ABSTRACT OF THESIS

EFFECTIVENESS OF PROJECTED VISUAL AIDS IN TEACHING A NUTRITION UNIT

Submitted by

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ABSTRACT

Background of the problem

The use of projected visual aids in education has been the subject of considerable discussion for many years. From the time of the first controlled experiment on the effectiveness of visual aids, until the present time, many studies have been made on the subject. Most of these studies have indicated that projected visual aids are effective in most fields of education in increasing cooperation and contributions to class discussions, improving gain and retention of learning, and increasing voluntary reading of supplementary material.

There has been some question in the minds of home economics teachers as to the value of using projected visual aids. The questionable quality of many films now available and the difficulties of securing and using films have discouraged many teachers. Other teachers have recognized these difficulties but have felt that films were effective to some degree and have attempted to use them. The experiment on the effectiveness of projected visual aids in a nutrition unit, reported herein, was conducted in an attempt to contribute to the solution of this problem facing home economics teachers.

Problem

What effect has the use of projected visual aids on pupil learning in a short nutrition unit in Royster Junior High School, Chanute, Kansas?

Problem analysis.--1. What gain in pupil learning results from teaching by the discussion method using required reference reading but no projected visual aids?

2. What gain in pupil learning results from teaching by the discussion method using projected visual aids but no required reference reading?

3. How do these gains in pupil learning compare?

Delimitation.--This study was limited to the girls in the ninth-grade home economics classes at Royster Junior High School, Chanute, Kansas, during the fall semesters of 1946 and 1947.

Definition of terms.--1. In this study, the term, projected visual aids, includes sound and silent films and materials which may be used in an opaque projector.

2. In this study, learning is measured only in terms of acquisition of information and not in terms of modification of attitudes, habit formation, or interest development.

Selection of groups

In order to discover the extent to which projected visual aids are effective in teaching a nutrition unit, an experiment involving control and experimental groups was performed.

The experiment was conducted with the ninth-grade home economics classes at Royster Junior High School, Chanute, Kansas, during the fall semesters of 1946 and 1947. In 1946, there were two experimental classes and one control class; in 1947, there were only two classes, one a control class and the other an experimental class. From these classes, 30 girls were selected for the control group and 30 for the experimental group. These cases were so selected in pairs of similar I.Q., chronological age, and pre-test scores that the resulting groups were comparable in terms of the means and standard deviations of these factors. The critical ratios for the differences between control and experimental groups in mean and variability of these three factors were not significant, the highest t value being .92.

Selection of projected visual aids

Film catalogs from all film distributors whose addresses could be obtained were consulted to compile a list of the films which might be of value for use in the nutrition unit. Twenty-two films were selected from catalog descriptions and procured for previewing by the investigator.

Each film was previewed at least two times by the teacher before the final selection was made. Choice of films was based upon the following basic evaluation questions suggested by Fern and Robbins (17:63-65):

1. Is the film content correlated with the learning situation?

2. Is the material accurate?

3. Is the instructional technique a "built-in" feature?

4. Is the technical quality of the film satisfactory?

The selection of the films to be used proved to be difficult because of the very limited number of films which were of good quality as judged by these criteria. Five films which most nearly met those standards were chosen. They were:

Proof of the Pudding

A B C of Food

Food Makes a Difference

Vitamin B_1

Something You Didn't Eat

The opaque projector sequences used were planned and constructed with the objectives and subject matter of the unit in mind and consideration was given to the possible interest in the material and the ease of understanding.

The test

Test items were formulated by the teacher conducting the study after she had outlined the objectives of the unit and the subject matter to be covered to attain these objectives. Test items were then submitted to a seminar class in educational research at Colorado Agricultural and Mechanical College in the summer of 1946, to obtain suggestions from the home economics teachers enrolled in that course. Their criticisms were considered in omitting some items and reconstructing others. Only one form of the test was made, as the same test was used for pre-testing and delayed re-testing.

After the experiment had been completed, the validity of the individual test items was checked against the validity of the total test. This was done by dividing the 89 re-test papers into thirds according to the rank of the test scores. The correct responses on the upper and lower thirds of the papers were tallied and compared. Four items which were negative discriminators were discarded in the final scoring of the pre-test and re-test on the basis of the results of this analysis.

The reliability of the test was then determined by the split-halves method in which the scores on the odd and even items are correlated by the Pearson product-moment formula and then corrected by the Spearman-Brown formula. The coefficient of reliability after correction was +.79,

which indicates a fair degree of reliability for measuring group differences.

Methods of teaching the unit

The control group was taught the unit in nutrition by the discussion method using required reference reading, but using no projected visual aids. The experimental group was taught the same unit by the discussion method including the use of projected visual aids, but without reference reading being required. The teaching of the unit included eight daily class periods, averaging 55 minutes each.

Findings

Gain in learning in the control group.--For the control group the mean re-test score was 10.33 points higher than the mean pre-test score. The variability on the re-test was higher than the variability of the scores on the pre-test. The t value obtained for the difference between the means indicated a high degree of significance (3.48). The t value obtained for the difference in variability indicated a fair degree of significance (2.50).

Gain in learning in the experimental group.--An analysis of the scores of the experimental group on the pre-test and re-test showed the gain in pupil learning in the experimental group to average 12.3. Similarly the variability of the scores on the re-test was higher than that on the pre-test. The t value of the superiority of the mean

scores on the re-test compared with that on the pre-test was 7.07, disclosing a high degree of significance. The greater variability of scores on the re-test was not significant, having a t value of .99.

Comparison of gains in learning in control and experimental groups.--The mean gain of the experimental group was higher than the mean gain of the control group, but the variability was greater for the control group. Determination of the t value for the difference between experimental and control groups in gain and variability of gain revealed that the difference in gain was not significant (1.45), but that the difference in variability was significant above the five per cent level (2.59).

Implications

In this study, projected visual aids were found to be effective in increasing pupil knowledge of nutrition, but that effectiveness was not significantly superior to the effectiveness of the control method which utilized required reference reading and no projected visual aids. The implication growing out of this study for home economics teachers is that at the present time, they may feel free to select, on the basis of their individual school situations, either projected visual aids or required reference readings as devices for teaching nutrition, because no significant difference was found between the effectiveness of these methods of increasing pupil learning of nutrition information.

Suggestions for further study

While this experiment was being conducted, various problems were encountered which indicate the possibilities of further study of the effectiveness of projected visual aids in teaching nutrition:

1. In this study two types of projected visual aids were used, films and opaque projector materials. Studies comparing the effectiveness of each of these types of aids might reveal a difference in the appropriateness of these aids for teaching nutrition.

2. Repetition of this experiment using films which were especially designed for the unit instead of using films now available might result in different conclusions. Such an experiment would give a more direct comparison between this experiment and earlier ones which used films especially designed. This type of experiment would also give a better comparison between the control and experimental methods because the quality and subject matter could be made to be more nearly comparable to the quality and subject matter of the reference material used.

3. Since the real test of the success of a nutrition unit lies in the development of better food habits of the students, some value should be

inherent in an experiment which compares the effectiveness of various methods of instruction in terms of habit formation, attitude modification, and interest development. Difficulties in measuring these three factors would be encountered, but if such measuring devices could be constructed, an experiment of this type should yield valuable information.

T H E S I S

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Submitted by

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In partial fulfillment of the requirements

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COLORADO AGRICULTURAL AND MECHANICAL COLLEGE

July 28 1948

I HEREBY RECOMMEND THAT THE THESIS PREPARED UNDER MY SUPERVISION BY VIRGINIA LEE ENDLY

ENTITLED EFFECTIVENESS OF PROJECTED VISUAL AIDS IN TEACHING A NUTRITION UNIT

BE ACCEPTED AS FULFILLING THIS PART OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF EDUCATION

MAJORING IN HOME ECONOMICS EDUCATION

CREDITS 3

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Permission to publish this thesis or any part of it must be obtained from the Dean of the Graduate School.

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Chapter I

INTRODUCTION

The use of projected visual aids in education has been the subject of considerable discussion for many years. Before World War II, visual aids were being used to some extent, but they did not occupy a particularly prominent place in most teaching techniques. The recent reports of successful visual instruction programs for the armed forces during World War II have resulted in a more careful scrutiny of the visual aids programs in the various departments of the schools.

Home economics teachers vary in their attitudes toward the use of projected visual aids. Some teachers feel that many home economics films are of questionable quality and that therefore it is better not to use films at all. Other teachers recognize the defects in films available at the present time, but consider them effective to some extent and attempt to use them in the best possible way.

One means of analyzing the problem of the use of projected visual aids in home economics classes is to conduct studies to determine the effectiveness of the films now available in teaching certain areas of home economics.

This study of the effectiveness of available projected visual aids in a unit on nutrition was undertaken for that purpose.

Problem

What effect has the use of projected visual aids on pupil learning in a short nutrition unit in Royster Junior High School, Chanute, Kansas?

