted in both the transparency treatment schools and the six control schools, as explained previously.
There was no difference between the treatment and control groups of schools in students' academic achievement in composite subject matter due to the use of prepared overhead projected transparencies.

Values of F at the five and one percent levels of significance were obtained from Wert et al. (21, p. 421).

The mean scores for the composite subject matter areas are reported in Table 11 for the treatment and control schools.

Table 11. Composite mean posttest scores by objectives for the treatment and control schools

<table>
<thead>
<tr>
<th>Schools</th>
<th>Posttest scores Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>62.81</td>
</tr>
<tr>
<td>Treatment</td>
<td>60.09</td>
</tr>
<tr>
<td>Difference</td>
<td>2.72</td>
</tr>
</tbody>
</table>

An analysis of the composite mean posttest scores revealed a 2.72 higher score for the control group as compared to the transparency group of schools. To determine the extent of differences between the two groups of schools, an analysis of variance was conducted as reported in Table 12.
Table 12. Analysis of variance on students' academic achievement in composite subject matter comparing schools using prepared overhead projected transparencies with control schools

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degree of freedom</th>
<th>Sum of squares</th>
<th>Mean square</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>1</td>
<td>88.35</td>
<td>88.35</td>
<td>1.03</td>
</tr>
<tr>
<td>Error</td>
<td>46</td>
<td>3940.34</td>
<td>85.66</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>47</td>
<td>4028.69</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

.05 = 4.05
.01 = 7.21

It was observed from the 1.03 F-value that no significant difference was found between the treatment and control groups of schools when the composite posttest scores were compared. The null hypothesis was not rejected.

To further compare the two groups of schools, teacher pre-test scores on each subject matter area and teacher attitude scores were used as covariates as illustrated in Table 13.

An examination of Table 13 reveals the F-value of 0.28 was not significant which supports the findings reported in the analysis of variance test. Therefore, there was no significant difference between the treatment and control groups of schools in student attainment using the composite mean post-test scores.
Table 13. Analysis of covariance on students' academic achievement in composite subject matter comparing schools using prepared overhead projected transparencies with control schools, using teacher pre-test scores and teacher attitude scores as covariates

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degrees of freedom</th>
<th>Sum of squares</th>
<th>Mean square</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>1</td>
<td>193.63</td>
<td>193.63</td>
<td>0.28</td>
</tr>
<tr>
<td>Error</td>
<td>44</td>
<td>30904.32</td>
<td>702.37</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>45</td>
<td>41097.95</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ .05 = 4.06 \]
\[ .01 = 7.24 \]

Specific Subject Matter Areas

To satisfy the second objective of the study, the mean posttest scores of the treatment and control schools were examined by specific subject matter areas. The subject matter areas were animal health, commercial fertilizer, small gas engines and farm credit.

$H_0$ -- There was no difference between the treatment and control groups of schools in students' academic achievement in animal health subject matter due to the use of prepared overhead projected transparencies.

Values of $F$ at the five and one percent levels of significance were obtained from Wert et al. (21, p. 419).
Data presented in Table 14 reveal the composite animal health mean scores of the transparency and control schools by specific objectives.

Table 14. Animal health mean pretest and posttest scores by objectives for treatment and control schools

<table>
<thead>
<tr>
<th>Test</th>
<th>Schools</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Treatment</td>
<td>Control</td>
<td></td>
</tr>
<tr>
<td>Posttest</td>
<td>56.18</td>
<td>57.37</td>
<td></td>
</tr>
<tr>
<td>Pretest</td>
<td>36.77</td>
<td>34.71</td>
<td></td>
</tr>
<tr>
<td>Difference</td>
<td>19.41</td>
<td>22.66</td>
<td></td>
</tr>
</tbody>
</table>

Schools in the transparency group were observed to have the lowest mean score difference. The control schools had a 22.66 difference as compared to 19.41 for the transparency group.

An analysis of variance was computed on the two group means by specific objectives to test for the differences between the groups. The sum of squares, mean squares and F-values for the analysis of variance test are presented in Table 15.

The nonsignificant F-value of 0.06 derived from the analysis of variance on the posttest means by objectives revealed no difference between the two groups. A similar
Table 15. Analysis of variance on students' achievement in animal health subject matter comparing schools using prepared overhead projected transparencies with control schools

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degrees of freedom</th>
<th>Sum of squares</th>
<th>Mean square</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>1</td>
<td>4.21</td>
<td>4.21</td>
<td>0.06</td>
</tr>
<tr>
<td>Error</td>
<td>10</td>
<td>665.51</td>
<td>66.55</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>11</td>
<td>669.72</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[.05 = 4.96\]

\[.01 = 10.04\]

observation was made when the same test was conducted on the overall mean posttest scores.

Based on these findings the null hypothesis was not rejected that there was no difference among students' academic achievement in animal health subject matter when compared with schools using prepared overhead projected transparencies.

\(H_0\) -- There was no difference between the two groups of schools in students' academic achievement in commercial fertilizer subject matter due to the use of prepared overhead projected transparencies.

Mean composite pretest and posttest scores are presented in Table 16 for the commercial fertilizer subject matter unit by specific objectives.
Table 16. Commercial fertilizer mean pretest and posttest scores by objectives for treatment and control schools

<table>
<thead>
<tr>
<th>Test</th>
<th>Schools</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Treatment</td>
<td>Control</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>54.72</td>
<td>55.31</td>
<td></td>
</tr>
<tr>
<td>Pretest</td>
<td>32.16</td>
<td>36.38</td>
<td></td>
</tr>
<tr>
<td>Difference</td>
<td>22.56</td>
<td>18.93</td>
<td></td>
</tr>
</tbody>
</table>

The transparency group showed the highest gain in scores in the commercial fertilizer area with a 22.56 mean gain as compared with 18.93 mean gain for the control schools. However, when the posttest scores were compared in an analysis of variance test no significant difference was found between the two groups by specific objectives as shown by data in Table 17. An analysis of variance test was also conducted on the overall mean scores which revealed no significant difference between the two groups.

Table 17. Analysis of variance on students' academic achievement in commercial fertilizer subject matter comparing schools using prepared overhead projected transparencies with control schools

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degrees of freedom</th>
<th>Sum of squares</th>
<th>Mean square</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>1</td>
<td>1.04</td>
<td>1.04</td>
<td>0.009</td>
</tr>
<tr>
<td>Error</td>
<td>10</td>
<td>1148.18</td>
<td>114.82</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>11</td>
<td>1149.22</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

.05 = 4.96
.01 = 10.04
The F-value of 0.009 was not significant. The null hypothesis that there are no differences among schools in students' academic achievement in commercial fertilizer subject matter when compared with schools using prepared overhead projected transparencies was not rejected.

An analysis of variance was conducted using the overall posttest scores. No significant difference was found between the treatment group and the control group.

**H_{0g} -- There was no difference between the two groups of schools in students' academic achievement in small gasoline engine subject matter due to the use of prepared overhead projected transparencies.**

In Table 18 are data comparing the mean composite pretest and posttest scores for the small gasoline engine subject matter unit by specific objectives.

Table 18. Small gasoline engine mean pretest and posttest scores by objectives for treatment and control schools

<table>
<thead>
<tr>
<th>Test</th>
<th>Schools</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Treatment</td>
<td>Control</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Posttest</td>
<td>64.56</td>
<td>69.03</td>
<td></td>
</tr>
<tr>
<td>Pretest</td>
<td>39.01</td>
<td>36.15</td>
<td></td>
</tr>
<tr>
<td>Difference</td>
<td>25.55</td>
<td>32.88</td>
<td></td>
</tr>
</tbody>
</table>
An analysis of the mean differences indicated that the control schools had a 32.88 mean gain in the small gasoline engine unit as compared to a 25.55 mean gain for the treatment schools.

To test for difference between the two groups by posttest mean scores, an analysis of variance test was conducted. The results of the test are presented in Table 19.

Table 19. Analysis of variance on students' academic achievement in small gasoline engine subject matter comparing schools using prepared overhead projected transparencies with control schools

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degrees of freedom</th>
<th>Sum of squares</th>
<th>Mean square</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>1</td>
<td>59.76</td>
<td>59.76</td>
<td>2.06</td>
</tr>
<tr>
<td>Error</td>
<td>10</td>
<td>290.26</td>
<td>29.06</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>11</td>
<td>350.02</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The analysis of variance test provided a nonsignificant F-value revealing that the mean posttest scores were not significantly different. A parallel test using the overall posttest scores also indicated no significant difference. The null hypothesis was not rejected that there was no difference
between the two groups of schools in students' academic achievement in small gasoline engine subject matter due to the use of prepared overhead projected transparencies.

Ho9 -- There was no difference between the media and control groups of schools in students' academic achievement in farm credit subject matter due to the use of prepared overhead projected transparencies.

Farm credit mean pretest and posttest scores for the treatment and control schools are presented in Table 20.

<table>
<thead>
<tr>
<th>Test</th>
<th>Treatment Mean</th>
<th>Control Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posttest</td>
<td>64.90</td>
<td>69.52</td>
</tr>
<tr>
<td>Pretest</td>
<td>44.20</td>
<td>51.61</td>
</tr>
<tr>
<td>Difference</td>
<td>20.70</td>
<td>17.91</td>
</tr>
</tbody>
</table>

Data in Table 20 reveal a 20.70 mean gain in favor of the transparencies group when the pretest and posttest scores were compared. A 17.91 mean gain was obtained by the control group.

The two groups of schools were compared by the mean posttest scores in an analysis of variance test as shown in Table 21.
Table 21. Analysis of variance on students' academic achievement in farm credit subject matter comparing schools using prepared overhead projected transparencies with the control schools

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degrees of freedom</th>
<th>Sum of squares</th>
<th>Mean square</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>1</td>
<td>63.94</td>
<td>63.94</td>
<td>2.16</td>
</tr>
<tr>
<td>Error</td>
<td>10</td>
<td>296.09</td>
<td>29.61</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>11</td>
<td>360.03</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

.05 = 4.96
.01 = 10.04

Inspection of data in Table 21 concerning achievement in the farm credit subject matter area revealed no significant difference between the two groups of schools. A test involving the overall posttest scores also indicated no difference between the treatment and control schools. Based on these findings, the null hypothesis was not rejected that there was no difference between the two groups of schools in students' academic achievement in farm credit subject matter due to the use of prepared overhead projected transparencies.

To further analyze the effectiveness of projected transparencies on instruction in specific units in each of the four curriculum areas in vocational agriculture, an analysis of covariance was used to adjust for differences due to various variables.
Ho\textsubscript{10} -- There was no difference between the treatment and control groups of schools in students' academic achievement in animal health subject matter due to the use of prepared overhead projected transparencies when using pretest by objectives, I.Q. and agriculture achievement scores as covariates.

Values of F at the five and one percent levels of significance were obtained from Wert et al. (21, p. 419).

The mean and adjusted mean posttest scores by specific objectives are revealed in Table 22 for the treatment and control schools.

