EFFECTIVENESS OF A SENSORY EVALUATION TRAINING VIDEO FOR USE IN A RESTAURANT SETTING

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TRAINING VIDEO FOR USE IN A

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TABLE OF CONTENTS

LIST OF TABLES

Table Page

Table Page

Table Page

Table Page

LIST OF FIGURES

CHAPTER I

THE RESEARCH PROBLEM

Introduction

"Sensory evaluation is a scientific discipline used to evoke, measure, analyze and interpret reactions to those characteristics of foods and materials as they are perceived by the senses of sight, smell, taste, touch and hearing (Prell, 1976). The complex sensation that results from the interaction of our senses is used to measure food quality in programs for quality control and new product development. The sensory analyst's job is to provide input about the sensory aspects of products at every step of the food process chain, from raw materials to finished goods and this includes the final consumption. The information provided by the sensory analyst in most cases cannot be provided by chemical or physical tests. Instruments can accurately measure various components of food products but only human judges can integrate these components into what we call flavor.

Since 1965, knowledge of the chemical senses has grown; new sensory evaluation methods have evolved; old methods have been improved, both in application and theoretical

understanding; powerful computers are widely available for data analysis (Amerine, Pangborn, & Roessler, 1965). Food scientists and manufacturers realize the importance of sensory evaluation in product quality. But, the restaurant industry has been slow to exploit this vital tool to maintain or improve food quality. In order for sensory evaluation to be most effective training should be utilized.

Judges, or sensory analysts must be properly trained for the task at hand. Training is designed to familiarize an individual with test procedures, improve an individual's ability to recognize, and identify sensory attributes in complex food systems so that panelist can provide precise, consistent, and standardized sensory measurement which can be reproduced.

Pasta, made from Oklahoma hard red winter wheat, is a food product that needs to be analyzed by a sensory taste panel. The researcher and Dr. Sue Knight have been funded, by the Oklahoma Wheat Commission, to develop an acceptable pasta utilizing Oklahoma wheat. A vital part of the food product development process is sensory evaluation. Blair (1978) states "sensory evaluation is critical to marketing and to the development and maintenance of products with high levels of acceptability" p. 62. Development of this project was the result of an effort to train a sensory evaluation panel to determine the acceptability of pasta products produced during the research.

Purpose

The School of Hotel and Restaurant Administration (HRAD) at Oklahoma State University is training students in various skills necessary for restaurant management. A part of this judgmental training included learning evaluation techniques for analyzing food products. Another major responsibility of restaurant graduates will be to train employees. Therefore, students should be aware of an educational tools available to develop and enhance training programs. An additional benefit of the video is that it may be used to train Hotel and Restaurant Administration students.

Educational alternatives that will reduce cost without sacrificing quality are needed in our changing society. Educational videos can meet the demands of training for employees. By allowing individualized instruction, videos enable learners to proceed at their own pace, while the restaurant manager continues to perform managerial duties. Educational alternatives, such as the video, should be considered, and examples of their effectiveness demonstrated to students.

In a library search conducted by the researcher no educational tools were found to train for sensory evaluation in the restaurant. Therefore, the researcher developed an education training video focusing on sensory evaluation in the restaurant. This study was conducted to develop and evaluate a training video showing the use of sensory

evaluation in a restaurant setting.

Although managers must constantly make decisions involving menu items and product selection that involves sensory evaluation, they are not using basic sensory evaluation principles to make decisions (Skelton, 1984). Neither are these principles adequately taught to restaurant management students. The purpose of the research is to develop and test a video to train sensory evaluation panels. This is useful for product development and for the restaurant industry, to demonstrate how this educational medium can be applied to product development.

Objectives

The objectives of this study are:

1. To develop a training video showing basic sensory evaluation techniques as applied to product development and the restaurant industry.

2. To use a video in training restaurant management students in sensory evaluation.

3. To determine effectiveness of the sensory evaluation video as an educational tool in training restaurant management students.

4. To determine the attitudes about sensory evaluation of the restaurant management students after viewing a sensory training video.

Null Hypotheses

H_1: There will be no difference in effectiveness between an experimental group and a control group of restaurant students as sensory panelists due to viewing a sensory evaluation training video.

H_2: There will be no difference in attitude scores between a experimental group and a control group towards sensory evaluation of restaurant students due to viewing the sensory evaluation training video based on pre-test and post-test.

Assumptions

1. Sensory evaluations are useful in product evaluation in a controlled study.
2. Training is effective in increasing the efficiency of the sensory evaluation process.
3. The panel selection process is valid and reliable.
4. The responses of the students in pre and post testing and in these evaluation of food products are honest representations of their true opinions.
5. College students enrolled in Hotel and Restaurant Administration serve as a representative sample of students seeking professions in restaurant establishments.
6. The testing conditions will adequately control the variables that influence panelists responses.

Limitations

1. The study is limited to a selected group of Hotel and Restaurant Administration students at Oklahoma State University.
2. There will be no way to ascertain whether responses represent the true opinions of the students.

Definitions

The terms in use throughout the study are defined as follows.

1. Acceptance is: 1) an experience, or feature of experience characterized by positive (approaching a pleasant) attitude; 2) actual utilization (purchase, eating). May be measured by preference or liking for specific food item (Institute of Food Technology, 1964).

2. Effectiveness is the consequence of a stimulus that changes behavior (Hulse, Egeth, & Deese, 1980).

3. Flavor is the total of the sensations perceived by means of the taste buds, olfactory organ, and the buccal cavity which may include pain, temperature, and tactile sensation (Meilgaard, Ceville, & Carr, 1987).

4. Hedonic Scales measure the state or degree of pleasantness or unpleasantness (McGill, 1979)

5. Instruction is the deliberate arrangement of experience(s) to help a learner achieve a desirable change in performance; the management of learning, which in

education and training is primarily the function of the instructor (Heinich, Molenda, & Russell, 1985).

6. Quality is : 1) an aspect, attribute, characteristic, or fundamental dimension of experience, which involves variation in kind rather than in degree; 2) the composite of those characteristics that differentiate among individual units of a product and have significance in determining the degree of acceptability of that unit by the user (Williams, & Atkin, 1983).

7. Sensory is pertaining to the sense organs (Institute of Food Technology, 1964).

8. Sensory evaluation is the evaluation of food through the use of our senses (odour, taste, tactile, temperature, pain, etc) (Jellinek, 1985).

9. Sensory panel is a group of individuals that may be selected on the basis of sensitivity to stimuli, reliability, or whose perceptions are judged to be representative of some larger population. It is used to obtain information concerning the sensory attributes of physical stimuli (Institute of Food Technology, 1964).

10. Taste is those sensations mediated by the taste buds. One of the senses, the receptors for which are located in the mouth and are activated by a large variety of different compounds in solution. Most investigators usually limit gustatory qualities to four: saline, sweet, sour, bitter. Distinguished from flavor, the experience to which taste contributes (Institute of Food Technology, 1964).

11. Visual aids are a communication device to serve as a more concrete referent to meaning than the spokes or written word (Heinich, Molenda, & Russell, 1985).

CHAPTER II

REVIEW OF LITERATURE

Introduction

A major concern of the restaurant industry is unsatisfied customers. According to Engoron (1988) 54 percent of customers expectations are not met at a restaurant. Skelton (1984) believes, quality assurance programs should be installed to ensure a high quality product. Therefore, food quality should be a major goal of the food-service operations. Sensory evaluation panels are utilized to judge quality characteristics and differences among food items.

Pasta, made from Oklahoma hard red winter wheat, is a food product that needs to be analyzed by a sensory taste panel. The researcher and Knight were funded, by the Oklahoma Wheat Commission, to develop an acceptable pasta utilizing Oklahoma wheat. A vital part of the food product development process is sensory evaluation. However, these panelist need some training.

Improved management of food service through improved education of professionals and training of employees, has been of great concern since the 1970's (Fiedler & Norton, 1987). There is an expanding need for education services in

business and social organizations with benefits to potential employers, the employee, and the instructor (Taylor, & Watts, 1981). And, to be most effective training should utilize the best teaching procedures available. One solution is to use educational videos for efficient, low-cost, and equable education.

The intent of this section is to describe the use of a educational video on sensory evaluation, as a training program, to increase and maintain quality food products. A good understanding of sensory evaluation, implementation strategies, and potential problems areas, may result in a better understanding of how this science is used to maintain a consistently high quality product, and thus, increased customer satisfaction.

History of Sensory Evaluation

Of all the food technology techniques that have developed over the past decade, few have received the widespread attention given sensory evaluation (Meiselman, & Rivlin, 1986). Although it was largely neglected until the Second World War, rapid production and distribution technology developed during this time (IFT, 1979). But, food rations were rejected by the armed forces, on account of unsatisfactory food products. This caused Americans to become aware of providing acceptable food for their servicemen. (Dove, 1947; Helm & Trolle, 1946). The army established the Chicago Quartermaster Subsistence Research

and Development Laboratory "to discover techniques for measuring and evaluating acceptability" (Dove, 1947, p. 41). As a result, interest in sensory evaluation in general grew rapidly.

Sensory testing is central to the growing food industry and is used in product development, and quality control (IFT, 1978). Blair (1978) states " sensory evaluation is critical to marketing and to the development and maintenance of products with high levels of acceptability" p. 62. Sensory qualities are the accepted standards for perfumes, essential oils and flavorings, as well as coffee, tea, beer, wines, and distilled spirits (Pangborn, 1964). Even the government will accept the results of sensory panel studies as scientific evidence (Konigsbacher, 1978). It is clear that sensory evaluation is not just another food development trend. "We must never forget that all of our millions of dollars worth of business depend upon that little sensation which food products make upon the tongues of our customers" (Platt, 1931).

Sensory evaluation is basically: "A scientific discipline used to evoke, measure, analyze and interpret reactions to those characteristics of foods and materials as they are perceived by the senses of sight, smell, taste, touch and hearing" (Prell, 1976).

Sensory testing can establish the worth of a food product or even its very acceptability. "Sensory testing evaluates alternative courses in order to select the one

that optimizes value for money" p. 1 (Meligaard, Civille, & Carr, 1987). Replacing an ingredient because of cost or availability without changing the product's characteristics is difficult. According to Erhardt (1978) sensory panels are ideally suited for evaluations of this kind. But, the difficulty lies in the fact that only human judges, can detect sensory differences. This implies a need for planning a techniques for educating individuals to be the "best" judge possible (Skelton, 1984).

Educational Philosophy

Improved management of food service through improved education of professionals and training of employees has been of great concern since the 1970's (Feidler & Norton, 1987). With the growing need for trained managers in the service industry, the question arises: "who is going to train these people professionally?" According to Osborn & Lewis (1983) "today's home economics educators need to focus their efforts on identifying prospective clients and designing appropriate and relevant programs for them" (p. 20). An area of focus should be the hospitality industry.

Home economics can claim an important part in this training by using the knowledge from the root disciplines pursued in our education. Home economists are trained in the areas of education, communication, and food service. As a result, the home economist can help restaurant managers train employees to meet changing patterns in the work force.

Home economics is a combination of areas, yet each of these areas, or specializations, contributes to an overall unity of purpose. Green (1989) stated the purpose of home economics in higher education is the "preparation of professionals; the discovery of new knowledge; and the extension of knowledge to selected audiences of adults and youth to improve the quality of life for families through education, prevention, and development" (p. 43). This includes the designing of educational materials, such as the educational video, to meet needs (Rossmann, Parsons, & Holman, 1983). There is an expanding need for educational services in business and social organizations with benefits to potential employers, the employee, and the teacher (Taylor, & Watts, 1981). In addition, by having a home economist design the training, he or she can "respond to and support the changing roles of society" (Griffin, 1989, p. 42). By achieving a better understanding of society, the individual can develop realistic goals and make responsible decisions for both self and family. The ultimate goal of home economics then is "to empower individuals and families to relate to their interaction with all sectors of society" (Deacon, 1987, p. 62). Home economics educators have the knowledge and teaching skills to design effective educational videos for the restaurant industry.

Utilizing the Education Video

Of all the educational teaching techniques that have

been developed over the past decade, few have received the widespread attention given educational videos (Wagner, 1982). Developing training videos to meet the needs of the industry is a worth while goal. Scott, Sollie, and Duffey (1983) found that the video tape is effective for giving students "added insight and improving the use of communication skills" (p. 18). The positive impact of video in technical communication has been substantiated in a number of organizations (Thomas, 1980). According to Carliner (1987), "audiovisual presentations show certain types of information more clearly than other media, they provide a sensory experience, and their physical characteristics affect the manner in which people learn information from them" (p. 14). As video technology becomes more popular, restaurants are beginning to use videos as training aids (Weinstein, 1987). The ability to visually see a presentation enhances understanding, increases retention, and heightens the interest of the audience (Roberts, 1979). Research in sensory reception has repeatedly shown that material that is seen is remembered 55 percent better than material that is only heard (Roberts, 1979). It is true, a picture is worth a thousand words.

Educational videos can meet the demands of training for employees. By allowing individualized instruction, videos enable learners to proceed at their own pace, while the restaurant manager continues to perform managerial duties. A video tape can be played back by students, if a point has

not been understood, far more easily than asking a lecturer to repeat the information again. Flexibility that arises from throwing off the burden of the timetable provides many of the educational benefits of using media. Videos also provide accurate, consistent training (Wagner, 1982).

The educational video has a high initial cost; however, the video is a teaching tool that can be used over and over again, thus saving the company time and money (Reinhart, 1987). Thomas (1980) believes the video processing system will decrease the cost and increase the effectiveness of training communication. And, a major advantage of the video cassette as instructional material is the ease with which it can be produced (Heinich, Molenda, & Russell, 1985). Some of the larger restaurant chains like Hardees find that videos are easier and cheaper than having a trainer sent to every store (Weinstein, 1987).

The benefits of the educational video are numerous. Training alternatives that will reduce cost without sacrificing quality are needed in our changing society. Rather than having untrained employees, educational alternatives, such as the video, should be considered. As, previously stated, videos are easy to produce. This implies a need for understanding the tasks involved in planning and producing a video.

Planning the Video

Educational videos require careful planning. Effective

planning of the video involves: 1) analyzing learner characteristics; 2) stating objectives; 3) selecting, modifying, or designing materials; 4) utilizing materials; 5) requiring learner response; and 6) evaluating (Heinich, Molenda, & Russell, 1985). This section investigates the steps in planning a training video, including the importance of utilizing sensory evaluation for continued success of a restaurant establishment.

Analyze Learner Characteristics

With the growing importance of consumer opinion in product development and quality control, restaurants have begun to look for efficient ways to develop taste panels, for both product development and quality control. The industry will draw panelists from the population available, which are employees and managers. The restaurant industry is an example of an industry that employs people who do not have a high school education.

According to Hodgkison (1986), the entry level work force between now and the end of the decade will become increasingly females, blacks, and minorities. And, the demographics in the United States have changed from being predominantly youth to being primarily adults. Hodgkison (1986) believes, most of these people will not have a high school education. Therefore, educational objectives need to be set with these factors in mind.

Stating Objectives

An objective is a highly specific statement about what is to be accomplished (Reddin, 1971). Mintzberg (1983) agrees that objectives are clear, specific standards frequently but intermittently adjusted to optimum levels above current performance, developed in cooperation with those to whom they apply. An objective not only provides a clear picture of what is to be achieved, it can and should also provide a clear evaluation device by which achievement can be measured (Reddin, 1971).

The entire organization must have common vision, understanding, and unity of direction and effort before objectives can be set (Drucker, 1974). Therefore, answers to certain questions in the restaurant industry are essential: 1) Are sales declining? 2) Have recent consumer tests indicated dissatisfaction with product quality? 3) Are rising ingredient costs forcing alternative formulations? 4) What procedure is most appropriate to accomplish the objectives? 5) What experimental testing is most efficient? and 6) What is the objective of the sensory project? (Erhardt, 1978; IFT, 1964). The ability to ask these questions and to answer them correctly serves as a foundation for the analysts to build and justify objectives for sensory evaluation.

Select, Modify, or Design Materials

Once the objectives have been defined there are three

options: 1) select available materials, 2) modify existing materials, or 3) design new materials (Heinich, Molenda, & Russell, 1985). The trainer will draw from one of these options in designing the video. This implies a need for understanding where these materials can be found.