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Chapter II

REVIEW OF LITERATURE

A survey of the literature on the effectiveness of visual aids in home economics revealed that little research has been recorded on that subject. However, the question of the effectiveness of projected visual aids in other fields of education has been the subject of considerable research. A review of that material presented a background for the study of the effectiveness of visual aids in home economics.

Introduction of projected visual aids into education, 1909-1918

Instructional agencies, other than public schools, were the first to use projected visual aids. In 1909, Somerfeldt (35) discussed the difficulty of training people for the manufacturing trades and stated:

> The moving picture machine offers a partial solution of the problem of imparting individual instruction in the trades. Next to actually doing the thing or seeing a skilled workman do it, is the seeing of it done in a series of moving pictures. (35:76)

By 1911, health and welfare agencies were using movies as a method of educating the public. In that year, Best (6) stated that he felt that the use of movies in

health education in the Winnipeg recreation program had been a success.

By 1912, reports were being made of a moving picture experiment conducted by Edison in a school in East Orange, New Jersey. The experiment evidently involved only one type of group and was not a comparison between groups which were taught with films and those which were taught without films, because no description of groups or procedures was included in the accounts of the experiment. However, Edison's comments on it were worth considering. Inglis (23) reported that Edison said:

> Teach the children everything from mathematics to morality by little dramas acted out before the camera and reproduced in the schoolroom at very low cost. Sort o' swing the education in on them so attractively that they'll want to go to school. You'll have to lick 'em to keep 'em away. (23:8)

Benson (5) also quoted Edison as saying that although moving pictures would not take the place of all school books, they would replace most of the books used below the ninth grade.

These predictions by Edison brought on an avalanche of comment from other educators. The Literary Digest for October 4, 1913, (14) had an account of the suggestions John Dewey made after a visit to Edison's experimental school. He warned teachers of some of the difficulties which lay ahead in visual instruction. First, there was the expenditure necessary and the reluctance of school boards to appropriate the money. Second, Dewey felt that

seeing films is a vicarious experience which is profitable in instances in which the actual experience cannot be had, but that it must not be used to replace those experiences. His general comment on visual aids was favorable. He stated:

> Despite all that has been indicated, there can be no doubt that Mr. Edison is developing an educational instrument that is destined to play a new and most important part in school work. (14:577)

Reports by various educators indicated that from the time of Edison's experiment in 1912, until the beginning of controlled experimentation on the subject in 1918, the concept of films as a teaching device progressed from the stage of being a novelty in the field of education to the stage of being considered a teaching aid worthy of careful analysis. Ives (24) said that although motion pictures were becoming an important factor in education, there were problems of cost, scarcity of educational films, and educators' unawareness of the possibilities of projected visual instruction. Lanier (28) suggested that film producers and instructors should work together on the films so that real educational value would be possible. Averill (3) commented that there was a great need for an investigation and report of the value of motion pictures. Abrams (1) was concerned with the possibility that visual instruction might become merely an end in itself instead of an aid to instruction. Stitt(37) suggested that the next step would

be away from mere amazement at the wonders of reproducing images on the screen and toward the use of films as a motivator of pupil activity. Mason (29) critized the production of films of doubtful value and the poor method of visual instruction existing in classrooms at that time.

Few experiments were actually conducted before 1918, to determine the value of projected visual aids. Therefore, it was necessary to use the less scientific material reviewed above to evaluate the status of projected visual aids in that period.

Educational research on the effectiveness of projected visual aids, 1918-1948

Kinder (25) reported that there were 236 research studies in visual education for the period 1918-1937 alone. Since that time, many other experiments have been conducted on that subject. Only representative studies have been included in this review of literature.

The first controlled experiment reported was performed in 1918, when Sumstine (38) wrote a comparative study on first, second, third, and fourth grade pupils using a film, Farming with DuPont Dynamite. The purpose of the study was to determine the relative effectiveness, as measured by a memory test, of visual, auditory, and auditory-visual instruction. One conclusion made was that: "Mental images received thru the eye seemed to be better

remembered than images thru the eye and ear or thru the ears." (38:238)

A group of experiments was conducted in the early 1920's under the direction of Freeman (19). These were made possible by a grant to the University of Chicago from the educational committee of the Commonwealth Fund in April of 1922. Freeman concluded that in general, teaching with visual aids was superior to mere verbal instruction except in instances in which the films used were not appropriate.

In 1925, Skinner and Rich (34) conducted an experiment on the effectiveness of visual aids in seventh-grade geography. They found that the difference in learning due to projected visual aids was slight, but that interest and retention of learning were increased through the use of visual aids.

In 1928, an experimental study of a visual method in Latin instruction was conducted by Fenton and Hill (16). They said: "Data insufficient to make any conclusion other than the statement that the experimental group was far more cooperative." (16:678)

The National Education Association and the Eastman Kodak Company jointly sponsored a study conducted by Wood and Freeman (43) in 1928. The study included 11,000 pupils divided into control and experimental groups in sixth-grade geography and junior high science. They reported that the experimental groups with which visual

aids were used learned more in both subjects tested than the control groups with which no projected visual aids were used. In summarizing the Wood-Freeman experiments, Dessez (11) felt it important to point out that all of the films used had been produced according to scenarios written by experienced educators especially for use in the classrooms.

In 1929, Knowlton and Tilton (26) conducted a study on the effectiveness of visual aids in teaching seventh-grade social studies classes in New Haven, Connecticut. They found that the use of movies contributed to gain and retention of learning, increased the students' contributions to class discussion, and increased voluntary reading of supplementary material.

The findings from three other experiments contemporary with the Wood-Freeman and Knowlton-Tilton studies were summarized by Koon (27). He pointed out that Weber (41) found that the use of films increased learning 25 per cent; that Rulon (12) found that the use of films increased learning 20.5 per cent; and that Arnspiger (2) stated that films made "marked and lasting contributions." (27:52) These studies were conducted in the fields of geography, general science, natural science, and music.

An experiment conducted by Wittich and Fowlkes (42), in 1946, contributed additional evidence of the effectiveness of films. According to them the validity of

sound and silent films used in classrooms depended upon presentation of information which was specifically adapted to the techniques of sound and motion and which could not be better presented by another medium.

Dent (10) in his discussion of the status of visual aids, in 1946, summarized educational research on that subject by saying that: "In the school field, experimental evidence has favored the use of audio-visual aids in practically every controlled experiment." (10:5) He added that motion pictures should be used only when motion is necessary to give a clear impression.

Visual education in the armed forces of World War II

Although much publicity has been given to statements of the effectiveness of projected visual aids in instructing members of the armed forces, a survey of the literature revealed only one report of an actual experiment substantiating those statements. Gibson (20) recorded an experiment in which three methods of instruction in position firing in gunnery classes for aviation cadets were compared. The film method increased learning to a significant degree more than the manual or lecture methods increased learning. The critical ratio for the film method compared with the manual method was 5.13. The critical ratio for the film method compared with the lecture method was 5.04. He also found a significant difference in favor

of the film method in the retention of learning.

In 1945, Hosp (22) described a two-year investigation of visual instruction in the armed forces' training program which was to be made by the American Council on Education and directed by Dr. Alonzo G. Grace, but the results of that study were not yet (1948) available.

Many opinions have been given on the success of visual education in military training. Quinn's (33) opinion is representative of these. He said that: "It is conservatively estimated that students acquire information 30% faster and retain knowledge gained 50% longer thru the use of such training devices." (33:43)

Educators have studied the part visual aids have played in the armed forces and the possible implications for the schools. Deer (9) cautioned educators about carelessly interpreting the Army's successful visual aids program into terms of public school education. He stated that: "It is specifically a training program for adults and not an adequate educational design for guiding the growth of children." (9:107)

Elliott (15) pointed out some of the reasons for the success of the use of visual aids in military training. He stated that the Army picked the best of educational procedures; the films were designed to teach specific things; the students had had a background for that type of instruction in the public schools; there was a motivation;

the aims were specific and limited.

Dale (7) added to that list of reasons by stating that there was a better set of instructors in the Army; a wide variety of teaching tools was used; and classes were small and individualized.

Educators have been eager to have careful evaluations made of the visual education program of the armed forces. Stenius (36) suggested that such evaluations should precede analysis of the status of visual instruction. Dent (10) also commented that such reports were needed, but stated that it might be several years before adequate, objective accounts of visual instruction in the armed forces would be available.

Status of projected visual education in the field of home economics

The earliest reference to the use of projected visual aids in home economics discovered was in 1912, when the Bureau of Education of the Department of the Interior (40) listed "domestic science" as one of the school subjects for which it had lantern slides.

In 1915, the film library of the University of Minnesota (31) listed a home economics film, A Lesson in Etiquette. At that same time, the University of Nebraska (31) listed the following home economics films: Indigestion, How to Cook a Wholesome Meal, and Sanitary Homes and Better Babies.

