



Development and evaluation of audio-visual aids for the teaching of foods
by Carol Ann Harper

A thesis submitted in partial fulfillment of the requirements for the degree of MASTER OF SCIENCE
in Home Economics

Montana State University

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Abstract:

The purpose of this project was to explore, develop, and evaluate personalized audio-visual materials for use with students in a beginning foods laboratory. A film and slide series were developed to be presented to a sample of six Consumer Foods Management Laboratory students.

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A subjective test given to both control (conventional teaching methods used) and test group respondents following each laboratory experience revealed no significant differences using chi-square tests between either the conventional method or the personalized audiovisual in each case. Use of the sign test revealed that the conventional methods used were best, but the difference between the scores of the film group and conventional method group was believed not to be significant educationally.

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Date September 23, 1977

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AIDS FOR THE TEACHING OF FOODS

by

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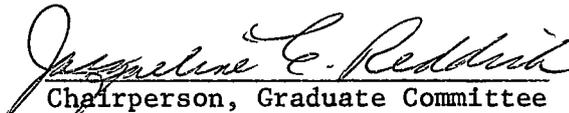
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ABSTRACT

The purpose of this project was to explore, develop, and evaluate personalized audio-visual materials for use with students in a beginning foods laboratory. A film and slide series were developed to be presented to a sample of six Consumer Foods Management Laboratory students.

A test used to evaluate student acceptance of both the film and slide series revealed acceptance of both. Students evaluated the film as adequate but the slide series was more than adequate. Individual respondents showed little uniformity among their overall evaluation of both the film and slide series. This tended to reveal the most reliable evaluations, whereas uniformity may have revealed that respondents did evaluate each statement separately.

A subjective test given to both control (conventional teaching methods used) and test group respondents following each laboratory experience revealed no significant differences using chi-square tests between either the conventional method or the personalized audio-visual in each case. Use of the sign test revealed that the conventional methods used were best, but the difference between the scores of the film group and conventional method group was believed not to be significant educationally.

CHAPTER I

INTRODUCTION

Importance of the Study

Primitive man was the forerunner of instruction through the use of visual media. His drawings on cave walls have told the present world much about how he lived. It is apparent that early man discovered " . . . that communication which appealed to the senses resulted in greater interest, understanding and retention" (Wilkinson, 1971, p. 1).

Modern man also learns through the use of all his senses. Wilkinson (1971) tells us sight (75-90%) is the most valuable sense for learning, then sound (10-15%), smell (3-4%), and taste (1-2%).

Retention of what a person learns is also increased by sensory learning. It makes possible the continuation of the learning process. The greatest amount of retention is gained through the combination of seeing and listening (47%). The amount of information retained is much lower when single sensory sources of information are used--reading (9%), listening (16%), and seeing (26%) (Wilkinson, 1971).

Because the combination of seeing (visual) and listening (sound) is the most effective way to learn, it would appear that the use of audio-visual materials would be a valuable way to learn. Dale (1969, p. 3) describes the importance of the use of audio-visual materials as:

. . . based upon the principle that all teaching can be greatly improved by the use of such materials because they can help make the learning experience memorable. We have said "all" teaching because audio-visual materials, when used intelligently, can promote the most effective kind of learning, in adults as well as children, in college as well as grade school--

Kinder (1959, p. 11) emphasizes, "Many educators are aware that conditions today require not only more learning, but in many respects different kinds of learning". With the need for more learning increasing, ways which may free the teachers of routine and detailed tasks make it possible to devote more time to the individual student and class preparation (DeKieffer, 1965).

Commercially produced audio-visual (AV) materials are often expensive. Then too, the exact learning experience needed may not be available. Kemp and Syumki (1968b) suggest that after a person has selected an important topic, he should examine the commercial materials available and plan to prepare his own if the appropriate materials are not available. This makes possible materials that have local emphasis and are appropriate to a particular grade level, making specific personalized audio-visual materials invaluable.

Need for the Study

Food supplies for demonstrations and laboratory experiences have become a major expenditure in the foods preparation laboratory. Budget increases that will keep up with the inflationary trends cannot be guaranteed. Demonstrations of food preparation techniques can help

students learn, but each time a demonstration is given, food supplies are used. If the repetitious demonstration can be eliminated, the food supplies would no longer have to be purchased for them.

Time is also a valuable resource. Students may be absent from class or may not understand the instructions. When this occurs the teacher must repeat the assignment. Educational media available to which students could refer save the teacher time for other tasks or individualized instruction.

Personalized AV materials could make it possible to have instructional materials readily available that would fit the needs of a particular method of instruction preferred by the class instructor. They make possible the development of individualized learning packets or self-instruction, possible forerunners to a future competency based program and could be catalogued in the resource room and checked out by students for review or individual make-up lessons.

There are various methods of preparing AV materials; such as, video taped recordings, movies with sound or taped recordings, slide shows with taped recordings, or filmstrips with taped recordings. Written scripts could be substituted for taped recordings.

Two methods of preparing AV materials may be helpful--the movie and slides. It requires some knowledge of the equipment being used to prepare AV materials of acceptable quality. Availability of materials needed for the preparation of the AV materials have to be considered,

also. When the various AV materials are produced the equipment needed to project them must be readily accessible. The person must also know how to use the equipment or be able to learn to work it.

Purpose of this Study

The purpose of this study was to explore, develop, and evaluate personalized AV materials for use with students in a beginning foods preparation laboratory. It was designed to show whether the production of personalized AV materials was feasible and acceptable.

Assumptions

The following assumptions were made dealing with this study:

1. It is assumed that personalized AV materials can be produced that will aid in the learning process
2. It is assumed that the demonstration and the film will show the same pie making techniques
3. It is assumed that the papers and the slide series will show the same information about the purpose of filling out meal management forms
4. It is assumed that all students have similar knowledge about the topics to be presented before they are shown the AV materials

Hypothesis

1. The personalized AV materials will be acceptable to the students in the beginning foods preparation laboratory
2. There will be no learning difference between the students taught by the personalized AV materials and those taught by the conventional methods
3. The personalized AV materials do reduce the cost of laboratory instruction
4. They do require less time to use than the two-crust, fruit-filled pie demonstration or the lecture used to explain the meal management forms

Limitations

Limiting factors of this study were placed on the population. The population excluded all but students enrolled in the Consumer Foods Management Laboratory, Fall Quarter 1975, at Montana State University; therefore, the finding cannot be applied to a universal study. The Consumer Foods Management Laboratory is a course which is offered twice each year, making it impossible to get data from the total population.

