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DEVELOPMENT OF A COURSE TO TEACH BASIC CONCEPTS  
OF SENSORY EVALUATION TO FOODSERVICE PERSONNEL

BY

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## INTRODUCTION

The senses evaluate, judge, and screen nutrition. Intuition, learned behavior, and experiences interact with the senses to determine what we will eat, how food will nourish the body, and if eating will be a satisfying experience. If the mouth, nose, and eyes are not fed with the kind of nutrition they need and want, the food prepared will never reach its final destination--the digestive system (1).

Emphasis is being placed on nutrition through the senses in foodservices across America. Caring what students, patients, employees, and cafeteria visitors eat, and insuring that they do eat, has meant preparing food in such a way that it entices and satisfies the senses (2).

Dr. Morley Kare, director of the Monell Chemical Senses Center (1), observed that taste and smell remain important throughout a person's life. They can accelerate in importance as other senses diminish. Old people become concerned with the flavor of their food. Eating is a genuine avenue of expression and can give a person reason to live. When discussing nutrition services for older Americans, McCool and Posner (3) emphasized the importance of evaluating meal quality on a regular basis, through

periodic sampling, to maintain a consistently acceptable selection of food.

For the average consumer, the factors most closely associated with the concept of food quality are those related to the sensory characteristics of the food. Cardello and Mahler (4) described the use of sensory evaluation techniques in the development of acceptable and nutritious rations for military personnel. Spears and Vaden (5) identified sensory evaluation as an ongoing component of a quality control program in a foodservice operation, with small trained panels judging quality characteristics and differences among food items and consumer panels evaluating menu item acceptance and preference.

Sensory evaluation has been defined as a scientific discipline used to evoke, measure, analyze, and interpret reactions to those characteristics of foods and materials as they are perceived by senses of sight, smell, taste, touch, and hearing (6). A greater awareness of sensory evaluation, the shift toward a consumer-oriented environment, and the high financial risk of new product development have provided new opportunities for the development of sensory evaluation (7). Control of raw materials and finished products, evaluation of stored products, analysis of competitive products, new product development, investigation of odors and flavors of foods, market tests,

and hedonic tests are among the present uses of sensory evaluation (8).

Foodservice directors have many decisions to make that would benefit from sensory evaluation procedures used in business and industry. Value analysis in the procurement of food products may be assisted by sensory difference testing. New product development, quality control of ingredients, recipe standardization and reformulation, or a process change, such as prepreparation, require sensory evaluation for sound decisions.

At the present time sensory evaluation methods are taught in food science departments in the United States, Europe, and South America. Food companies have created and maintained a sensory evaluation function, linked closely to the research and development function (9).

Although a major goal identified for the American School Food Service Association (2) is improvement of the quality and acceptability of school food and nutrition programs by utilizing sensory evaluation prior to the service of the meal, it is necessary at the present time to send panelists to a university or a workshop for training in sensory evaluation. Few foodservice facilities have employees with sensory training.

The objective of this project was the development and teaching of a course to train foodservice workers in sensory evaluation methods. The instructional materials introduced and illustrated basic concepts of sensory evaluation. The course was developed as part of a step-wise process, to be used with a self-instruction unit for foodservice directors.



## REVIEW OF LITERATURE

### History of Sensory Evaluation

The history of attempts to understand the senses can be documented as far back as the early Greeks. Heraclitos, in the 5th century, B.C., stated that knowledge comes to man "through the door of the senses." The Greeks developed a theory of perception that attempted to explain why sensory knowledge was valid (10). In a history of sensation and perception in experimental psychology, Boring (10) detailed the lack of scientific development of the chemical senses and postulated that in the future the means to control and predict odors and tastes in new situations would be available.

#### Early Developments

"When war comes, it is easier to dress men alike than it is to feed them alike," commented Dr. W.F. Dove, Chief, Food Acceptance Research, U.S. Armed Forces (11). During World War II, the Quartermaster General of the army found that, although the ration items being produced for consumption by soldiers had passed all Federal or Army specifications for quality, including nutritive value, the soldiers refused to eat some of the food items. This situation resulted in the establishment of the Food Accep-

tance Research Branch of the Chicago Quartermaster Subsistence Research and Development Laboratory. Their objective was to discover the causes of non-acceptance of foods and to develop techniques for measuring and evaluating acceptability. The difference-preference test was developed for this purpose. Dove reported that panelists were selected for their ability to detect small differences in a series of paired samples of the same food. They were asked to define the differences when detected. The second facet of the test was to ascertain which of the samples was preferred. No discussion of training of the judges was reported (11).