The most comprehensive listing of current educational video recordings is the Index to Educational Video Tapes published by the National Information Center for Educational Media (NICEM). For the postsecondary level, over a thousand recorded courses are described in Televised Higher Education: Catalog of Resources. In addition, Videolog, Video Source Book, and Chicorel Index to Video Tapes and Cassettes are annual directories of programs encompassing both entertainment and educational topics. Since there are no video cassettes on sensory evaluation, materials must be modified or designed for this study to be complete.

Modified or designed educational videos can be prepared to fit industry or personal needs (Heinich, Molenda, & Russell, 1985). Three items are necessary for the production of a video: 1) camera video equipment, 2) a script, and 3) visual aids (Carliner, 1987; Floyd, 1987; Heinich, Molenda, & Russell, 1985). The camera video equipment can be purchased, borrowed, or rented.

The next step after gathering equipment is writing the script. Carliner (1987) states, "writing an audiovisual script is no different from writing any other type of technical documentation. Your ultimate goal is the same:

to communicate technical information to a specific audience" (p.11). The information should be stated clearly, without overloading the audience (Carliner, 1987; Floyd, 1987). Carliner (1987) believes, no more that five main ideas should be presented at one time. Lists longer than five items are difficult for people to process. Simple sentences and phrases also make it easier to process information (Williams, 1985). If technical terms and acronyms are necessary, repeat them often so that users become accustomed to the terms (Farace, 1984).

Voice fluctuations offer numerous benefits when reading the script. "Each change in sound theoretically stimulates the audience, thus increasing attention" (Carliner, 1987, p. 13). Sound cues, such as music, sound effects, and pregnant pauses, can also be used for emphasis and variety (Farace, 1984).

Visual aids also have a powerful effect on audience stimulation (Floyd, 1987). "The primary function of a visual as a communication device is to serve as a more concrete referent to meaning than the spoken or written word (Heinich, Molenda, & Russell, 1985, p. 65). Floyd (1987) believes the presentation can be enhanced by utilizing the following points: 1) special emphasis can be placed on each main point; 2) the camera can emphasize critical steps by zooming in on the subject; 3) color and text can be used to focus attention; 4) colors can also highlight graphic illustrations; and 5) graphic and photographs can be

superimposed to describe actions or to review information.

Planning is necessary to meet the visual needs of the script. This manifestation is enhanced by the fact that, "visuals have far greater impact on what viewers remember than any words in the script" (Floyd, 1987, p.10). The script should not compete with the visuals. Effective narratives enhance the visuals. After either selecting, modifying, or designing the video, it must be implemented into the restaurant training program.

Utilizing the Video

Research in educational psychology as well as the practical experiences of thousands of teachers in all sorts of settings demonstrate that learning is greatly enhanced when learners are prepared for the coming activity (Hulse, Egeth, & Deese, 1980). This includes clarifying objective for the lesson, mentioning clues, giving specific things to look for, and directing challenging questions that are answered on the video (Heinich, Molenda & Russell, 1985). Curiosity can also be stimulated by, "evoking questions the students would like answered about this subject" (Heinich, Molenda & Russell, 1985, p. 242). If the restaurant manager is excited about learning new skills in the profession, he is going to work hard at evaluating food properties, because it is his reputation on the line, as well as the restaurant. A successfully implemented training video depends on a lot of factors. But, the factor that

can lead to complete success is commitment. Unless such commitment is made, there are only promises, hopes, and plans, but no successes.

Learner Responses and Evaluation

The fifth step in this model is encouraging student response to the instructional stimuli. "Educators have long realized that participation in the learning process by the learner enhances learning" (Heinich, Molenda, & Russell, 1985. p.54). This implies the need for applying this basic sensory training in analyzing a food product. This application process also gives the learner, or evaluator, the opportunity to ask questions. Building learner participation and opportunity for response into the instructional situation is highly desirable since it has been firmly established as an effective teaching technique (Heinich, Molenda, & Russell, 1985).

The final concept of this model for effective learning is evaluation. Evaluation is an important means of gathering data. Drucker (1974) believes that a measurement plan must be built into the implementation plan in such a way that we can realize early whether or not the objectives are actually fulfilled. An analysis of the plan will yield a great deal of information about potential areas for improvement or reasons to drop the objective from the plan (Drucker, 1974; Reddin, 1971).

Heinich, Molenda, and Russell (1985) discuss three

purposes for evaluating the video: 1) to evaluate learner achievement, 2) to evaluate media and methods, and 3) to evaluate the instructional process. Capabilities of the process, product, or attitude type could be assessed to some extent by means of written or oral test. But, "more direct and stronger evidence would be provided by observing the behavior in action" (Heinich, Molenda, & Russell, 1985, p. 56). In this case, it would be utilizing the knowledge in an actual sensory evaluation test.

This video planning process delineates all tasks to be done and indicates by whom, when, and how; mapping out the scope of the sensory evaluation program in detailed sequential steps (Helm & Rose, 1986). The smooth functioning of this system is an agreement between the restaurant and the evaluators in accomplishing their own or the restaurants objectives (Hersey & Blanchard, 1982).

Training A Sensory Taste Panel

Careful selection of panelists is an integral part of the sensory process. Rainey (1979) identifies six key characteristics that a panelist must possess: 1) interest in the sensory program; 2) motivation to perform a selected task; 3) time available for panel participation; 4) normal taste acuity (Amerine, Pangborn, & Roessler, 1965); 5) good health, being free from allergies, frequent head colds, and sickness; and 6) capable of producing reliable and consistent judgements.

A sensory panel is usually composed of 10 to 20 persons (American Society of Testing and Materials, 1968). The minimum number of panelist should be four or five (Larmond, 1977). Ill persons, especially those suffering from a cold, should not participate in a test (Jellinek, 1985).

Physiological Background

Physiological attributes are necessary for sensory evaluation. The American Society for Testing and Materials, or ASTM (1968), identifies the five senses used as: 1) taste, 2) feel, 3) smell, 4) hearing, and 5) sight. Two or more of these senses are used in the process of perception. "The subject receives a jumble of near-simultaneous sensory impressions, and he or she will not without training be able to provide an independent evaluation of each" (Meilgaard, Civille, & Carr, 1987, p. 5).

Sight

The appearance is the first sense utilized. "Preliminary acceptance or rejection of a food usually is based on the appearance" (Campbell, Penifield, & Griswold, 1962, p. 457). Appearance includes sensations such as brightness, color, and shape (Jellinek, 1985).

Piggot (1984) believes that color is the "most important" appearance characteristic of foods. An example would be the ripening of fruit or the association of color change with deterioration and spoilage. Hood and Riordan

(1973) found that when bright red beef and discolored (but wholesome) beef are sold together, shoppers discriminate against the discolored meat.

Foods have an boundless variety of appearance characteristics. Their surface can be dull, shiny, rough, even, wet, dry, soft, hard, crisp or tough (Meilgaard, Civille, & Carr, 1987). Recent advances in measuring color through instruments have occurred, but Kramer and Twigg (1970) believe, "instrumental values must be correlated with consumer panel responses" p. 40.

Smell

The smell qualities are also primarily guides to identifying and discriminating products from one another (Meiselman, & Rivlin, 1986). People can perceive many different odors (ASTM, 1968). These food odors are called aromas. And, "aromatics are the volatiles perceived by the olfactory system from a substance in the mouth" p. 6 (Meilgard, Civille, & Carr, 1987). The trigeminal and, possible the terminal nerves also play a part in sense of smell (Maruniak, & Mackay-Sim, 1984). But, "the olfaction contributes by far the predominant component" (Maruniak, & Mackay-Sim, 1984, p. 24).

The Skramlik method is used when the presence of odorants in the air alone is not sufficient to cause an odour sensation (1926, p. 46).

> Block your nose and through the mouth inhale air saturated with an odorant. In exhaling, part of the air coming from the lungs is pressed into the nasal cavity and the wings of the nose get blown up. Finally exhale through the mouth, hold the breath and open the nose. During the whole exercise no odour is perceived. Upon inhaling now through the nose, the odorant of the experiment is smelled immediately.

"Since, by and large, these volatile substances which cause olfactory sensations occur in extremely minute quantities, their identification and quantitative estimation by the classic chemical methods are extremely difficult, and certainly impractical for use in routine quality evaluation" p. 110 (Kramer & Twigg, 1970). Stewart and Whitaker (1984) also believe that it is difficult to measure the persistence of odors. This implies the use of human judges in evaluating the smell of a food product.

Sound and Feel

Three senses - touch, sight, and hearing - are involved in the sensory assessment of texture. The British Standards Institution (1975) define texture as: "The attribute of a substance resulting from a combination of physical properties and perceived by the senses of touch, sight, and hearing." Texture is measured by the muscles of the tongue, jaw, and lips; while moisture properties are measured by the tactile nerves in the surface of the lips and tongue; and by the sound of the object when bitten. (Meilgaard, Civille, & Carr; 1987; Oldfield, 1960).

Attempts have been made to identify, define and

classify specific textural terms. Some of these attributes are hard, soft, cohesive, adhesive, brittle, crumble, chewy, tender, gummy, springy, resilient, elastic, dry, moist, wet, oily, and greasy (Brennan, 1984; Meilgaard, Civille, Carr, 1987; Tilgner, 1962). A single food can have one, two, or many of these attributes (Vickers & Bourne, 1976).

Training for sensory evaluation of texture require knowledge of the product and of the physiology of chewing (Jellinek, 1985; Civille & Szczesniak, 1973). Brennan (1984) states, "the type of panel, the degree of training and the form of test used in sensory assessment of texture will vary according to the information required and the purpose for which it is required". Definition of terms that would be used on the evaluation form for that product, are helpful when training for textural attributes.

Taste

Although the senses of sight, smell, and feeling are very important to how we perceive; by far the most important sense when it comes to rating flavor is the sense of taste. The sense of taste is part of a perceptual system that involves all of the chemically sensitive nerves and end organs of the oral and nasal cavities that aid in the investigation of the chemical environment (Gibson, 1966). There are four basic tastes; sweet, salty, sour and bitter, and all the various food tastes are composed of these four or blends of two or more of the basic tastes (Crocker, 1945;

Cowart, 1981).

Taste is a specific sensory channel which " arouses hedonic processes reflected not only in taste preferences and aversions, but also in the reinforcement of a variety of instrumental responses; modulated by feedback from the viscera and also by learning" p. 291 (Pfaffmann, Frank, & Norgren; 1979). Pangborn (1964) believes human variability is a problem but, instrumental analysis supplement can never be substituted for human measurement. Acceptability of the food product to the customer is the key to a successful restaurant.

Before an appropriate test is made, the researcher must know more about sensory evaluation than physiological attributes. Evaluating sensory perceptions correctly requires background information on methods of production and potential future usage of the food products. Dove (1947) believes, "in devising techniques for the determination of acceptability, we have sought the combined experience of many persons who have been interested in one or more aspects of testing food for quality, in the psychology and physiology of appetite and hunger, in taste and flavor tests, in psycho- physics, in psychometrics, in organoleptics, in food habits, in food preparation, and in statistics of populations, to name a few. Such an approach is necessary since the correct interpretation of non-acceptance of a food doubtless does not rest upon any one specialty." This implies a need for designing the

appropriate test to meet the objectives of the project.

Designing the Appropriate Sensory Test

The purpose of sensory evaluation is to evaluate products in terms of differences or similarities and identification or quantification of sensory characteristics (IFT, 1981). Sensory evaluation tests involve discrimination and descriptive evaluations. Examples of sensory evaluation tests used to either discriminate or describe differences in samples include: 1) Preference/acceptance tests; 2) Discriminatory tests; and 3) Descriptive tests (Larmond, 1969).

Preference/Acceptance Test

Consumer preference tests will establish which sample is preferred by the largest number of people (IFT Committee, 1964; Larmond, 1969; Kramer, & Twigg, 1970). The reaction of the consumer will aid in detection of the representative product of the population being studied. Preference tests can be classified as follows: a) paired preference, b) multiple paired, and c) rank preference (Meilgaard, Civille, Carr; 1987).

In the paired preference test the panelist is asked to select the best sample, from the two food products. "When using a paired preference test, the hedonic or desirability level of one of the samples should be known" p.23 (Larmond, 1977) (see Figure 1). The panelist is asked to enter the

NAME: DATE:

PRODUCT:

Evaluate the sweetness of these two samples of canned peaches. Taste the sample on the left first, Indicate which sample is sweeter.

581	716
___	___

Comments:

Figure 1. Questionnaire for Simple Paired Comparisons Test.

sample code number of the preferred sample in the blank provided. This test is easy to administer, easy for the panelist to do, easy to interpret and with the added question "why?", additional pertinent information may be detected.

Multiple paired testing is harder to administer and interpret, but statistically more accurate. This type of evaluation allows the panelist to analyze several pairs at one seating. One or two samples can be paired with two or more other samples (Meilgaard, Civille, & Carr, 1987). Therefore, panelists are evaluating the same products several times. There is always the opportunity for each paired comparison to be correct or incorrect half the time. However, in paired comparisons, "all responses need not be correct in order to reach a statistically significant conclusion" p. 140 (Kramer & Twigg, 1970).

To determine the preference of more than two items, the rank test is used. Ranking is defined as a method in which a series of three or more samples are presented at the same time and arranged in order of intensity or degree of some designated attribute. But, ranking gives no information on the size of differences, quality or preference. Ranking is a method of classification into categories on an ordered scale.

"Ranking which sample they like best, prefer, or consider most desirable is a task most panelists readily understand and seem to accept as an enjoyable challenge" p.

5-4 (McGill, 1979). Figure 2 is an example of a score card utilized in a ranking test. Panelist are presented all samples simultaneously identified by codes. The panelist are asked to rank all samples in order of preference.

Acceptance tests are used to determine the effective status a product has on the consumer. The degree of acceptability or unacceptability, or dislike to like is scored on a hedonic scale. A scale, as used in rating and scoring, is a continuum divided into spaced successive values, which may be graphic, descriptive or numerical, used in reporting assessments. The hedonic scale reported by Peryam and Pilgrim (1957) was a nine point scale using the following terms:

9-like extremely
8-like very much
7-like moderately
6-like slightly
5-neither like or dislike
4-dislike slightly
3-dislike moderately
2-dislike very much
1-dislike extremely

McGill (1979) believes seven to ten point scales must be used, because panelists tend to avoid using the end points on a scale, to use fewer than seven scale points may not allow the panelist to show the degrees of variation observed. The facial hedonic scale shown in Figure 3 is applicable when using young children as panelist, or when word descriptors may not be understood. A smile or frown has universal meaning. Unstructured scales, or Likert scales such as the one shown in Figure 3, allow the respondent more

NAME:

PRODUCT:

Please rank these samples from the one your like best to the one you like least.

1st_____2nd_____3rd_____4th_____

Like Best Like Least

Comments:

Figure 2. Ranking for Preference.

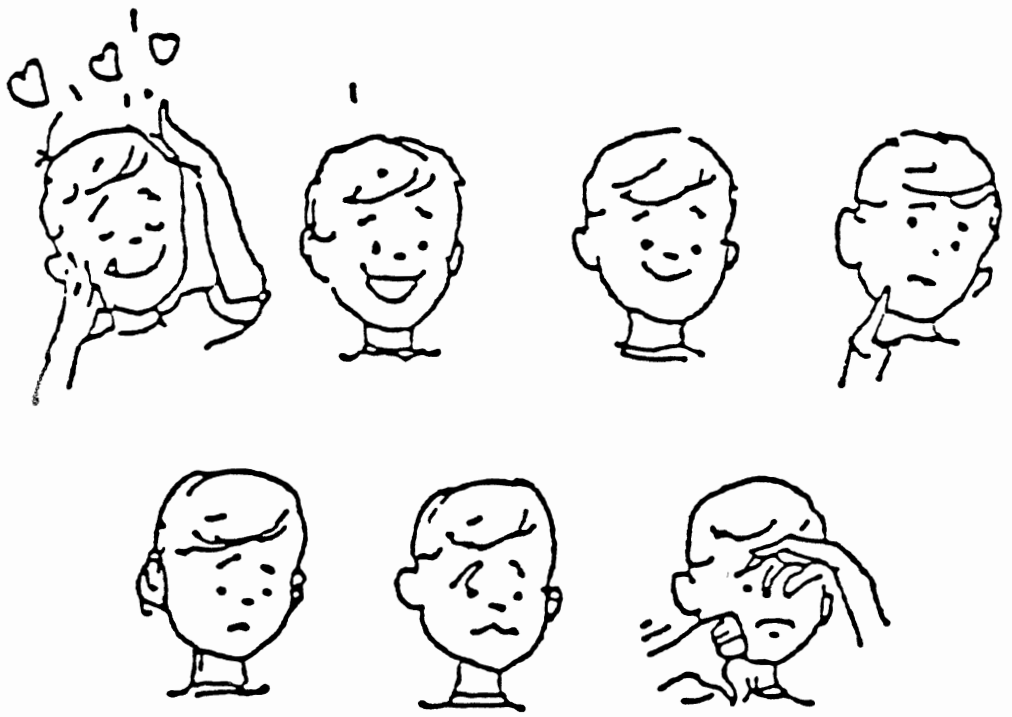


Figure 3. Facial hedonic scale , used in acceptance tests.

freedom in marking samples values (Meilgaard, Civille, & Carr, 1987). This type of ranking can also be used for more than two products. And, by using one evaluation sheet for several products forces the panelist to compare each product directly with the others, for each characteristic ranked.