Definition of Terms

The following terms are given to help clarify meanings of words used in this paper that may not be familiar to all who read it.

Audio-visual--any device by means of which the learning process may be encouraged or carried on through the senses of hearing and/or sight (Good, 1973, p. 23).

Demonstration-- . . . the procedure of doing something in the presence of others, either as a means of showing them how to do it themselves or in order to illustrate a principle, for example, showing a group of students . . . how to prepare a certain food product, . . . (Good, 1973, p. 171).

Medium (p. media)-- . . . a means of effecting or causing something; as . . . a channel of communication (Gove, 1969, p. 526).

Personalized audio-visual materials--materials which can be made by a person to meet the individual needs of the person in contact with the needs of the instructor or class in which the audio-visual materials are to be used.

CHAPTER II

REVIEW OF LITERATURE

The purpose of this paper was to develop and evaluate audio-visual aids produced for use in a beginning foods laboratory at Montana State University. It was designed to show whether or not personalized materials were both feasible and acceptable.

The literature topics are limited to a brief history of the use of film and slides for educational purposes and the usefulness of personalized audio-visuals--specifically slides and films for use in a basic foods course. Also discussed is the theory of individualized instruction and some ways personalized slide series and films may be used in such a program.

History

Eastman Kodak first used motion pictures as audio-visual materials. One of their efforts, a silent motion picture film series on American History, was proven to be a valuable educational aid (Kemp and Syumki, 1968b). In the 1930's sound motion pictures arrived establishing silent and sound motion pictures as valuable teaching tools. Films were used during World War II to train military personnel, making it possible to train greater numbers than by teaching personnel alone (Kemp, 1968).

The first 16mm film was expensive for the amateur photographer. Consequently, professionals directed and produced the films, and the educator purchased or rented them. When 8mm film and film equipment were developed, amateur motion pictures became possible (Kemp and Syumki, 1968a). Among the limitations for 8mm film were grainy picture quality and less image sharpness. Its greatest advantage was its relatively low cost (Kemp and Syumki, 1968a) making it possible for the educator to personalize motion picture films. Although these lacked audio aspects, silent movies made with great care could show a specific learning activity. It was possible to have audio by recording a tape to go along with the film.

In 1965 a new film, Super 8, was developed (Kemp, 1968) making it possible to reduce 16mm film content to Super 8 with little loss of the picture size as the picture ratio of each frame in each type was similar. It is forty-seven percent larger than the Standard 8, yet the film widths are similar (Crocker, 1970). In addition there was adequate space for sound track alongside the picture because of smaller sprocket holes allowing for sound on the film.

The 1960's brought wider use of slide projected materials, because the equipment needed to project the slides was more reasonably priced and easier to operate. The advent of trays and drums to hold a large number of slides in proper sequence made teachers more willing to produce and use slide sets because they no longer had to load slides

one at a time (Kemp, 1968).

Today, many educational film companies produce films and slides for classroom use. In many cases these materials are excellent and can be frequently used by the teacher. There are times when a teacher has a need for more than a commercial film or set of slides that pertain specifically to lecture or locale.

Production and Use of Personalized Audio-Visuals

Prior to production of AV materials each person should consider the advantages and disadvantages (Kennedy, 1972). When commercially prepared materials are used the persons for whom the materials were selected must also be considered. This will prevent the use of production of images that may not meet the objective goals the instructor made by using them.

8mm Films

Forsdale (1962, p. 7) called 8mm film " . . . the paperback of film", because both film and equipment made it possible for more people to enjoy producing their own movies just as the paperback book made it possible for more people to purchase and use books.

The 8mm films are an excellent source of learning (Kemp and Syumki, 1968b) because they are especially adaptable to brief, single-concept topics that may be used for independent study. Since two types

are available, a choice is possible as to what type of film is most appropriate for different topics. For small groups of fifteen to twenty people, or independent study, Standard 8mm film is appropriate (Kemp and Syumki, 1968a) although sound is not possible with this type of film unless a tape recording is correlated with it. Super 8 film is the best film selection if the group size is as large as two hundred people, since screen image can be as large as eight feet wide (Kemp and Syumki, 1968b).

Care must be taken when sound is added to the motion picture as it is only valuable to the content of the film when the rate of sound input is very slow (Kemp, 1968). If the sound is not slow it becomes a hinderance to the learning process, because the mind must have time to record what is being said and shown.

The 8mm film can be placed into cartridges and used as short topic films (Peterson, 1971 and Kemp, 1968). These film loops may be shown to small classes or to individuals with great ease. The continuous-loop film is very simple to show, but projects itself repeatedly until stopped. Its one disadvantage is that it must be stopped at the beginning of the topic or run once again as there is no way to back up the film in the cartridge.

Although the continuous-loop film is a convenient means of projecting film, it costs more than a reel-to-reel. Cartridges are not interchangeable since manufacturers have not adopted a standard

cartridge (McGrew, 1973 and AMC Sullivan Photo, 1977).

The use of 8mm sound films in school by educators is very limited for the following reasons: 1) The " . . . lack of standardization in format among the 15 or more manufacturers of 8mm sound projectors" (Hitchens, 1974, p. 30) makes it difficult to choose a single one; 2) The educator is limited to films developed for his particular projector format; and 3) There is a lack of a variety of commercial films produced that will fit within a school budget.

Slide Series

There are many advantages to slide series in education (Coltharp, 1967). Since slides can be projected for an indefinite time period without damage to the slide, the teacher and students are not hurried permitting slides to be discussed in detail. A totally darkened room is not necessary making it possible for students to take notes if they so desire. Since classrooms are seldom designed for total darkness, slides are easier to show. This also helps keep a greater control of the students activities during the projection of the slides.