In 1928, Dorris (13) discussed the possibilities of using films and slides in the various areas of home economics. Although she did not submit any proof, she suggested that moving pictures could be used effectively in teaching cooking.

Very little research has been done on the effectiveness of projected visual aids in teaching home economics. Dale and Hoban (8) reported two studies on the effectiveness of films in developing desirable diet habits, one made in 1924 and one in 1931. They reported that the use of films in these studies did not increase learning. They also pointed to a part of the Freeman experiment made in 1924, by Hollis (19), which resulted in the conclusion that the demonstration method was superior to the film in teaching manipulatory skills such as the making of an omelet.

In 1941, Moyer (32) conducted an experiment to discover the effect of using a moving picture to teach simple sewing techniques to seventh-grade girls. The moving picture used was designed especially for use in the unit. She concluded that the moving picture was a good aid to use in such teaching because it was possible to show sewing position and sequence of movement to large groups at one time.

Although experimental research on projected visual aids for home economics is limited, the fact that

home economics teachers are interested in that teaching device is evidenced in the literature reviewed by audio-visual sections and articles in Practical Home Economics, What's New in Home Economics, and Journal of Home Economics. See for example (4) (18) (30).

Summary

Projected visual aids were introduced into public school classrooms in 1912, but their development toward effectiveness has been slow. Review of the literature from 1918 to 1948 indicated that projected visual aids have been found to be effective in most fields of education in increasing cooperation, gain, and retention of learning, contributions to class discussion, and voluntary reading of supplementary material. The claimed successes in the use of visual aids in the armed forces' training programs emphasized the possibilities of that method of instruction. Projected visual aids have been used in home economics classes, but no experiments were discovered which measured their effectiveness in a unit on nutrition.

Chapter III

METHODS AND MATERIALS

This experiment on the effectiveness of projected visual aids in teaching a nutrition unit was conducted during the fall semesters of 1946 and 1947 at Royster Junior High School, Chanute, Kansas.

Selection of groups

In order to have a basis for comparing gains in pupil learning resulting from teaching with and without projected visual aids, it was necessary to select two groups for this experiment. The control group was taught the unit in nutrition by the discussion method using required reference reading but having no projected visual aids. The experimental group was taught the same unit in as nearly the same manner as possible, but with the use of available projected visual aids substituted for required reference reading.

An attempt was made to schedule classes so that there would be only two classes in ninth-grade home economics during each of the two years the study was made. However, this was possible only in 1947. In 1946, scheduling of other courses in the school program made it necessary to have three classes in ninth-grade home economics. The

largest of these was arbitrarily designated as a control class and the two smaller ones as experimental classes. In 1946, the control class met during the first hour in the morning and the experimental classes met during third and fourth hours in the morning. In an attempt to eliminate a possible variable which might be inherent in the time of day the classes met, the class hours of the experimental and control groups were reversed for 1947. The 1947 control class met fourth hour and the 1947 experimental class met first hour.

The ideal arrangement would have been to have had all classes comparable in terms of the number of pupils and length of the class periods, and the individuals in the classes paired exactly on the basis of I.Q., chronological age, previous experience in home economics classes, and scores on the pre-test. However, in this particular school situation, the ideal arrangement was impossible. Consideration of the total school program made it impossible to have classes composed of the same number of pupils. The fourth-hour class period was 53 minutes long compared with 57 minutes for the other classes, and this could not be changed. However, the reversal of the experimental and control groups during the second year of the experiment lessened the effect of this variable. I.Q.'s and chronological ages were not available for all students at the time of enrollment. There were some new students with no

previous experience in home economics who could not be excluded from the ninth-grade home economics classes. The girls could not be enrolled in experimental and control groups on the basis of pre-test scores because the enrollment had to be completed prior to the administration of the pre-test.

The I.Q.'s available 1/ at the time of enrollment were considered and an attempt was made to enroll those girls whose I.Q.'s were recorded in such a manner that the classes were somewhat comparable. The new students whose I.Q.'s were not available were enrolled at random.

After the I.Q.'s of all girls had been obtained and the experiment had been conducted, 30 girls were selected from the control classes and 30 from the experimental classes. These cases were so selected in pairs of similar I.Q. and chronological age that the resulting groups were comparable in terms of the means and standard deviations of these two factors. Data on these groups were analyzed in the study.

The test

Test items were formulated by the teacher conducting the study after she had outlined the objectives of the unit and the subject matter to be covered to attain these objectives 2/. Test items were then submitted to a

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1/ I.Q.'s were based on scores on the Otis Self-Administering Test of Mental Ability converted into Stanford Binet I.Q.'s.

2/ See Appendix A.

seminar class in educational research at Colorado Agricultural and Mechanical College in the summer of 1946, to obtain suggestions from the home economics teachers enrolled in that course. Their criticisms were considered in omitting some items and reconstructing others. Only the one form of the test 3/ was made as the same test was used for pre-testing and delayed re-testing. The final form of the test included 88 items and consisted of the following types of questions: true and false, multiple choice, arrangement, matching, and short answer.

Selection of visual aids for projection

Film catalogs from all film distributors whose addresses could be obtained were consulted to compile a list of the films which might be of value for use in the nutrition unit. Twenty-two films 4/ were selected from catalog descriptions and procured for previewing by the investigator.

Each film was previewed at least two times by the teacher before the final selection was made. Choice of films was based upon the following basic evaluation questions suggested by Fern and Robbins (17:63-65):

1. Is the film content correlated with the learning situation?

3/ See Appendix B.

4/ See Appendix C.

2. Is the material accurate?

3. Is the instructional technique a "built-in" feature?

4. Is the technical quality of the film satisfactory?

The selectim of the films to be used proved to be difficult because of the very limited number of films which were of a good quality as judged by these criteria. Five films 5/ which most nearly met those standards were chosen. They were:

Proof of the Pudding

A B C of Food

Food Makes a Difference

Vitamin B1

Something You Didn't Eat

The opaque projector sequences were planned and constructed with the objectives and subject matter of the unit in mind and consideration was given to the possible interest in the material and the ease of understanding. A wooden slide arrangement was made so that the sequences could be mounted on long strips of paper six inches wide, thus making it unnecessary to open the machine to insert each picture separately 6/. There were 75 of these opaque projector cards used. All of the cards were in color.

5/ These films are described in Appendix D.

6/ Directions for making the slide arrangement were given by Walter (39:439).

Thirteen of them were typed or printed questions or statements. The other cards were sketches or magazine pictures of food and people with headings or questions to direct the girls' thinking.

Administering the pre-test

The pre-test was administered on Friday before the unit was begun on the following Monday. The nature of pre-tests in general was explained briefly, and all directions for taking the test were read aloud as the students read them silently. Time was allowed for any questions necessary to clarify the directions. The girls were allowed the remainder of the class period for taking the test, but the slowest one had completed it about two or three minutes before the end of the hour. The remaining time was spent in replying to questions they had about the answers to individual test items. There was no difference between control and experimental teaching on that day.

Methods of teaching the unit

The unit was taught at a time that was natural and logical as determined by the teacher and pupils in their over-view planning of the unit and covered the same subject matter in control and experimental groups. Both groups had the same bulletin board arrangements and access to the same reference materials. With the control group,

the discussion method was used and reference reading and oral reports were required, but no projected visual aids were used. With the experimental group, the discussion method was used with projected visual aids and opaque projector reports were required. All films used in the experimental classes are described in Appendix D. The following account of the teaching of the unit was written from the notes made by the teacher during the experiment.

First day.--The first class period of the unit was begun in both groups with a comment by the teacher that although not all of the tests had been scored, the sampling that had been scored indicated that most of the girls needed some additional study of the foods that should be eaten. Because the pre-test had seemed quite difficult to the girls, they readily agreed with this suggestion. The girls discussed briefly the information and habits they already had in connection with nutrition.

An outline for the unit was developed by the girls and the teacher. The girls suggested the same three questions as were used in the original outline made by the teacher:

"I. How much shall we eat?"

"II. What kinds of food shall we eat?"

"III. How can we plan meals to include those foods?"

The wording and order of the questions differed from class

to class and also differed among the individuals in each class, but the same thought content prevailed.

Sources which might be used to gain information which would answer these questions were then discussed. The girls suggested books, charts, the department file, films, and the experiences of themselves and other people, such as doctors, mothers, and teachers. Because films were listed as a possible source of information, it was necessary to tell the girls in the control group that they would not be seeing films. The 1946 control group was told that they would not see films because of difficulties in scheduling the use of the projection room. That explanation was not suitable for the 1947 control class because the girl who raised the question had already indicated that she recalled that during 1946 some classes had seen films throughout the nutrition unit and other classes had not. It was necessary to tell the 1946 control group that the teacher was trying one way with one class and another way with the other class to see if films were worth the time and money involved.