Discriminatory Test

A discriminatory test is used to determine whether a difference exists between samples (Larmond, 1977). This test employs three samples (two identical and one different) presented simultaneously. The judge is asked to determine which of the three is the odd sample (IFT, 1964; Larmond, 1977). Since the panelist is looking for the odd sample, the samples should differ only in the variable being studied. All other differences should be masked. Blindfolds are helpful in this study.

This method is very useful in quality control work to ensure that samples are the same, identifying a difference or preference between two like products. It is also useful in determining if ingredient substitutions result in a detectable difference in the product. This test can save the restaurant owner money, if the panelist determine there is no difference between two products, or two ingredients with different prices. This test is easy to administer, easy for the panelist to do, and easy to analyze. But, if a difference exists, another test should be conducted to determine which sample is superior. Preference and

acceptance test can be used for this purpose.

Descriptive Test

"Descriptive analysis seeks to describe and analyze all of the perceived aroma, flavor and or texture characteristics of a product" p. 6-2 (Civille, 1979). The panelist must be able to detect, describe, and score intensities of these characteristics (IFT, 1964; Civille 1979). Extensive training is needed when conducting descriptive tests.

The score sheet for descriptive testing, can be structured or unstructured (Larmond, 1977). The structured scale, uses terms on the scale representing equal sensory intervals. For instance, the scale may range from not bitter, trace of bitterness, slightly bitter, bitter, very bitter, to extremely bitter, as in Figure 4 (p. 43 Larmond, 1977). An example of a unstructured score sheet used in descriptive analysis is shown in Figure 5 (p. 50 Larmond, 1977). "Unstructured scales, with verbal anchors at the ends only, eliminate the problem of unequal intervals that is associated with structured scales" p. 49 (Larmond, 1977).

The descriptive analysis method is considered the most sophisticated sensory method (Civille, 1979). Training the analyst, administering the test, and evaluating the test are time consuming for the analyst and the researcher. But, statistically designed sampling procedures can insure good quality control. "If the panel has become familiar with

NAME:

Evaluate these samples for bitterness. Indicate the amount of bitterness in each sample on the scales below.

419	172
___not bitter	___not bitter
___trace of bitterness	___trace of bitterness
___slightly bitter	___slightly bitter
___bitter	___bitter
___very bitter	___very bitter
___extremely bitter	___extremely bitter

Comments:

Figure 4. Questionnaire for Scoring Descriptive Analysis.

Name:

Please evaluate the firmness and chewiness of these sample of wieners.

1. Firmness - make vertical lines on the horizontal line to indicate your rating of the firmness of each sample. Label each vertical line with the code number of the sample it represents.

Please taste the samples in the following order:

572 681 437 249

---

very soft very firm

2. Chewiness - make vertical lines on the horizontal line to indicate your rating of the chewiness of each sample. Label each vertical line with the code number of the sample it represents.

---

very mushy very rubbery

Comments:

Figure 5. Descriptive Analysis with Scaling.

typical formulation and processing variables during training, he can troubleshoot for the production staff by identifying the potential source of variation in a product" p. 6-4 (Civille, 1979).

Steps in Evaluating a Food Product

Panelists should be instructed prior to each study on the sensory techniques to be used. They should understand the methods, scales, score sheets, and terminology to be used in a test. For instance, if pasta is being evaluated, the panelist should be familiarized with a sample of pasta cooked to the "al dante" stage so they know what the preferred firmness of pasta is before they try to rate samples as to soft, to firm or just right. Although these techniques will differ somewhat with the product, every panelist on a given panel should use the same techniques, and have the same pre-training when actually rating a sample, the panelist should follow these steps.

First, panelists should smell the product. If nothing is perceived after three smells, the panelist should sniff the product with the mouth closed.

Second, the panelist should look carefully at the appearance of the product. The product should be broken so the interior of the product can be evaluated.

And then, when tasting a product, check for one attribute at a time. For example; use one bite to check mouthfeel, another bite for moisture, etc. The sample

should be swirled around in the mouth in such a way that it touches all parts of the tongue. Being sure the sample reaches the papillae at the edges of the tongue where the sour taste is perceived as well as the tip and center of the tongue so that sweet and salty are correctly evaluated. And, the sample should contact the rear of the tongue to identify bitter, but do not swallow the sample. Swallowing causes the stomach to become unnecessarily full and sickness could result, particularly if you are rating several characteristics for several different samples.

The forth step is, rinsing the mouth to rid it of sample residue before proceeding to the next sample; take a drink of distilled water and swirl it into all areas of the mouth. Spit water into a large waste cup. Do not swallow the water. Cold or hot water is avoided because temperature extremes will dull the sense of taste.

Panel member training is designed to familiarize an individual with sensory terminology, improve an individual's ability to recognize and identify sensory attributes in complex food systems, and improve an individual's sensitivity, and memory so that he/she can provide precise, consistent, and standardized sensory measurement which can be used for maintaining a regularly high quality product in the restaurant.

CHAPTER III

RESEARCH PROCEDURES

Introduction

This study developed and tested a video in order to demonstrate how this educational medium could be applied in product development, and later in education of restaurant students. This chapter outlines the research design, sample and population, video development, data collection, and data analysis.

Research Design

The impact of a training video in sensory evaluation was studied in this investigation. Effectiveness of the video was evaluated by using a post-test control group design (Campbell, & Stanley, 1963). A pre-test/post-test control group design was utilized for evaluating attitude changes.

A pre-test/post-test design was used to determine whether there would be differences in the attitudes of restaurant students toward sensory evaluation as a result of viewing the sensory evaluation training video. A pre-test/post-test control group design is a true experimental design which controls for all significant confounding

variables (personal history, maturation, testing, instrumentation, regression, selection process, mortality, selection interactions, and repeated measures) with the exception of pre-test/treatment interaction effects. It is based, however, on the assumption that random assignment of students to the experimental and control groups is possible, ensuring that the effects of extraneous variables will be random across treatments and controls.

Following a post-test design, a comparison of sensory ratings were used to test the effectiveness of sensory perceptions of restaurant students who viewed a sensory evaluation training video. According to Campbell and Stanley (1963) this design is frequently used for the initial introduction of new educational research. The post-test control group design controls for all sources of internal invalidity. And, the post-test control for the reactive or interaction effect of pre-testing.

Sample and Population

The population from which the sample was randomly selected were students enrolled in the School of Hotel and Restaurant Administration at Oklahoma State University during the summer semester of 1990. Of the 75 enrolled in the School of Hotel and Restaurant Administration at Oklahoma State University during the summer semester of 1990, twenty-two participated in this study. The panel included students classified as sophomores, juniors, and

seniors. These students were identified as having no previous association or training in sensory evaluation.

The participants of the sensory evaluation educational video included eleven males and eleven females, ranging from nineteen to thirty six years of age. The participants were divided into two groups, fifteen for the experimental group and seven for the control group. The groups were uneven due to the fact that four of the participants randomly selected to be in the control group had scheduling conflicts. These students were assigned to the experimental group.

Video Development

Planning and development of the video began by utilizing the ASSURE model. This model by Heinich, Molenda, and Russell (1985) is a procedural guide for planning and delivering instruction that incorporates media. The ASSURE model involves: 1) analyzing learner characteristics; 2) stating objectives; 3) selecting, modifying, or designing materials; 4) utilizing materials; 5) requiring learner response; and 6) evaluating the materials (Heidi, Molenda, & Russell, 1985).

The planning process involved several steps. The first step was to analyze learner characteristics. For this study future restaurant managers, with no previous training in sensory evaluation, and enrolled in an upper division Hotel and Restaurant Administration class at Oklahoma State

University for the summer semester in 1990, were the learners being utilized.

The second step in planning and developing the video was to state objectives. The objectives of the researcher's video were to: (1) show the importance in utilizing sensory evaluation techniques when evaluating food products; (2) demonstrate basic tasting techniques involved in sensory evaluation; (3) discuss common evaluation forms that are practical for any restaurant setting and demonstrate methods for completing the form; (4) discuss the environment needed for effective sensory taste panels; and (5) explain the utilization of statistical charts in analyzing the results easily. Once objectives had been set materials were selected to design the sensory evaluation video.

The designing process began by developing an outline of sensory evaluation information to be covered in the video script. The script was then written to enforce and enhance the sensory evaluation subject areas covered in the outline (see Appendix A). Visual aids were utilized throughout the video to reinforce the script, and for audience stimulation. Important text information was superimposed, graphics highlighted for emphases, and backgrounds reinforced. Visuals were arranged for filming by purchasing, preparing, and presenting the food product in a professional and attractive manner. Wrigley's gum was a visual utilized to give an example of a company that saved money, time, and effort when practicing the results of a sensory evaluation

panel. Another example of food product utilized as a visual aid was a red delicious apple. A bright red apple was utilized to emphasize the fact that appearance of a product has an effect on our evaluation of that product. The appearance of a bright red apple would suggest a crisp, juicy, flavorful apple. Once the script was written, and the visual aids prepared, the video equipment was set up.

A dining room, utilized as a training facility for Hotel and Restaurant Administration students at Oklahoma State University, was selected as the location for filming. The dining room was available to the researcher and provided the panelist with a quiet, comfortable environment. The dining area utilized in this study was separate from the preparation area, therefore odors from preparation were kept from the testing area.

A sensory evaluation testing area is also located in the same building as the dining room in this study. This sensory testing area demonstrated an efficient tasting area. A hand-held video recorder was utilized in both the dining area and the sensory testing area.

A graduate student in television and communication filmed the video. A volunteer was used as the actress, the researcher served as the commentator and appeared on the tape. The filming of the video took nineteen hours and included; set-up of lights and camera, filming the actress, editing the mistakes, and adding the voice to the video. The completed video was sixteen minutes long.

The fourth step involved in planning and delivering instruction that incorporates media, was to utilize the material. The sensory evaluation video was utilized to familiarize a selected group of Hotel and Restaurant Administration students with sensory evaluation procedures. Once the video had been viewed, responses were collected from the learners. The second group of students who participated in the study, and did not observe the educational video or receive any training, were the control group.

The fifth step was to require learner responses. Three forms were utilized to elicit responses from the video observers (trained panelist) and the non-observers (untrained panelist). An evaluation form consisting of fourteen questions was utilized to evaluate any attitude differences of restaurant students toward sensory evaluation after viewing the sensory evaluation training video. Untrained or control panelists were evaluated on their attitude after participating in a sensory evaluation panel. The trained and untrained panelists also evaluated two food products using a triangle test discussed in the sensory evaluation video. In this test, the panelist received three coded samples of pasta. Two of the samples were the same, and the panelists were asked to identify the odd sample. During the tasting session, all panel members also rated samples using a ranking evaluation consisting of bipolar line scales. Each line scale on the evaluation form was 100

mm long, with a midpoint drawn in. The middle of the scale (50mm) represented the optimum rating of a standard, good quality product. The ranking test was also discussed and demonstrated in the sensory evaluation video. Fresh pasta and dried pasta made from Oklahoma hard red winter wheat was utilized for both sensory tests.

Pasta created from Oklahoma hard red winter wheat was utilized for this study. The Oklahoma Wheat Commission was funding the researcher and Dr. Sue Knight to develop an acceptable pasta utilizing Oklahoma wheat. The pasta developed was evaluated by the sensory panelists.

The sixth and final step, in the planning and delivering of instruction that incorporats media, was evaluation. A t-test was used to analyze the result of the fourteen question attitude test. A table by the American Society for Testing and Materials (ASTM) (1968) was used to analyze the triangle test (see Appendix C). An analysis of variance (ANOVA) was performed to evaluate the results of the ranking test.

Data Collection

The instrument for evaluating student attitudes before and after viewing the video was adapted from Heinich's, Molenda's and Russell's (1985) study, with changes appropriate for the sensory evaluation video. The questionnaire as used in the Heinich, Molenda and Russell study was pilot tested on a class studying biology. The

structure of the questions were left identical but, the subject area was changed to sensory evaluation (see Appendix B).

Several evaluation forms have been developed by the American Society for Testing and Materials (1968), for use in evaluating food products. Although several evaluation instruments have been developed, the researcher utilized a triangle test and ranking test for this study. Schutz (1971) believes the ability to receive the same results twice in sensory evaluation is possible if the experimenter is utilizing good measurement techniques. Thus, reliable results are possible. Internal validity can be controlled by positioning and coding samples in a randomized form. And, external validity can be controlled thru random selection of panelist for a representative population (Schutz, 1971). Reliability and validity were established by the researcher when designing the sensory evaluation procedures.

The triangle test is easy to administer and use for quality control work of food products. The panelist were told one of the three food samples was different. They are to identify the different food sample by placing a check next to the number, on the answer sheet, that corresponds with the number on the sample cup with the different food product in it. The triangle test can be very profitable for the restaurant manager. An example, would be the evaluation of two brands of gingersnap cookies. If the manager feels

there is no difference between the two but price, then a sensory evaluation team can test this hypothesis. And, if this turns out to be the case, the restaurant can save money, without jeopardizing a quality product. Sometimes, however, we need to know more about products than just "is there a difference?" The ranking test is utilized to compare food products with others, while looking at several characteristics at a time.

Data Analysis

An evaluation of the pre-test scores provides a test of the equivalence of the groups, while comparisons of the post-test scores provides a test of the impact of the training video. The t-test compares the experimental and control group mean scores of the pre-test/post-test.

Analysis of the results of the triangle test is based on the probability that, if there is no detectable difference, the odd sample will be selected by chance one-third of the time. Tables for rapid analysis of triangle test data were prepared by Roessel et al. (1946) to determine if the panelist can detect a difference. The chi-square test was utilized to see whether significant differences exist between the experimental and control groups results.

For analyzing the ranking test, the analysis of variance (ANOVA) was performed using the Statistical Analysis System. To determine if the difference between the

samples was significant, the calculated F value, from the Analysis of Variance, was checked with the tabulated F value.

CHAPTER IV

FINDINGS

Introduction

The purpose of this research was to develop and test a video in order to demonstrate how this educational medium can be applied in product development. The sixteen minute long educational video was designed and developed by the researcher at Oklahoma State University.

The study was guided by the following objectives.

1. To develop a training video showing basic sensory evaluation techniques as applied to product development and the restaurant industry.
2. To use a video in training restaurant management students in sensory evaluation.
3. To determine effectiveness of the sensory evaluation video as an educational tool in training HRAD students.
4. To determine the attitudes of the restaurant management students after viewing a sensory training video.

The findings described in this chapter resulted from the pre-test and post-test for attitudes responded to by experimental and control groups. And, the results from the post-test responded to by experimental and control groups for effectiveness.

Population and Sample

This study explains the flexibility of using a video to train a panel in procedures of sensory evaluation of a pasta product. A pre-test and a post-test design was utilized for assessing attitudes, a post-test design was followed in determining effectiveness. The participants were students enrolled in the Hotel and Restaurant Management program at Oklahoma State University during the summer semester of 1990. Participants came from a population of a larger number of students who shared the same interest. All panelists volunteered to participate in the sensory evaluation study.

Twenty-two students participated in this study. There were 22 usable responses from the pre-tests and post-tests given to participants, 15 from the experimental group and 7 from the control group. The groups were evenly divided, but eight of the participants from the control group were unable to complete the study. Uneven groups had no effect on the statistical results. Mean scores were utilized in analyzing for the Analysis of Variance and also for the t-test.