Although action is usually thought of in terms of real life happenings or moving pictures, either films or video-tape, " . . . the still picture can suggest action . . ." (Dale, 1969, p. 243). This is done by arranging a sufficient number of still slide photographs in a series. It is now possible to combine audio with slides, using the

slide tape synchronizers. Sets of slides and tapes are produced commercially.

Cost

Commercially prepared AV materials are a convenient way to present information, but not all information is presented by them. When commercial materials do not cover the information wanted, it may become a good idea to produce some to cover a given topic.

Personalized AV materials in some cases may be feasible if they could be made for a substantial savings compared to the commercial ones.

Films

Commercial. Commercially produced films have two purposes-- advertising and education. There are some commercially produced films available that do not advertise. The price of this type of films often depends on producers. Some are available free of charge from advertisers and some are available for a nominal fee. If appropriate, these are the most helpful for classroom use.

Some films are produced solely for profit. An estimated cost for single six-minute commercially prepared film for the home economics curriculum was \$42.00 (\$7.00 per minute) (Gale, 1969)

Rental prices for some foods and nutrition related color 8mm films average \$8.50--seventeen minute films, \$6.50--eleven minute films, and \$3.50--five minute films (Educational Motion Pictures, 1975).

These had to be obtained and returned by pre-arranged dates. If used repeatedly, cost could become excessive.

Personalized 8mm films. Initial production costs are the expensive part of personalized AV materials. Dunning (1971) found the initial expense to be two to four times that of an individual laboratory class demonstration. It is possible to defray costs by showing each film more often. In the Dunning study, it would require at least two showings to different laboratory classes to defray expenses.

Slide Series

Commercial. People usually prepare their own slide series, because the slide is relatively easy to produce. A tape can be prepared to go along with the slide series from the prepared script. Because a slide-tape presentation is relatively easy to prepare, there are few sources for purchasing them already prepared. An example of the cost of a prepared slide tape presentation was \$20.00 for one dealing with contraceptive methods. This slide-tape presentation consisted of " . . . 27 color 2X2" slides, cassette tape, and instructor's manual" (Matson's Audiovisual, ND, p.2).

Personalized. In 1967 Coltharp said the cost of commercially produced slides was " . . . one dollar or less per slide," while black-and-white or color slides produced by the school could be made " . . . for less than fifty cents each . . ." (1967, p. 15). Black-and-white

slide film is no longer available to the amateur consumer so all slides must be produced in color (AMC Sullivan Photo, 1976 and Paul Marsh, 1975).

To complete a slide-tape presentation, a tape would need to be made in addition to the slides. The cost of this would depend upon the brand of cassette tape purchased and the time it took to record the script.

Individualized Instruction

There are four basic steps to individualizing instruction (Humphreys, 1975). 1) Individualize the time within limits so students have as much time to complete the tasks they are assigned as is reasonably needed, 2) The tasks need to be individualized, so a student may do the tasks without aid or little advice from the teacher, 3) The unit sequence needs goals for each component part with precise working statement for each component; as well as a variety of activities to provide solutions to the problem statements or meet the performance objectives, and 4) Last of all competency for each individual must be measured.

Individualized instruction programs are increasingly appropriate for educational purposes. Belland (1975) believed that discussion and lecture have been the major teaching methods because they were convenient. To individualize learning for students an educator must realize

that the initial time to individualize will be extensive.

When learning is individualized the educator and the institution for which he works must allow for changes in their teaching and administrative duties. In addition, the educator has to be willing to learn and try new things themselves before they can be effective with students.

Hoover (1976) believes that as more individualized instruction programs are implemented, they are proving to be advantageous to the learning process because:

1. They combine the freedom of independent study with the necessary structure to insure attainment of objectives
2. Competition is based upon the past achievement of each student
3. The individual is capable of learning on his own with minimum direction from teachers
4. The teacher's role is changed to that of a facilitator of learning
5. Learning is measured by specific behavioral objectives
6. The learner does not have to wait for feedback on work done

Personalized Audio-Visual Materials

Student competency in a basic foods laboratory varies greatly in food selection, preparation, and serving abilities. Individualized instruction packets for use in a basic foods laboratory were developed by Short, Hough, Dibble, and Sarenpa (1969) in order to best meet the

needs of students and staff. A pretest was used to determine if a student needed to do the laboratory work. Absent students were able to make up labs and others were able to review. This freed the staff time for other class preparation and improved scheduling for laboratory classes. Commercial materials were often included or modified to fit the needs of the packets. When commercial materials were not available, personalized AV materials were produced. Authors developed script and the university Center for Instructional Communications produced the materials (Short, *et al.*, 1969, p. 41). Both commercially produced and personalized materials appear to be equally acceptable to most of the students as self-instructional materials.

Instructor produced sound film-loops demonstrating sewing techniques to help students with specific projects have also been made. These permit students to return to any particular sound film-loop for review or reinforcement of a technique. At the end of the class the students enjoyed being able to return to a sound film-loop for help and pace themselves to complete their project assignments (Reich, 1975).

Dunning (1971) compared two laboratory teaching methods in a basic foods laboratory. She found that using her prepared Super 8mm films made it possible to stop the motion at any place (just so it was not too frequent as to disturb the students' concentration) for discussions or questions. It was also possible to return to any part of the film if students required. The films made possible a standard product for

all the classes, and the department was spared the cost of performing the demonstration for each of the classes. Less time was required to run the film and discuss it than it took to perform the demonstration, leaving more time to do other tasks or give more individual help to the students.

CHAPTER III

METHOD

The purpose of this study was to determine the effectiveness of personalized AV materials prepared for specialized use in a foods management laboratory.

Population

During the fall quarter of 1975-76 there were thirty-five students enrolled in the Consumer Foods Management course. The Consumer Foods Management Laboratory enrolled a total of nineteen students in two sections. Sixteen of the students were enrolled concurrently in the laboratory and lecture course. Three students (two in section 01 and one in section 02) had taken the lecture during previous quarters.