Citing the need for objectivity in the field of flavor measurement, Peryam and Swartz (12) developed tests, using methods worked out at the Seagram Laboratories, to identify sensory differences. The duo-trio, triangular, and dual-standard tests were described. Observers were instructed so that they were familiar with the type of test, the sequence of samples, and the requirement that they make a decision.

A technique to evaluate consumer preference of foods was developed at the Quartermaster Food & Container Institute during the 1940s. Using a variation of a rating technique, the hedonic scale, the procedure was used to

predict soldiers' food choices. The standard number of persons used for a test at the Institute was 40. Panelists received instructions for rating the food but no other training was reported (13).

Flavor studies at Arthur D. Little, Inc. (14) resulted in the development of the flavor profile method of sensory analysis, an objective method of evaluating food products. This method identified and integrated points of difference so that products could be judged separately as well as in groups. Persons who were to become panelists were given extensive training in the fundamentals of taste testing. To gain experience and confidence, they sat in on panel sessions and were introduced to ramifications of flavor problems. Panel members became acquainted with each new flavor problem under consideration (14). The profile method utilized a panel of four or more persons with normal abilities to taste and smell and who underwent generalized training in analytical flavor work (15, 16).

According to Caul (15), the crystallization of the field of sensory evaluation paralleled closely the growth and trends of the food industry. When commercial agriculture and production of manufactured foodstuffs on a large scale were beginning, taste testing to meet quality control demands for flavor was fairly informal. The food

industry viewed sensory evaluation as the responsibility of the company expert taster who had often been trained by his predecessor and had developed the ability to set standards of quality.

Caul (16) described panel training for the flavor profile consisting of orientation in preparation for formal profile panels. She reported that the flavor profile led to the development of a theory and philosophy of flavor that made it possible to teach an effective approach to creative flavor work and to substitute the findings of a group for the judgment of a single established expert.

The Institute of Food Technologists, recognizing the need for standardization of techniques and methods, developed a Sensory Testing Guide in 1964. The guide outlined types of food industry problems to which sensory tests might apply and provided information regarding type of tests, training procedures for panelists, size of panels, number of samples per test, methods of analysis of data, references, and a glossary of terms (17).

Changes in the traditional methods of food preparation and new and less expensive methods of production, storage, and distribution emphasized the growing need for the sensory analysis of food, according

to Amerine, Pangborn, and Roessler (18). The authors identified sensory problems associated with packaging materials, ingredients such as monosodium glutamate, and quality control.

When discussing the evaluation of wines and brandies, Amerine (19) said that every winery should have at least one person, or preferably a panel of tasters, who could classify the cellar's wines as to types, color, odor, and flavor, and who had a good memory for wine characteristics. As a part of training he advised judging the same wines in blind tastings on several different days. He suggested keeping notes on the tastings and comparing them to increase skill and confidence. Hedonic ratings, on a 7 point scale, and a descriptive system using panel tasting were recommended. The author emphasized the importance of thorough sensory examination by a panel and recommended that evaluations be conducted every six months. He believed that use of reference samples was essential for both experienced and inexperienced tasters.

#### Present Status of Sensory Evaluation

When reviewing the history of sensory evaluation, Pangborn (20) commented that significant advances had been made in food psychophysics and noted the need for basic

developmental work along with quality control studies. The author pointed out several weaknesses in the field, including insufficiently trained judges and a lack of comprehensive teaching programs both in and out of academic institutions. As a result, the author believed young people were not being adequately prepared to assume supervisory duties in quality control and food psychophysics.

Tilgner (21) stated that most food commodities were evaluated by sensory means and that biased and subjective appraisal prevailed almost everywhere. He believed that emphasis should be placed on fundamentals of sensory analysis at the undergraduate level, as it is with other basic analytical courses for students in food science and technology curricula.

When summarizing the progress of sensory evaluation, Moskowitz (9) described the early 1960s as a time of ferment in food science and sensory analysis, and the late 1960s as a time of new approaches to sensory evaluation. Magnitude estimation, the study of mixtures, and the use of recently developed methods such as multidimensional scaling were used for assessing the chemical senses and the perception of food. The 1970s found researchers using the flavor profile, the texture profile, magnitude estimation scaling, and quantitative descriptive analysis. Sen-

sory evaluation moved from the research and development laboratory into marketing research in the 1980s, utilizing model building methods for product optimization.

In 1984 Pangborn (22) concluded a discussion of principles of analytical sensory methods by observing that sensory science remains an underdeveloped field of food science, replete with unresolved problems, and seeks the expertise of multidisciplinary research teams. Approached as a science, advances in sensory evaluation have been and will continue to be made.