The last half of that period marked the beginning of the different teaching for control and experimental groups. The experimental group was shown a 10-minute sound film, Proof of the Pudding, on the general aspects of nutrition. They were prepared for viewing this film by the teacher's suggestions that they listen and watch carefully,

and that they take notes on mimeographed lists of questions which were provided 7/. The questions were discussed briefly with the girls to be certain that they understood them. The class then went to the projection room where a shaded light arranged in the aisle enabled them to see to take notes and yet left the screen sufficiently darkened. The film was shown once. The few minutes of discussion at the end of the hour were rather superficial as the time was limited.

The control group was given the same list of questions on nutrition in general. Instead of seeing a film to obtain the answers, the control group was given a list of suggested references for each question and was allowed a supervised study period in which to solve the problems presented.

Second day.--The experimental group discussed the answers they had obtained from the film, Proof of the Pudding. This discussion lasted the greater part of the hour. Near the end of the hour the teacher told them that they would see a film, A B C of Food, the next day. She suggested that they be certain to remember their paper and pencils so they could take notes. The assignment was made for the fifth day of the experiment. The girls were asked to keep an account of their meals for one day on blanks which were given to them.

7/ A list of these questions appears in Appendix E.

The girls in the control group said that they needed more time to answer the questions they had worked on the first day. They finished them in about 15 minutes. Their discussion comparing the information they had found had to be made in a somewhat shorter time than the discussion which the experimental group had on the same questions because of the study period the control group needed at the beginning of the hour. At the end of the hour, the assignment was made for the seventh day. The girls were asked to keep an account of the food they had during one day and to report their findings to the class. Ways of making these reports interesting were discussed.

Third day.--The experimental group was shown the film, A B C of Food, at the beginning of the hour. The girls compared notes taken during the showing of the film and asked to see the film again. The film included information on the first two questions of the outline:

"I. How much food should we eat?"

"II. What kinds of food should we eat?"

Led by the teacher, the girls discussed the points brought out in the film.

Members of the control group discussed for about 20 minutes the first question on their outlines: "How much food should we eat?" Then the girls and the teacher decided as a group what additional material they needed to obtain during their study period. That study session con-

tinued until the end of the hour.

Fourth day.--The experimental group saw the film, Food Makes a Difference. The points brought out in the film were centered around the first two questions in the outline. The film was shown only once and then the topics brought out in it were discussed.

The control group based its discussion on the material the girls had found on the first question during their study period the preceding day. At the end of about 30 minutes they had completed their discussion on that question and for the remainder of the class hour they had a study session during which they tried to answer the second question. They needed considerable guidance in their choice of material to read. They informally organized themselves into committees to work.

Fifth day.--The experimental group was shown the sequences which had been prepared for the opaque projector. The showing took the entire hour as the girls asked questions and made comments as the material was projected onto the screen. The records which they had prepared of their meals for one day were collected.

The control group continued the procedure used during the class period of the preceding day. They spent a little over half of the hour comparing the information they had found on question two of the outline and used their supervised study period to read on question three.

Sixth day.--The experimental group was shown the film, Vitamin B_1. The students took notes on the film and compared their findings during the discussion period. The last part of the discussion period was used to answer questions on the three parts of the outline. About five or 10 minutes at the end of the hour were devoted to a review of the basic seven food groups in preparation for the lesson for the next day.

Members of the control group reviewed questions one and two very briefly and discussed question three. They used the last five or 10 minutes of the hour to review the basic seven foods groups in preparation for the lesson for the next day.

Seventh day.--The experimental group was shown the accounts of daily meals which had been handed in by the girls on the fifth day and pasted onto strips of paper by the teacher so that the material could be used in the opaque projector machine. Each girl's account was checked by the class against the basic seven food requirements and suggestions were made by the girls and the teacher for improvements in the girls' diet practices as reported in the accounts.

The girls in the control group gave brief talks on accounts they had made of their meals for one day. Each account was checked by the class and the teacher against the basic seven food requirements. The reports

varied in manner and quality of presentation, but, in general, they were considered by the teacher to be better than the usual reports given by these same individuals during other units.

Eighth day.--The experimental group was shown the film, Something You Didn't Eat. This film was used as a review because of its general nature. The girls enjoyed the film more than they had enjoyed any of the other projected visual aids, but they had few questions on it. The opaque projector sequences were reviewed rather quickly; the images were left on the screen only long enough for the girls to observe them carefully and ask questions if they had any. Very few questions were asked. Near the end of the hour, the girls summarized their ideas on improvements needed in their own diets.

Girls in the control group summarized the main things they had learned in the unit and concluded that they needed to improve their diet habits.

Administering the re-test

After a five weeks' interval, the test which had been used as a pre-test was administered again.

Chapter IV

ANALYSIS OF DATA

Introduction

Data for this study were obtained from 60 ninth-grade girls enrolled in home economics at Royster Junior High School, Chanute, Kansas. Half of the girls were in control classes which were taught a unit in nutrition by the discussion method using required reference reading but no projected visual aids. The other girls were in experimental classes which were taught the same unit by the discussion method using projected visual aids but no required reference reading.

Definition of statistical terms

The statistical terms used in the tables and explanation of the analysis are as follows:

C or c = control group

E or e = experimental group

M = mean = a measure of central tendency

SE = standard error of the statistic

SE_M = standard error of the mean

SD = standard deviation = a measure of variability

SE_{SD} = standard error of the standard deviation

$M_c - M_e$ = difference between the means of experimental and control groups

$SE_{(M_c - M_e)}$ = standard error of the difference between the means of experimental and control groups

t = the ratio of any statistic to its standard error

Throughout the study, the value of t will be interpreted in three classifications:

t greater than 2.76 indicates a high degree of significance (one per cent or higher)

t between 2.05 and 2.76 indicates a fair degree of significance (five per cent or higher)

t less than 2.05 indicates little or no significance

$SD_c - SD_e$ = difference between the standard deviations of experimental and control groups

$SE_{(SD_c - SD_e)}$ = standard error of the difference between the standard deviations of experimental and control groups.

Validity and reliability of test

External validity of the test was checked by the procedure described in Chapter III. After the experiment had been completed, the validity of the individual test items was checked against the validity of the total test. This was done by dividing the 89 re-test papers into thirds

according to the rank of the test scores. The correct responses on the upper and lower thirds of the papers were tallied and compared. Four items which were negative discriminators 1/ were discarded in the final scoring of the pre-tests and re-tests on the basis of the results of this analysis.

True and false items were scored by subtracting the number of wrong responses from the number of correct responses. The scores on the multiple choice and short answer sections of the test were the number of correct responses. The two arrangement questions involved four possible points each. In the matching section of the test incorrect responses were subtracted from the correct responses for each question which involved more than one response.

The reliability of the test was then determined by the split-halves method in which the scores on the odd and even items are correlated by the Pearson product-moment formula (21:151) and then corrected by the Spearman-Brown formula (21:169). The coefficient of reliability after correction was + .79.

Equivalence of groups

There were 89 girls enrolled in ninth-grade home economics during the fall semesters of 1946 and 1947. As

1/ Negative discriminators are those items on which the lower third of the group excelled the upper third.

many as possible of these were selected in pairs, one from the control group and one from the experimental group. The pairs were so selected on the basis of similar I.Q. and chronological age that the two resulting groups of 30 each were comparable in terms of the means and standard deviations of I.Q. and chronological age 2/. Most of the cases which were discarded were not included because there were no similar cases with which to match them. A few cases were discarded because the girls had been absent during part of the unit. Although the groups were not matched on the basis of pre-test scores, the results of the selection described were analyzed to compare the two groups on the basis of pre-test scores also.

Similarity of the two groups in I.Q., chronological age, and pre-test scores, and in the variability of these same characteristics is shown in Table 1. Although the groups were very similar in these abilities, the *t* statistic was computed to determine the significance of the difference of their means. The mean ability of the control group, as measured in terms of each of these three characteristics, was slightly higher than that of the experimental group, but that difference was not significant in any instance (Table 2). It should be observed that all of these differences favor the control group, but there is no

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2/ Raw data appear in Appendix F.

Table 1.--STATISTICS OF TWO GROUPS IN TERMS OF INTELLIGENCE, CHRONOLOGICAL AGE, AND PRE-TEST SCORES.

Factor	Group	M	SE_M	SD	SE_{SD}
I.Q.	C	105.40	1.73	9.33	1.23
	E	105.1	1.70	9.18	1.21
C.A. (Months)	C	170.97	.90	4.84	.64
	E	170.70	.79	4.24	.56
Pre-test scores	C	33	1.55	8.37	1.10
	E	32.2	1.31	7.05	.93

way of discovering the exact significance of the total of these differences. The differences in the variability of the two groups in these three characteristics were likewise not significant (Table 2).