Students in both sections were determined randomly by the computer placement. At the beginning of the quarter some students changed sections due to time preferences or to scheduling difficulties that arose after registration.

The data producing sample consisted of the total students enrolled in the two sections of the Consumer Foods Management Laboratory. Section 01 with thirteen students were chosen as the control group as their meeting time was more convenient for the regular teaching staff. The six section 02 students were the test group.

Procedures

Preparation

Topics for both film and slide series were suggested by the instructor. Two topics were chosen--preparation of a two-crust, fruit-filled pie and instructions for filling out meal management forms.

Film. The two-crust, fruit-filled pie was chosen for the film because pie making requires many motions and seemed more adaptable to this procedure.

The final script as shown in Appendix A designates both information to be presented and the action to be filmed. It was reviewed by the Consumer Foods Management Laboratory instructor to assure the same content and techniques as presented in the demonstration were included.

An actress was selected for the film. She was interested in the project, willing to donate time as needed, and had previous experience with the material to be presented in the film. Methodology acceptable to the class instructor was used and a rehearsal without film was conducted.

A Super 8mm Nizo S 480 camera was recommended by an audio-visual materials expert. It was placed on a tripod to prevent unnecessary movements and eliminate as much blurring as possible.

Super 8 Ektachrome film was used, to provide color and as large a picture as possible. The large picture was desirable, because the finished film would be projected to as many as twenty people for a single showing. Since editing might be necessary, silent Super 8 film was used.

Photoflood lamps were added to the normal illumination to produce as natural a color as possible. Ektachrome film can be exposed inside a building without photoflood lamps, but the developed film will have a blue color rather than a natural color. The film was processed by a commercial developer, previewed, and edited.

Slide Series. One aspect of the Consumer Foods Management Laboratory that students found difficult to understand were the forms required for the meal management portion. In the normal sequence, explanations require part of two class periods. When students are unable to attend class or do not fully understand the process, out of class hours were also needed. Since no actual movements would be needed, slides seemed a suitable method to present this topic.

A script (Appendix B) was written for the slide series to give the explanation of the forms and how to use them. Appropriate illustrative materials were developed to illustrate the script. These were reviewed by the class instructor for errors or omissions.

A Canon TL 35mm single lens reflex camera with a close-up lens was used to make it possible to focus upon materials at approximately one

to two feet range. Without the special lens objects would not have been large enough to produce picture of the illustrations to be shown. The camera was placed on a copy stand equipped with artificial lights to hold it still and free the photographer's hands.

Ektachrome film was used, as it could be developed quickly and those slides which were not acceptable could be replaced.

Audio portion. A SONY TC-580 reel-to-reel tape recorder and a Norelco 4408 Stereo reel-to-reel tape recorder were used to make the original tapes. They were copied onto a cassette tape in order to produce as high sound quality as possible. Cassette tapes were used as the final recorded source because they are easy to store and use.

In order to synchronize the audio with the visuals (slide series and film) the information to be taped for each visual was shown and the audio portion read.

Data Collection

As these were first attempts at producing a film and slide series for educational purposes, the data to be collected were to show students reactions. This information would be helpful in improving these materials or others that might be produced at some future date. The data were also to show degree of learning the information presented by means of personalized AV materials compared to the regular methods.

Film. After the students viewed the film they completed a subjective test (Appendix A) on SPECTRO-FAN cards provided by the Cooperative Extension Services, Montana State University, Bozeman, Montana (Appendix A). SPECTRO-FAN cards are used to answer statements that may have a value from one to seven. By stacking the cards so all responses to each statement (A to A, B to B, . . .) are in order, then fanning the cards, it is possible to view a large number of responses to each statement at one time. The card has answer places on all four edges of one side of the card, so the fanning process may be continued on all four edges depending on the number of statements to be measured.

A written subjective test used to discover information acquired by the control group who saw a demonstration of the pie making (Appendix A) and the test group who saw the pie making film (Appendix A) was administered. The criteria used to correct the subjective test for the film and demonstration are shown in Appendix A.

The instrument used to evaluate the film (Appendix A) was reviewed by students in the fall quarter 1975 Consumer Foods Management course who were not part of the project, and graduate students in the fall quarter 1975 Home Economics graduate seminar. Several changes were made to make the statements read more smoothly and more understandably.

The subjective tests given (Appendix A) were reviewed by one instructor from the foods department and from the nutrition department. No changes were necessary.

The evaluation of the film was used to determine the students' reactions to what was presented, how it was presented, and the use of the film (Appendix A).

Slide series. An evaluation of the slide series (Appendix B) was selected to determine the students' reactions to the audio-visual materials and gain information on manner of presentation, and ease of use. SPECTRO-FAN cards were again used.

The subjective test that asked the students to tell what information could be derived from preplanned meal plans that was helpful in meal preparation was used (Appendix B). Both the test group and the control group answered the question five days after each review method was used. The criteria used to correct the responses of each person taking the subjective test were listed (Appendix B).

Evaluation statements for the slide presentation had the same format as the film. Wording had to be changed to accommodate the slide series (Appendix B). The changes made clarified the types of graphics used in the slide series compared to the film and the word film was changed to slide series where necessary.

The subjective review test (Appendix B) administered was reviewed by the Consumer Foods Management class instructor. The instructor had written tests for her class many times before.

No tests used in this study were evaluated by computer services for validity or reliability.

Records

Time. The total time required to produce and use both the film and slide series was recorded in order to make comparisons with normal teaching procedures. The persons using the normal procedures were asked to maintain records of the length of time needed to present certain portions of their topics and to set-up prior to or clean-up after the presentation was made. Time records were also made of the time used to make the personalized AV materials.

Cost. To determine the cost comparisons between film and food records were maintained. The cost items included such things as the unexposed film, development of the exposed film, and cost of food used to make a two-crust, fruit-filled pie. This enabled an approximation of the instructional time that could be saved by using the slide series which students could operate themselves.