Table 22. Animal health mean and adjusted mean posttest scores by objectives for treatment and control schools

<table>
<thead>
<tr>
<th>Schools</th>
<th>Posttest scores</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Adjusted mean</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>57.37</td>
<td>56.29</td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td>56.18</td>
<td>57.26</td>
<td></td>
</tr>
<tr>
<td>Difference</td>
<td>1.19</td>
<td>.97</td>
<td></td>
</tr>
</tbody>
</table>

Data in Table 22 reveals a mean difference of 1.19 in favor of the control schools. When the mean scores were adjusted, the treatment schools showed a .97 gain over the control schools. An analysis of variance test was conducted on the mean posttest scores and a nonsignificant F-value of 0.06
was disclosed. The adjusted mean scores in an analysis of covariance test are shown in Table 23.

Table 23. Analysis of covariance on students' achievement in animal health subject matter comparing schools using prepared overhead projected transparencies with control schools

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degree of freedom</th>
<th>Sum of squares</th>
<th>Mean square</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>1</td>
<td>18.41</td>
<td>18.41</td>
<td>0.64</td>
</tr>
<tr>
<td>Error</td>
<td>7</td>
<td>200.33</td>
<td>26.62</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>218.74</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

.05 = 5.59
.01 = 12.25

The analysis of covariance test provided a nonsignificant F-value of 0.64 between the two groups of schools. The null hypothesis that there was no difference between the treatment and control groups of schools in students' academic achievement in animal health subject matter due to the use of prepared overhead projected transparencies when using pretest by objectives, I.Q. and agriculture achievement scores as covariates was not rejected.
Ho₁₁ -- There was no difference between the treatment and control groups of schools in students' academic achievement in commercial fertilizer subject matter due to the use of prepared overhead projected transparencies when using pretest by objectives, I.Q. and agriculture achievement scores as covariates.

The data in Table 24 reveal the mean and adjusted mean posttest scores by specific objectives for the treatment and control schools.

Table 24. Commercial fertilizer mean and adjusted mean posttest scores by objectives for treatment and control schools

<table>
<thead>
<tr>
<th>Schools</th>
<th>Posttest scores</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Adjusted mean</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>55.31</td>
<td>53.02</td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td>54.72</td>
<td>57.01</td>
<td></td>
</tr>
<tr>
<td>Difference</td>
<td>0.59</td>
<td>3.99</td>
<td></td>
</tr>
</tbody>
</table>

Examination of data in Table 24 indicates that the control schools had a 0.59 higher mean posttest score. However, the mean scores when adjusted for pretest by objectives, I.Q. and agricultural achievement scores, reveal the treatment schools were 3.99 higher than the control schools.
In an analysis of variance test an F-value of 0.07 was noted which was not significant. An analysis of covariance test was conducted to determine if the two groups of schools were significantly different.

Table 25. Analysis of covariance on students' achievement in commercial fertilizer subject matter comparing schools using prepared overhead projected transparencies with control schools

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degree of freedom</th>
<th>Sum of squares</th>
<th>Mean square</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>1</td>
<td>2.04</td>
<td>2.04</td>
<td>0.07</td>
</tr>
<tr>
<td>Error</td>
<td>7</td>
<td>193.10</td>
<td>27.59</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>195.14</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[.05 = 5.59\]
\[.01 = 12.25\]

Examination of data in Table 25 reveals no significant difference between the treatment and control schools. The null hypothesis was not rejected that there was no difference between the treatment and control groups of schools in students' academic achievement in commercial fertilizer subject matter due to the use of prepared overhead projected transparencies when using pretest by objectives, I.Q. and agriculture achievement scores as covariates.
Ho₁₂ -- There was no difference between the treatment and control groups of schools in students' academic achievement in small gasoline engines subject matter due to the use of prepared overhead projected transparencies when using pretest by objectives, I.Q. and agriculture achievement scores as covariates.

Table 26 contains the mean and adjusted mean posttest scores by specific objectives for the small gas engines subject matter area for both groups of schools.

Table 26. Small gasoline engines mean and adjusted mean posttest scores by objectives for treatment and control schools

<table>
<thead>
<tr>
<th>Schools</th>
<th>Posttest scores</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
</tr>
<tr>
<td>Control</td>
<td>69.03</td>
</tr>
<tr>
<td>Treatment</td>
<td>64.56</td>
</tr>
<tr>
<td>Difference</td>
<td>4.47</td>
</tr>
</tbody>
</table>

Data presented in Table 26 portray a 4.47 mean score difference between the control and treatment schools. When the means were compared in an analysis of variance test, an F-value of 2.06 was obtained which was not significant. A further test of covariance was conducted as illustrated in Table 27.
Table 27. Analysis of covariance on students' achievement in small gasoline engines subject matter comparing schools using prepared overhead projected transparencies with control schools

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degree of freedom</th>
<th>Sum of squares</th>
<th>Mean square</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>1</td>
<td>24.64</td>
<td>24.64</td>
<td>0.95</td>
</tr>
<tr>
<td>Error</td>
<td>7</td>
<td>182.13</td>
<td>26.02</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>206.77</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

No significant difference was found with the 0.95 F-value which supports the null hypothesis that there was no difference between the media and control groups in the small gasoline engine subject matter area.

\[ H_{013} \] -- There was no difference between the treatment and control groups of schools in students' academic achievement in farm credit subject matter due to the use of prepared overhead projected transparencies when using pretest by objectives, I.Q. and agriculture achievement scores as covariates.

Treatment and control schools' mean and adjusted mean posttest scores by specific objectives are presented in Table 28.
Table 28. Farm credit mean and adjusted mean posttest scores by objectives for treatment and control schools

<table>
<thead>
<tr>
<th>Schools</th>
<th>Posttest scores</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Adjusted mean</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>69.52</td>
<td>62.94</td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td>64.90</td>
<td>71.48</td>
<td></td>
</tr>
<tr>
<td>Difference</td>
<td>4.62</td>
<td>8.54</td>
<td></td>
</tr>
</tbody>
</table>

As revealed by data in Table 28, the control schools had a 4.62 higher mean posttest score. However, the mean scores, when adjusted by using the three mentioned covariates, reveal the treatment schools were 8.54 higher than the control schools. In an analysis of variance test a nonsignificant F-value of 2.15 was obtained. A test of analysis of covariance was conducted with the results presented in Table 29.

Table 29. Analysis of covariance on students' achievement in farm credit subject matter comparing schools using prepared overhead projected transparencies with control schools

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degree of freedom</th>
<th>Sum of squares</th>
<th>Mean square</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>1</td>
<td>24.97</td>
<td>24.97</td>
<td>0.82</td>
</tr>
<tr>
<td>Error</td>
<td>7</td>
<td>213.42</td>
<td>30.49</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>238.39</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

.05 = 5.59
.01 = 12.25
The null hypothesis was not rejected that there was no difference between the treatment and control groups of schools in students' academic achievement in farm credit subject matter due to the use of prepared overhead projected transparencies when using pretest by objectives, I.Q. and agriculture achievement scores as covariates.

Parallel analysis of covariance tests was calculated for the mean overall posttest scores to determine if a difference existed between the two groups. No difference was found between the treatment and the control groups in the four subject matter areas.

Teacher attitude scores and the teacher pretest scores on each of the four areas were used as covariates to determine if there was a difference between treatment and control groups of schools.

\[ H_{0.14} \text{ -- There was no difference between the treatment and control groups of schools in students' academic achievement in animal health subject matter due to the use of prepared overhead projected transparencies when using teacher attitude scores and teacher pretest scores as covariates.} \]

The mean and adjusted mean posttest scores by specific objectives are presented in Table 30 for the treatment and control schools.
Table 30. Animal health mean and adjusted mean posttest scores by objectives for treatment and control schools using teacher attitude scores and teacher pretest scores as covariates

<table>
<thead>
<tr>
<th>Schools</th>
<th>Posttest scores</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Adjusted mean</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>57.37</td>
<td>55.28</td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td>56.18</td>
<td>58.27</td>
<td></td>
</tr>
<tr>
<td>Difference</td>
<td>1.19</td>
<td>2.99</td>
<td></td>
</tr>
</tbody>
</table>

A 1.19 mean posttest score difference was noted in Table 30. The media group had a 58.27 adjusted mean score as compared to 55.28 for the control group. The two groups of schools were compared in an analysis of covariance as illustrated in Table 31.

Table 31. Analysis of covariance on students' academic achievement in animal health subject matter comparing schools using prepared overhead projected transparencies with control schools, using teacher attitude scores and teacher pretest scores as covariates

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degree of freedom</th>
<th>Sum of squares</th>
<th>Mean square</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>1</td>
<td>42.74</td>
<td>42.74</td>
<td>0.59</td>
</tr>
<tr>
<td>Error</td>
<td>8</td>
<td>582.75</td>
<td>72.84</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>9</td>
<td>625.49</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[.05 = 5.32\]
\[.01 = 11.26\]

The F-value of 0.59 disclosed in Table 31 was not significant and the null hypothesis was not rejected.
Ho$_{15}$ -- There was no difference between the treatment and control groups of schools in students' academic achievement in commercial fertilizer subject matter due to the use of prepared overhead projected transparencies when using teacher attitude scores and teacher pretest scores as covariates.

Data presented in Table 32 relate the mean and adjusted mean posttest scores by specific objectives for the treatment and control schools.

Table 32. Commercial fertilizer mean and adjusted mean posttest scores by objectives for treatment and control schools using teacher attitude scores and teacher pretest scores as covariates

<table>
<thead>
<tr>
<th>Schools</th>
<th>Posttest scores</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Adjusted mean</td>
</tr>
<tr>
<td>Control</td>
<td>55.31</td>
<td>52.71</td>
</tr>
<tr>
<td>Treatment</td>
<td>54.72</td>
<td>57.32</td>
</tr>
<tr>
<td>Difference</td>
<td>.59</td>
<td>4.61</td>
</tr>
</tbody>
</table>

Examination of data in Table 32 reveals that the treatment group had a 4.61 higher adjusted mean score than the control group. The two groups were tested by analysis of covariance as illustrated in Table 33 to determine if there was a significant difference between the two groups.
An analysis of data in Table 33 reveals an F-value of 1.58 in favor of the treatment schools. This was not significant which supports the null hypothesis.

\[ H_0 : \text{There was no difference between the treatment and control groups of schools in students' academic achievement in small gasoline engine subject matter due to the use of prepared overhead projected transparencies when using teacher attitude scores and teacher pretest scores as covariates.} \]

The mean and adjusted mean posttest scores for the small gasoline engine unit by objectives are given in Table 34 for the treatment and control schools.
Table 34. Small gasoline engine mean and adjusted mean post-test scores by objectives for treatment and control schools using teacher attitude scores and pretest scores as covariates

<table>
<thead>
<tr>
<th>Schools</th>
<th>Posttest scores</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Adjusted mean</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>69.03</td>
<td>66.88</td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td>64.56</td>
<td>66.71</td>
<td></td>
</tr>
<tr>
<td>Difference</td>
<td>4.47</td>
<td>.17</td>
<td></td>
</tr>
</tbody>
</table>

A study of data in Table 34 indicates that the control group of schools had a 4.47 higher mean score than the treatment group. In an analysis of variance test an F-value of 2.06 was calculated in favor of the control school. After the means were adjusted, only 0.17 difference appeared between the two groups of schools. The two groups of schools were compared in an analysis of covariance and reported in Table 35.