Table 2.--COMPARISON OF THE TWO GROUPS IN TERMS OF MEAN ABILITY AND VARIABILITY IN INTELLIGENCE, CHRONOLOGICAL AGE, AND PRE-TEST SCORES.

	Central tendency			Variability		
Factor	M_c-M_e	$SE_{(M_c-M_e)}$	t	SD_c-SD_e	$SE_{(SD_c-SD_e)}$	t
I.Q.	.30	2.42	.12	.15	1.73	.09
C.A.(months)	.27	1.20	.22	.60	.85	.71
Pre-test scores	.80	2.03	.39	1.32	1.44	.92

Gain in pupil learning in control group

For the control group the mean re-test score was 10.33 higher than the mean pre-test score (Table 3). The variability of the scores on the re-test was higher than the variability of the scores on the pre-test.

Table 3.--STATISTICS OF PRE-TEST AND RE-TEST SCORES OF THE CONTROL GROUP.

Test	M	SE_M	SD	SE_{SD}
Pre-test	33	1.55	8.37	1.10
Re-test	43.33	2.53	13.65	1.79

The t value obtained for the difference between the means indicated a high degree of significance (Table 4). The t value obtained for the difference in variability indicated a fair degree of significance.

Table 4.--COMPARISON OF PRE-TEST AND RE-TEST SCORES OF CONTROL GROUP IN TERMS OF CENTRAL TENDENCY AND VARIABILITY.

Measure	Difference	SE	t
Mean	10.33	2.97	3.48
Standard deviation	5.28	2.11	2.50

Gain in pupil learning in the experimental group

An analysis of the scores of the experimental group on the pre-test and re-test showed the gain in pupil

learning in the experimental group to average 12.3 (Table 5). Similarly the variability of the scores on the re-test was higher than that on the pre-test.

Table 5.--STATISTICS OF PRE-TEST AND RE-TEST SCORES OF THE EXPERIMENTAL GROUP.

Test	M	SE_M	SD	SE_{SD}
Pre-test	32.2	1.31	7.05	.93
Re-test	44.5	1.09	5.85	.77

The t value of the superiority of the mean score on the re-test compared with that on the pre-test was 7.07, disclosing a high degree of significance (Table 6). The greater variability of scores on the re-test was not significant, being considerably less than two.

Table 6.--COMPARISON OF PRE-TEST AND RE-TEST SCORES OF THE EXPERIMENTAL GROUP IN TERMS OF CENTRAL TENDENCY AND VARIABILITY.

Measure	Difference	SE	t
Mean	12.3	1.74	7.07
Standard deviation	1.20	1.21	.99

Comparison of gains in pupil learning in control and experimental groups

Table 7 shows that the mean gain of the experimental group was higher than the mean gain of the control group, but that the variability in gain was greater for the

control group. Determination of *t* for the difference

Table 7.--GAINS OF CONTROL AND EXPERIMENTAL GROUPS.

Group	M	SE_M	SD	SE_{SD}
C	9.9	2.04	10.98	1.44
E	13.3	1.23	6.63	.87

between experimental and control groups in gain and variability of gain (Table 8) revealed that the differences in gain were not significant (*t* = 1.45) but that difference in variability was significant above the five per cent level (*t* = 2.59).

Table 8.--COMPARISON OF GAINS OF CONTROL AND EXPERIMENTAL GROUPS IN TERMS OF CENTRAL TENDENCY AND VARIABILITY.

Measure	Difference	SE	t
Mean	3.4	2.38	1.43
Standard deviation	4.35	1.68	2.59

Summary of the analysis of data

The test used as a basis for measuring the amount of pupil learning had a coefficient of reliability of +.79. The control and experimental groups used in the study did not differ significantly in I.Q., chronological age, or pre-test scores.

There was a significant gain in pupil learning

in nutrition in both control and experimental groups. There was a greater variability in both groups in the re-test scores compared to the variability in pre-test scores. The t values obtained for that difference in variability indicated a fair degree of significance for the control group, but indicated little or no significance for the experimental group.

A comparison of gains in experimental and control groups showed that the gain in pupil learning in the experimental group was higher than that of the control group, but that the difference was not significant. The variability of the gain in the control group was significantly greater than that of the experimental group.

Chapter V

DISCUSSION

In considering the results of this study of the effectiveness of projected visual aids in teaching nutrition, it is wise to keep in mind the general nature of the procedure followed. The control group was taught a nutrition unit by the discussion method using required reference reading, but no projected visual aids. The experimental group was taught a similar unit by the discussion method using projected visual aids, but having no required reference reading. In both groups pupil learning was measured by a test of information on nutrition.

The evidence presented by the analysis of data indicates that both groups made significant gains in information. The gain of the experimental group was greater, but it was not significantly larger (using the five per cent level) than that of the control group and therefore the observed difference in gain implies no superiority of the experimental method. It should be emphasized that the results of this study do not indicate that the use of projected visual aids was not effective, but rather that the use of projected visual aids in this experiment was not significantly more effective than the control method which

utilized reference reading.

The variability in gain shown by members of the control group was significantly greater than that shown by the members of the experimental group. A possible implication of this significant difference is that individual differences in reading ability and study habits have a greater influence on learning in groups taught by the control method.

Since the experiments of Knowlton and Tilton (26), Weber (41), Rulon (12), Arnspiger (2), Moyer (32), and Wittich and Fowlkes (42) resulted in conclusions that the use of projected visual aids was superior to other methods of teaching, possible explanations of the dissimilarity between the results of their experiments and this one should be investigated.

Such an investigation involves consideration of the possible operation of various uncontrolled factors. Among these factors is the extent to which the groups participating in the experiment were representative of ninth-grade home economics classes in general. In so far as could be determined, the classes used in the experiment did not differ from other ninth-grade home economics classes. It is probably true that the girls had had more experience with the control method, but it is conceivable that this is universally true.

A comparison of skill and effectiveness in the

use of the two methods does not seem to indicate that this factor functioned as a variable. Although it is true that the teacher was more experienced in the use of the control method, her experience with projected visual aids was supplemented by study of generally accepted methods of using projected visual aids which probably resulted in a degree of skill which was comparable to the skill in the use of the control method.

Consideration of the test used to measure gains in knowledge indicates that the test was probably not responsible for the dissimilarity of the results of this experiment as compared to other experiments. The test had a reliability coefficient of +.79, which indicates that it was a fairly reliable instrument to use for measurement of group differences.

It is obvious that the quality of the projected visual aids used is an important factor in determining the results of a study of this type. Although the projected visual aids used in this experiment were the best available at the time, they did not fully measure up to standards set for such devices. The visual aids used in the experiments of Wood-Freeman (43), Moyer (32), and Gibson (20) were designed especially for the units studied and therefore should reasonably have been expected to be more effective than the visual aids used in this experiment.

Another factor which may have entered in is the

possibility that the subject of nutrition is one in which projected visual aids are not as effective as they are in other fields. According to Wittich and Fowlkes (42) the validity of films is dependent upon presentation of information which is especially adapted to the techniques of sound and motion and which cannot be better presented by another medium.

Whatever the possible explanations of the dissimilarity of the results of this study and those conducted in other subject fields, the fact remains that in this study, projected visual aids were found to be effective in increasing pupil knowledge of nutrition, but that effectiveness was not significantly superior to the effectiveness of the control method which utilized required reference reading and no projected visual aids.

The implication growing out of this study for home economics teachers is that at the present time, they may feel free to select, on the basis of their individual school situations, either projected visual aids or required reference readings as devices for teaching nutrition, because no significant difference was found between the effectiveness of these methods of increasing pupil learning of nutrition information.

Suggestions for further study

While this experiment was being conducted, various

problems were encountered which indicate the possibilities of further study of the effectiveness of projected visual a aids in teaching nutrition:

1. In this study two types of projected visual aids were used, films and opaque projector materials. Studies comparing the effectiveness of each of these types of aids might reveal a difference in the appropriateness of these aids for teaching nutrition.

2. Repetition of this experiment using films which were especially designed for the unit instead of using films now available might result in different conclusions. Such an experiment would give a more direct comparison between this experiment and the earlier ones cited. This type of experiment would also give a better comparison between the control and experimental methods because the quality and subject matter could be made to be more nearly comparable to the quality and subject matter of the reference material used.

3. Since the real test of the success of a nutrition unit lies in the development of better food habits of the students, some value should be inherent in an experiment which compares the effectiveness of various methods of

instruction in terms of habit formation, attitude modification, and interest development. Difficulties in measuring these three factors would be encountered, but if such measuring devices could be constructed, an experiment of this type should yield valuable information.

Chapter VI

SUMMARY

Background of the problem

The use of projected visual aids in education has been the subject of considerable discussion for many years. From 1918, the time of the first controlled experiment on the effectiveness of visual aids, until the present time, many studies have been made on the subject. Most of these studies have indicated that projected visual aids are effective in most fields of education in increasing cooperation and contributions to class discussions, improving gain and retention of learning, and increasing voluntary reading of supplementary materials.