Analysis of Data

Responses to questions for the total study on the evaluation and subjective test were analyzed statistically using standard statistical methodology. Questions on the evaluation tests were initially structured to avoid an obvious response. All answers for this test were based on a numeric scale of 1 to 7 with one representing "disagree strongly" and seven representing "agree strongly".

Evaluation of the film and slide series was reflected by three statistics: The mean (X), standard deviation (s), and coefficient of

variation (CV). The latter two reflect the stability of responses.

Duncan's Multiple Range Test was used to reveal any significance among the means of the evaluation tests.

Contingency chi-square methods were used to determine if the number of correct answers (or incorrect answers) was independent of the question for each educational program or method.

A sign test is used to compare the scores from the subjective tests for both the control and test groups. This deviation will show if there is an educational difference between the two teaching techniques--one is better than the other, or they are the same.

CHAPTER IV

RESULTS AND DISCUSSION

To determine the effectiveness of personalized AV materials prepared for use in a foods management laboratory was the purpose of this study.

Sample Size

Fall quarter 1975 students registered in HE-C 227, Consumer Foods Management Laboratory, were used as participants for this study. Section 01 had thirteen students and 02 had six students. They were the control and test groups, respectively.

Interpretation of Data

To facilitate interpretation of data from the evaluation of the personalized AV materials, prior to analysis, data were transposed so that a value of seven equaled a "strongly positive" response and one "strongly negative" response to each statement.

Standard statistical methodology was used to describe the objective test and subjective test data. The use of three statistics helped to evaluate these characteristics. The mean (\bar{X}) for each question, the corresponding standard deviation (s), and the coefficient of variation (CV). The latter two statistics reflect stability or uniformity of responses; and the CV relates \bar{X} and s in a unit free

(%) value permitting non-tested comparisons. As a guideline a CV of greater than 25% was determined to show non-uniformity.

Using a pooled estimate of error based on sixty degrees of freedom (DF), means could be separated, at $p=.05$ using Duncan's Multiple Range Test and reveals a significant difference among some means. Any mean scores that have a letter in common are not significantly different (Table I). (The letters have no importance other than they are a random way of showing means that have something in common.)

Both s and CV are useful in determining the stability or uniformity of responses for each question.

Film

Characteristics. Four specific areas--sound track, graphics, sequencing, and purpose of the film--were evaluated by the respondents in the test group. The sound intensity and enunciation has to be of good quality for students to learn from this source. Graphics were used in various portions of the film; they must be large enough and clearly printed for them to read easily. The film showed the steps of making a two-crust, fruit-filled pie sequentially. The best possible characteristic for showing the steps would be for each sequence to be shown an adequate amount of time and for each sequential step to be easy to follow. Each AV aid has a purpose and the best way to use it must be decided. In the case of this film, to know whether to use the

TABLE I. EVALUATION OF FILM.

Evaluation Description	Mean*	Standard Deviation	Coefficient of Variation
Sound intensity	5.67 e	1.24	22%
Enunciation	5.17 c,d,e	1.07	21%
Size of graphics	3.83a,b,c	1.20	31%
Clarity of graphics	3.50a,b	1.61	46%
Time adequacy	4.17 b,c,d	1.57	38%
Readability	5.17 c,d,e	1.69	33%
Sequences too short	4.17 b,c,d	0.69	17%
Too long	4.83 c,d,e	1.07	22%
Sequences adequately timed	3.83a,b,c	1.20	31%
Clarity of procedural steps	4.50 b,c,d,e	1.12	25%
Review	5.83 e	1.35	33%
New material	3.00a	1.15	38%

*Mean scores with a letter in common are not significantly different using Duncan's Multiple Range Test.

film as a review or to show new material, were the questioned purposes.

Sound track. For questions involving sound track (sound intensity and enunciation) mean scores were moderately high ($\bar{X} > 5.00$), and CV's were moderate (sound intensity=22% and enunciation=21%). This suggests uniform responses which respondents deemed to be adequate. One

respondent did say that the projector noise made it difficult to hear the sound track well leading to the speculation that the respondents may have been more satisfied with the sound track if something could have been done about the noise from the projector (Table I).

Graphics. Size, clarity, length of time shown and readability are important attributes of the graphics. The evaluation of size, clarity, and length of time shown appeared to be slightly above average to slightly below average with mean scores of 3.83, 3.50, and 4.17, respectively. The scores mentioned would appear to show that the graphics were acceptable, but the mean score of 5.17 for overall readability of the graphics would appear to reflect that the students thought the graphics were good, as the students could read them fairly easy. Comparing the mean scores for clarity of lettering (3.50) and readability (5.17) there is substantial confusion. Students responded that the lettering was not too clear, but they could easily read the graphics. The mean scores for the size of lettering and length of time shown compared to readability were non-significantly different. Respondents did not respond uniformly to any of the questions in this area of evaluation (Table I).

Sequencing. In order for a film to increase learning it must be properly times and presented so procedural steps are easy to follow. The length of the sequences were rated as adequate being neither too short ($\bar{X}=4.17$) nor too long ($\bar{X}=4.83$). Comments concerning adequately

timed sequences seemed to reflect the respondents dissatisfaction with the timing of the sound track narrative to the filmed sequences. Participants did not respond uniformly to the statement concerning the timing of the sound track narrative compared to the filmed sequences though. The slightly above average mean score reflects that respondents believe the information was fairly clear and that the procedural steps were fairly easy to follow; although, again the respondents did not respond uniformly (Table I).

Purpose. Students believed the film made an adequate review of the procedures for making a pie. There is some question as to its effectiveness for showing new material as the mean score was low at 3.00. There was little uniformity of responses from the respondents. The mean scores for the two purposes compared showed a significant difference showing that the students believed the film would be a better review than one which shows new materials (Table I).

Respondents reaction. (The use of F with a subscript describes the respondents. Respondents were not coded so respondent F_1 may not be the same person as S_1 relating to the slide series.) Respondent reaction to each question was added to get a single mean score and reflects an overall picture of each respondent to the film. The standard deviation and coefficient of variation has been figured.

The "F" test showed the mean scores to have no significant difference.