Treatment for the Students

The treatment consisted of training which included the following components:

- The experimental group observed the 16 minute training video on sensory evaluation followed by instruction on skills in filling out the evaluation forms.

- The control group only received the instruction in filling out the sensory evaluation forms, and this group did not view the sensory training video.

Examination of Hypotheses

Two hypotheses were examined in an effort to identify significant differences between the experimental and control groups.

Effectiveness of Sensory Video

H_1: There will be no difference in effectiveness of restaurant students as sensory panelists due to viewing a sensory evaluation training video.

For the purpose of evaluating effectiveness of training, sensory evaluation forms developed by the American Society for Testing and Materials (1968) were utilized. A triangle test and a ranking test were utilized for this study (See Appendix B).

Comparison of Products

The triangle test was used to determine whether panelists could detect if a difference exists between two samples. Fresh pasta and dried pasta were utilized for the triangle test. The panelists were instructed to indicate and identify the odd sample (dried pasta in this case) on the evaluation sheet, by checking the blank space next to the code number that corresponded to the sample's code. A table

by ASTM (1968) was used to analyze the triangle test (see Appendix C). For the control group, seven correct judgments out of seven in a triangle test indicate a significant difference at the .1% level. For the experimental group, eleven correct judgements out of fifteen in a triangle test indicate a significant difference at the 1% level. The chi-square value of 5.46 (p=.0194) indicates that there is a significant difference between the control and experimental groups. Observations by the researcher denote that the experimental group did take more time evaluating the products, and indicates greater difference due to detail. Significant differences do exist between the experimental and control groups, therefore the researcher does reject the null (H_1).

Ranking of Pasta Product

The ranking test was utilized to compare six pasta products, while looking at several characteristics (color, flavor, texture, and acceptability). The panelists were instructed to "place straight lines through the scales indicating their sensory evaluation and label their marks with the corresponding numbers on the cups". As an example, a completed sample evaluation form was available on the top of the evaluation form. Analysis of variance (ANOVA) was performed, using the Statistical Analysis System, to determine whether significant differences existed among the two groups of panelists.

An analysis of variance comparing the experimental group to the control group was performed on pasta made from Oklahoma hard red winter (HRW) wheat and durum semolina. For the attribute acceptability, there was no significant difference. The analysis of variance results for color of this pasta yielded a probability value of .8417 which was not significant at the .05 level. Results of the analysis of variance for differences between scores of flavor for the control and experimental groups of this pasta yielded a probability value of .8318 which was not significant at the .05 level. The analysis of variance for texture of this particular pasta yielded a probability value of .6113 which is not significant at the .05 alpha level. There were no significant differences between the scores of the control group versus the scores of the experimental groups for any of the attributes studied for pasta made with Oklahoma hard red winter wheat and durum semolina (see Table I).

The analysis of variance comparing experimental to control groups was performed on pasta made from Oklahoma hard red winter wheat and whole egg. For the attribute, acceptability, there was no significant difference. Results of the analysis of variance for color of this pasta yielded a probability value of .4985 which was not significant at the .05 level. The results of the analysis of variance for differences between scores of flavor for the control and experimental groups of this pasta yielded a probability

value of .4013 which was not significant at the .05 level. The analysis of variance for texture of this particular

TABLE I

SUMMARY OF THE ANALYSIS OF VARIANCE OF DIFFERENCES BETWEEN THE CONTROL AND EXPERIMENTAL GROUPS SCORES OF ATTRIBUTES STUDIED FOR PASTA MADE FROM OKLAHOMA HARD RED WINTER WHEAT AND DURUM SEMOLINA FLOUR

Attributes	F Value	Pr>F
Acceptability	0.13	0.7220
Color	0.04	0.8417
Flavor	0.05	0.8318
Texture	0.27	0.6113

*For complete ANOVA see Appendix C.

pasta yielded a probability value of .7274 which is not significant at the .05 alpha level. There were no significant differences between the scores of the control group versus the scores of the experimental group for any of the attributes studied for pasta made with Oklahoma hard red winter wheat and whole egg (see Table II).

TABLE II

SUMMARY OF THE ANALYSIS OF VARIANCE OF DIFFERENCES BETWEEN THE CONTROL AND EXPERIMENTAL GROUPS SCORES OF ATTRIBUTES STUDIED FOR PASTA MADE FROM OKLAHOMA HARD RED WINTER WHEAT AND WHOLE EGG

Attributes	F Value	Pr>F
Acceptability	0.23	0.6356
Color	0.48	0.4985
Flavor	0.74	0.4013
Texture	0.12	0.7274

*For complete ANOVA see Appendix C.

An analysis of variance comparing the experimental group to the control group was performed on pasta made from Oklahoma hard red winter wheat and dry egg whites. For the attribute acceptability, there was no significant difference. The analysis of variance procedure for color of this pasta yielded a probability value of .8182 which was not significant at the .05 level. Results of the analysis of variance for differences between scores of flavor for the control and experimental groups of this pasta yielded a probability value of .6233 which was not significant at the

.05 level. The analysis of variance for texture of this particular pasta yielded a probability value of .9817 which is not significant at the .05 alpha level. There were no significant differences between the scores of the control group versus the scores of the experimental group for any of the attributes studied for pasta made with Oklahoma hard red winter wheat and dry egg whites (see Table III).

TABLE III

SUMMARY OF THE ANALYSIS OF VARIANCE OF DIFFERENCES BETWEEN THE CONTROL AND EXPERIMENTAL GROUPS SCORES OF ATTRIBUTES STUDIED FOR PASTA MADE FROM OKLAHOMA HARD RED WINTER WHEAT AND DRY EGG

Attributes	F Value	Pr>F
Acceptability	0.00	0.9873
Color	0.05	0.8182
Flavor	0.25	0.6233
Texture	0.00	0.9817

*For complete ANOVA see Appendix C.

An analysis of variance comparing experimental to control group was performed on pasta made from Oklahoma hard red winter wheat and fresh egg whites. For the attribute, acceptability, there was no significant difference. Results of the analysis of variance for color of this pasta yielded a probability value of .2553 which was not significant at the .05 level. The results of the analysis of variance for differences between scores of flavor for the control group and the experimental group yielded a probability of .9634 which was not significant at the .05 level. The analysis of variance results for texture of this particular pasta yielded a probability value of .0292 which is significant at the .05 alpha level. There were no significant differences between the scores of the control group versus the scores of the experimental group for any of the attributes studied, except texture, for pasta made from Oklahoma hard red winter wheat and fresh egg whites (see Table IV).

An analysis of variance comparing the ratings of the experimental group to those of the control group was performed on pasta made from Oklahoma hard red winter wheat and fresh egg yolk. For the attribute acceptability, there was no significant difference. The analysis of variance procedure for color of this pasta yielded a probability value of .5265 which was not significant at the .05 level. Results of the analysis of variance for differences between scores of flavor for the control group and experimental group yielded a probability value of .7923 which was not significant at the

TABLE IV

SUMMARY OF THE ANALYSIS OF VARIANCE OF DIFFERENCES BETWEEN THE CONTROL AND EXPERIMENTAL GROUPS SCORES OF ATTRIBUTES STUDIED FOR PASTA MADE FROM OKLAHOMA HARD RED WINTER WHEAT AND FRESH EGG WHITE

Attributes	F Value	Pr>F
Acceptability	0.43	0.5214
Color	1.38	0.2553
Flavor	0.00	0.9634
Texture	5.52	0.0292

*For complete ANOVA see Appendix C

.05 level. The analysis of variance for texture of this particular pasta yielded a probability value of .6714 which is not significant at the .05 alpha level. There were no significant differences between the scores of the control group versus the scores of the experimental group for any of the attributes studied for pasta made with Oklahoma hard red winter wheat and fresh egg yolk (see Table V).

TABLE V

SUMMARY OF THE ANALYSIS OF VARIANCE OF DIFFERENCES BETWEEN THE CONTROL AND EXPERIMENTAL GROUP SCORES OF ATTRIBUTES STUDIED FOR PASTA MADE FROM OKLAHOMA HARD RED WINTER WHEAT AND EGG YOLK

Attributes	F Value	Pr>F
Acceptability	1.70	0.2077
Color	0.42	0.5265
Flavor	0.07	0.7923
Texture	0.19	0.6714

*For complete ANOVA see Appendix C.

An analysis of variance comparing experimental to control groups was performed on pasta made from Oklahoma hard red winter wheat and no egg. For the attribute acceptability, there was no significant difference. The analysis of variance procedure for color of this pasta yielded a probability value of .7885 which was not significant at the .05 level. Results of the analysis of variance for differences between scores of flavor for the control and experimental group of this pasta yielded a probability value of .1451 which was not significant at the

.05 level. The analysis of variance for texture of this particular pasta yielded a probability value of .5905 which was not significant at the .05 alpha level. There were no significant differences between the scores of the control group versus the scores of the experimental group for any of the attributes studied for pasta made with Oklahoma hard red winter wheat and no egg (see Table VI).

TABLE VI

SUMMARY OF THE ANALYSIS OF VARIANCE OF DIFFERENCES BETWEEN THE CONTROL AND EXPERIMENTAL GROUPS SCORES OF ATTRIBUTES STUDIED FOR PASTA MADE FROM OKLAHOMA HARD RED WINTER WHEAT AND NO EGG

Attributes	F Value	Pr>F
Acceptability	0.97	0.3367
Color	0.07	0.7885
Flavor	2.31	0.1451
Texture	0.30	0.5905

*For complete ANOVA see Appendix C.

The data were further analyzed to discern if there was a significant difference in the characteristics of the various pasta. Figure 6 is a line graph showing the mean ratings of the control group versus the experimental group for individual pastas and characteristics. This graph is drawn to depict how the groups varied from the optimum response, the optimum score being 50. The solid line on the graph indicates the mean ratings for the experimental, or video viewing group, while the dotted line indicates the mean ratings for the control group. According to this graph the pasta made from Oklahoma hard red winter wheat and durum

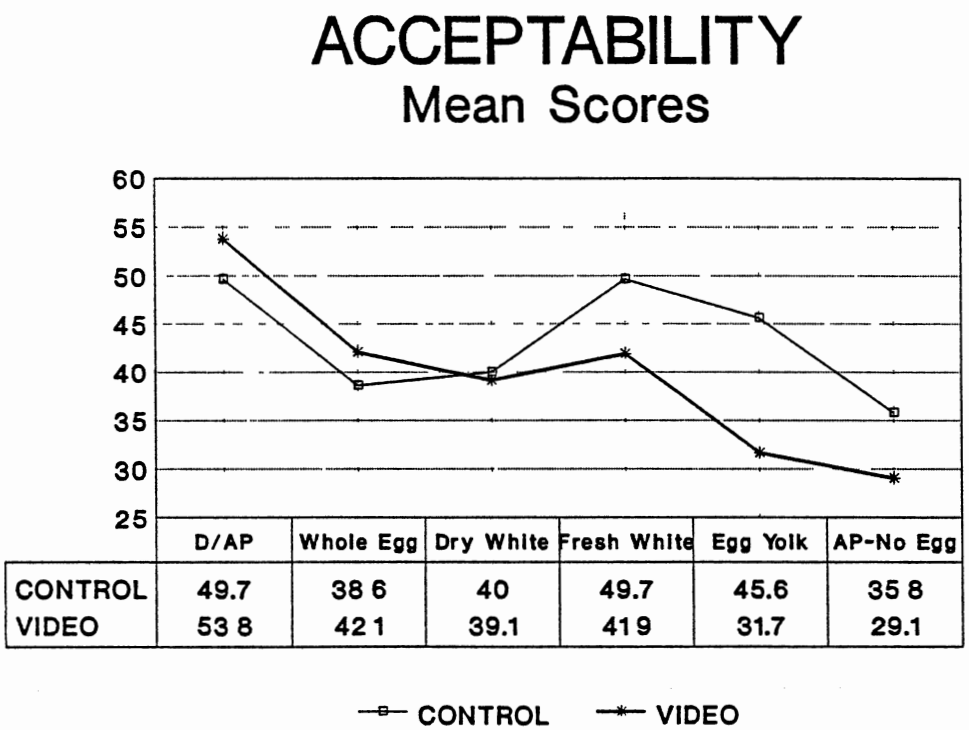
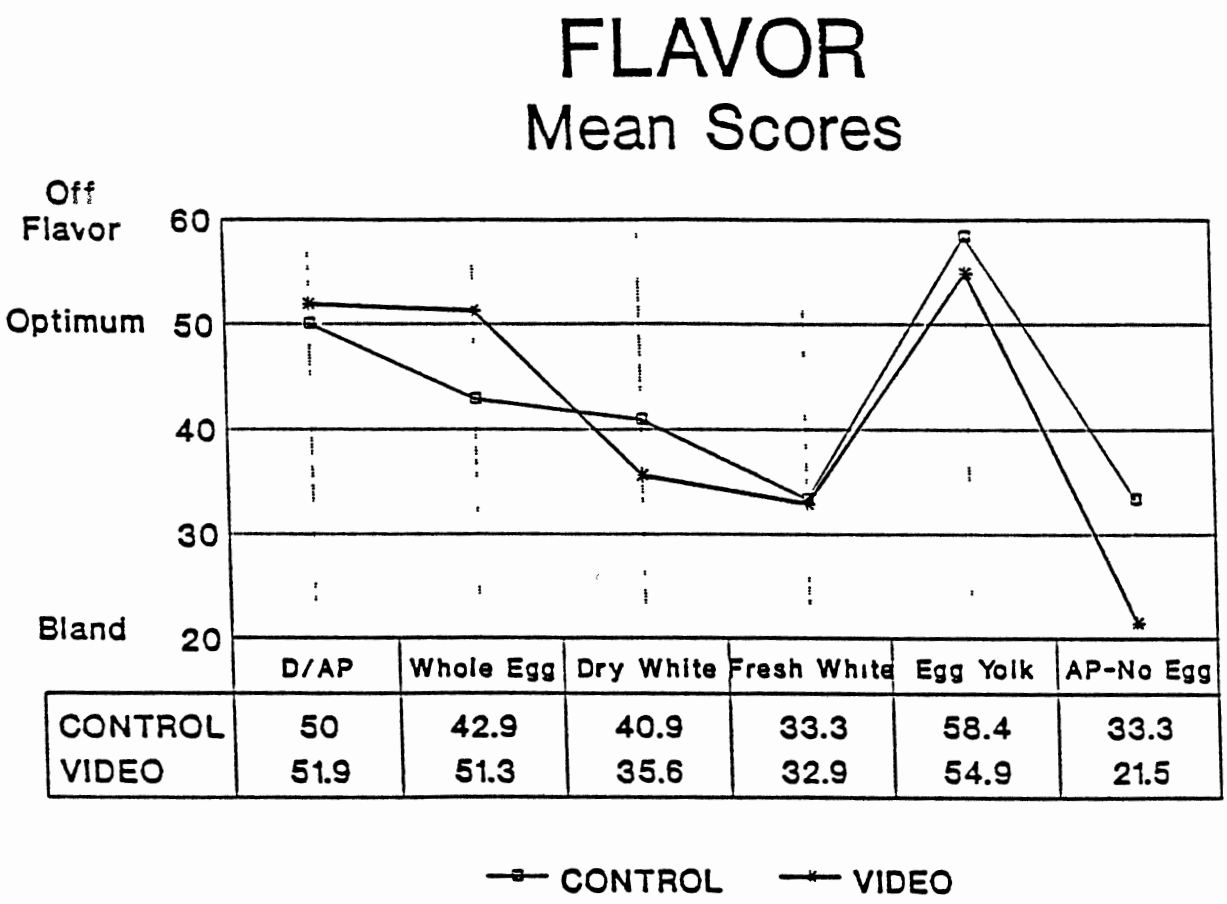
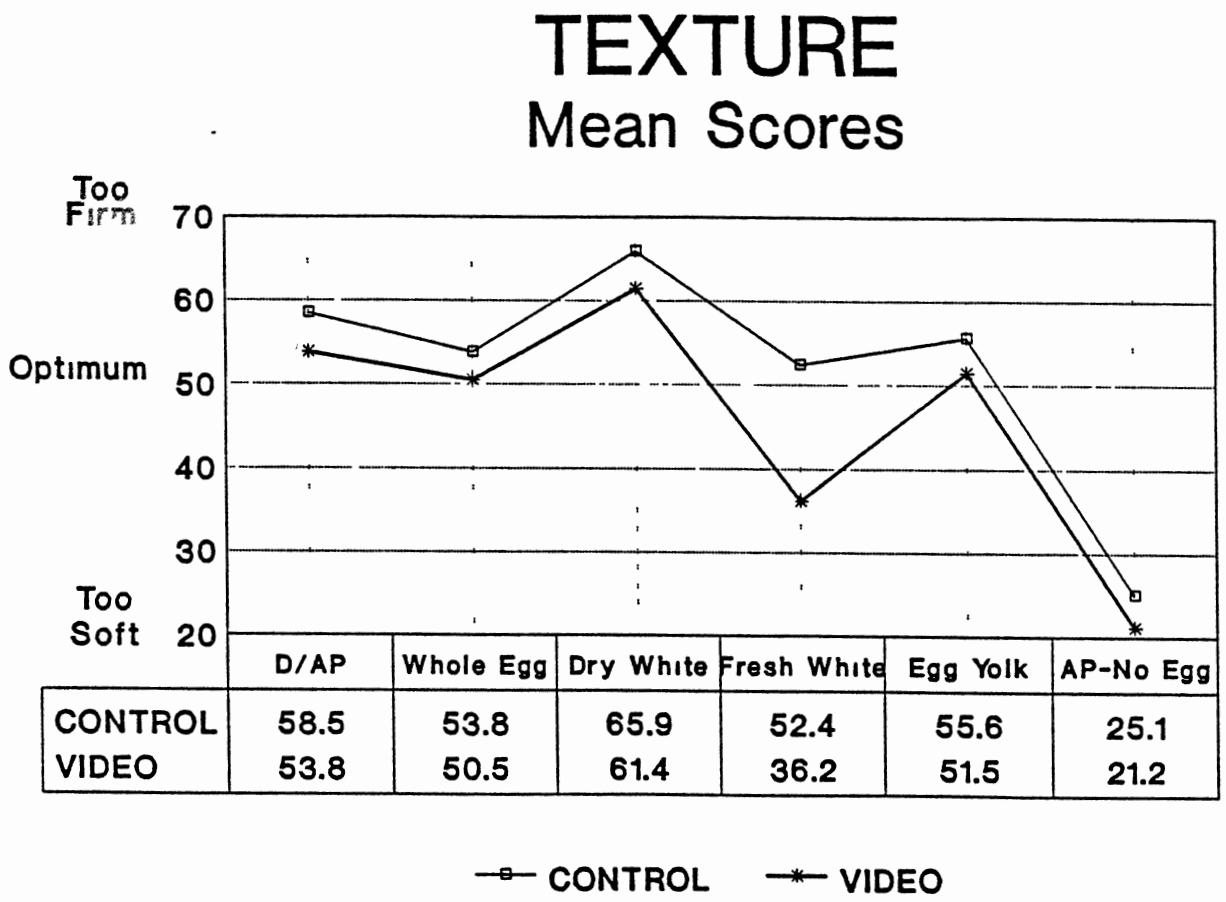