Table 35. Analysis of covariance on students' academic achievement in small gasoline engine subject matter comparing schools using prepared overhead projected transparencies with control schools when using teacher attitude scores and teacher pretest scores as covariates

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degree of freedom</th>
<th>Sum of squares</th>
<th>Mean square</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>1</td>
<td>14.35</td>
<td>14.35</td>
<td>0.41</td>
</tr>
<tr>
<td>Error</td>
<td>8</td>
<td>279.65</td>
<td>34.96</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>9</td>
<td>294.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

.05 = 5.32
.01 = 11.26
An examination of data in Table 35 indicates an F-value of 0.41 which was not significant. The null hypothesis was not rejected.

\[ H_{0} \quad \text{There was no difference between the treatment and control groups of schools in students' academic achievement in farm credit subject matter due to the use of prepared overhead projected transparencies when using teacher attitude scores and teacher pretest scores as covariates.} \]

The mean and adjusted mean posttest scores for the farm credit unit by objectives for the treatment and control schools appear in Table 36.

| Table 36. Farm credit mean and adjusted mean posttest scores by objectives for treatment and control schools using teacher attitude scores and teacher pretest scores as covariates |
|-------------------------------|-------------------|
| Schools                      | Posttest scores   |
|                              | Mean  | Adjusted mean |
| Control                      | 69.52 | 63.85          |
| Treatment                    | 64.90 | 70.57          |
| Difference                   | 4.62  | 6.72           |

An analysis of data in Table 36 reveals that the control schools had a 4.62 higher mean posttest score than the treatment schools. However, after the means were adjusted using the two covariates, the treatment schools had a 6.72 higher
score. The two groups of schools were compared in an analysis of covariance and reported in Table 37.

Table 37. Analysis of covariance on students' academic achievement in farm credit subject matter comparing schools using prepared overhead projected transparencies with control schools, using teacher attitude scores and pretest scores as covariates

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degree of freedom</th>
<th>Sum of squares</th>
<th>Mean square</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>1</td>
<td>72.79</td>
<td>72.79</td>
<td>2.87</td>
</tr>
<tr>
<td>Error</td>
<td>8</td>
<td>202.76</td>
<td>25.35</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>9</td>
<td>275.55</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ .05 = 5.32 \]

\[ .01 = 11.26 \]

Data presented in Table 37 disclosed that the 2.87 F-value in favor of the transparency group was approaching the 5 percent level of significance. The null hypothesis, however, could not be rejected.

An analysis of covariance was also conducted on the posttest overall scores using the same covariates. Parallel results were obtained from these tests. Scores from the Kuder Outdoor, Agriculture Achievement, I.Q., and D.A.T. Mechanical tests were also used in a combination of covariates with both the posttest by objectives and posttest overall scores with no significant difference disclosed between the two groups of schools.
Types of Transparencies

A secondary purpose of this study was to determine the effectiveness of various types of transparencies on instruction in vocational agriculture. The six treatment schools were divided by random selection into three groups of two schools each. Schools in group 1 tested black on clear background transparencies, group 2 tested black on colored background transparencies, and group 3 used a combination of transparencies with some new developments.

Values of F at the five and one percent levels of significance were obtained from Wert et al. (21, p. 419).

$H_{018}$: There are no differences among various types of transparencies on students' academic achievement in composite subject matter in vocational agriculture.

Mean posttest scores of the three transparency groups of schools by specific objectives are shown in Table 38.

Table 38. Mean posttest scores by objectives for three types of transparencies

<table>
<thead>
<tr>
<th></th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posttest</td>
<td>56.89</td>
<td>61.70</td>
<td>61.68</td>
</tr>
</tbody>
</table>
The treatment schools in group 1 showed a mean posttest score of 56.89. Groups 2 and 3 treatment schools had posttest scores of 61.70 and 61.68 respectfully.

An analysis of variance test was conducted to determine if significant differences were present among the three groups. Results are shown in Table 39.

### Table 39. Analysis of variance on student academic achievement in composite subject matter in vocational agriculture when compared with three types of overhead projected transparencies

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degrees of freedom</th>
<th>Sum of squares</th>
<th>Mean square</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>2</td>
<td>122.75</td>
<td>61.38</td>
<td>1.10</td>
</tr>
<tr>
<td>Error</td>
<td>21</td>
<td>1167.82</td>
<td>55.61</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>23</td>
<td>1290.57</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$.05 = 3.47$

$.01 = 5.78$

It was observed that the 1.1 F-value was nonsignificant which supported the null hypothesis that there were no differences among various types of transparencies on student academic achievement in composite subject matter in vocational agriculture.

Additional analyses were made comparing the various types of transparencies for the four subject matter areas. However,
no significant differences were found between the three groups of transparencies on student academic achievement by subject matter area.

Factors Related to Student Achievement

The fourth objective of the study was to determine the factors related to student achievement in vocational agriculture when overhead projected transparencies are used.

A comparison was made in a correlation matrix comparing student achievement on posttest scores with selected variables. Scores from the following tests were used as the selected variables: Intelligence Quotient; Differential Aptitude, mechanical reasoning; Differential Aptitude, abstract reasoning; Differential Aptitude, verbal reasoning; Agriculture Achievement and Kuder Outdoor Interest.

Data in Table 40 report the correlation values obtained from the correlation matrix for the animal health subject matter area.

Table 40. Values for correlations between posttest scores and selected variables for animal health subject matter units in treatment and control schools

<table>
<thead>
<tr>
<th>Selected variables</th>
<th>Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Treatment</td>
</tr>
<tr>
<td>Agriculture achievement</td>
<td>0.67</td>
</tr>
<tr>
<td>DAT, verbal</td>
<td>0.60</td>
</tr>
<tr>
<td>I.Q.</td>
<td>0.56</td>
</tr>
<tr>
<td>DAT, abstract</td>
<td>0.44</td>
</tr>
<tr>
<td>DAT, mechanical</td>
<td>0.35</td>
</tr>
<tr>
<td>Kuder outdoor</td>
<td>0.22</td>
</tr>
</tbody>
</table>
An analysis of data in Table 40 reveals the highest correlations between the Agriculture Achievement, DAT, verbal and I.Q. test scores and the posttest by objective scores for the transparency treatment group of schools. Scores from the DAT, abstract, I.Q. and Agriculture Achievement tests had the highest correlation values for the control group of schools. Students in the treatment group of schools scored lower on all variables except on the Agriculture Achievement test. It was noted that the treatment group of schools had a .22 lower correlation value for the DAT, abstract test than the control group of schools.

Commercial fertilizer subject matter correlation values are presented in Table 41.

Table 41. Values for correlations between posttest scores and selected variables for commercial fertilizer subject matter unit in treatment and control schools

<table>
<thead>
<tr>
<th>Selected variables</th>
<th>Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Treatment</td>
</tr>
<tr>
<td>Agriculture achievement</td>
<td>0.63</td>
</tr>
<tr>
<td>DAT, verbal</td>
<td>0.54</td>
</tr>
<tr>
<td>I.Q.</td>
<td>0.49</td>
</tr>
<tr>
<td>DAT, mechanical</td>
<td>0.37</td>
</tr>
<tr>
<td>DAT, abstract</td>
<td>0.32</td>
</tr>
<tr>
<td>Kuder outdoor</td>
<td>0.22</td>
</tr>
</tbody>
</table>
A study of the data in Table 41 indicates that Agriculture Achievement, DAT, verbal and I.Q. test scores were the best predictors of posttest scores in commercial fertilizer for both the treatment and control schools. It was revealed that the treatment group of schools had an 0.32 correlation value for the DAT, abstract test as compared to an 0.23 for the control group of schools.

Data presented in Table 42 relate the correlation values between the small gasoline engine subject matter area and selected variables.

<table>
<thead>
<tr>
<th>Selected variables</th>
<th>Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Treatment</td>
</tr>
<tr>
<td>Agriculture achievement</td>
<td>0.59</td>
</tr>
<tr>
<td>I.Q.</td>
<td>0.50</td>
</tr>
<tr>
<td>DAT, verbal</td>
<td>0.39</td>
</tr>
<tr>
<td>DAT, mechanical</td>
<td>0.29</td>
</tr>
<tr>
<td>DAT, abstract</td>
<td>0.26</td>
</tr>
<tr>
<td>Kuder outdoor</td>
<td>0.16</td>
</tr>
</tbody>
</table>

Correlation values listed in Table 42 relate that the Agriculture Achievement and I.Q. test scores were the two highest correlation values for the treatment group of schools.
However, the test scores for control group of schools revealed that the DAT, mechanical and abstract scores had the highest correlations with the posttest scores. The Kuder outdoor test scores were least correlated with small gasoline engine subject matter in both groups of schools. The control group of schools scored much higher on the DAT, mechanical test than did the transparency group of schools.

Farm credit subject matter and selected variable correlation values for the treatment and control schools are listed in Table 43.

Table 43. Values for correlations between posttest scores and selected variables for farm credit subject matter units in treatment and control schools

<table>
<thead>
<tr>
<th>Selected variables</th>
<th>Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Treatment</td>
</tr>
<tr>
<td>Agriculture achievement</td>
<td>0.49</td>
</tr>
<tr>
<td>I.Q.</td>
<td>0.43</td>
</tr>
<tr>
<td>DAT, verbal</td>
<td>0.34</td>
</tr>
<tr>
<td>DAT, abstract</td>
<td>0.32</td>
</tr>
<tr>
<td>Kuder outdoor</td>
<td>0.23</td>
</tr>
<tr>
<td>DAT, mechanical</td>
<td>0.22</td>
</tr>
</tbody>
</table>

An analysis of data in Table 43 indicates that Agriculture Achievement and I.Q. test scores were correlated at a higher level with posttest scores by objectives in the farm credit
subject matter area for the treatment group of schools. The highest correlation values in the control group of schools were scores on the Kuder Outdoor, I.Q. and Agriculture Achievement tests. The treatment group of schools' correlation values are all lower than the control group of schools. The Kuder Outdoor test scores indicated an 0.63 difference between the two groups of schools.

To further analyze the factors affecting student achievement, the treatment and control schools were compared using the students' mean posttest scores by objectives for each subject matter area with the students' scores on selected variables. The variables selected for the analysis were: Agriculture Achievement; Differential Aptitude, verbal; Intelligence Quotient; Kuder Mechanical and Kuder Outdoor Tests.

In each subject matter analysis, both the treatment and control groups of students were divided into an upper and a lower level determined by their test scores for each of the selected variables.