All data are based on twelve questions with a scale of one to seven. Interpretation of s and CV are identical as all data are based on the same number of questions and scale. CV shows a relationship of s to mean score.

Four respondents (F_1 , F_3 , F_4 , and F_5) had adequate mean scores. Their s and CV scores reflected little uniformity and could reveal that these respondents had authentic reactions for each question.

Although mean scores were not similar for respondents F_2 and F_6 , both respondents answered the questions fairly uniformly suggesting each may have chosen a similar value on the one to seven scale to indicate a reaction to the entire film instead of responding to each question separately (Table II).

Learning assessment. Chi-square values were used to indicate the difference in the two teaching methods--the filmed demonstration and the laboratory demonstration. The goal was to be able to state whether the two methods would result in similar learning in the two groups or would result in one method being superior to the other.

The respondents from both the test group and the control group took a subjective test which was to be used to assess their knowledge of preparing a two-crust, fruit-filled pie. They were to list the steps needed to prepare the pie.

For the control group the chi-square value of the subjective test was 14.06. The probability that departures from the randomness were

TABLE II. RESPONDENTS REACTION TO FILM.

Respondents	Mean	Standard Deviation	Coefficient of Variation
F ₁	4.17	1.42	34%
F ₂	5.25	1.09	21%
F ₃	4.08	1.50	37%
F ₄	4.50	2.06	46%
F ₅	4.50	1.85	41%
F ₆	4.50	0.96	21%

due to error was less than 1%. The answers the control respondents gave were not independent of the question. Obvious prior knowledge of the subject was indicated. For the test group chi-square was 13.00. The probability that departures from the randomness were due to error was greater than 1% but less than 5%. The film group, as a result of the educational program apparently tended to vary more randomly. In neither case would the null hypothesis, variation from the expected model of independence of responses to the questions and educational method, be accepted. Neither method appeared to be superior to the other.

Sign test. The sign test was used to compare the scores from the subjective test questions for both the control and test groups. This deviation will show if there is an educational difference between the

two teaching techniques--one is better than the other, or they are the same. The number of paired observations is very small so one should hesitate to accept the results (Steel, 1960). The average scores for the test group and control group were 52.75% and 62.90%, respectively. The probability that the higher score of the control (demonstration) group is a result of sampling error is 5% or less. Thus it is concluded that the control group had a higher mean performance in pie preparation recall than the test group, and that the mean of the test group is significantly lower than the mean of the control group. This 10.15% difference may not be a meaningful educational difference in spite of its statistical significance.

Cost analysis. The demonstration cost of \$1.08 for a two-crust, fruit-filled pie included food only. Food cost for the film was the same. In addition, there was the cost of undeveloped film, developing, splicing tape for editing, and the cassette tape. Thus the initial cost of the film was \$11.84 and would require eleven showings before the costs of the film were defrayed.

In actuality the demonstration presented to the control group included only a single, unbaked shell. The demonstration did not have the food stuff on hand to complete the entire process reducing the costs to \$0.15. Since it did not show all the techniques necessary to make a two-crust, fruit-filled pie, it makes cost comparison of the two processes unrealistic (Table III).

TABLE III. COST COMPARISONS.

Materials	Single Unbaked Shell*	Demonstration Two-crust, Fruit-filled Pie	Film
Pie Ingredients:			
2 cups Flour	\$0.05	\$0.10	\$0.10
2/3 cup plus 2 tablespoons Vegetable Shortening	0.09	0.18	0.18
1 teaspoon Salt	0.01	0.01	0.01
1 (16 ounces) Commercial Pie Filling	-----	0.79	0.79
Total	\$0.15	\$1.08	\$1.08
Audio-Visual:			
Undeveloped Film (2 at \$3.49 each)	-----	-----	\$6.98
Developing (2 at \$1.39 per roll)	-----	-----	2.78
Splicing Tape (1/2 pkg. at \$0.59 per pkg.)	-----	-----	0.30
Cassette Tape	-----	-----	0.70
Total	\$0.00	\$0.00	\$10.76

*One-half recipe for single shell.

Time analysis. It required twenty-four minutes to complete the demonstration of a single, unbaked shell. This demonstration was not the specified procedure, but the demonstrator had not prepared adequately for a two-crust, fruit-filled pie demonstration and food products were not available. It seems realistic to use the same time (forty minutes) it took to complete a two-crust, fruit-filled pie for the film. Ten

minutes of the baking time for the two-crust pie were used for cleaning up, and the remainder of the baking time used for other duties. Preparations for the film took about 3.5 hours (210 minutes) in addition to the forty minutes for the actual preparation of the pie filmed (Table IV).

No visuals were used for the single shell demonstration, but they were to be used for the two-crust, fruit-filled pie demonstration. Graphics were prepared for the filmed demonstration that took about twenty minutes to prepare, so it is estimated that the same time would be needed for the laboratory demonstration. An estimated five minutes were also allowed for the exhibition of the finished pie.

Each time the film is shown twenty-five minutes are required to set-up, project, discuss, and put away. Compared to the shell demonstration (twenty-four minutes) there is no time saved. When compared to that of a two-crust, fruit-filled pie, it is possible to save twenty minutes for each use. This suggests the film would have to be shown twelve times to defray the time it took to prepare the filmed demonstration.

Slide Series

Characteristics. The four specific areas evaluated for the film were also evaluated for the slide series--sound track, graphics, sequencing, and purpose of the slide series. Evaluation of the slide

TABLE IV. TIME COMPARISONS.

Preparation	Single Unbaked Shell	Demonstration Two-crust, Fruit-filled Pie	Film
Pie:			
Set-up	8 minutes	10 minutes	10 minutes
Preparation	5	15	20
Discussion	5	5	--
Clean-up	6	10*	10*
Total	24 minutes	40 minutes	40 minutes
Audio-Visual:			
Preparation of graphics	--	20**	20 minutes
Set-up for filming	--	--	25
Show finished product	--	--	10
Put away equipment	--	5	15
Splicing film	--	--	35
Record cassette tape	--	--	105
Total	--	25 minutes	210 minutes
To Show Completed Film:			
Set-up	--	--	5
Projection	--	--	6
Discussion	--	--	10
Put away	--	--	4
Total	--	--	25 minutes

*The pie is baking during this time. The rest of the baking time (total 45 minutes) may be used for other duties.