Figure 6. Mean ratings of the control group versus the experimental for acceptability.



	D/AP	Whole Egg	Dry White	Fresh White	Egg Yolk	AP-No Egg
CONTROL	50	42.9	40.9	33.3	58.4	33.3
VIDEO	51.9	51.3	35.6	32.9	54.9	21.5

Figure 7. Mean ratings of the control group versus the experimental for flavor.



	D/AP	Whole Egg	Dry White	Fresh White	Egg Yolk	AP-No Egg
CONTROL	58.5	53.8	65.9	52.4	55.6	25.1
VIDEO	53.8	50.5	61.4	36.2	51.5	21.2

Figure 8. Mean ratings of the control group versus the experimental for texture.

semolina was the most acceptable product for the experimental and control groups. In Figure 7, the control group scored the pasta made from Oklahoma hard red winter wheat and durum semolina flour as having the best flavor. The experimental groups scored the pasta made from Oklahoma hard red winter wheat and whole egg as having the best flavor. Figure 8 depicts the results of the experimentaland control group scores for the attribute texture. Pasta made from Oklahoma hard red winter wheat and whole egg had the best texture, for both the experimental and control groups. In Figure 9, the experimental and control groups scored the pasta made from Oklahoma hard red winter wheat and durum semolina flour as having the optimum color. Overall, the control group tended to score attributes higher for the different varieties of pasta. There were no significant differences between responses of the control group versus the experimental group, except for the texture of the pasta made with Oklahoma Hard Red Winter wheat and fresh egg white. The difference was significantly different at the .05 level (P=.014). Therefore, the video did not significantly affect the effectiveness of the participants viewing the sensory training video.

Attitudes Toward Sensory Evaluation

H_2: There will be no difference in attitudes towards sensory evaluation of restaurant students due to viewing the sensory evaluation training video based on pre-test and

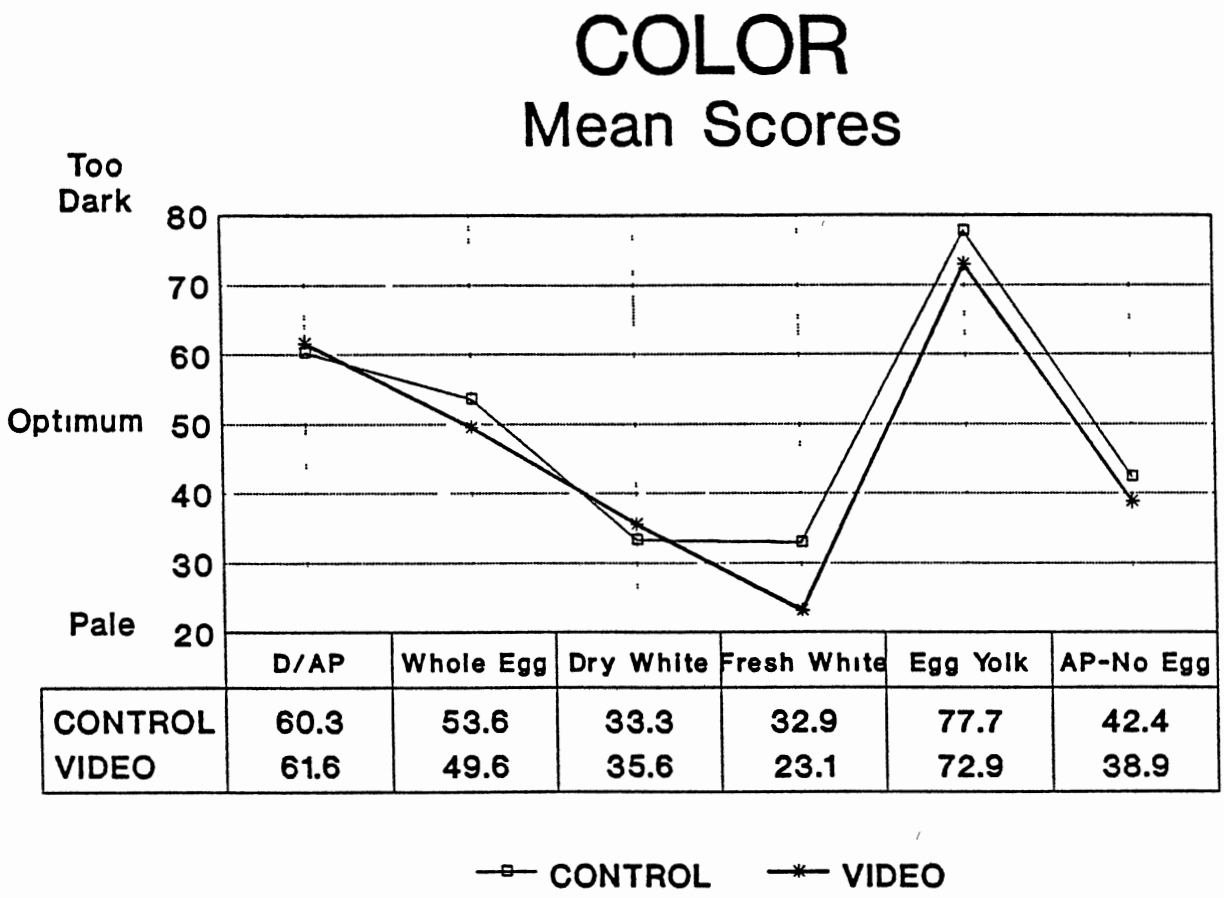


Figure 9. Mean ratings for the control group versus the experimental for color.

post-test.

The fourteen items on the attitude scale portion of the instrument were used to test the possibility of significant difference between the participants of the experimental group and control group regarding attitudes toward viewing a video on sensory evaluation as an educational method (see Appendix B). A rating of two indicated "strongly agree"; one indicated "agree"; negative one indicated "disagree"; negative two indicated "strongly disagree"; and zero indicated uncertain. The reverse of this scale was utilized for questions initiating a negative response.

The sum of the fourteen attributes as totalled (after taking into account the four reversals, represented by negative scores). This score represents an overall attitude towards sensory evaluation and could range in value from -28 to 28.

The t-test was used to compare the experimental and control group mean scores of the pre-test and post-test. First the researcher compared the scores of the control and experimental group for both the pre-test and the post-test. Then the researcher compared the scores of the pre-test and the post-test for both the control and experimental groups.

Table VII presents the findings for the t-test comparing the scores of the control and experimental group for the pre-test. The t-test comparing the scores of the control and experimental group for the post-test. There were no significant differences for any of the fourteen

TABLE VII

T-TEST ANALYSIS COMPARING SCORES OF THE CONTROL AND EXPERIMENTAL GROUP FOR THE PRE-TEST, AND A T-TEST ANALYSIS COMPARING SCORES OF THE CONTROL AND EXPERIMENTAL GROUP FOR THE POST-TEST

		Prob>|t| Pre-test	Post-test
1.	Sensory evaluation is very interesting to me.	.4848	.9197
2.	I don't like sensory evaluation, and I don't think it has real importance.	.5036	.1861
3.	I am always under a terrible strain, I don't like to make decisions.	.7882	.1036
4.	Sensory evaluation is fascinating and fun.	.7399	.2308
5.	Sensory evaluation can make me feel sure I have chosen the right product.	.8793	.7772
6.	Sensory evaluation makes me feel uncomfortable, restless, and impatient.	.7379	.2672
7.	In general, I have a good feeling toward sensory evaluation.	.3136	.4772

TABLE VII (continued)

8.	When I hear the words sensory evaluation, I have a feeling of dislike.	.3407	.4558
9.	I approach sensory evaluation with a feeling of hesitation.	.3902	.3352
10.	I fully understand the importance of sensory evaluation in providing a quality food product to the customer.	.4388	.7603
11.	I have always enjoyed evaluating food products.	.1962	.9545
12.	It make me nervous to even think about doing a sensory evaluation.	.9531	.7603
13.	I feel at ease in sensory evaluation and like it very much.	.2299	.9524
14.	I feel a definite positive reaction to sensory evaluation; it's enjoyable.	.5082	.8240
	OVERALL ATTITUDE SCORE	.6249	.6632

questions. The p-value comparing overall attitude score of the experimental group with the control group for the pre-test was .6249. And, the p-value comparing the mean value of the experimental and control group for the post-test is .6632. Therefore, the researcher did not reject the hypothesis (H_2), and concluded that there were no differences between the control and experimental group for either the pre-test or post-test scores.

The data were further analyzed to discern if there was a significant difference between the pre-test and post-test of the control group, and the experimental group was studied to determine differences between the pre-test and post-test. Table VIII presents the findings of the t-test comparisons between the pre-test and post-test scores of the experimental and control groups. The p-value comparing the overall attitude score of the pre-test and post-test for the control group was .2730, and the p-value comparing the means of the pre-test and post-test of the experimental group was .5738. The overall attitude score of the control group versus the experimental group for the pre-test and post-test are reported in Table IX. This table is included to depict how much the groups varied from each other. No significant differences existed between the pre-test and post-test for either the control group or the experimental group, therefore the researcher did not reject the null hypothesis (H_2).

Careful observation of the t-test scores reported in Table VIII resulted in finding significant differences for

TABLE VIII

T-TEST ANALYSIS COMPARING SCORES OF THE PRE-TEST AND POST-TEST FOR THE EXPERIMENTAL GROUP, AND A T-TEST ANALYSIS COMPARING SCORES OF THE PRE-TEST AND POST-TEST FOR THE CONTROL GROUPS

	Prob>|t| control	Exp
1. Sensory evaluation is very interesting to me.	.7778	.7036
2. I don't like sensory evaluation, and I don't think it has real importance.	.0306	.0830
3. I am always under a terrible strain, I don't like to make decisions.	.6110	.4259
4. Sensory evaluation is fascinating and fun.	.8427	.0302
5. Sensory evaluation can make me feel sure I have chosen the right product.	.3465	.1999
6. Sensory evaluation makes me feel uncomfortable, restless, and impatient.	.4105	.6791

TABLE VIII (continued)

7.	In general, I have a good feeling toward sensory evaluation.	.1960	.8490
8.	When I hear the words sensory evaluation, I have a feeling of dislike.	.2299	.6966
9.	I approach sensory evaluation with a feeling of hesitation.	.2472	.6612
10.	I fully understand the importance of sensory evaluation in providing a quality food product to the customer.	1.0000	.1395
11.	I have always enjoyed evaluating food products.	.3962	.6566
12.	It make me nervous to even think about doing a sensory evaluation.	.5517	.5851
13.	I feel at ease in sensory evaluation and like it very much.	.2572	.7936
14.	I feel a definite positive reaction to sensory evaluation; it's enjoyable.	.3005	.3130
	OVERALL ATTITUDE SCORE	.2730	.5733

TABLE IX

MEAN RATING FOR THE PRE-TEST AND POST-TEST SCORES OF THE EXPERIMENTAL AND CONTROL GROUPS

			Control	Exp.
1.	Sensory evaluation is very interesting to me.	Pre	.8571	.5000
		Post	.7143	.6666
2.	I don't like sensory evaluation, and I don't think it has real importance.	Pre	-1.1428	-0.9000
		Post	-1.7142	-1.4000
3.	I am always under a terrible strain, I don't like to make decisions.	Pre	-1.5714	-1.5000
		Post	-1.7142	-1.3333
4.	Sensory evaluation is fascinating and fun.	Pre	.0000	-0.2000
		Post	.1428	.7333
5.	Sensory evaluation can make me feel sure I have chosen the right product.	Pre	.2857	.2000
		Post	.8571	.7333
6.	Sensory evaluation makes me feel uncomfortable, restless, and impatient.	Pre	-0.7142	-0.9000
		Post	-1.2857	-0.7333
7.	In general, I have a good feeling toward sensory evaluation.	Pre	0.2857	.8000
		Post	1.0000	.7333

TABLE IX (continued)

8.	When I hear the words sensory evaluation, I have a feeling of dislike.	Pre Post	-0.5714 -1.1428	-1.0000 -0.8666
9.	I approach sensory evaluation with a feeling of hesitation.	Pre Post	0.0000 -0.8571	-0.6000 -0.4000
10.	I fully understand the importance of sensory evaluation in providing a quality food product to the customer.	Pre Post	1.1428 1.1428	0.9000 1.2000
11.	I have always enjoyed evaluating food products.	Pre Post	.0000 .5714	.8000 .6000
12.	It make me nervous to even think about doing a sensory evaluation.	Pre Post	-1.2857 -1.1428	-1.3000 -1.2000
13.	I feel at ease in sensory evaluation and like it very much.	Pre Post	-0.2857 .4285	.3000 .4000
14.	I feel a definite positive reaction to sensory evaluation; it's enjoyable.	Pre Post	.0000 .5714	.3000 .6666
	Average Average	Pre Post	.5408 .9489	.7000 .8333

two of the fourteen questions. For question number two asking, "I do not like sensory evaluation and I do not think it has real importance" the control group p-value comparing the pre-test and post-test scores was .0306 which is significant at the .05 alpha level. For question number four asking, "sensory evaluation is fascinating and fun" the experimental group p-value comparing the pre-test and post-test scores was .0302 which is significant at the .05 alpha level.

Observations by the researcher denoted that the experimental group took more time evaluating the products, and indicates greater difference due to detail. The experimental group also utilized sensory evaluation techniques discussed in the training video. These same techniques were not utilized by the control group. The experimental group questioned the researcher after the experiment to find out the correct answer. The control group did not show this concern.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter summarizes the study. Information is provided about the purposes, objectives, hypotheses, sample and population, instrument, data collection, findings and conclusions, and recommendations.