There has been some question in the minds of home economics teachers as to the value of using projected visual aids. The questionable quality of many films now available and the difficulties of securing and using films have discouraged many teachers. Other teachers have recognized these difficulties, but have felt that films were effective to some degree and have attempted to use them. This experiment on the effectiveness of projected visual aids in a nutrition unit was conducted in an attempt to contribute to the solution of this problem facing home

economics teachers.

Source of data

In order to discover the extent to which projected visual aids are effective in teaching a nutrition unit, an experiment involving control and experimental groups was performed. The control group was taught the unit in nutrition by the discussion method using required reference reading, but using no projected visual aids. The experimental group was taught the same unit by the discussion method including the use of projected visual aids, but without reference reading being required. The members of these two groups were so selected that there were no significant group differences in I.Q., chronological age, or scores on a pre-test of the nutrition unit taught.

Method of collecting data

A pre-test was given to discover the amount of knowledge on nutrition which the two groups had at the beginning of the experiment. The two groups were then taught the nutrition unit with all factors except the experimental one held as constant as possible. Five weeks after the completion of the unit, the test was readministered. A comparison of the scores on the pre-test and re-test of both groups was made to determine the comparative effectiveness of the two methods in terms of increase in pupil knowledge.

Findings

Both groups made significant gains in their knowledge of the subject matter of nutrition. The gain of the experimental group was greater than that of the control group, but the difference in the two was not significant at the five per cent level, indicating that the experimental method employed was not significantly superior to the more conventional method of discussion plus required reference reading. There was a significantly greater variability in the control group which might imply greater influence of individual differences in groups taught by the control method.

It is important to note that the results of this study do not indicate that the experimental method was not effective, but show that it was not significantly more effective than the control method which utilized required reference reading instead of projected visual aids.

A P P E N D I X

APPENDIX TABLE OF CONTENTS

Appendix A.--OUTLINE OF SUBJECT MATTER OF NUTRITION UNIT

OUTLINE OF SUBJECT MATTER OF NUTRITION UNIT

WHAT SHALL WE EAT?

Objectives:

The ultimate objective of the unit, "What shall we eat?" is to help the child improve his food habits. We cannot determine the extent to which that is accomplished, but we can determine the degree to which he has developed the basic understandings which may enable him to improve these habits. This unit should provide for him the answers to the following problems:

I. How much food should I eat each day?

II. What kinds of food should I eat?

III. How can I plan meals to include those foods?

I. HOW MUCH FOOD SHOULD I EAT EACH DAY?

A. Measuring food:

1. Food is measured in terms of calories.
2. A calorie is a measure of the amount of energy in foods.
3. All foods do not give us the same amount of energy.
   a. Carbohydrates give us 4 calories per gram.
   b. Protein foods give us 4 calories per gram.
   c. Fat gives us 9 calories per gram.
4. Our food is not pure carbohydrate, pure protein, or pure fat, so scientists have determined the caloric content of foods for us. We should know the caloric content of some of the more common foods.

B. Factors which determine the amount of food needed by the body are age, sex, activity, size, climate and season and body condition. Appetite is not a reliable guide.

C. Amount of food needed by different types of people varies. It varies with the amount of work, the size of the person, and the individual rate of using energy. The average ninth grade girl needs from 2500 to 2800 calories a day.

II. WHAT KINDS OF FOOD SHOULD I EAT?

A. Introduction:

1. Appetite is not a reliable guide.

2. Nutritionists have figured out an easy way for us to check on our daily diets. They have divided the foods we need into seven groups. If we include foods from each of these groups, we have a balanced diet.

THE BASIC SEVEN

I. Green and yellow vegetables.

II. Oranges, tomatoes, grapefruit, raw cabbage, salad greens.

III. Potatoes and other vegetables and fruits.

IV. Milk and milk products.

V. Meat, poultry, fish or eggs.

VI. Bread, flour and cereals.

VII. Butter and fortified margarine.

B. The basic seven is figured on the basis of our needs. We need foods to make us go, make us grow and to keep us growing and going.

1. Foods especially for energy - those "to make us go."

a. Carbohydrates - so named because of the chemicals which are a part of them--carbon, hydrogen and oxygen.

1. Starches - foods rich in starch are bread, crackers, cake, cereals of all kinds, dried peas and beans, potatoes.

2. Sugars - foods rich in sugar are molasses, honey, dried fruits, candy, jelly, preserves and most desserts.

b. Fats

1. Fats are the high power energy food - $2\frac{1}{4}$ times as much energy from fat as from carbohydrates or protein.
2. Foods rich in fat are butter, cream, vegetable oils, lard, vegetable fats, chocolate, nuts, cheese, salad dressings, fat meat - especially pork.

c. Protein foods also furnish energy, but are not classed as "energy foods" because:

1. They are most important as body builders.
2. They are too expensive to be the big sources of energy.
3. Excessive amounts of protein foods overtax the kidneys.

2. Foods especially for growth and repair (Foods "to make us grow")

A. Protein

1. Some proteins are complete, i.e., they contain everything the body needs for growth. Good sources of complete protein are meat, fish, eggs, cheese, poultry, milk.

2. Some proteins are incomplete., i.e., they do not contain everything the body needs for growth and must be supplemented by complete proteins. The incomplete protein foods include beans, peas, nuts, and cereals.

b. Vitamins are chemical substances which have been found in certain foods. Vitamins do not furnish energy, but stimulate growth and keep the body tissue in good condition; in that sense, they are "foods for growth."

c. Minerals are also chemical substances which have been found in certain foods. They do not furnish energy, but play important parts in maintaining the body.

1. Calcium and phosphorus help in building and maintaining bones and teeth. Calcium is found in milk, oranges, cheese, egg yolk, leafy vegetables, and cabbage, carrots, cauliflower, celery, turnips, dried beans and peas, figs and nuts. Phosphorus is found in meat, especially liver and veal.

2. Iron helps build good red blood cells. It is found in lean meat, liver, greens, egg yolk, dried fruits, blueberries and blackberries, and nuts. Copper is

necessary to utilization of iron.

3. Iodine contributes to the development of all body tissues. Iodine is found in seafood and iodized salt.

3. Foods which regulate and protect the body ("keep us going and growing")

a. Minerals function as regulating foods as well as contributing to growth.

b. Vitamins:

Scientists are discovering new facts about vitamins all of the time. They have discovered the vitamins in some foods, but there are many foods which have not been tested completely and quite possibly many vitamins which have not been discovered. Most of the ones which have been discovered are obtainable in the form of pills or capsules, made from material extracted from foods. A few are made synthetically. According to present knowledge, the following are the most important vitamins: (We will consider three questions about each: What does it do for us?, From what foods can we get it?, and What are some of its characteristics?.)

Vitamin A

What does it do for us?

Vitamin A is necessary for growth and for the general health and vigor of tissues such as the skin, the membrane linings of the digestive and respiratory tracts, and the eyes. It is also necessary for clear vision at night.

From what foods can we get it?

Fishliver oils
Butter
Cream
Eggs
Liver
Yellow and green vegetables
Apricots
Tomatoes
Enriched margarine

What are some of its characteristics?

Vitamin A itself occurs only in the animal foods listed above, but substances from which the body can obtain Vitamin A are in the vegetables listed.

Vitamin A in fats is lost if the fat becomes rancid.

Vitamin A is lost if heated in the presence of air; however, ordinary cooking measures do not cause a great deal of loss.

Dried fruits and vegetables lose half or more of their vitamin A when dried.

Vitamin A can be stored in the body.

Vitamin A is fat soluble.

Vitamin B Complex

Vitamin B complex is made up of at least six vitamins. The most important of these are thiamin chloride (B_1), riboflavin (B_2 or G) and Nicotinic Acid.

Vitamin B_1

What does it do for us?

It stimulates the appetite.

It aids digestion

It helps maintain normal nervous system.

From what foods can we get it?

Whole grain products
Lean pork
Dried peas and beans
Green peas
Soybeans
Yeast
Enriched bread
Nuts
Other fruits and vegetables.

What are some of its characteristics?

Thiamin is not stored in the body.

Thiamin is water soluble.

It is not destroyed by heat unless soda is used.

Vitamin B_2

What does it do for us?

It is necessary for normal growth and well-being.

It prevents skin trouble.

It prevents pellagra

It prevents loss of hair.

It prevents cataract.

From what foods can we get it?

Yeast
Eggs
Milk
Meat
Liver
Beans, peas, peanuts
Tomato juice

What are some of its characteristics?

It is not easily destroyed by heat alone, but is easily destroyed by soda.

It is not stored in the body.

It is water soluble.

Nicotinic Acid

What does it do for us?

It helps prevent pellagra, a disease characterized by loss of appetite, loss of weight and general weakness.

From what foods can we get it?