**The graphics could be saved for future demonstrations.

series is reflected statistically in the same manner as the film (Table V).

TABLE V. EVALUATION OF THE CHARACTERISTICS OF THE SLIDE SERIES.

Evaluation Description	Mean*	Standard Deviation	Coefficient of Variation
Sound intensity	6.60 d	0.46	7%
Enunciation	6.40 c,d	0.80	13%
Size of graphics	5.40 b,c,d	2.33	43%
Clarity of graphics	4.20 ^{a,b}	2.48	59%
Time adequacy	5.00 b,c,d	2.28	46%
Readability	6.60 d	0.44	7%
Sequences too short	5.40 b,c,d	1.36	25%
Too long	5.00	1.79	36%
Sequences adequately timed	4.60 ^{a,b,c}	0.91	20%
Clarity of procedural steps	5.80 b,c,d	1.47	25%
Review	3.20 ^a	1.72	54%
New material	5.30 b,c,d	2.40	41%

*Mean scores with a letter in common are not significantly different using Duncan's Multiple Range Test.

Sound track. For both questions involving the sound track (intensity of sound and enunciation) the mean scores are greater than 6.00 which means the respondents thought the sound track was good. The other statistics concerning the intensity of the sound were very low as were those concerning the clearness of the enunciation showing

responses were uniform.

Graphics. Four characteristics of the graphics were considered-- size, clarity, length of time shown, and readability. Readability is a key point. The mean score of 6.60 indicates that the students believed the graphics could be easily read. The low standard deviation and coefficient of variation indicates that these responses were uniform. Substantial confusion occurs when the mean values concerning the clear printing is compared to readability, because a mean of 4.20 indicated that the clarity of printing for the graphics only adequate. The standard deviation and coefficient of variation concerning clarity of printing reflects non-uniform responses indicating that students could not agree about the actual quality of the printing. Mean scores concerning the size of graphics and the length of time to view the graphics indicate moderately high scores meaning the respondents over-all believed the graphics were better than adequate. Standard deviation and coefficient of variation statistics reflect that respondents did not respond uniformly to this characteristic.

Sequencing. The timing and procedural steps of the slide series must be done properly for learning to result. The respondents to the sequencing of the slide series believed them to be adequately timed reflected by a mean score of 4.60. The mean score reflecting that the sequences were not too short was 5.40 and not too long was 5.00. The mean score reflecting the clarity of the procedural steps was 5.30 which

shows the respondents believe them to be fairly clear and easy to follow. Student responses were uniform for all questions but the one concerning the sequences being too long, this means students were not able to agree as to whether the sequences were too long.

Purpose. The statistical analysis of the educational value of the slide series showed it would not be valuable as a review technique. Responses to this statement showed little uniformity meaning they could not agree to its value as a review. The respondents did believe this was acceptable as a way to show new material since the mean was moderately high at 5.80. Again these responses were not uniform. Three respondents commented that they thought the slide series was good and should be used before filling out their meal management forms.

Respondents reaction. (The use of S with a subscript describes the respondents. Respondents were not coded so respondent S_1 may not be the same person as F_1 related to the film.) There is a significant difference between the mean scores of S_2 ($\bar{X}=4.17$) and S_4 ($\bar{X}=6.42$) but none of the other students had significantly different mean scores. S_2 believed the slide series to be only adequate where as S_4 believed the slide series to be good. A significant difference shown between two students reflects that these people truly disagreed in their evaluation of the slide series. The significant difference shown between S_2 and S_4 may reflect a preference between the two students as to how they like to learn. S_4 , who rated the slide series to be

good, may enjoy learning by use of AV materials, where S₂ may be more critical of AV instruction (Table VI).

TABLE VI. RESPONDENTS REACTION TO SLIDE SERIES.

Respondents	Mean*	Standard Deviation	Coefficient of Variation
S ₁	5.50	1.12	20%
S ₂	4.17	2.27	54%
S ₃	5.92	1.75	30%
S ₄	6.42	0.73	11%
S ₅	4.75	2.50	53%

*Mean scores with a letter in common are not significantly different using Duncan's Multiple Range Test.

The values of the standard deviation ranged from a high of 2.50 for respondent S₅ to a low of 0.73 for respondent S₄. This suggests that respondent S₄ reacted more uniformly to the twelve questions than any other respondent.

Respondents S₂ and S₅ have mean scores of 4.17 and 4.75, respectively, while S₃ has a fairly high mean score of 5.92. These three students showed little uniformity in response. This tends to lead to the belief that these students may have revealed the more valuable responses, as they may have taken the time to evaluate each question more thoroughly.

S₁ and S₄ had moderately high (5.50) and high (6.42) responses, respectively, but coefficient of variation statistics indicate these respondents may have answered the questions with careful consideration of each question (Table VI).

Learning assessment. Chi-square values were used for the same purpose as for the film--to compare the two learning methods statistically for a difference.

Again, the respondents from the test and control groups took a subjective test which was to be used to assess their knowledge of filling out meal management forms that could aid them in future meal preparation.

The control group chi-square was 14.83. The probability that departures from the randomness were due to error was less than 1% and answers were not independent of the question. Obvious prior knowledge (the slide series was used as a review) is indicated. The test group chi-square was 12.10. The probability was similar between 5 and 1%, but tended to vary more randomly. In neither case would the null hypothesis, variation from the expected model of independence of questions and responses, be accepted. Neither method appears to be superior to the other.

Sign test. To compare the scores from the subjective test for both the control and test groups, the sign test is used. This deviation will show if there is an educational difference between the

two methods--one being superior or both being the same.

The mean of all scores for the control group respondents and test group respondents were 65.45% and 43.33%, respectively. A 22% difference may be meaningful as an educational difference and shows that the control group had the superior method used. The probability that the higher value of the control group is a result of sampling error is 5% or less, making possible to conclude that the control group had a higher performance than the test group.