Purposes and Objectives

The purposes of the study were to develop and test a video in order to demonstrate how this educational medium can be applied in product development.

The objectives developed for the study were as follows:

1. To develop a training video showing basic sensory evaluation techniques as applied to product development and the restaurant industry.

2. To use a video in training restaurant students in sensory evaluation; and

3. To determine effectiveness of the sensory evaluation video as an educational tool to training restaurant management students.

4. To determine the attitudes of the restaurant management students after viewing a sensory training video.

Hypotheses

Two null hypotheses were formulated for the study.

H_1: There will be no differences in effectiveness between a experimental group and a control group of restaurant students as sensory panelists due to viewing a sensory evaluation training video.

H_2: There will be no difference in attitudes scores between a experimental group and a control group towards sensory evaluation of restaurant students due to viewing the sensory evaluation training video based on pre-test and post-test.

Sample and Population

The population for the study were students in the School of Hotel and Restaurant program at Oklahoma State University. The sample consisted of 22 students enrolled in the program for the summer semester of 1990. Each sample had an experimental group of fifteen participants and the control group of seven participants. A pretest and a post-test design was utilized for assessing attitudes, a post-test design was followed in determining effectiveness.

Instrument

The instrument for evaluating student attitudes before and after viewing the video was adapted from Heinich's, Molenda's and Russell's (1985) study, with changes appropriate for the sensory evaluation video. Fourteen

items were used to test the possibility of significant difference between the participants of the experimental and control groups regarding attitudes toward viewing a video on sensory evaluation as an education method. The respondents were asked to respond to their feeling toward sensory evaluation.

Several evaluation forms have been developed by the American Society for Testing and Materials (1968), that can be used in evaluating food products. For the purpose of this study, a triangle test and ranking test were used.

Data Collection and Analysis

Prior to the data collection, the experimental group participated in both video training and a practice session where they familiarized themselves with sensory evaluation procedures. Training was also designed to ease any anxieties of the participants. Both control group did not receive any training. The experimental and control groups rated samples using a ranking evaluation consisting of bipolar line scales. Each line scale on the evaluation form was 100 mm long, with a midpoint drawn in. The middle of the scale represented the optimum rating of a standard, good quality product.

The experimental and control groups also evaluated two food products using a triangle test. In this test, the panelists received three coded samples. Two of the samples were the same, and the panelist was asked to identify the

odd sample.

A table by ASTM (1968) was used to analyze the triangle test. More specifically, an evaluation of the pretest scores provides a test of the equivalence of the groups, while comparisons of the post-test scores provides a test of the impact of the training video. The t-test compares the experimental and control group mean scores of the pre-test/post-test. Analysis of the results of the triangle tests is based on the probability that if there is no detectable difference, the odd sample will be selected by chance one-third of the time.

For analyzing the ranking test, the analysis of variance (ANOVA) was performed using the Statistical Analysis System. To determine if the difference between the samples was significant, the calculated F value, from the Analysis of Variance scale, was checked with the tabulated F value.

Data were collected, using a fourteen item attitude scale, to test the possibility of significant difference between the participants of the experimental and control groups regarding attitudes toward viewing a video on sensory evaluation as an educational method. The t-test was used to compare the experiment and control group mean scores of the pretest and post-test. The t-test was also performed using a non-parametric design.

Findings and Conclusions

The purpose of this research was to develop and test a video in order to demonstrate how this educational medium can be applied to product development. The sixteen minute long educational video was designed and developed at Oklahoma State University, by the researcher.

H_1. There will be no difference in effectiveness between a experimental group and a control group of restaurant students as sensory panelist due to viewing a sensory evaluation training video. The triangle test was used to determine whether panelists could detect if a difference existed between two samples. For the control group, seven correct judgements out of seven in a triangle test indicate a significant difference at the .1% level. For the experimental group, eleven correct judgements out of fifteen in a triangle test indicated a significant difference at the 1% level. Four trained panelists could not detect the different product. This difference could be due to: 1) differences in panelist sensitivity; 2) differences in the product itself; and/or 3) differences in the experiment. Both the trained and untrained panelists could detect the odd sample in the triangle test. The chi-square value of 5.46 (p=.0194) indicates that there is a significant difference between the control and experimental groups, therefore the researcher did reject the null hypothesis. Although there were no significant differences

between the control and experimental groups there were behavioral changes, observed by the researcher, due to viewing the education sensory evaluation video.

Analysis of variance (ANOVA) was performed, using the Statistical Analysis System, to determine whether significant differences existed among the two groups of panelists, utilizing the ranking test. There were no significant differences between responses of the control group versus the experimental group, except for the pasta made with Oklahoma Hard Red Winter wheat and fresh egg white. The difference was significantly different at the .05 level (P = .014). Significant findings between the trained and untrained panelists on texture indicates trained panelists are different in their perceptions of texture sensory evaluations. It is the researchers opinion, that the video did have an affect on the experimental group. Sensory tasting techniques were demonstrated by the experimental group during the testing session, this leads the researcher to believe that the experimental group learned techniques necessary in effective sensory evaluation.

H_2. There will be no difference in attitudes towards sensory evaluation of restaurant students due to viewing the sensory evaluation training video based on pre-test and post- test. Fourteen questions on the attitude scale portion of the instrument were used to test the possibility of significant difference between the participants of the

experimental and control groups regarding attitudes toward viewing a video on sensory evaluation as an educational method. The t-test was used to compare the experimental and control group mean scores of the pre-test and post-test. No significant differences existed between the experimental and control groups of participants, therefore the research did not reject the null hypothesis.

Although there were no significant findings for attitudes between those viewing and those who did not view the sensory training video, careful observation of t-test scores resulted in finding near significant differences in values for several questions. In question two, the trained panelist felt sensory evaluation was "real important", while the untrained did not rate this questions prominently. Also, the trained panelist did not feel "under a terrible strain" when making a decision and "uncomfortable" during sensory evaluation. And, according to the scores for question three and six the untrained panelist did feel "terrible strained", and "uncomfortable" about sensory evaluation.

The researcher observed the use of residue cups and rinsing the mouth for all the panelists of the experimental (or trained) group, but not one panelist from the control (or untrained) group. The importance of the residue cups and rinsing the mouth was enforced in the sensory training video. This is an important factor because it rids the mouth of any food sample residue before proceeding to the

next sample. Failure to rinse between samples could drastically influence sensory evaluation. Therefore, the researcher feels the group observing the video learned a very important step in evaluating food products. Observation also showed, that the experimental group utilized more time in evaluating the food products. This indicates greater difference due to detail of the experimental group. And, the fact that the experimental group asked questions after testing, leads the researcher to believe that the experimental group was more concerned about sensory evaluation after viewing the video.

Recommendations

This study was undertaken to develop and test a video in order to demonstrate how this education medium can be applied in product development. The researcher looked at the effect of the education video on both the participants attitudes toward a sensory evaluation video as well as participants effectiveness in evaluation of pasta made from Oklahoma hard red winter wheat. Recommendation of directions for future procedures for sensory evaluation video training are detailed in the following paragraphs.

1. It is recommended that the education video be continued as an effective way for training sensory evaluation.

2. It is recommended that simplified food product be utilized in basic sensory training and then progress to more

difficult food products, as the panelist become comfortable with the sensory evaluation techniques.

3. It is recommended that research be continued to identify the knowledge gained on the subject of post-training sensory evaluation.

4. It is recommended that individual gain scores be calculated, for identifying smaller differences in group scores.

5. It is recommended that a larger sample size be utilized, for increased validity of the study.

6. It is recommended that further research be done using the instrument developed by the researcher to refine the ability to measure attitudes toward a video as an educational medium when educating for sensory evaluation.

Implications

The findings and conclusions of this study led the researcher to make the following statements as to the effects of video training as an education medium in product development.

1. Education and the industry could utilize the same educational materials in training employees and students.

2. The video could be developed into a videoconference with multiple receiving sites, to reach many students and restaurant managers at one time.

3. Previous knowledge is not required to learn about sensory evaluation.

4. Home economics has a program providing students with the educational knowledge to develop training for the restaurant industry and restaurant management programs.

REFERENCES

American Society of Testing and Materials (1968). Manual on Sensory Testing Methods. Spec. Techn. Phbl. No. 434, Philadelphia: American Society for Testing and Materials.

American Society of Testing and Materials (1985). Basic Principles of Sensory Evaluation, Spec. Techn. Publ. No. 433, Philadelphia: American Society for Testing and Materials.

Amerine, M. A., Pangborn, R. M., & Roessler, E. B. (1964). Examination of Food by Sensory Methods. New York: Academic Press

Amerine, M. A., Pangborn, R. M., & Roessler, E. B. (1965). Principles of Sensory Evaluation of Foods. New York: Academic Press.

Blair, J. R. (1978). Interface of marketing and sensory evaluation in product development. Food Technology, 32(11), 61-62.

Brennan, J. G. (1984). Texture perception and measurement. In J.R. Piggott (Ed.), Sensory Analysis of Food.(pp.59-91). New York: Elsevier Applied Science Publishers.

British Standards Institute (1975). Glossary of Terms Relating to the Sensory Analysis of Food, BS 5098. British Standards Instituion, London

Bouton, P. E., Food, A. L., Harris, P. V. & Ratcliff, D. (1975). Objective-subjective assessment of meat tenderness. Journal of Texture Studies, 6(3), 315-328.

Campbell, A., Penfield, M. & Griswold, R. (1962). The Experimental Study of Food.(2nd ed.). Boston: Houghton Mifflin Company.

Campbell, D. T., & Stanley, J. D. (1963). Experimental and Quasi-Experimental Designs for Research. Boston: Houghton Mifflin Company.

Carliner, S. (1987). Audiovisual words: the scriptwriter's tools. Technical Communication, 43(1), 11-14.

Civille, G. V. (1979). Descriptive Analysis. In M.R. Johnson (Ed.), Sensory Evaluation Methods for the Practicing Food Technologists. (pp. 6-1 to 6-28). Illinois: Chicago.

Civille, G. V., & Szczesniak, A. S. (1973). Guidelines to training a textrue profile panel. Journal of Texture Studies, 4, 204-223.

Cowart, B.J. (1981). Development of taste perception in humans: sensitivity and preference throughout the life span. Psychological Bulletin, 90, 43-73.

Crocker, E. C. (1945). Flavor. New York: McGraw-Hill.

Deacon, R. (1987). Visions for the 21st century, 1987 AHEA commemmorative lecture. Journal of Home Economics, 79(3), 62-70.

DeMan, J., Voisey, P., Rasper, V. & Stanley, D. (1987). Rheology and Texture in Food Quality. Westport, Connecticut: The AVI Publishing Company, Inc.

Dove, W. F. (1947). Food acceptability, its determination and evaluation. Food Technology, 1, 39-50.

Drucker, P. (1974). Management: Tasks Responsibilities, Practices. New York: Harper & Row.

Engoron, E. (1988). Does the restaurant industry have a cloud cover? Briefing, 12(7), 4.

Erhardt, J. P. (1978). The role of the sensory analyst in product development. Food Technology, 32(11), 57-58.

Farace, J. (1984). Ten steps to better slide shows. Training, 21(7), 52, 56-67.

Fiedler, S., & Norton, V. (1987). Trends in Management of Food Service Outside the Home. In American Home Economics Association (Eds.). Definitive Themes in Home Economics and their impact on Families 1909-1984. (pp. 87-101). Washington, D.C.: American Home Economics Association.

Floyd, S. (1987). Visualization: The key to effective scriptwriting. Technical Communication, 43(1), 8-10.

Gibson, J. (1966). The Senses Considered as Perceptual Systems. Boston: Houghton Mifflin.

Green, K. B. (1989). The future of home economics in higher education. Journal of Home Economics, 81(1), 43-39.

Griffin, S. F. (1989). Futures planning for homes economists. Journal of Home Economics, 81(3), 41-43.

Heinich, R., Molenda, M. & Russell, J. (1985). Instructional Media and the New Technologies of Instruction (2nd ed.). New York: John Wiley & Sons.

Helm, K. & Rose, J. (1985). The competitive edge: marketing strategies for the registered dietitian. United States: The American Dietetic Association.

Helm, E. & Trolle, B. (1946). Selection of a taste panel. Wallerstein Laboratories Communications, 9, 28.

Hersey, P. & Blanchard K. (1982). Management of organization behavior: utilizing human resources (4th ed.), Englewood Cliffs, New Jersey: Prentice-Hall, Inc.

Hodgkison, H. (1986). Guess who's coming to work? Unpublished manuscript, Ohio State University, Columbus.

Hood, D. E., & Riordan, E. B. (1973). Discolouration in pre-packaged beef: measurement by reflectance spectrophotometry and shopper discrimination. Food Technology, 8, 333-343.

Hord, S. (1987). Evaluating Educational Innovation. New York: Croom Helm.

Hulse, S. H., Egeth, H., & Deese, J. (1980). The Psychology of Learning. New York: McGraw-Hill Book Company.

IFT Sensory Evaluation Committee. (1964). Sensory testing guide for panel evaluation of foods and beverages. Food Technology, 18(11), 25-31.

IFT Sensory Evaluation Division. (1978). Optimizing sensory evaluation in product development. 38th Annual Meeting of the Institute of Food Technologists. Food Technology, 32(11), 56-66.

IFT. (1979-80). Sensory Evaluation Methods for the Practicing Food Technologist. Unpublished IFT short course.

IFT Sensory Evaluation Division. (1981). Consumer sensory testing sequence in product development and optimization. 41st Annual Meeting of the Institute of Food Technologists. Food Technology, 35(11), 65-76.

Jellinek, G. (1985). Sensory Evaluation of Food. England: Ellis Horwood.

Konigsbacher, K. S. (1978). How the government views sensory evaluation. Food Technology, 32(11), 64-66.

Kramer, A. & Twigg, B. (1970). Quality Control for the Food Industry (3rd ed.). Westport, Connecticut: The AVI Publishing Company, Inc.

Kramer, A. & Szczesniak, A. (1973). Texture Measurements of Foods. Boston: D. Reidel Publishing Company.

Larmond, E. (1977). Methods for Sensory Evaluation of Food. Canada:

Maruniak, J. A., & Mackay-Sim, A. (1984). The sense of smell. In J. R. Piggot (Ed.), Sensory Analysis of Foods (pp.23-57). New York: Elsevier Applied Science Publishers.

Meilgaard, M., Civille, G. & Carr, T. (1987). Sensory Evaluation Techniques. Boca Ratton, Florida: CRC Press, Inc.

Meiselman, H. & Rivlin, R. (1986). Clinical Measurement of Taste and Smell. New York: Macmillan Publishing Company.

McGill, L. A. (1979). Acceptance/preference testing. In IFT (Ed.). Sensory Evaluation Methods for the Practicing Food Technologist (pp. 5-1 - 5-13). Unpublished IFT short course.

Mintzberg, H. (1983). Power in and around organizations. Englewood Cliffs, New Jersey: Prentice-Hall.

Moskowitz, H. (1987). Food Texture Instrumental and Sensory Measurement. New York: Marcel Dekker, Inc.

Moskowitz, H. (1985). New Directions for Product Testing and Sensory Analysis of Foods. Westport, Connecticut: Food & Nutrition Press, Inc.

Oldfield, R.C. (1960). Perception in the mouth. Texture in Foods, 7, 3.

Osborn, B. L. & Lewis, L. H. (1983, Fall). Home economics education for adults: then and now. Journal of Home Economics. 18-20 & 60-61.

Pangborn, R. (1964). Sensory evaluation of foods: A look backward and forward. Food Technology, 18(9), 63-67.

Peryam, D. & Pilgrim, F. J. (1957). Hedonic scale method for measuring food preferences, Food Technology, 11(9), 9- 11.

Pfaffmann, C., Frank, M., & Norgren, R. (1979). Neural Mechanisms and Behavioral Aspects of Taste. Ann. Rev. Psychol, 30, 283-325.

Piggott, J. R. (1984). Sensory Analysis of Foods. New York: Elsevier Applied Science Publishers.

Prell, P. A. (1976). Preparation of reports and manuscripts which include sensory evaluation data. Food Technology, 30(11), 40.

Platt, W. (1931). Scoring food products. Food Ind., 3, 108.