\( H_{0.19} \) **There was no difference between mean animal health posttest scores and two levels of DAT, verbal scores for treatment and control groups of schools.**

Values of \( F \) at the five and one percent levels of significance were obtained from Winer (22, p. 644).
The mean posttest scores for the animal health subject matter area and two levels of DAT, verbal scores for the transparency and control groups of schools are reported in Table 44.

Table 44. Mean animal health posttest scores and two levels of DAT, verbal scores for the treatment and control groups of schools

<table>
<thead>
<tr>
<th>Posttest scores</th>
<th>Mean posttest scores based on two levels of DAT, verbal scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schools</td>
<td>Mean</td>
</tr>
<tr>
<td>Control</td>
<td>58.06</td>
</tr>
<tr>
<td>Treatment</td>
<td>56.83</td>
</tr>
<tr>
<td>Difference</td>
<td>1.23</td>
</tr>
</tbody>
</table>

Data presented in Table 44 disclose that the control schools received a 1.23 higher mean posttest score than did the treatment schools. The mean score difference for the upper one-half DAT, verbal group was 3.99 compared to 6.45 for the lower one-half group. An analysis of variance was conducted to determine if there were differences between the two levels of achievement and the two groups of schools.

An examination of data in Table 45 reveals that the F-value of 19.62 was highly significant. Therefore, the null hypothesis was rejected and it was concluded that there was a highly
significant difference between mean animal health posttest scores at two levels of DAT, verbal scores for treatment and control groups of schools.

Table 45. Analysis of variance on mean animal health posttest scores and two levels of DAT, verbal scores for the treatment and control groups of schools

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degrees of freedom</th>
<th>Sums of squares</th>
<th>Mean square</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>1</td>
<td>9.04</td>
<td>9.04</td>
<td>0.16</td>
</tr>
<tr>
<td>Level</td>
<td>1</td>
<td>1136.17</td>
<td>1136.17</td>
<td>19.62**</td>
</tr>
<tr>
<td>Interaction</td>
<td>1</td>
<td>163.54</td>
<td>163.54</td>
<td>2.82</td>
</tr>
<tr>
<td>Error</td>
<td>20</td>
<td>1158.03</td>
<td>57.90</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>23</td>
<td>2466.78</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table of F-value at the .01 level with 1 and 20 degrees of freedom = 8.10. Significant at the .01 level of confidence.

H₀²₀ — There was no difference between mean commercial fertilizer posttest scores and two levels of the Nebraska Agriculture Achievement scores for treatment and control groups of schools.

Commercial fertilizer mean posttest scores by objectives and two levels of the Agriculture Achievement scores for the treatment and control schools are shown in Table 46.
Table 46. Mean commercial fertilizer posttest scores and two levels of the Agriculture Achievement scores for the treatment and control groups of schools

<table>
<thead>
<tr>
<th>Schools</th>
<th>Mean posttest scores based on two levels of Agriculture Achievement scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>Mean</td>
</tr>
<tr>
<td></td>
<td>54.50</td>
</tr>
<tr>
<td>Control</td>
<td>53.63</td>
</tr>
<tr>
<td>Difference</td>
<td>.87</td>
</tr>
</tbody>
</table>

Data presented in Table 46 indicate that only .87 difference was found in mean posttest scores between the two groups of schools. Mean score differences of 5.40 for the upper one-half and 7.14 for the lower one-half groups were noted. The mean scores are compared in an analysis of variance as disclosed in Table 47.

Table 47. Analysis of variance on mean commercial fertilizer posttest scores and two levels of the Nebraska Agriculture Achievement scores for the treatment and control groups of schools

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degrees of freedom</th>
<th>Sums of squares</th>
<th>Mean square</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>1</td>
<td>4.55</td>
<td>4.55</td>
<td>0.04</td>
</tr>
<tr>
<td>Level</td>
<td>1</td>
<td>2454.10</td>
<td>2454.10</td>
<td>19.69**</td>
</tr>
<tr>
<td>Interaction</td>
<td>1</td>
<td>235.81</td>
<td>235.81</td>
<td>1.89</td>
</tr>
<tr>
<td>Error</td>
<td>20</td>
<td>2492.17</td>
<td>124.61</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>23</td>
<td>5186.63</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table of F-value at the .01 level with 1 and 20 degrees of freedom = 8.10. Significant at the .01 level of confidence.
It was observed from the analysis in Table 47 that a highly significant difference existed between the two levels of the Agriculture Achievement scores and the posttest scores in the commercial fertilizer area for both groups of schools. The hypothesis was rejected.

$H_{021}$ - There was no difference between mean small gasoline engine posttest scores at two levels of the Kuder mechanical interest test scores for treatment and control groups of schools.

Data in Table 48 reveal the mean small gasoline engine posttest scores by objectives and two levels of the Kuder mechanical interest test for the transparency media and control groups of schools.

<table>
<thead>
<tr>
<th>Posttest scores</th>
<th>Mean posttest scores</th>
<th>Mean posttest scores based on two levels of Kuder mechanical scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schools</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>70.45</td>
<td>74.28 66.63</td>
</tr>
<tr>
<td>Treatment</td>
<td>66.03</td>
<td>68.68 63.38</td>
</tr>
<tr>
<td>Difference</td>
<td>4.42</td>
<td>5.60 3.25</td>
</tr>
</tbody>
</table>
Data in Table 48 reveal that the control schools had a 4.42 higher mean posttest score than the treatment schools. The upper one-half group had a 5.60 mean score difference in favor of the control group. In the lower one-half group the control schools had a 66.63 mean score as compared to 63.38 for the treatment schools.

An analysis of variance test appears in Table 49 which reports the results of the difference between the two levels of the Kuder test for the treatment and control groups of schools.

Table 49. Analysis of variance on mean small gasoline engine posttest scores and two levels of the Kuder mechanical interest scores for the treatment and control groups of schools

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degrees of freedom</th>
<th>Sums of squares</th>
<th>Mean square</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>1</td>
<td>117.26</td>
<td>117.26</td>
<td>3.35</td>
</tr>
<tr>
<td>Level</td>
<td>1</td>
<td>251.49</td>
<td>251.49</td>
<td>7.18*</td>
</tr>
<tr>
<td>Interaction</td>
<td>1</td>
<td>8.25</td>
<td>8.25</td>
<td>0.24</td>
</tr>
<tr>
<td>Error</td>
<td>20</td>
<td>700.72</td>
<td>35.04</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>23</td>
<td>1077.72</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Table of F-value at the .05 level with 1 and 20 degrees of freedom = 4.35. Significant at the .05 level of confidence.

It was observed that the 7.18 F-value difference in the two levels of student achievement on the Kuder mechanical test
score was significant at the .05 level of confidence. Based on these findings, the null hypothesis was rejected and the hypothesis accepted that there was a difference between mean small gasoline engine posttest scores by objectives at the two levels of the Kuder mechanical test for the treatment and control groups of schools.

H022 -- There was no difference between mean farm credit posttest scores at two levels of the I.Q. test for treatment and control groups of schools.

Mean farm credit posttest scores by objectives and two levels of the I.Q. scores are presented in Table 50 for the two groups of schools.

Table 50. Mean farm credit posttest scores and two levels of the I.Q. test scores for the treatment and control groups of schools

<table>
<thead>
<tr>
<th></th>
<th>Mean posttest scores based on two levels of I.Q. scores</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
</tr>
<tr>
<td>Schools</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>67.86</td>
</tr>
<tr>
<td>Treatment</td>
<td>65.21</td>
</tr>
<tr>
<td>Difference</td>
<td>2.65</td>
</tr>
</tbody>
</table>
Posttest scores as presented in Table 50 indicate a 2.65 mean difference in favor of the control schools. Mean score differences of 4.70 for the upper one half and 0.61 for the lower one-half groups were found. To test for differences between the groups of mean scores, an analysis of variance test was calculated. The results of these tests are presented in Table 51.

Table 51. Analysis of variance on mean farm credit posttest scores and two levels of the I.Q. test scores for the treatment and control groups of schools

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degrees of freedom</th>
<th>Sums of squares</th>
<th>Mean Square</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>1</td>
<td>42.29</td>
<td>42.29</td>
<td>0.92</td>
</tr>
<tr>
<td>Level</td>
<td>1</td>
<td>1464.84</td>
<td>1464.84</td>
<td>31.74**</td>
</tr>
<tr>
<td>Interaction</td>
<td>1</td>
<td>25.05</td>
<td>25.05</td>
<td>0.54</td>
</tr>
<tr>
<td>Error</td>
<td>20</td>
<td>923.14</td>
<td>46.16</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>23</td>
<td>2455.32</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table of F-value at the .01 level with 1 and 20 degrees of freedom = 8.10. Significant at the .01 level of confidence.

Inspection of the F-values in Table 51 reveals a highly significant value of 31.74 when the two levels of student I.Q. scores were compared with posttest scores on farm credit subject matter for both the transparency media and the control groups of schools. The null hypothesis was rejected.
Further parallel analyses were conducted using the selected variables for each subject matter area. Results of the tests are summarized in Table 52 by overall test results and by specific objectives.

Table 52. Summary of analysis of variance tests by two levels of student scores on selected variables for the control and treatment groups of schools

<table>
<thead>
<tr>
<th>Subject matter</th>
<th>Variable</th>
<th>F-values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Overall</td>
</tr>
<tr>
<td>Animal health</td>
<td>Agriculture</td>
<td>20.88**</td>
</tr>
<tr>
<td></td>
<td>Achievement</td>
<td></td>
</tr>
<tr>
<td>Commercial fertilizer</td>
<td>Kuder Mechanical</td>
<td>2.80</td>
</tr>
<tr>
<td>Small gasoline engine</td>
<td>I.Q.</td>
<td>7.74*</td>
</tr>
<tr>
<td>Small gasoline engine</td>
<td>DAT, verbal</td>
<td>10.92**</td>
</tr>
<tr>
<td>Small gasoline engine</td>
<td>Agriculture</td>
<td>17.81**</td>
</tr>
<tr>
<td></td>
<td>Achievement</td>
<td></td>
</tr>
<tr>
<td>Small gasoline engine</td>
<td>Kuder Outdoor</td>
<td>0.28</td>
</tr>
<tr>
<td>Farm credit</td>
<td>DAT, verbal</td>
<td>19.88**</td>
</tr>
<tr>
<td>Farm credit</td>
<td>Agriculture</td>
<td>48.93**</td>
</tr>
<tr>
<td></td>
<td>Achievement</td>
<td></td>
</tr>
<tr>
<td>Farm credit</td>
<td>Kuder Outdoor</td>
<td>1.74</td>
</tr>
<tr>
<td>Farm credit</td>
<td>Kuder Mechanical</td>
<td>0.09</td>
</tr>
</tbody>
</table>

*Table of F-values with 1 and 20 degrees of freedom at the .05 level = 4.35; **.01 level = 8.10.

Only two of the selected variables were used in the animal health and commercial fertilizer subject matter areas. This
was due to empty cells in various classes in the experimental
groups of schools.

No significant difference was found between the treatment
and control groups of schools when compared on the basis of two
levels of student scores on selected variables.