Cost analysis. For the lecture the instructor spent \$0.90 on materials for illustrated materials to show the students how to fill out their meal management forms. For a total of nineteen slides, the cost was \$3.50. If used for class presentations only, the slide show would be more expensive to use than the illustrated visuals the instructor had, but when used for review and/or individual use their cost is defrayed quickly. The instructor spends approximately 2.5 hours per quarter giving students out of class instructions on filling out the meal management forms. The value of the instructor time was figured to be \$7.40 per hour. At this rate the slides would need to be used approximately one-half hour to defray costs (Table VII).

Time analysis. Preparation of the lecture materials was shorter (15 minutes) than the preparation of materials used to make the slide series (220 minutes). It takes thirty-three minutes to set-up, project, discuss, and put away the slides. Compared to the time it

TABLE VII. COST COMPARISONS.

	Instructor	Slide Series
Preparation:		
Illustrated materials	\$ 0.90	\$0.32
Film	----	1.79
Development	----	1.39
Total	\$ 0.90	\$3.50
Quarterly Out-Side Class Instruction:		
Time used	2.50 hours	2.50 hours
Cost of instructor's time per hour	\$ 7.40*	----
Total	\$18.50	----

*Calculated: $\text{Monthly Pay} \div \text{Working Days} = \text{Pay/Day}$
 $\text{Pay/Day} \div \text{Hours/Day} = \text{Pay/Hour}$

takes to present the material in class (twenty-five minutes), the slides would take more time to use than the initial lecture/discussion time (Table VIII). Based on these time estimates, use of the slide series is not justifiable.

TABLE VIII. TIME COMPARISONS.

Forms	Lecture	Slide Series
Preparation:		
Illustration materials	15 minutes*	100 minutes
Photograph materials	--	30
Discuss importance of required information	--	<u>90 (record on tape)</u>
Total	<u>15 minutes</u>	<u>220 minutes</u>
Completed Slide Series:		
Set-up	-- minutes	10 minutes
Discussion	25	10
Put away	--	5
Project	--	<u>8</u>
Total	<u>25 minutes</u>	<u>33 minutes</u>

*The illustrated materials could be used for future lectures.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

A major expenditure in the foods preparation laboratory is the food supplies necessary for demonstration and laboratory experiences. It is almost impossible to make budget increases that will keep up with the inflationary trends. The demonstration is used effectively as a teaching method, but it is necessary to use food supplies each time this method is used. If the repetitious demonstration is replaced by an equally successful method which requires no food supplies, the food budget could be decreased to some degree.

Time is another valuable resource. Teachers often have to repeat instructions or information to students because of absenteeism or misunderstood instructions. When a teacher does not have to repeat the instructions herself, she is able to spend that time on other tasks.

The purpose of this study was to explore, develop, and evaluate audio-visual aids that might be useful in a beginning foods laboratory at Montana State University. It was designed to show whether or not the produced personalized audio-visual materials would be acceptable or feasible for use in the laboratory.

Students enrolled in the two sections of the HE-C 227 course, Consumer Foods Management Laboratory, were the population. A film

and slide series were produced and used for portions of two separate laboratory experiences with the test group section. The control group was made of students from the other section and were taught by the conventional methods used. An evaluation for each personalized audio-visual aid was developed as well as a subjective test to evaluate recall of each learning activity. Only test group participants evaluated the personalized AV materials, but both groups were tested for recall of what was taught during each laboratory experience.

Data concerning the evaluation of each personalized AV aid were analyzed using standard statistical methodology. The mean, standard deviation, and coefficient of variance for each question and each respondent, were determined. Some statistical differences were found concerning paired questions for both the film and the slide series, but statistical differences were not found concerning individual respondents evaluation of the film. There was statistical difference between two respondents concerning the slide series. It was believed this difference may have reflected a preference between the two students as to how they like to learn. The one that rated the slide series high may enjoy using AV materials more than the other.

Contingency chi-square methods were used to determine whether the number of correct answers was independent of the question for each educational method. This showed no difference between the two methods used for each laboratory experience.

A sign test was used to compare the mean score of the test group and control group for each laboratory experience. The deviation shown between each group for each laboratory experience was significant. The deviation for the film and demonstration may not be educationally meaningful.

Conclusions

The following conclusions have been made and can only be applied to the population of this study.

Some significant differences were found in both the film evaluation and the slide series evaluation using Duncan's Multiple Range Test to compare paired mean scores. Students responded positively to the readability of the graphics, yet they responded negatively to clarity of the printing for both the film and the slide series. Concerning the film, respondents believed the film was most useful as a review aid rather than one that showed new material. Respondents believed differently about the purpose of the slide series than the film. They believed it was best used to show new material rather than review material.

A mean was obtained for individual respondents of the test group to determine how each respondent evaluated each personalized AV material on a whole. For the majority there was little uniformity in responses. This was believed to mean these students gave the most thought to their response to each question, so may have resulted in the

most reliable evaluations.

Both the film and the slide series were accepted by the students. The film was rated as adequate on most evaluated areas; whereas, the slide series was rated good on most evaluated areas.

Chi-square values were used to compare the mean score of each group for each separate laboratory experience tested. The comparison of scores for both laboratory experience resulted in a rejection of the null hypothesis, that the answers given to the question asked after the lessons were given were not dependent on the method used. Obvious prior knowledge of the subject was indicated for both laboratory experiences.

The sign test was used but the results of this test were not reliable, because the number of paired observations was too small. It did reveal a significant difference in the two methods used for both laboratory experiences. The conventional methods used in both cases were the best for learning.

The actual demonstration given was of a single, unbaked shell instead of the two-crust, fruit-filled pie that was to be made. Because of this, the cost comparison of the demonstration and the film is unrealistic. It was figured a two-crust, fruit-filled demonstration could have been given for the same cost it took to make the pie in the film. Comparing the cost of the two-crust, fruit-filled pie demonstration revealed that the film would have to be shown eleven times to