Lean meat
Chicken
Liver
Green and leafy vegetables
Beans and peas
Milk

What are some of its characteristics?

It is water soluble.

There is some question about the extent

to which it is stored in the body.

Vitamin C

What does it do for us?

It prevents scurvy.

It improves resistance to infections.

It helps produce good teeth.

From what foods can we get it?

Citrus fruits
Tomatoes
Apples
Potatoes
Berries
Cabbage
Green leaves (head lettuce not particularly good)
Bananas
Watermelon

What are some of its characteristics?

It is the most unstable of all vitamins.

Heat is quite destructive to it.

It is not stored in the body.

It is water soluble.

Vitamin D

What does it do for us?

It is necessary for bone and teeth development.

It prevents rickets. It aids in the use of calcium and phosphorus.

From what foods can we get it?

Fishliver oils.
Salmon
Egg yolk

Irradiated milk.

Sunshine is our best source.

What are some of its characteristics?

It is fat soluble.

It can be stored.

Rules of food preparation to conserve vitamins:

I. Expose to as little air as possible.

A. Cook unpeeled when possible

B. Do not chop before cooking

C. If served raw, chop just before serving.

D. Serve as soon as cooked

E. Start quick frozen foods without thawing.

II. Cook as quickly as possible

A. Start in boiling water

B. Cook only until done.

III. Use as little water as possible and do not throw it away.

IV. Do not use soda

V. Bake, boil or steam rather than fry.

III. How can I plan meals to include the right foods?

A. Be sure that there is a good representation of each of the Basic Seven in the daily meals.

B. Food habits to watch

1. Three meals a day

2. Have clean hands

3. Eat slowly

4. Pleasant atmosphere.

Appendix B.--UNIT TEST ON NUTRITION

Name_____Hour_____Date_____

Directions: There are twenty-six statements below. Some are true and some are false. If the statement is true, circle the T. If the statement is false, circle the F.

DO NOT GUESS

T F 1. Men usually require more calories than women do.
T F 2. Appetite is not a reliable guide to follow in selecting food.
T F 3. Dried fruits and vegetables do not lose any of their Vitamin A in the drying process.
T F 4. People need more energy in summer than in winter.
T F 5. You should use as little water as possible in boiling vegetables.
T F 6. Stirring foods while they are cooking will conserve the vitamins.
T F 7. Vegetables should be cooked as short a time as possible.
T F 8. Sugar is one type of energy food.
T F 9. A good source of Vitamin A value is carrots.
T F 10. Pure protein gives us less energy per gram than pure carbohydrate does.
T F 11. Potatoes are an example of a starchy vegetable.
T F 12. After a person has finished growing, he does not need to eat protein foods.
T F 13. An office worker would require more calories per day than would a lumberjack.
T F 14. A ten year old child requires more food than a two year old.
T F 15. Milk is a good source of calcium.
T F 16. Liver is a better source of iron than spinach is.
T F 17. Soda added to tomato soup destroys the Vitamin C.
T F 18. If the lunch and dinner supply all of the daily requirements of food, it is not necessary to eat breakfast.
T F 19. There is less loss of vitamins in frying vegetables than in boiling them.
T F 20. Boiled vegetables should be started to cook in boiling water.
T F 21. You should start cooking frozen vegetables without thawing them.
T F 22. Fat furnishes quicker energy than sugar does.
T F 23. Proteins furnish energy as well as contributing to body growth and repair.
T F 24. A lettuce sandwich would furnish more materials for growth than would a meat sandwich.
T F 25. Vitamins and minerals are high in caloric value.
T F 26. Vegetables should be cooked uncovered to conserve vitamins.

Directions: Below is given a number of questions each followed by a series of answers. Only one answer is correct. Find the correct answer and place its number in the parenthesis in front of the questions.

( ) 1. Which of the following gives twice as much energy as protein does? 1 carbohydrates 2 fat 3 vitamins 4 minerals.

( ) 2. What are calories? 1 a measure of the amount of energy a food gives us 2 a measure of the amount of heat required to raise one gram of water one degree farenheit 3 a measure of the amount of vitamins in food.

( ) 3. How much sugar does it take to give you 100 calories? 1 one tablespoon 2 two tablespoons 3 three tablespoons 4 one-fourth cup.

( ) 4. Approximately how many calories would you receive from an average serving of oatmeal, rice or shredded wheat? 1 fifty 2 one hundred 3 two hundred 4 three hundred.

( ) 5. Which of the following is the richest in Vitamin A value? 1 apricots 2 peas 3 pears 4 plums

( ) 6. Which of the following would furnish the most energy? 1 a candy bar 2 an orange 3 a glass of milk 4 an apple.

( ) 7. Which of the following does not help in the growth and repair of the body? 1 water 2 vitamins 3 minerals 4 carbohydrates 5 protein.

( ) 8. Which of the following would be the poorest substitute for meat in a luncheon menu? 1 cheese souffle 2 potato salad 3 tunafish salad 4 scrambled eggs.

( ) 9. Which of the following is the least starchy? 1 potatoes 2 sweet potatoes 3 beets 4 carrots 5 lettuce.

( ) 10. Why are protein foods not classed as "energy foods"? 1 excessive amounts of protein overtax the lungs 2 protein does not furnish as much energy as carbohydrates do 3 they are more important as body builders.

( ) 11. Which of the following is not a carbohydrate? 1 sugar 2 starch 3 Vitamin A.

( ) 12. What are complete proteins? 1 those which contain all of the protein elements for growth 2 those which are supplemented by a sufficient amount of vitamins and minerals 3 those which contain enough protein to maintain growth.

( ) 13. What does phosphorus do for our bodies? 1 helps Vitamin D, protein and calcium build bones and teeth 2 enables the body to utilize the sugar and starch 3 helps Vitamin C function.

( ) 14. Which of the following is the poorest source of Vitamin D? 1 sunshine 2 fishliver oils 3 lettuce 4 egg yolk.

( ) 15. Which of the following is the poorest source of calcium? 1 milk 2 cheese 3 bread.

( ) 16. Which of the following is the poorest source of phosphorus? 1 lean meat 2 fish 3 oatmeal.

( ) 17. Which of the following is the best source of iodine? 1 chicken 2 lettuce 3 seafood.

( ) 18. Which of the following is the best s ource of Vitamin B_2? 1 yeast 2 lettuce 3 potatoes 4 wholewheat bread.

( ) 19. Which of the following is the poorest source of iron? 1 milk 2 liver 3 greens.

( ) 20. Why does the body need iron? 1 to increase the appetite 2 to build red blood cells 3 to promote growth.

( ) 21. Why do some people take codliver oil? 1 to prevent faulty bone structure 2 to prevent beriberi 3 to prevent scurvy.

( ) 22. Which of the following is not a citrus fruit? 1 lemon 2 orange 3 apple 4 tangerine 5 grapefruit.

( ) 23. What is a well-balanced diet? 1 one which includes liberal amounts of all of the vitamins and minerals 2 one which provides all of the material the body needs 3 one which supplies enough food to prevent hunger.

( ) 24. Which of the following is not a protein food?
1 eggs 2 carrots 3 cheese 4 milk.

( ) 25. Which of the following is not a complete protein
1 chicken 2 beans 3 lean meat.

Arrange the following in the order of their caloric content beginning with the highest.

1.	1. cottage cheese
2.	2. eggs
3.	3. bacon
4.	4. whole milk

Arrange the following in the order of their caloric content beginning with the highest.

1.	1. potatoes
2.	2. lettuce
3.	3. corn
4.	4. carrots

Directions: In the right hand column below there is a list of vitamins. In the left hand column are some phrases each of which is descriptive of one or more of the vitamins in the right hand column. Put the number of that vitamin or vitamins in the parenthesis.

( ) a. obtained from sunshine	1. Vitamin A values
( ) b. prevents pellagra and cataracts	2. thiamin chloride
( ) c. prevents scurvy	3. nicotinic acid
( ) d. found in citrus fruits	4. riboflavin
( ) e. helps maintain normal nervous system	5. Vitamin C
	6. Vitamin D
( ) f. found in most yellow foods	
( ) g. stored in the body	
( ) h. the least stable of all	
( ) i. fat soluble	
( ) j. water soluble	
( ) k. helps prevent night blindness	
( ) l. stimulates the appetite	
( ) m. necessary for bones and teeth	
( ) n. found in butter	
( ) o. found in whole grain products	
( ) p. found in fishliver oils.	

Directions:
Below are some questions, each to be answered by one word or phrase. Write the answers in the parenthesis to the right.

1. What mineral is necessary if the body is to use the iron it gets? (_____)1.

2. What two things does the body need in addition to carbohydrates, fats, proteins, minerals, and vitamins? (_____)2. (_____)2.