Rainey B. (1979-80). Selection/training of panelist. In IFT (Ed.). Sensory Evaluation Methods for the Practicing Food Technologist (pp. 7-1 - 7-10). Unpublished IFT short course.

Reddin, W. (1971). Effective management objectives: The 3-D method of mbo. New York: McGraw-Hill.

Reinhart, C. (1987). How do you determine the use of new training technologies? Training and Development Journal, 41(8), 22-26.

Roberts, E. A. (1979). Advice for the user of visual aids, Technical Communication. 26(4), 15-17.

Roessel, E. B., Warren, J., & Guymon, J. F. (1946). Food Research. 13, 503-505.

Rossmann, M. M., Parsons, J. H., & Holman, D. (1983). Career alternatives for home economics educators. Journal of Home Economics, 75(1), 12-15.

Scanlan, R. (1977). Flavor Quality: Objective Measurement. Washington, D.C.: American Chemical Society.

Scott, J. P., Sollie, D. L. & Duffey, N. (1983). Teaching communication skills with videomodeling and videofeedback in the university classroom. Home Economics Research Jounal, 12(1), 17-24.

Schutz, R. G. (1971). Sources of invalidity in the sensory evaluation of foods. Food Technology, 25( ), 53-58.

Skelton, M. (1984). Sensory evaluation of food. The Cornell H.R.A. Quarterly, February, 51-57.

Skramlik, E. von: (1926). Handbuch der Physiologie der niederen Sinne. Leipzig: Georg Thieme.

Stewart, K. K., Whitaker, J. R. (1984). Modern Methods of Food Analysis. Westport, Connecticut: AVI Publishign Company, Inc.

Taylor, R. E., & Watts, R. L. (1981). The Educational Needs of Business and Industry. Policy for education of educators: issues and implications, Washington.

Thomas, W. (1980). The future impact of video. Technical Communication, 27(2), 22-23.

Tilgner, D. J. (1962). Dilution tests for odor and flavor analysis. Food Technology, 16(2), 26.

Vickers, Z., & Bourne, M. M. (1976). A psychoacoustical theory of crispness. Journal of Food Science 41, 1163-1164.

Wagner, L. (1982). The Economics of Educational Media. New York: St. Martin's Press.

Weinstein, J. (1987). Keep an eye on video. Restaurants and Institution, 97(21), 22-23.

Williams, A. & Atkin, R. (1983). Sensory Quality in Foods and Beverages: Definition, Measurement and Control. London: Ellis Horwood Limited.

Williams, G. (1985, May). Writing words people hear. Video Manager.

APPENDIXES

APPENDIX A

VIDEO SCRIPT

VIDEO SCRIPT

I. INTRODUCTION

II. BASIC SENSORY CONCEPTS Sight

Smell

Sound

Texture

Four Basic Taste

Tasting Techniques

Training for the Four Basic Taste

III. EVALUATION FORMS

Triangle Test

Ranking Test

Hedonic Scale

IV. CONTROLLED ENVIRONMENT

V. STATISTICS

VI. CONCLUSION

VIDEO SCRIPT

Introduction

This couple is trying our restaurant for the first time. The staff is friendly, the lighting soft, and the table correctly set; but these people are getting ready to make a sensory evaluation. Based on this evaluation, they will return and be regular patrons or leave, never to return and worse still advise their friends to stay away.

People have always had opinions about their food, but most of us do not know how to measure an opinion. Sensory evaluation is a field of science that provides accurate and usable data about taste opinions.

Although food scientists and manufacturers realize the importance of sensory evaluation in product quality, the restaurant industry has been slow to exploit this vital tool to maintain or improve food quality for our patrons and - bottom line - increase profits.

Sensory evaluation is a discipline that measures and interprets reactions to foods as perceived by the senses of sight, taste, touch, and hearing. Instruments can accurately measure various components of food, such as sugar or acidity, but only human judges can integrate these components into what we call flavor. And those "human judges" who are your patrons make the final and most important judgment on your

establishment.

Wrigley's is an example of a company who utilized a sensory panel when they were considering adding sugar to their product. The panel determined this was not necessary since there was no difference in perceived sweetness when sugar was increased. Thus, saving the company money, time, and effort.

If a poor product is served, your restaurant will be empty like ours. Sensory evaluation can be used to achieve and maintain a quality food product. Some simple principles will allow any restaurant owner, unskilled in sensory science, to provide better food for the patrons and more profit for the business.

Basic Sensory Concepts

Sight

Sensory evaluation is more than just taste. The appearance of a product has an effect on our evaluation of that product. Foods have an infinite variety of appearance characteristics, and subjects are influenced by the overall appearance of the food product. If blue mashed potatoes were used, for example. The flavor would be unchanged but a negative effect would be perceived immediately. The color of fruit may indicate the stage of ripeness and hence its firmness. The appearance of a bright red apple would suggest a crisp,

juicy, flavorful apple. Or, a more common example, would be the meat that comes out of the microwave an unappealing gray. We are accustomed to meat that is brown on the outside from the oven or grill. These preconceived judgements can have an effect on the way the product is evaluated.

Smell

Although the study of sensory perception is an exacting science and taste panelists can be highly trained professionals a restauranteur can obtain excellent information by using volunteer panelists with a minimum of training. Most people cooperate readily and responsibly when they realize the importance of sensory evaluation. Panelists can be drawn from staff and patrons alike, and we will demonstrate the basic skills needed. For instance, a good panelists do not have to have extremely sensitive noses but they do need to be able to discriminate among some basic food odors and know how to properly "smell" a food sample.

We perceive odor at the regio olfactoria nerve located in the upper section of the nasal cavity. These nerves are highlighted in the picture to show exactly where they are. Ordinary breathing does not force air into the upper nasal chamber. However, a definite sniff does force the inhaled air to contact the odor perception nerve. The first attempt to identify an odor

should be a light whif, then proceed to the sniffing technique demonstrated here by Stacy. This methods allows the odorant to come into full contact with the olfactory nerves. Stacy is identifying extracts from the sensory lab, but extracts such as vanilla or maple, onion juice, or garlic oil from the restaurant kitchen may be used so long as labels or other visual clues are removed.

To show how important sight and smell are to perceived flavor, notice how difficult it is to tell the difference between maple syrup and plain corn syrup when both of these two senses are blocked. Our analyst can not tell the difference between these syrups.

Sound

We all know that the sound emitted when certain foods are bitten and chewed are a reflection of the texture of these foods. For example, the crunch of a cracker or the breaking sound of a crisp apple, when taking the first bite, affect the textural perception of that food product.

A method of rating raw apple texture definition and values has been designed by Diehl and Hamman and can be used to help in training panelist to analyze texture differences. For example, "crispness" is defined as the degree to which rupture is heard, using a scale of 1-5, or chewiness is the number of chews required to prepare

the sample for swallowing. Further, unpleasant harsh sounds detract from the food flavor. That is why we want pleasant sounds - not loud noises in our eating establishments. This also explains why sensory evaluations are always done in quiet surroundings.

Texture

Very often sensory assessments of texture are made on the basis of the way the food sample feels in the mouth, that is when it is bitten, chewed, and swallowed. Training for texture perception is essential. To give a more complete picture of the mouth feel of foods, products can be presented such as cream cheese, hard cooked eggs, mozzarella cheese, cheetos, and hard candy. Once the textures have been sampled, the panelist can rank the samples in order of increasing hardness by placing the sample number in the blank provided. Notice how easily this is done on the texture rating scale shown here.

Four Basic Taste

Although the senses of sight, smell, and feeling are very important to how we perceive; by far the most important sense when it comes to rating flavor is the sense of taste. There are four basic tastes: sweet, salty, sour and bitter, and all the various food tastes are composed of these four or blends of two or more of

the basic tastes.

It is not important that panelists be extremely sensitive to these tastes, but it is imperative that they can detect and identify the four basic tastes. Further there must be agreement among the panelist as to what the flavors are. We have noticed that many people confuse the bitter and sour tastes.

Taste is a close range or contact sense, operating only when the sensory receptors are in contact with the source of taste. The receptors are mainly situated on the tongue surface, but some are spread over the entire oral cavity, down the esophagus, and even on the trachea and the larynx.

The four basic tastes can be elicited from different parts of the human tongue. The tip of the tongue is particularly sensitive for sweet, the following lateral edges for salty, then sour, and the base of the tongue, way back in the mouth, is mainly where bitter taste is perceived. You can see that a food sample with "bitter" flavor notes, for example, would be incorrectly judged if the panelists did not allow the sample to contact the bitter receptor areas.

Tasting Techniques

Now that you have given your panelists a short "basic training," they are ready to judge your food products. Panelists should be instructed prior to each

study on the sensory techniques to be used for that particular food. They should understand the methods, scales, score sheets, and terminology to be used in a test.

First, panelist should smell the product. If nothing is perceived after three smells, the panelist should sniff the product with the mouth closed.

Second, the panelist should look carefully at the appearance of the product. The product should be broken so the interior of the product can be evaluated.

And third, when testing a product, check for one attribute at a time. For example; use one bite to check mouth feel, another bite for moisture, etc.

The fourth step is, rinsing the mouth to rid it of sample residue before proceeding to the next sample: take a drink of the distilled water and swirl it into all areas of the mouth. Spit water into a large opaque waste cup. Do not swallow the water. Cold or hot water is avoided because temperature extremes will dull the sense of taste.

Training for the Four Basic Taste

Some of the principles involved in sensory evaluation, whether in the initial training phase or when actually rating products are illustrated in this study where the panelists are trying to identify the four basic tastes. The samples are prepared in

distilled water so that hard water, water and treatment chemicals, or the flavor in tap water do not interfere with flavor perception. The samples are labeled so as to not "telegraph" the answer. Also, the mouth is rinsed with additional distilled water between samples to avoid flavor carry over. All the samples should be the same color, and at the same temperature. Samples are best identified by a code rather than a descriptive name. Codes such as A, B, and C or 1, 2, and 3 are undesirable because "a" or "number one" suggests first choice to the judges. Randomly selected letters, three-digit numbers, geometric shapes, colors, or symbols can be used. When one series of samples is to be evaluated several times, judging will be more accurate if the code and order of presentation are altered each time. Each panelists then tastes the samples, using the proper tasting techniques, and identifies on the score sheet the flavor of the samples, using the codes available.

Evaluation Forms

Triangle Test

Perhaps the most common test and certainly one that is easy to use is the triangle test. In this test, the panelist receives three coded samples. Two of the samples are the same, and the panelist is asked to identify the odd sample. The method is very useful in

quality control work to ensure that samples from different production lots are the same or identifying a difference or preference between two like colored beverages. Since the panelist is looking for the odd sample, the samples should differ only in the variable being studied. All other differences should be masked. Therefore application of the triangle test is limited to products which are homogeneous. But, this type of test is easy to administer and can be very profitable for the restaurant owner. An example, would be the evaluation of two brands of gingersnap cookies. If the manager feels there is no difference between the two, but price, an sensory evaluation team, can test this hypothesis. And if this turns out to be the case, the restaurant can save a lot of money, without jeopardizing a quality product. This could also be used to evaluate two brands of ice cream that look the same but could differ in taste or texture.

Ranking Test

Sometimes we need to know more about products than just "is there a difference?" When comparing two products, such as catsup for instance, a rating scale that looks at several characteristics can be used. To use this kind of scoring effectively, all the panelists must be evaluating and familiar with the characteristics typical of that food. For example, the sugar scale for

the catsup ranges from very sweet to not sweet, or the viscosity ranges from too thin to too thick and these are just two characteristics we might want to rate in catsup. It is sometimes appropriate to use only one sheet to score more than one product. The use of one evaluation sheet for several products forces the panelist to compare each product directly with the others, for each characteristic ranked.

This type of ranking can be used for more than two products. But, ranking more than 4 or 5 samples may prove difficult as panelists tend to do more retasting of samples and the score sheets can become very cluttered.

Hedonic Scoring

It is possible to obtain sensory data even from young people. For this kind of testing hedonic happy face scales can be used. The young children will not have to read or even understand word descriptors used by the researcher. A smile or frown has universal meaning. However, the question may arise concerning whether the gender or age of the face may influence opinions. Mary Jo is evaluating gingersnap cookies.

Controlled Environment

A special testing area is used for sensory evaluation so that distractions can be kept to a minimum

and conditions can be controlled. Lighting, odor, and comfort are three considerations when setting up an evaluation area. The panelists should be provided with a quiet, comfortable environment. Foreign odors and odors from food preparation should be kept from the testing room. Smoking should not be permitted at any time, and smokers should not smoke 30 minutes prior to the evaluation.

Individual booths should be arranged which removes the panelist from sight, sound, and smell of preparation. The individual booths also allow for individual scoring, not consensus. Restaurants can use partitions in the dining room for the appropriate environment.

Statistics

Fortunately we do not have to be a statistician in order to correctly interpret our data. If we stay with simple tests and score cards, tables are available to help us draw conclusions and avoid making expensive mistakes.

Either of these overall manuals are inexpensive, easily obtained, and present the basic principles of sensory evaluation and how to calculate and interpret results.

Conclusion

Could this be your restaurant? Are your customers disappearing along with your profits? Maybe they don't like the food! Computerized menus, state of the art equipment and the best management systems are great, but only the human tongue can determine if your food tastes good!

When developing or testing foods, scientists actually use highly trained sensory evaluation panels. Unfortunately as you well know, no restaurant comes equipped with a highly trained scientific taste panel. However during the course of this video, you have seen and learned the basic principles of sensory tests, and see how these principles could be adapted to your situation. Learning about sensory evaluation might help you if you have been faced with disappearing customers.

APPENDIX B

EVALUATION FORMS

QUESTIONNAIRE FOR
TRIANGLE TEST

Name_____ Date_____

Product_____

Two of the samples are identical, the third is different.

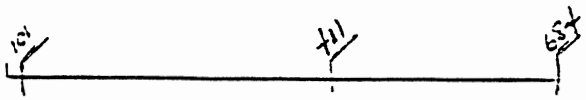
1. Taste the samples in the order indicated and identify the odd sample.

Code	Check odd sample
R	_____
H	_____
T	_____

COMMENTS:

Product_____
Name_____
Date_____

Directions: Place straight lines through the scales indicating your sensory evaluation and label your marks with the corresponding numbers on the cups. Your evaluation sheet may look something like this:



Evaluation of the pasta:

* The middle of the scale is the best rating
** The extreme right of the scale is the best rating.

COLOR*

TOO Pale, Pasty — OFF-Color (Too yellow, gray, or brownish color)

Texture*

Soft or mushy — Too firm, almost brittle

Pasta Flavor*

Too Bland Flavorless — Strong or off flavor

Overall Acceptability**

Very Bad — Very Good

Comment:

Thank you for your assistance in the taste panel.

Attitude Scale: Biology

Each of the statements below expresses a feeling toward biology. Please rate each statement on the extent to which you agree. For each, you may (A) strongly agree, (B) agree, (C) be undecided, (D) disagree, or (E) strongly disagree.

A	B	C	D	E
strongly agree	agree	undecided	disagree	strongly disagree

___ 1 Biology is very interesting to me
___ 2 I *don't* like biology, and it scares me to have to take it
___ 3 I am always under a terrible strain in a biology class
___ 4 Biology is fascinating and fun
___ 5 Biology makes me feel secure, and at the same time it is stimulating
___ 6 Biology makes me feel uncomfortable, restless, irritable, and impatient
___ 7 In general, I have a good feeling toward biology
___ 8. When I hear the word *biology*, I have a feeling of dislike
___ 9 I approach biology with a feeling of hesitation
___ 10 I really like biology
___ 11 I have always enjoyed studying biology in school
___ 12 It makes me nervous to even think about doing a biology experiment
___ 13 I feel at ease in biology and like it very much
___ 14 I feel a definite positive reaction to biology; it's enjoyable

HOW DO YOU FEEL ABOUT SENSORY EVALUATION?

Please respond to each of the statements below.

DIRECTIONS: Circle the letter (ex. SA, A, D, SD, or U) following each statement that best describes the extent to which you agree or disagree with the statement.