Analysis of the data in Table 52 reveals that the F-value
was highly significant when the Agriculture Achievement test
and the posttest scores on the animal health unit were com-
pared.

In comparing the small gasoline engine subject matter
posttest scores and the I.Q. scores, the F-value was signifi-
cant at the .05 level for the overall analysis, and at the .01
level for the specific objectives analyses. Agriculture
Achievement and DAT, verbal scores also yielded F-values sig-
nificant at the .01 level of confidence when compared to the
small gasoline engine subject matter posttest scores.

Variables that were not significantly related to the post-
test scores for the farm credit subject matter unit were the
Kuder Outdoor and Kuder Mechanical scores. However, the DAT,
verbal and Agriculture Achievement scores were both signifi-
cantly correlated at the .01 level of confidence.
DISCUSSION

The primary purpose of this study was to determine the effectiveness of overhead projected transparencies on instruction in vocational agriculture.

Students' mean pretest scores by specific objectives in each of the four subject matter areas were examined, using an analysis of variance test. No significant difference was found between the treatment and control groups of schools in animal health, commercial fertilizer, small gasoline engine and farm credit subject matter areas. This might have been due, in part, to the homogeneous background of students taking vocational agriculture in the twelve schools involved in this study. It is noted that the pretest analysis was conducted on mean scores, which did not take into account the range of difference between the low and high ranking students.

Composite mean posttest scores for the control and treatment groups of schools were compared in an analysis of variance test. There was no difference between the two groups of schools in the composite test. The four instructional subject matter units composed a typical program in vocational agriculture for the purpose of this study. To measure a typical program, a composite analysis was made. The fact that no difference was found between the two groups of schools in the composite analysis may indicate that no major gains or losses
by subject matter areas were incurred between the two groups of schools.

A further composite was made between the two groups of schools using teacher pretest scores on each subject matter area and teacher attitude scores as covariates. In an analysis of covariance test, no significant difference was found between the two groups of schools. Since students' attitudes have been shown to be influenced by teachers, it would not seem unreasonable to examine the attitudes of vocational agriculture teachers. The reliability of teacher attitude and its true effect on student achievement is open to question.

The mean posttest scores of the treatment and control groups of schools were examined by specific subject matter areas. When each of the four subject matter areas were tested, no significant difference was indicated between the two groups of schools in students' academic achievement. Prepared overhead transparencies were projected in the units of instruction at specific times for each subject matter area. There may have been an over-use of the instructional media. A total of 738 prepared overhead transparencies were supplied to the treatment group of schools. An average of eight or nine transparencies were projected each day of the testing period. The vocational agriculture students in the transparency media treatment group of schools may have found viewing transparencies for the 14-day testing period monotonous.
Perhaps the instructors in the treatment schools relied solely on overhead projected transparencies as their instructional aid, even though some other instructional aids were permitted. In contrast, the instructors in the control schools may have used a variety of allowed instructional techniques which might have stimulated a higher degree of student interest.

The researcher feels that the specific subject matter areas of vocational agriculture lend themselves to the use of one or more media of teaching. Therefore, overhead projected transparencies would not normally be used in such a concentrated effort in the teaching of all subject matter areas. It appears to have been a case of selecting the correct media for the specific job.

The instructors participating in the project were given a two-day training period to familiarize them with the project and with the duties they were to perform. The researcher feels that the instructors may not have had ample training to do the thorough job that the project required. Also, the demands of a complete program of vocational agriculture are many and varied, and it may have been possible that too much of the instructors' time was needed to perform activities outside of the testing program.

At the conclusion of the testing period, project teachers were requested to furnish their evaluation of the effectiveness of using overhead projected transparencies.
In an examination of the evaluations, it was found that the project teachers rated the effectiveness of transparencies as contributing "much to very much" in the following areas: (1) in reaching the assigned instructional objective for a given problem area, (2) when used as a method of presenting the subject matter, (3) in creating student interest, (4) in implementing student involvement, and (5) in achieving student understanding. The ratings supplied by the teachers were the two highest ratings on the evaluation form.

The evaluations also revealed the instructors listed that they had "some" degree of competence in using transparencies at the start of the project, with an increase to "much" competence during the third week of the experimental period. Instructors listed that "little" outside factors interfered with their teaching during the three-week experiment.

The researcher feels that the project teachers were in the best position to constructively evaluate the effectiveness of transparencies on instruction for their groups of students. Therefore, it appears from the teachers' evaluations that transparencies provided more toward student achievement than may have been indicated by posttest scores.

An analysis of covariance test was conducted using pretest by objectives, Intelligence Quotient and the Nebraska Agriculture Achievement tests as covariates. There was no evidence to verify that a statistically significant difference existed between the students' academic achievement on mean posttest
scores. The adjusted means in the analysis of covariance test revealed that a high percentage of the posttest means were in favor of the treatment group of schools.

A secondary purpose of this study was to determine the effectiveness of various types of transparencies on instruction in vocational agriculture. The six treatment schools were subdivided by random selection into three groups of two schools each. Schools in group 1 tested black on clear background transparencies, group 2 tested black on colored background transparencies, and group 3 tested a mixed variety of transparencies. The differences in mean posttest scores revealed that the black on colored background transparency group had the highest mean posttest score, whereas the black on clear background transparency group had the lowest mean posttest score. Although no significant difference was found between the two transparency groups, the mean posttest score difference may indicate that students favor a variety of color in transparencies used as instructional media. Further breakdown for statistical analysis of the transparency types was limited due to the small numbers within each transparency group.

An analysis of the factors related to student achievement in animal health subject matter disclosed that scores from the Nebraska Agriculture Achievement, DAT, verbal and Intelligence Quotient tests revealed the highest correlations with the posttest mean scores for the transparency treatment group of schools. Scores for the DAT, abstract, Intelligence Quotient
and Nebraska Agriculture Achievement tests had the highest correlation values for the control schools.

It was also noted that students in the treatment group of schools scored lower on all selected variables except the Agriculture Achievement test. However, no difference existed on posttest scores between the transparency media and control groups of schools. This information would indicate that the use of the prepared transparencies may have influenced students' achievement more than the posttest scores reveal.

In the commercial fertilizer subject matter area, the best predictors of mean posttest scores for both the treatment and control groups of schools were the following tests: Nebraska Agriculture Achievement, DAT, verbal and Intelligence Quotient. It was revealed that the treatment group of schools had an 0.32 correlation value for the DAT, abstract test as compared to an 0.23 correlation value for the control group of schools. This may have been due, in part, to the fact that little abstract reasoning was illustrated on the overhead projected transparencies for the commercial fertilizer subject matter area.

In the small gasoline engine subject matter area, the Nebraska Agriculture Achievement and the Intelligence Quotient tests had the two highest correlation values for the treatment group of schools. However, for the control group of schools, the test scores revealed the DAT, mechanical and the DAT,
abstract scores resulted in the highest correlations with the posttest mean scores.

When the two groups of schools were compared on DAT, mechanical, it was noted that the control group of schools scored higher than did the transparency schools. Although the DAT, mechanical scores for the treatment group of schools were lower than for the control group of schools, the posttest results of the transparency group were equal to those of the control group. This would tend to indicate that the use of the prepared overhead transparencies did increase student achievement.

Scores from the Nebraska Agriculture Achievement and the Intelligence Quotient tests were correlated at a higher level with posttest mean scores in the farm credit subject matter area for the treatment group of schools. The highest correlation values in the control group of schools were between posttest scores and scores on the Kuder Outdoor, Intelligence Quotient and Nebraska Agriculture Achievement tests.

When the two groups of schools were compared, it was found that the treatment group of schools' correlation values were all lower than those of the control group of schools. The researcher feels that if a group of students score low on a selected variable, but perform well on the posttest, transparencies did contribute to the student achievement.

Conclusions from the correlation values would reflect that the Nebraska Agriculture Achievement and the Intelligence
Quotient test scores were the best predictors of posttest mean scores in the four subject matter areas used in this study. It would appear logical to expect certain tests to predict certain results. The DAT, mechanical test would seem likely to be a good predictor of results of posttest in the small gasoline engine subject matter area. This was not true for the transparency treatment group of schools. It may have been due, in part, to the fact that no laboratory sessions were included in the small gasoline engine unit in this experimental study. However, it should be remembered that these results can only be generalized to a particular student population and set at learning conditions.

Further analysis of the factors affecting students' academic achievement were made using the students' mean post-test scores for each subject matter area with the students' level of achievement on selected variables. The findings indicated that the students who scored high on the Nebraska Agriculture Achievement, DAT, verbal and Intelligence Quotient tests also scored high on posttest mean scores in the four subject matter areas. There was no difference between treatment and control groups of schools. Evidence from this analysis made the researcher question whether the four subject matter areas were academically oriented or vocationally oriented.

It is possible that the selection of schools might have affected the results of the study. Although a random selection
was used, five of the six control schools were located within a small geographical area of the state. In contrast, the transparency treatment schools were well distributed throughout the state. To prevent any possible social-economic difference, the researcher feels a better sample of control schools would have been obtained by a systematic randomization. An example of this theory might be the selection of one school from each of the six vocational agriculture districts in the state.

The control group of schools was also faced with the problem of "image" on their respective fronts. This human factor may account for their excellent performance and achievement. Apparently, teachers and students who are made to feel important and who have a favorable attitude toward their work and studies are more productive. The treatment group of schools may have acted in reverse to this supposition due to their receiving prepared transparencies which led them to believe they had a "leading edge." The investigator concluded that the teaching effectiveness is so complex that it cannot be assessed satisfactorily by a single observation.

Today's rapidly changing technology shows the promise of some day revolutionizing the educational process. Just as the one room school has been outmoded, current methods of presenting material to students may some day be outdated. Television has already found its way into classrooms around the nation. Educators are looking to the future. Change is rapidly taking
place and the extent and future of educational media programs cannot be fully established at this time.

Vocational agriculture should be extended to cover more students and more offerings. The programs must be both broad enough and deep enough to provide the individual with flexibility, matching programs to present and emerging occupations, and developing talented leadership in agriculture. The researcher feels that the overhead projector and transparencies will play an important role in this regard.

Agriculture is an ever-changing field. New discoveries in the biological and physical sciences, plus new theories and the results of improved research in the behavioral sciences mean that textbooks ever lag behind. Consequently, many vocational agriculture instructors rely heavily on monthly publications as well as on other periodicals and materials that can be reproduced for overhead projection.

Agriculture is a flexible subject matter area where the curriculum must be tailor-made to fit local school conditions. Thus, textbooks published for nationwide consumption are frequently not satisfactory for a particular school condition.

There is a further reason why overhead projectors are highly desirable in vocational agriculture classes. Agriculture is a broad field. To be adequately prepared for a classroom takes a great deal of time. An overhead projector drastically cuts the countless hours that would have to be spent in preparing a teacher's own visual aids.
Lists of funded proposals indicate that more research than ever before is being done in vocational education, including vocational agriculture. Agriculture educators cannot depend on researchers in the other fields of education to provide the answers to questions in vocational agriculture. The research must come from within the field in question by persons well versed in the concepts and practices of that field and well qualified in the methods and techniques of research. The bulk of educational research has been done by graduate students and subject matter specialists, rarely by professional researchers.