3. What do manufacturers add to oleomargarine to make it a satisfactory substitute for butter? (_____)3.

4. How many calories should the average 9th grade girl have each day? (_____)4.

5. How do we measure the amount of food we eat each day? (_____)5.

6. How much milk should a ninth grade girl have each day? (_____)6.

7. How many glasses of water should you drink each day? (_____)7.

8. Which contains more calories, bananas or pears? (_____)8.

Directions: There are some menus given below. Each one includes foods from six of the Basic Seven. Tell which one of the basic seven is omitted in each menu.

1. Roast beef, celery, lettuce-tomato salad rolls, butter, ice cream bar. (_____)1.

2. Steak, potatoes, carrots and peas, cabbage salad, butter, jelly, ice cream, wafers. (_____)2.

3. Fried chicken, potato salad, milk, sliced tomatoes, rolls, butter. (_____)3.

Appendix C.--LIST OF FILMS PREVIEWED

LIST OF FILMS PREVIEWED

Film	Distributor
A B C D of Health	Indiana University
A B C of Food	Kansas University
America Learns to Fly	Iowa University
Breads and Cereals	Kansas University
Food Makes a Difference	Kansas University
Gentle Art of Meat Cookery	Kansas University
Foods and Nutrition	Kansas University
Fruits and Vegetables	Kansas University
Fundamentals of Diet	Kansas University
Hidden Hunger	Swift and Company
Kids Must Eat	Kansas University
Meat for America	Kansas University
More Life in Living	Iowa University
Principles of Baking	Kansas University
Meats with Approval	Kansas University
Proof of the Pudding	Kansas University
Something You Didn't Eat	Kansas University
Sunday Night Supper	University of South Dakota
Vim, Vigor and Vitamins	Indiana University
Vitamin B_1	Kansas University
Vitamin D	Kansas University
Well Balanced Diet	Kansas University

Appendix D.--DESCRIPTIONS OF FILMS USED IN THE NUTRITION UNIT

DESCRIPTIONS OF FILMS USED IN THE NUTRITION UNIT

Proof of the Pudding

Distributor: University of Kansas, Lawrence, Kansas
Time: 10 minutes
Sound
Service fee: $.50

Notes made on film during preview
Animals in zoo being fed carefully
Zoo food specialist preparing food
People need to be fed just as carefully
Energy foods
Building foods
Regulating foods
These three types of food build up a good health structure.
If one of these types is left out, the structure tumbles.
Pictures of a study of diet with rats
Woman mixing cake in kitchen: combining foods is like mixing a cake; there must be the right ingredients in the right proportions.
Woman and two children in doctor's office where the children are given a physical examination pointing out signs of good nutrition.
Woman returns from marketing and unpacks her market basket which contains the foods her family should have.

A B C of Food

Distributor: University of Kansas, Lawrence, Kansas
Time: 15 minutes
Silent
Service fee: $.60

Notes made on film during preview
Body is like an engine; it needs fuel
Food is the fuel -- people eating
Most of the fuel is burned -- steam locomotive.
Not destroyed -- just changed -- furnace
Into heat and energy.
So with food -- warmth -- more needed in a snowstorm
Warmth is only part of it -- a native in hot climate gathering eggs.
Some engines burn wood and coal
Body is quite wonderful - it burns several kinds of fuel
Energy -- sugar, starch and fat.
Harder the work, colder the air, more energy food you need.
Food helps build, too.

Child's body is still growing -- needs food for growth
Adults need building foods because of repair of body cells
Pictures of protein food -- usually people eat too much protein
Too much fuel chokes the fire and it goes out
Poor fuel results in clinkers and ashes, but not heat or energy
Body needs regulating foods -- vitamins, minerals and cellulose
Water is necessary
Milk an excellent food

Food Makes a Difference

Distributor: Kansas University, Lawrence, Kansas
Time: 20 minutes
Silent
Service fee: $2.00

Notes made on film during preview
Pictures of wheat fields
Wheat needs certain things - farmers reap harvest
Livestock needs certain things and farmers know it
But do we think same about children's diet?

Picture of primitive kitchen, straggly looking mother and family sitting down to plates of starch food and coffee. Poor manners.

Better home (comparison is good point - quality of diet is not entirely dependent upon economic level)
Children need proper food. Farmers experiment with livestock and grain. We can't experiment with people, but we can use white rats.
Rats react to food somewhat as people do.
Picture of a rachetic child followed by an account of a rat experiment on effects of food on bone structure.
Chart showing the difference in growth and condition of rats
Pictures of children who have not had the right food for growth and development:
- bow legs
- knock knees
- stooped back
- flat, narrow chest
- decayed, uneven teeth
- nervous, irritable, listless and dull
- handicapped in school because of condition

Emphasis on milk, fruits and vegetables.

Vitamin B_1

Distributor: Kansas University, Lawrence, Kansas
Time: 15 minutes
Silent
Service fee: $.60

Notes made on film during preview
Woman cooking cereal - no relationship given
Putting milk on cereal
Brown rice and whole wheat grains good sources of vitamin B_1
Vegetables - peas, tomatoes, cabbage, spinach
Fruits - oranges, pineapple, fresh fruits of most kinds
Milk
Liver and kidney
Vitamin B_1 can be made synthetically
Experiment on pigeons and feedings of rice polishings
Similar experiments on rats
Pictures of rats and pigeons give some idea of beri-beri as a result of lack of vitamin B_1.

Something You Didn't Eat

Distributor: Kansas University, Lawrence, Kansas
Time: 11 minutes
Sound and color
Service fee: $.50

Notes made on film during preview
Walt Disney cartooning used
Boy going fishing - eats green apples
Sick in bed - "something you ate"
Other side of the picture - "something you didn't eat"
1747 - burial at sea - results of scurvy
Ship's doctor puzzled
Diet consists of meat, broth and biscuits
Adds two oranges and a lemon to diet of some men
They remain healthy
1890 - polished rice diet - people sickened and died
whole grain rice substituted - people were healthier
20th century scientists have been working on food problems, too
Basic seven - chain - as strong as its weakest link
Vitamin C and sources emphasized
Vitamin B_1 and sources emphasized
7 out of every 10 families in U.S. have dietary weaknesses
Jones family - and relationship of diet to complexion, energy, etc.
Pictures of good meals

Basic seven chart again
Pictures of more meals based on basic seven.
Mrs. Jones serving - basic seven chart in her kitchen
Large basic seven chart at end of film

Appendix E.--QUESTIONS USED DURING FIRST DAY OF EXPERIMENT

1. Why do animals and people need food?

2. What are "nutritionists"?

3. What are some examples of "energy foods"?

4. What are some examples of "building foods"?

5. What are some examples of regulating and protecting foods?

6. What happens if some of the foods needed are left out?

7. What are some indications of good health?

Appendix F.--RAW DATA OF THE EXPERIMENT

RAW DATA FOR CONTROL GROUP

Case	C.A.(months)	I.Q.	Pre-test	Re-test	Gain
1	167	116	38	40	2
2	166	115	46	45	-1
3	175	115	37	67	30
4	161	113	34	33	-1
5	170	111	43	41	-2
6	167	111	23	29	6
7	171	110	29	51	22
8	176	110	41	46	5
9	176	109	36	58	22
10	172	108	36	49	13
11	174	108	29	49	20
12	171	108	37	52	15
13	167	105	39	34	-5
14	160	104	26	50	24
15	174	103	36	49	13
16	178	102	34	42	8
17	176	101	23	40	7
18	169	101	24	22	-2
19	169	100	42	60	18
20	179	99	17	35	18
21	180	97	37	37	0
22	163	97	24	31	7
23	167	95	39	34	-5
24	169	94	22	18	-4

Case	C.A.(months)	I.Q.	Pre-test	Re-test	Gain
25	170	90	25	33	8
26	176	78	18	22	4
27	175	118	47	60	13
28	171	119	45	63	18
29	171	120	38	76	38
30	168	107	29	37	8

RAW DATA FOR THE EXPERIMENTAL GROUP

Case	C.A.(months)	I.Q.	Pre-test	Re-test	Gain
1	167	115	32	40	8
2	161	115	31	47	16
3	171	115	25	40	15
4	164	108	26	47	21
5	170	109	31	53	22
6	166	112	37	45	8
7	171	109	35	57	22
8	174	111	31	49	18
9	176	106	32	51	19
10	172	107	36	47	11
11	175	106	34	42	8
12	171	109	35	46	11
13	168	107	22	44	22
14	164	104	23	43	20
15	174	103	28	29	1
16	172	102	30	56	26
17	176	106	43	57	14
18	168	101	33	38	5
19	173	100	33	47	14
20	174	98	28	31	3
21	177	92	30	41	11
22	166	97	31	44	13
23	165	91	21	32	11
24	172	93	34	57	23

Case	C.A.(months)	I.Q.	Pre-test	Re-test	Gain
25	171	90	27	40	13
26	177	79	23	30	7
27	172	114	30	46	16
28	174	114	48	54	6
29	176	121	53	71	18
30	167	109	27	32	5

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