STATEMENT:					
____1. Sensory evaluation is very interesting to me.	SA	A	D	SD	U
____2. I don't like sensory evaluation, and I don't think it has real importance.	SA	A	D	SD	U
____3. I am always under a terrible strain, I don't like to make decisions.	SA	A	D	SD	U
____4. Sensory evaluation is fascinating and fun.	SA	A	D	SD	U
____5. Sensory evaluation can make me feel sure I have chosen the right product.	SA	A	D	SD	U
____6. Sensory evaluation makes me feel uncomfortable, restless, and impatient.	SA	A	D	SD	U
____7. In general, I have a good feeling toward sensory evaluation.	SA	A	D	SD	U
____8. When I hear the words sensory evaluation, I have a feeling of dislike.	SA	A	D	SD	U
____9. I approach sensory evaluation with a feeling of hesitation.	SA	A	D	SD	U

Please complete the next page.

____10. I fully understand the importance of sensory evaluation in providing a quality food product to the customer.	SA	A	D	SD	U
____11. I have always enjoyed evaluating food products.	SA	A	D	SD	U
____12. It make me nervous to even think about doing a sensory evaluation.	SA	A	D	SD	U
____13. I feel at ease in sensory evaluation and like it very much.	SA	A	D	SD	U
____14. I feel a definite positive reaction to sensory evaluation; it's enjoyable.	SA	A	D	SD	U

Strongly Agree	Agree	Disagree	Strongly Disagree	Uncertain

APPENDIX C

TRIANGLE TEST ANALYSIS CHART

ANOVA'S FOR PASTA

No. of Judgments	Minimum Number Required		
	5%	1%	.1%
1			
2			
3	3		
4	4		
5	4	5	
6	5	6	
7	5	6	7
8	6	7	8
9	6	7	8
10	7	8	9
11	7	8	10
12	8	9	10
13	8	9	11
14	9	10	11
15	9	10	12
16	9	11	12
17	10	11	13
18	10	12	13
19	11	13	14
20	11	13	14
21	12	13	15
22	12	14	15
23	12	14	16
24	13	15	16
25	13	15	17
26	14	15	17
27	14	16	18
28	15	16	18
29	15	17	19
30	15	17	19
31	16	18	20
32	16	18	20
33	17	18	21
34	17	19	21
35	17	19	22
36	18	20	22
37	18	20	22
38	19	21	23
39	19	21	23
40	19	21	24

No. of Judgments	Minimum Number Required		
	5%	1%	.1%
41	20	22	24
42	20	22	25
43	21	23	25
44	21	23	25
45	21	24	25
46	22	24	26
47	22	24	26
48	23	25	27
49	23	25	28
50	23	26	28
52	24	26	29
54	25	27	30
56	26	28	31
58	26	29	32
60	27	30	33
62	28	30	33
64	29	31	34
66	29	32	35
68	30	33	36
70	31	34	37
72	32	34	38
74	32	35	39
76	33	36	39
78	34	37	40
80	35	38	41
82	35	38	42
84	36	39	43
86	37	40	44
88	38	41	44
90	38	42	45
92	39	42	46
94	40	43	47
96	41	44	48
98	41	45	48
100	42	46	49

Number of correct identifications required for significance at various levels in triangle test. Chance probability is 33.3 percent, and the hypothesis is one-tailed.

American Society of Testing and Materials (1968). Manual on Sensory Testing Methods. Spec. Techn. Phbl. No. 434, Philadelphia: American Society for Testing and Materials.

TABLE X

ANALYSIS OF VARIANCE OF DIFFERENCES BETWEEN THE CONTROL AND EXPERIMENTAL GROUP SCORES OF ACCEPTABILITY ON PASTA MADE FROM OKLAHOMA HARD RED WINTER WHEAT AND DURUM SEMOLINA FLOUR

Source	DF	Sum of Squares	Mean Square	F Value	Pr>F
Sequence	1	79.67	79.67	0.13	0.7220
Error	20	12233.82	611.69		
Corrected Total	21	12313.50			

TABLE XI

ANALYSIS OF VARIANCE OF DIFFERENCES BETWEEN THE CONTROL AND EXPERIMENTAL GROUPS SCORES OF COLOR ON PASTA MADE FROM OKLAHOMA HARD RED WINTER WHEAT AND DURUM SEMOLINA FLOUR

Source	DF	Sum of Squares	Mean Square	F Value	Pr>F
Sequence	1	8.24	8.24	0.04	0.8417
Error	20	4029.02	201.45		
Corrected Total	21	4037.27			

TABLE XII

ANALYSIS OF VARIANCE OF DIFFERENCES BETWEEN THE CONTROL AND EXPERIMENTAL GROUPS SCORES OF FLAVOR ON PASTA MADE FROM OKLAHOMA HARD RED WINTER WHEAT AND DURUM SEMOLINA FLOUR

Source	DF	Sum of Squares	Mean Square	F Value	Pr>F
Sequence	1	6.63	16.63	0.05	0.8318
Error	20	7183.73	359.18		
Corrected Total	21	7200.36			

TABLE XIII

ANALYSIS OF VARIANCE OF DIFFERENCES BETWEEN THE CONTROL AND EXPERIMENTAL GROUPS SCORES OF TEXTURE PASTA MADE FROM OKLAHOMA HARD RED WINTER WHEAT AND DURUM SEMOLINA FLOUR

Source	DF	Sum of Squares	Mean Square	F Value	Pr>F
Sequence	1	73.12	73.12	0.27	0.6113
Error	20	5485.82	274.29		
Corrected Total	21	5558.95			

TABLE XIV

ANALYSIS OF VARIANCE OF DIFFERENCES BETWEEN THE CONTROL AND EXPERIMENTAL GROUPS SCORES OF ACCEPTABILITY FOR PASTA MADE FROM OKLAHOMA HARD RED WINTER WHEAT AND WHOLE EGG

Source	DF	Sum of squares	Mean square	F Value	Pr>F
Sequence	1	60.55	60.55	0.23	0.6356
Error	20	5229.44	261.47		
Corrected Total	21	5290.00			

TABLE XV

ANALYSIS OF VARIANCE OF DIFFERENCES BETWEEN THE CONTROL AND EXPERIMENTAL GROUPS SCORES OF COLOR FOR PASTA MADE FROM OKLAHOMA HARD RED WINTER WHEAT AND WHOLE EGG

Source	DF	Sum of Squares	Mean Square	F Value	Pr>F
Sequence	1	75.27	75.27	0.48	0.4985
Error	20	3167.31	158.36		
Corrected Total	21	3242.59			

TABLE XVI

ANALYSIS OF VARIANCE OF DIFFERENCES BETWEEN THE CONTROL AND EXPERIMENTAL GROUPS SCORES OF FLAVOR FOR PASTA MADE FROM OKLAHOMA HARD RED WINTER WHEAT AND WHOLE EGG

Source	DF	Sum of Squares	Mean Square	F Value	Pr>F
Sequence	1	342.90	342.90	0.74	0.4013
Error	20	9326.19	466.30		
Corrected Total	21	9669.09			

TABLE XVII

ANALYSIS OF VARIANCE OF DIFFERENCES BETWEEN THE CONTROL AND EXPERIMENTAL GROUPS SCORES OF TEXTURE FOR PASTA MADE FROM OKLAHOMA HARD RED WINTER WHEAT AND WHOLE EGG

Source	DF	Sum of Squares	Mean Square	F Value	Pr>F
Sequence	1	48.29	48.29	0.12	0.7274
Error	20	7731.16	386.55		
Corrected Total	21	7779.45			

TABLE XVIII

ANALYSIS OF VARIANCE OF DIFFERENCES BETWEEN THE CONTROL AND EXPERIMENTAL GROUPS SCORES OF ACCEPTABILITY FOR PASTA MADE FROM OKLAHOMA HARD RED WINTER WHEAT AND DRY WHITE

Source	DF	Sum of Squares	Mean Square	F Value	Pr>F
Sequence	1	0.09	0.09	0.00	0.9873
Error	19	6949.71	365.77		
Corrected Total	20	6949.80			

TABLE XIX

ANALYSIS OF VARIANCE OF DIFFERENCES BETWEEN THE CONTROL AND EXPERIMENTAL GROUPS SCORES OF COLOR FOR PASTA MADE FROM OKLAHOMA HARD RED WINTER WHEAT AND DRY WHITE

Source	DF	Sum of Squares	Mean Square	F Value	Pr>F
Sequence	1	25.56	25.56	0.05	0.8182
Error	19	8421.92	471.05		
Corrected Total	20	8446.59			

TABLE XX

ANALYSIS OF VARIANCE OF DIFFERENCES BETWEEN THE CONTROL AND EXPERIMENTAL GROUPS SCORES OF FLAVOR FOR PASTA MADE FROM OKLAHOMA HARD RED WINTER WHEAT AND DRY WHITE

Source	DF	Sum of Squares	Mean Square	F Value	Pr>F
Sequence	1	130.38	130.38	0.25	0.6233
Error	19	9936.28	522.96		
Corrected Total	20	10066.66			

TABLE XXI

ANALYSIS OF VARIANCE OF DIFFERENCES BETWEEN THE CONTROL AND EXPERIMENTAL GROUPS SCORES OF TEXTURE FOR PASTA MADE FROM OKLAHOMA HARD RED WINTER WHEAT AND DRY WHITE

Source	DF	Sum of Squares	Mean Square	F Value	Pr>F
Sequence	1	0.14	0.14	0.00	0.9817
Error	20	5179.31	258.96		
Corrected Total	21	5179.45			

TABLE XXII

ANALYSIS OF VARIANCE OF DIFFERENCES BETWEEN THE CONTROL AND EXPERIMENTAL GROUPS SCORES OF ACCEPTABILITY FOR PASTA MADE FROM OKLAHOMA HARD RED WINTER WHEAT AND FRESH WHITE

Source	DF	Sum of Squares	Mean Square	F Value	Pr>F
Sequence	1	268.12	268.12	0.43	0.5214
Error	20	12586.64	629.33		
Corrected Total	24	12854.77			

TABLE XXIII

ANALYSIS OF VARIANCE OF DIFFERENCES BETWEEN THE CONTROL AND EXPERIMENTAL GROUPS SCORES OF COLOR FOR PASTA MADE FROM OKLAHOMA HARD RED WINTER WHEAT AND FRESH WHITE

Source	DF	Sum of Squares	Mean Square	F Value	Pr>F
Sequence	1	440.38	440.38	1.38	0.2553
Error	19	6080.57	440.38		
Corrected Total	20	6520.95			

TABLE XXIV

ANALYSIS OF VARIANCE OF DIFFERENCES BETWEEN THE CONTROL AND EXPERIMENTAL GROUPS SCORES OF FLAVOR FOR PASTA MADE FROM OKLAHOMA HARD RED WINTER WHEAT AND FRESH WHITE

Source	DF	Sum of Squares	Mean Square	F Value	Pr>F
Sequence	1	0.59	0.59	0.00	0.9634
Error	20	5486.36	274.31		
Corrected Total	21	5486.95			

TABLE XXV

ANALYSIS OF VARIANCE OF DIFFERENCES BETWEEN THE CONTROL AND EXPERIMENTAL GROUPS SCORES OF TEXTURE FOR PASTA MADE FROM OKLAHOMA HARD RED WINTER WHEAT AND FRESH WHITE

Source	DF	Sum of Squares	Mean Square	F Value	Pr>F
Sequence	1	1347.05	1347.05	5.52	0.0292
Error	20	4880.40	244.02		
Corrected Total	21	6227.45			

TABLE XXVI

ANALYSIS OF VARIANCE OF DIFFERENCES BETWEEN THE CONTROL AND EXPERIMENTAL GROUPS SCORES OF ACCEPTABILITY FOR PASTA MADE FROM OKLAHOMA HARD RED WINTER WHEAT AND EGG YOLK

Source	DF	Sum of Squares	Mean Square	F Value	Pr>F
Sequence	1	896.09	896.09	1.70	0.2077
Error	19	10006.57	526.66		
Corrected Total	20	10902.66			

TABLE XXVII

ANALYSIS OF VARIANCE OF DIFFERENCES BETWEEN THE CONTROL AND EXPERIMENTAL GROUPS SCORES OF COLOR FOR PASTA MADE FROM OKLAHOMA HARD RED WINTER WHEAT AND EGG YOLK

Source	DF	Sum of Squares	Mean Square	F Value	Pr>F
Sequence	1	112.15	112.15	0.42	0.5265
Error	20	5399.16	269.95		
Corrected Total	21	5511.31			

TABLE XXVIII

ANALYSIS OF VARIANCE OF DIFFERENCES BETWEEN THE CONTROL AND EXPERIMENTAL GROUPS SCORES OF FLAVOR FOR PASTA MADE FROM OKLAHOMA HARD RED WINTER WHEAT AND EGG YOLK

Source	DF	Sum of Squares	Mean Square	F Value	Pr>F
Sequence	1	57.16	57.16	0.07	0.7923
Error	19	15222.64	57.19		
Corrected Total	20	15279.80			

TABLE XXIX

ANALYSIS OF VARIANCE OF DIFFERENCES BETWEEN THE CONTROL AND EXPERIMENTAL GROUPS SCORES OF TEXTURE FOR PASTA MADE FROM OKLAHOMA HARD RED WINTER WHEAT AND EGG YOLK

Source	DF	Sum of Squares	Mean Square	F Value	Pr>F
Sequence	1	80.41	80.41	0.19	0.6714
Error	20	8675.44	433.77		
Corrected Total	21	8755.86			

TABLE XXX

ANALYSIS OF VARIANCE OF DIFFERENCES BETWEEN THE CONTROL AND EXPERIMENTAL GROUPS SCORES OF ACCEPTABILITY FOR PASTA MADE FROM OKLAHOMA HARD RED WINTER WHEAT AND NO EGG

Source	DF	Sum of Squares	Mean Square	F Value	Pr>F
Sequence	1	192.38	192.38	0.97	0.3367
Error	19	3762.56	198.02		
Corrected Total	20	3954.95			

TABLE XXXI

ANALYSIS OF VARIANCE OF DIFFERENCES BETWEEN THE CONTROL AND EXPERIMENTAL GROUPS SCORES OF COLOR FOR PASTA MADE FROM OKLAHOMA HARD RED WINTER WHEAT AND NO EGG

Source	DF	Sum of Squares	Mean Square	F Value	Pr>F
Sequence	1	58.30	58.30	0.07	0.7885
Error	20	15778.64	788.93		
Corrected Total	21	15836.95			

TABLE XXXII

ANALYSIS OF VARIANCE OF DIFFERENCES BETWEEN THE CONTROL AND EXPERIMENTAL GROUPS SCORES OF FLAVOR FOR PASTA MADE FROM OKLAHOMA HARD RED WINTER WHEAT AND NO EGG

Source	DF	Sum of Squares	Mean Square	F Value	Pr>F
Sequence	1	596.74	596.74	2.31	0.1451
Error	20	4911.06	596.74		
Corrected Total	20	5507.80			

TABLE XXXIII

ANALYSIS OF VARIANCE OF DIFFERENCES BETWEEN THE CONTROL AND EXPERIMENTAL GROUPS SCORES OF TEXTURE FOR PASTA MADE FROM OKLAHOMA HARD RED WINTER WHEAT AND NO EGG

Source	DF	Sum of Squares	Mean Square	F Value	Pr>F
Sequence	1	85.34	85.34	0.30	0.5905
Error	20	5706.11	285.30		
Corrected Total	21	5791.45			

VITA

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Candidate for the Degree of

Doctor of Philosophy

Title: EFFECTIVENESS OF A SENSORY EVALUATION TRAINING VIDEO FOR USE IN A RESTAURANT SETTING

Major Field: Home Economics

Biographical:

Personal Data: Born in Nashville, Tennessee, June 21, 1960, the daughter of Dr. and Mrs. Joseph David Stokes.

Education: Graduate from Greenville High School, Greenville, Kentucky, in May 1978; received Bachelor of Science Degree in Home Economics Education from Western Kentucky University in Bowling Green, Kentucky in May 1982; received Master of Arts in Education degree in Home Economics Education from Western Kentucky University in December 1985; completed requirements for Doctor of Philosophy degree at Oklahoma State University in May, 1991.

Professional Experience: Catering Director with Professional Foodservice Management, 1982-1984; Graduate Assistant, Home Economics Department at Western Kentucky University, 1984-1986; Purchasing Agent, Home Economics Department at Western Kentucky University, 1985-1986; Teaching Associate at Oklahoma State University, 1986-1991.

Professional Organizations: American Home Economics Association, Oklahoma Home Economics Association; National Restaurant Association, Oklahoma Restaurant Association; Institute of Food Technologists; Phi Upsilon Omicron.