Learning processes and teaching methods are extremely fertile areas for the researcher. As theories of learning are made known, they need to be tested, and as the technology of education advances, the new media must be examined with regard to the vocational agriculture field.

The writer enthusiastically recommends more experimentation with overhead projected transparencies and their effectiveness on instruction in vocational agriculture.
SUMMARY

This study was a segment of an experimental project conducted cooperatively by the Iowa State University Department of Agricultural Education and the Iowa Department of Public Instruction. The title of the project was "An Experimental Evaluation of the Effectiveness of Selected Techniques and Resources on Instruction in Vocational Agriculture." The project was financed in part from funds from the Iowa Agriculture and Home Economics Experiment Station, but largely from funds from the Research Coordinating Unit under a research grant from Vocational Education Branch (VEA-1963-1964 (a) ancillary funds) Iowa Department of Public Instruction.

Project staff members and Department of Agricultural Education staff members prepared cooperatively the instructional materials for the total project. Emphasis was placed on testing innovative methods and techniques that may lead to improving instruction in vocational agriculture. Seven instructional techniques were tested in the overall study. The techniques included: audio-tutorial, single concept films, video tape, prepared lesson plans, field trips, demonstrations and transparencies.

The purpose of this study was to determine the effectiveness of overhead projected transparencies on instruction in vocational agriculture. A secondary purpose of the study was
to determine the effectiveness of color when used on overhead projected transparencies.

Four units of instruction in agriculture were selected for study during the experimental period. The four units selected and for which teaching outlines with specific objectives and references were prepared were: (1) animal health for the ninth grade students, (2) commercial fertilizers for the tenth grade students, (3) small gasoline engines for the eleventh graders, and (4) farm credit for the twelfth grade students.

A random sample of 12 Iowa high school vocational agriculture departments was selected from a list of Iowa high schools offering an approved four-year program of vocational agriculture for use in this study. Selection requirements were (1) that the enrollment of the department must be at least 39 students and (2) class size must be not less than seven nor more than 22 students. It was further required that all instructors have had at least one year of teaching experience.

The 12 schools in this study were randomly divided into two groups of six each. One group of schools was used as the control group while the other group tested the effectiveness of transparencies.

The six schools in this study using transparencies were subdivided into three groups of two schools each. One group was supplied black on clear transparencies, one group received black on colored background transparencies, while the third group received a mixed variety of transparencies, including
some with motion to be shown with a polarized adapter on the overhead projector. A total of 738 transparencies was supplied the treatment schools for use during the experimental period.

Three different meetings were held to train the instructors involved in the project in both the control and treatment schools. All instructional materials and visual aids were presented to the instructors during these training periods, as well as information concerning the instructional methods to be used. The only major difference in instructional methods between the control and the treatment schools was the use of prepared transparencies at specified times in the treatment schools.

A written test of 60 points for each subject matter area was constructed by members of the project team. All students in the 12 Iowa vocational agriculture departments cooperating in this study were given this test as a pretest prior to the beginning of the 14-day period of instruction, and again as a posttest upon completion of the instruction period. The pretest and posttest were administered under the direction of the guidance counselors in the respective schools.

Data were collected, coded and transferred to 80-column IBM cards for analysis by the Iowa State University Computation Center. Analysis of variance and analysis of covariance were used to evaluate the relationships between the control and transparency treatment groups of schools.
Preliminary tests were conducted using an analysis of variance test on students' pretest mean scores by specific objectives in each of the four subject matter areas. No significant difference was found between the treatment and control groups of schools in animal health, commercial fertilizer, small gasoline engine and farm credit subject matter areas. Therefore, all additional tests were based on the assumption that no differences existed between the two groups of schools at pretest time.

The specific objective of this study was to determine the effectiveness of projected transparencies on instruction in vocational agriculture. The four instructional subject matter areas composed a typical program in vocational agriculture for the purpose of this study.

Composite mean posttest scores were compared for the control and treatment groups of schools in an analysis of variance test. A nonsignificant value was obtained indicating that there was no difference between the two groups of schools in the composite test.

To further compare the two groups of schools, teacher pretest scores on each subject matter area and teacher attitude scores were used as covariates. In an analysis of covariance test no significant difference was found between the two groups of schools.

The mean posttest scores of the treatment and control groups of schools were examined by the specific subject matter
areas. When the four subject matter areas were tested in analysis of variance tests, no significant differences were indicated among schools in students' academic achievement when compared with schools using prepared overhead projected transparencies.

An analysis of covariance test was conducted using pretest by objectives, I.Q. and the Nebraska Agriculture Achievement test scores as covariates. Data obtained in the tests of analysis of covariance revealed that the covariates adjusted a high percentage of the posttest means in favor of the treatment schools. Data from the analysis of covariance test on the farm credit subject matter area were approaching the .05 percent level of confidence. However, no significant difference was found between the two groups of schools by specific subject matter area.

To determine the effectiveness of various types of transparencies on instruction in vocational agriculture, the six treatment schools were subdivided by random selection into three groups of two schools each. Schools in group 1 tested black on clear background transparencies, group 2 tested black on colored background transparencies, and group 3 tested a mixed variety of transparencies.

The colored background transparency group had the highest mean posttest score and the black on clear background had the lowest posttest score. However, when compared in an analysis of variance test, no significant difference on students'
academic achievement was found due to the use of the three types of transparencies.

A correlation analysis using individual student posttest scores for each of the four subject matter areas was conducted. Scores from the following tests were used as the selected variables: Intelligence Quotient, Differential Aptitude for Mechanical Reasoning, Abstract Reasoning, Verbal Reasoning, Agriculture Achievement and Kuder Outdoor Interest.

Correlation values from the selected variables in animal health subject matter disclosed that scores from the Agriculture Achievement, DAT, verbal and I.Q. tests revealed the highest correlation to posttest by objectives for the transparency treatment group of schools. Scores from the DAT, abstract, I.Q. and Agriculture Achievement tests had the highest correlation values for the control group of schools.

The Agriculture Achievement, DAT, verbal, and I.Q. scores were the best predictors of posttest scores in the commercial fertilizer subject matter area for both the treatment and control schools. In the small gasoline engine subject matter area, Agriculture Achievement and I.Q. test scores were the two highest correlation values for the treatment group of schools. However, the control group of schools' test scores revealed that DAT, mechanical and abstract scores had the highest correlation to the posttest mean scores. An analysis of the farm credit subject area indicated that Agriculture Achievement and I.Q. test scores were correlated at a higher level with
posttest mean scores for the treatment schools. The highest correlation values in the control group of schools were scores on the Kuder Outdoor, I.Q. and Agriculture Achievement tests.

To further analyze the factors affecting student achievement, the treatment and control schools were compared using the students' mean posttest scores by objectives for each subject matter area with the students' level of achievement on variables. The variables selected for the analysis were: Agriculture Achievement; Differential Aptitude, verbal; Intelligence Quotient; Kuder Mechanical and Kuder Outdoor tests.

In each subject matter analysis, both the treatment and control groups of students were divided into an upper and a lower level by their test scores for each of the selected variables. An analysis of variance was conducted for each subject matter area using the selected variables.

In the animal health subject matter area, the DAT, verbal and Agriculture Achievement variables were highly significant. The Agriculture Achievement test was significant at the .01 level of confidence in the commercial fertilizer area. The Kuder Mechanical test was significant at the .05 level for the small gasoline engine subject matter area. Data also revealed that the I.Q., DAT, verbal and Agriculture Achievement scores were highly significant with posttest scores. Agriculture Achievement and DAT, verbal test scores were both significant at the .01 level of confidence for the farm credit subject matter area.
Findings in this study indicate that the Nebraska Agriculture Achievement test, DAT, verbal and I.Q. scores are the most reliable predictors of students' academic achievement on posttest scores in the four subject matter areas selected for this study. Although no statistical positive significance was found between the transparency media and the control groups of schools, evidence presented did indicate that the vocational agriculture students using prepared overhead projected transparencies generally achieved as well, or better, than the students in the control groups of schools.
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APPENDIX A - SUBJECT MATTER OUTLINES
ANIMAL HEALTH

Problem Area Outline by Days

Day

1  The Economic Importance of Livestock Diseases and Parasites
2  Factors in Maintaining Animal Health
3 & 4 Causes, Symptoms, Prevention and Control of Major Cattle Diseases
5  Life Cycles, Symptoms, Prevention and Control of Major Cattle Parasites
6 & 7 Causes, Symptoms, Prevention and Control of Major Sheep Diseases
8  Life Cycles, Symptoms, Prevention and Control of Major Sheep Parasites
9 & 10 Causes, Symptoms, Prevention and Control of Major Swine Diseases
11 Life Cycles, Symptoms, Prevention and Control of Major Swine Parasites
12 Planning a General Livestock Health Program
13 Occupational Roles of the Veterinarian, Farmer, and Other Animal Health Workers
14 Summary and Review
15 Post-Test
Behavioral Objectives: (understandings and abilities)

Understanding of:
1) The relation between control of diseases and parasites with efficient production of livestock
2) The types, causes, symptoms, prevention and control of the major diseases and parasites of livestock
3) The occupational roles of the veterinarian, farmer, and other animal health workers
4) The possibilities for employment in occupations requiring a knowledge of animal diseases and parasites

Ability to:
1) Recognize normal and abnormal health conditions prevalent in livestock and livestock production
2) Plan an effective program for controlling livestock diseases and parasites
3) Maintain desirable animal health conditions for livestock
Day 1

1. PROBLEM AREA: The Economic Importance of Livestock Diseases and Parasites

Objectives:

To develop an understanding of:

a. The importance of livestock diseases and parasites upon profitable livestock production
b. The amount of damage done to livestock and livestock products by diseases and parasites
c. The cost of controlling livestock diseases and parasites

References:

a. Animal Health, Ch. 1, pp. 1-6

Day 2

2. PROBLEM AREA: Factors in Maintaining Normal Animal Health

Objectives:

To develop an understanding of:

a. The physical characteristics of the healthy animal
b. Characteristics that indicate abnormal health and behavior of animals
c. Proper management steps in preventing and controlling livestock diseases and parasites
d. Desirable livestock health conditions

To develop an ability to:

a. Recognize normal and abnormal livestock and livestock conditions
b. Determine when an animal needs medical attention

References:

a. Animal Health, Ch. 2, pp. 7-12
ANIMAL HEALTH

Days 3 and 4

3. PROBLEM AREA: Causes, Symptoms, Prevention, and Control of Major Cattle Diseases

Objectives:

To develop an understanding of:

a. The types of cattle diseases
b. Causes, symptoms, treatment, and prevention of the following diseases of cattle:

1. Brucellosis
2. Shipping Fever Complex
3. Foot Rot
4. Pinkeye
5. Ringworm
6. Mastitis
7. Leptospirosis
8. Calf Scours
9. Warts
10. Pneumonia
11. Milk Fever
12. Ketosis
13. Bloat

To develop an ability to recognize conditions of cattle that warrant calling a veterinarian

References:

a. Animal Health, Ch. 3, pp. 13-17; Ch. 4, pp. 18-29

Day 5

4. PROBLEM AREA: Life Cycles, Symptoms, Prevention, and Control of Cattle Parasites

Objectives:

To develop an understanding of:

a. The types of cattle parasites
b. The life cycles, symptoms, prevention, and control of major cattle parasites

1. Screw worms
2. Grubs
3. Flies
4. Stomach worms
5. Lice

To develop an ability to:

a. Recognize parasite infestations in cattle
b. Treat cattle parasites
c. Control cattle parasites
Day 5 (continued)

References:

a. Animal Health, Ch. 7, pp. 49-52; Ch. 8, pp. 53-58

Days 6 and 7

5. PROBLEM AREA: Causes, Symptoms, Prevention, and Control of Major Sheep Diseases

Objectives:

To develop an understanding of:

a. The types of sheep diseases
b. Causes, symptoms, treatment, and prevention of the following diseases of sheep:

1. Foot Rot 3. Sore Mouth 5. Lambing Paralysis

To develop an ability to recognize disease conditions in sheep that warrant calling a veterinarian

References:

a. Animal Health, Ch. 3, pp. 13-17; Ch. 5, pp. 30-35

Day 8

6. PROBLEM AREA: Life Cycles, Symptoms, Prevention, and Control of Major Sheep Parasites

Objectives:

To develop an understanding of:

a. The types of sheep parasites
b. The life cycles, symptoms, prevention, and control of the following major sheep parasites:

1. Screw Worm 5. Stomach Worm
2. Lice 6. Tapeworms
3. Ticks 7. Coccidiosis
4. Scabbies
Day 8 (continued)

Objectives: (continued)

To develop an ability to:

a. Recognize animal parasite infestations in sheep
b. Treat sheep parasites
c. Control sheep parasites

References:

a. Animal Health, Ch. 7, pp. 49-50; Ch. 9, pp. 59-66

Days 9 and 10

7. PROBLEM AREA: Causes, Symptoms, Prevention, and Control of Major Swine Diseases

Objectives:

To develop an understanding of:

a. The types of swine diseases
b. Causes, symptoms, treatment, and prevention of the following diseases of swine:

1. Cholera 5. Brucellosis
2. Erysipelas 6. Flu
3. Chronic Mycoplasmal 7. TGE
   Pneumonia 8. Leptospirosis
4. Atrophic Rhinitis 9. MMA

To develop an ability to recognize disease conditions in swine that warrant calling a veterinarian

References:

a. Animal Health, Ch. 3, pp. 13-17; Ch. 6, pp. 36-48
Day 11

8. PROBLEM AREA: Life Cycles, Prevention and Control of Major Swine Parasites

Objectives:

To develop an understanding of:

a. The types of swine parasites
b. The life cycles, symptoms, prevention, and control of the following major swine parasites:
   1. Ascarids
   2. Lungworms
   3. Mange
   4. Lice

To develop an ability to:

a. Recognize parasite infestations in swine
b. Treat swine parasites
c. Control swine parasites

References:

a. Animal Health, Ch. 7, pp. 49-50; Ch. 10, pp. 67-71

Day 12

9. PROBLEM AREA: Planning a General Livestock Health Program

Objectives:

To develop an understanding of:

a. The role of sanitation in an animal health program
b. The importance of preventive medicine

To develop an ability to:

a. Plan general livestock health programs
b. Evaluate current livestock health programs

References:

a. Animal Health, Ch. 11, pp. 73-74
b. Animal Health Handbook, pp. 6-7
10. PROBLEM AREA: Occupational Roles of the Veterinarian, Farmer and Other Animal Health Workers

Objectives:

To develop an understanding of:

a. The occupational roles for veterinarians, farmers, and other animal health workers
b. Opportunities for employment in the field of animal health

To develop an ability to care for sick animals

References:

a. Animal Health, Ch. 12, pp. 81-87
b. Animal Health Handbook, pp. 36-38

Day 14

11. PROBLEM AREA: Summary and review

Objectives:

To review previously covered material and answer student questions

References:

a. All previous assignments
COMMERCIAL FERTILIZERS
Problem Area Outline by Days

Day

1   Influence of Fertilizers on Farming
2 & 3 Essential Plant Food Elements and Their Function in Plant Growth
4   Hunger Signs of Crops
5 & 6 Taking a Soil Sample
7   Liming to Correct Soil Acidity
8 & 9 Understanding the Soil Test Report
10  Determining the Amount of Nutrients Available in the Soil
11  Determining Fertilizer Application Rates
12 & 13 Selecting Fertilizer Materials to Fill Nutrient Needs
14  Summary and Review
15  Post-Test
COMMERCIAL FERTILIZERS

Behavioral Objectives: (understandings and abilities)

Understanding of: 1) The influence of fertilizers on farming

2) The essential plant food elements and their function in plant growth

3) The effect of soil acidity on crop production

Ability to: 1) Recognize hunger signs of crops

2) Take a soil sample

3) Correct soil acidity by liming

4) Interpret the soil test report

5) Determine the amount of nutrients available in the soil

6) Determine fertilizer application rates

7) Select fertilizer materials to fulfill nutrient needs
Day 1

1. PROBLEM AREA: Influence of Fertilizers on Farming

Objectives:

To develop an understanding of:

a. The benefits to be gained from fertilizing
b. The increase in fertilizer use in Iowa and the local community
c. The need to maintain soil fertility
d. How plant food is lost

References:

a. Our Land and Its Care, pp. 2-21, 62-65, 67-68
b. Fertilizer Use in Iowa Reaches Record Level, Iowa Farm Service Publication No. 1231

Days 2 and 3

2. PROBLEM AREA: Essential Plant Food Elements and Their Function in Plant Growth

Objectives:

To develop an understanding of:

a. The essential plant food elements and their function in plant growth

   (1) Primary nutrients and their function in plant growth

   (a) The function of nitrogen in plant growth
   (b) The function of phosphorus in plant growth
   (c) The function of potassium in plant growth

   (2) Secondary plant nutrients and their function in plant growth

   (a) The function of calcium in plant growth
   (b) The function of magnesium in plant growth
   (c) The function of sulfur in plant growth

   (3) Micro plant nutrients and their function in plant growth

References:

a. Our Land and Its Care, pp. 23, 26-34
b. Growth and Nutrient Uptake by Corn, Pamphlet 277
Day 4

3. PROBLEM AREA: Hunger Signs of Crops

Objectives:

To develop an understanding of nutrient requirements of various crops

To develop an ability to:

a. Recognize primary plant food deficiencies
b. Recognize secondary plant food deficiencies
c. Recognize micro plant food deficiencies

References:

a. Our Land and Its Care, pp. 36-39
b. Be Your Own Corn Doctor -- NPK Bulletin

Days 5 and 6

4. PROBLEM AREA: Taking a Soil Sample

Objectives:

To develop an understanding of:

a. The effect of soil types on soil fertility
b. The effect of cropping sequence on soil fertility
c. Where soil samples may be analyzed

To develop an ability to:

a. Take a uniform and representative soil sample
b. Correctly fill out the soil and cropping information sheet

References:

a. How to take a Soil Sample, NPK Leaflet
b. Our Land and Its Care, p. 42
c. Soil and cropping Information Sheet, ST-8
Day 7

5. PROBLEM AREA: Liming to Correct Soil Acidity

Objectives:

To develop an understanding of:

a. What is soil acidity and how it is measured
b. The optimum pH range for farm crops
c. The effective calcium carbonate equivalent (ECCE) of various liming materials

To develop an ability to:

a. Correct soil acidity
b. Select proper liming materials
c. Determine proper liming rates

References:

a. Our Land and Its Care, pp. 18-19
b. Understanding Your Soil Test Report, Pamphlet 429, p. 5
c. Your Limestone Recommendation, (St-2)

Days 8 and 9

6. PROBLEM AREA: Understanding the Soil Test Report

Objectives:

To develop an understanding of:

a. What a soil test measures
b. How the amount of N, P, and K are determined by a soil test

to develop the ability to:

a. Select the correct soil test nutrient recommendation
b. Adjust soil test recommendations to specific crop yields

References:

a. Understanding Your Soil Test Report, Pamphlet 429, pp. 1-4
b. Soil Test Report, (ST-9)
Day 10

7. PROBLEM AREA: Determining the Amount of Nutrients Available in the Soil

Objectives:

To develop the ability to estimate:

a. The nitrogen credits for 1st or 2nd corn following a legume
b. The amount of carryover available from fertilizer applied the previous year
c. The amount of nutrients supplied from manure that has been applied since soil was sampled

References:

a. Understanding Your Soil Test Report, Pamphlet 429, pp. 1-4
b. Modern Farmers Need to be Accountants in the Cornfield, Iowa Farm Service Publication No. 1049

Day 11

8. PROBLEM AREA: Determining Fertilizer Application Rates

Objectives:

To develop an understanding of the factors that affect fertilizer application rates:

a. Nutrient requirements from soil test report
b. Nutrients available in the soil

To develop the ability to:

a. Calculate proper fertilizer application rates
b. Convert P₂O₅ to Phosphorous
c. Convert K₂O₅ to Potassium

References:

a. Understanding Your Soil Test Report, Pamphlet 429, pp. 2-4
b. Better Names for "Phosphate" and "Potash", Iowa Farm Service Publication No. 1050
9. **PROBLEM AREA: Selecting Fertilizer Materials to Fill Nutrient Needs**

Objectives:

To develop an understanding of the major sources of fertilizer materials available in the community.

To develop the ability to:

a. Change nutrient recommendations into amounts of a fertilizer grade
b. Select fertilizer materials that will fulfill nutrient needs

References:

a. *Understanding Your Soil Test Report*, Pamphlet 429, pp. 5-6
b. *Our Land and Its Care*, pp. 44-45, 56, 57

10. **PROBLEM AREA: Review and Summary**

Objectives:

To review previous material covered in this partial unit.

References:

a. Those cited for each of the problem areas studied
SMALL GASOLINE ENGINES
### SMALL GASOLINE ENGINES

#### Problem Area Outline by Days

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SMALL GASOLINE ENGINES

Behavioral Objectives: (understanding and abilities)

Understanding of: 1) Basic principles of small engine operation
2) Difference between two and four-stroke cycle engines
3) Function of piston, rings, crankshaft, camshaft, and valves as related to compression
4) Function of carburetor and component parts
5) Function of small engine ignition systems and component parts
6) Measuring devices used on small engines

Ability to: 1) Identify basic small engine components
2) Perform general maintenance on a small gasoline engine
3) Trouble shoot a small gasoline engine
4) Use various measuring and testing devices
5) Use a service manual
Day 1

1. PROBLEM AREA: Engine principles – Two and Four-Cycle Engines

Objectives:

To develop an understanding of:

a. The intake stroke, compression stroke, power stroke and exhaust stroke in an engine
b. The principles of operation of a two and four-cycle engine

References:

a. General Theories of Operation, Briggs & Stratton, Corp., pp. 2-3

Day 2

2. PROBLEM AREA: Nomenclature – Compression Factors

Objectives:

To develop an understanding of piston displacement and compression ratio as related to horsepower in a small engine

To develop an ability to:

a. Identify main parts of small engines
b. Calculate piston displacement and compression ratio

References:

a. General Theories of Operation, Briggs & Stratton, lorp., p. 4
b. Small Gasoline Engines Student Handbook, Penn. State Univ. p. 4
Days 3 and 4

3. PROBLEM AREA: Valves, Valve Timing and Camshafts

Objectives:

To develop an understanding of:

a. Valve operating conditions
b. Valve failures

to develop an ability to:

a. Identify parts of valve train
b. Determine usable valve margin and valve seat tolerances

References:

a. General Theories of Operation, Briggs & Stratton, Corp., pp. 4-7
b. Small Gasoline Engines Student Handbook, Penn. State Univ., pp. 5-7

Day 5

4. PROBLEM AREA: Ring Adjustment

Objectives:

To develop an understanding of:

a. The purpose of rings
b. Ring types and each's function

To develop an ability to:

a. Measure various ring clearances
b. Identify types of rings

References:

5. PROBLEM AREA: Measuring Devices

Objectives:

To develop an understanding of various measuring devices

To develop an ability to read micrometer and other measuring devices

References:


Days 7, 8, and 9

6. PROBLEM AREA: Carburetion, Carburetor Types and Adjustment, and Governors

Objectives:

To develop an understanding of:

a. Principles of operation of carburetors
b. How gaseous mixture is controlled within the carburetor
c. Governor types and operation

To develop an ability to:

a. Identify basic parts of the carburetor
b. Explain operation of various types of carburetors
c. Governor types and operation

References:

a. General Theories of Operation, Briggs & Stratton, Corp., pp 8-13, 20-21
Day 10

7. PROBLEM AREA: Air Cleaners

Objectives:
To develop an understanding of:

a. The importance of an air cleaner
b. The different types and principles of operations of air cleaners

to develop an ability to service various types of air cleaners

References:

a. General Theories of Operation, Briggs & Stratton, Corp., p. 14

Days 11 and 12

8. PROBLEM AREA: Ignition and the Magneto Cycle

Objectives:
To develop an understanding of:

a. The purpose of ignition systems
b. Principles of magneto-ignition systems
c. A complete magneto cycle

To develop an ability to:

a. Identify parts of magneto-ignition system

References:

a. General Theories of Operation, Briggs & Stratton, Corp., pp. 15-18
Day 13

9. PROBLEM AREA: Preventative Maintenance

Objectives:

To develop an understanding of:

a. The importance of maintenance on small gasoline engines
b. Why clean, fresh, regular gasoline should be used in small gasoline engines

To develop an ability to:

a. Determine and analyze engine problem by observation of spark plug
b. Properly service engine at proper time (spark plugs, breaker points, air cleaners and oil)
c. Properly prepare small gasoline engine for storage
d. Follow a service and maintenance schedule

Reference:


Day 14

10. PROBLEM AREA: Trouble Shooting and Review

Objectives:

To develop an understanding of procedures used in trouble shooting

To develop an ability to trouble shoot an engine

Reference:

a. Small Gasoline Engines Student Handbook, Penn. State Univ., pp. 64-65
Problem Area Outline by Days

Day
1 Introduction to Credit, "Problem"
2 "Problem", Application for Loan (Financial Statement)
3 Budgeting Principles
4 Budgeting the Problem
5 Budgeting, Complete Application for Loan
6 Types of Loans
7 Sources of Credit - Short Term & Intermediate
8 Sources of Credit - Long Term - (Land)
9 Interest Rates and Loan Costs
10 Collateral - Short and Intermediate Term
11 Collateral - Long Term
12 Credit Instruments - Short Term - Intermediate
13 Credit Instruments - Long Term - (Land)
14 Summary and Review
15 Post-Test
Behavioral Objectives: (understandings and abilities)

Understanding of: 1) The importance of credit in agriculture

2) Types of credit used for specific purposes

3) The sources of credit

4) Interest rates and loan costs

5) Credit instruments

6) The criteria used in granting farm credit

7) The criteria used to evaluate a credit source

8) The career potentials in farm credit

Ability to: 1) Use credit to increase farm income

2) Budget income and expenses to determine credit needs

3) Select correct credit source based on financial position and needs

4) Calculate the cost of various types of loans

5) Use credit instruments

6) Prepare a financial statement

7) Plan a repayment schedule
Days 1 and 2

1. PROBLEM AREA: The Problem

Objectives:

To develop an understanding of the need for credit

To develop an ability to:

a. Analyze a farming situation and determine the financial position of the applicant
b. Prepare a financial statement

References and Materials:

a. Financing Farm & Ranch Activities, pp. 8-11, 15
b. The Problem
c. Financial statement form

Days 3, 4, & 5

2. PROBLEM AREA: Budgeting

Objectives:

To develop an understanding of budgeting principles

To develop an ability to budget a farm credit problem

References and Materials:

a. Financing Farm & Ranch Activities, pp. 34, 36-37
b. The Problem
c. Budget Worksheet
d. Application for loan
Day 6

3. PROBLEM AREA: Types of Loans (based on length of loan in years)

Objectives:

To develop an understanding of:

a. The three types of loans normally available
b. Disadvantages and advantages of various types of credit

To develop an ability to classify credit requirements into loan types

References and Materials:

a. Financing Farm & Ranch Activities, pp. 12-13

Days 7 & 8

4. PROBLEM AREA: Sources of Credit

Objectives:

To develop an understanding of:

a. The sources of credit
b. An understanding of the criteria used to evaluate a credit source

To develop an ability to determine the type of credit source to use

References and Materials:

a. Financing Farm & Ranch Activities, pp. 32-41, 50-66
Day 9

5. PROBLEM AREA: Interest Rates and Loan Costs

Objectives:

To develop an ability to calculate the costs of various types of loans

References and Materials:

a. Financing Farm & Ranch Activities, pp. 18-19, 47-50

Days 10 & 11

6. PROBLEM AREA: Collateral

Objectives:

To develop an understanding of the criteria used in granting farm credit

To develop an ability to determine loan value of different types of collateral

References and Materials:

a. Financing Farm & Ranch Activities, pp. 14-17, 44-47
Days 12 and 13

7. PROBLEM AREA: Credit Instruments

Objectives:

To develop an understanding of the types of credit instruments

To develop an ability to use credit instruments

References and Materials:

a. Financing Farm & Ranch Activities, pp. 19-29, 35-39
b. Blank credit instrument forms

Day 14

8. PROBLEM AREA: Summary

Objectives:

To develop an understanding of the career potentials in farm credit work

To review previous problem area objectives

References and Materials:

a. Financing Farm & Ranch Activities
b. The Problem
c. Budget Worksheet
d. Application for loan
e. Credit instruments
APPENDIX B - TRANSPARENCY TITLES BY SUBJECT MATTER
Transparency Titles for Animal Health Unit

1. Animal health cover
2. Maintaining animal health (general)
3. Maintaining animal health (specific)
4. Cattle parasites introduction
5. Cattle screwworm life cycle
6. Cattle screwworm control
7. Cattle grub life cycle
8. Cattle grub control
9. Cattle flies life cycle
10. Control of cattle flies
11. Cattle stomach worms life cycle
12. Cattle stomach worms control
13. Life cycle of cattle lice
14. Control of cattle lice
15. Hog cholera
16. Erysipelas
17. Pneumonia
18. Atrophic rhinitis
19. Brucellosis
20. Flu
21. T.G.E. transmissible gastroenteritis
22. Leptospirosis
23. MMA syndrome
24. Life history of a roundworm of swine
25. Life history of a lungworm of swine
26. Livestock health program check list
Transparency Titles for Commercial Fertilizer Unit

1. Commercial fertilizer cover
2. Questions about fertilizers
3. Corn yields Iowa
4. Benefits gained from fertilizing
5. Table of cost/returns
6. Graph of cost/returns
7. How plant food is lost
8. Nutrients in fertilizers
9. Nitrogen
10. Phosphorus
11. Potassium
12. How to take a soil sample
13. Soil and cropping information sheet
14. pH requirements of crops
15. pH scale
16. Soil test report
17. Laboratory analysis worksheet
18. Lime requirement worksheet
19. Nutrient recommendation worksheet
20. Nutrient sources (credits and debits)
21. Worksheet instructions
22. Selecting fertilizer grade
23. How much fertilizer?
24. Fertilizer terms
25. Clarion-Nicollet-Webster soil association area
26. Tama-Muscatine soil association area
27. Adair-Seymour-Edina soil association area
28. Marshall soil association area
Transparency Titles for Small Gasoline Engine Unit

1. Small gasoline engine cover
2. Internal combustion engine production graph
3. Major markets for air-cooled engines graph
4. Operation of the two-stroke cycle engine
5. Operation of the four-stroke cycle engine
6. Comparison of two- and four-cycle engines
7. Piston displacement
8. Compression ratio
9. Valve operating conditions
10. Typical valve timing events
11. Valve parts named
12. Valve margin dimensions
13. Installing rings on the piston
14. Checking ring end gap
15. Measuring devices
16. Parts of the micrometer
17. Micrometer readings
18. Micrometer readings worksheet
19. Fuel supply systems
20. Parts of a float carburetor
21. The high speed system
22. The idle system
23. The choke system
24. Carburetor adjustment
25. Oil bath air cleaner
26. Parts of magneto ignition system
27. Function of a magneto
28. The condenser
29. Functions of condenser
30. The coil
31. Magneto ignition operation I
32. Magneto ignition operation II
33. Magneto ignition operation III
34. Hot and cold spark plugs
35. Maintenance schedule
36. Regular small engine maintenance (air cleaner)
37. Use high quality engine oil
38. Regular small engine maintenance (oil)
39. Regular small engine maintenance (spark plug)
40. Winter storage of small engines
41. Small engine maintenance log
Transparency Titles for Farm Credit Unit

1. Farm credit cover
2. Assets per farm graph
3. Characteristics of a business producing agricultural products
4. Planned use of money
5. Reasons for borrowing
6. Financial statement
7. Budget worksheet
8. Financial statement worksheet
9. Three types of credit (loans)
10. Types of credit (overlay)
11. Consumer credit or installment buying
12. Consumer credit
13. Production credit
14. What a borrower looks for in a lender
15. Cost of the loan
16. Computing true rate of interest
17. Cost of credit problem
18. Graph of loan payable
19. Graph of equal payment plan
20. Graph of decreasing payment
21. What a lender looks for in a borrower (1)
22. What a lender looks for in a borrower (2)
23. Credit instruments
24. Contracts
25. Payment terms
26. Graph of farm prices, land values and foreclosures
27. Check writing procedures
28. Basic credit rules