#### Sensory Evaluation Training Programs

##### Selection of Panel Members

Since the 1940s, the selection of panelists for sensory evaluation has been discussed extensively in sensory evaluation literature. Lowe and Stewart (23), writing about subjective and objective tests in food research, stated that a testing panel should be considered as a tool. They asserted that panel members should be healthy and seldom have colds, be good observers, be conscientious, and demonstrate the ability to concentrate on the job. Careless persons, although endowed with high sensitivity to food qualities, would not make consistent judges.

Harrison and Elder (24) stated that the use of a panel of tasters permitted one to estimate, to some degree, the confidence to be placed in their flavor judgments. Any method of selection should include a preliminary training period to acquaint the tasters with quality factors involved in the product to be tested, and should be followed by a blind test designed to show the individual's relative perception and discrimination. At the end of the testing, tasters should be ranked in decreasing order of their successes in correct pairings.

Motivation is an important determinant of a person's value as a panel member, according to Giradot, Peryan, and Shapiro (25). Interest and desire to do well predispose success. Although the authors recommended selecting panelists according to their ability to do well on test materials of the same product type as that to be tested, they stated that it might be possible to select a general purpose panel, since many candidates will have done well on some products but poorly on others. This panel would be less useful for a given product but would have possibilities as a time-saver when precision must be sacrificed to save time and labor.

Caul (15), in discussing the selection of panelists for the Flavor Profile method, stated that candidates considered for a panel should exhibit intelligence, com-



prehension, concentration, sustained interest, and motivation for sensory testing. Dawson, Brogdon, and McManus(26) stated that individuals should be healthy, since minor nose and throat infections can affect flavor perception. Age should be considered, although reports varied greatly as to the effect of age on panel members' acuity. The ability to discriminate can be affected by substances tasted prior to flavor evaluation.

All judges, according to Martin (27), should be tested for their ability to recognize the four basic tastes. Other important factors included availability and the person's interest in participating. Sex of the panelist and smoking habits had little influence on the person's ability to discriminate tastes.

When selecting texture profile panel members, a high degree of interest, availability, ability to communicate with others, and to work well in a group were listed as prime requisites by Civile and Szczesniak (28). Candidates for texture panels were tested with food samples to identify their ability to discriminate between stimuli during mastication. Individual interviews were used to judge availability, interest, regard for the work, extreme personalities, and common sense to deal with the application of texture profiling concepts.

Winger and Pope (29) described the selection and training of panelists for the evaluation of rancid flavor development in lamb during frozen storage. Panelists who were sensitive to the flavor change in the meat were chosen and rigorously trained over a period of nine months to distinguish rancid from other flavors in lamb, to use a line scale to score rancid flavor intensity, and to describe the overall flavor of the sample in simple descriptive terminology.

A successful testing program involves employees from all parts of the company, according to Stone and Sidel (30). To attract volunteers and maintain their interest requires careful planning and a commitment on the part of the company's management. They emphasized that sensory skills vary from person to person, that most individuals do not know what their ability is to smell, taste, or feel a product and that employees should never be made to feel that their work required that they "volunteer." The authors recommended that all individuals learn to take a test with the understanding that not all would qualify for all tests.

Sensory evaluation can be carried out scientifically through sensory testing, according to Jellinek (8). The sensory analyst can be compared to an instrument that objectively measures sensory differences or classifies the

quality of a product by using a well-defined quality scale. Jellinek recommended that panelists have normal olfactory and gustatory sensitivity which can be improved by training and warned that oversensitivity may be a disadvantage. She recommended that all interested persons, regardless of their age, be admitted to training. She reasoned that young persons may have more taste buds but older persons could concentrate better, balancing the results. Men and women are equally qualified for the sensory evaluation of food. Smokers and non-smokers are both suitable, as there are sensitive and less sensitive persons in both groups, but persons suffering from colds should not participate in tests.

#### Physical Arrangements

Environmental Factors. Sensory evaluation, which is concerned with human evaluation and measurement of physical stimuli, requires an environment that is controlled to avoid outside influences on judgment, stated Larmond (31), who described the environment for testing. The preparation area should be separate from the testing area so that panelists do not gain information to influence their decisions. Individual booths are desirable since, for most types of testing, independent judgments are required. Lighting should be uniform and

should not influence appearance. Smoking should not be permitted at any time, and cosmetic odors should be avoided. Odors from food preparation should be kept from the testing room.

Jellinek (8) suggested that institutes or industries which do not have a panel room use small tables placed one behind the other. Long tables with an adequate distance between test subjects to avoid mutual influence of the test subjects were listed as an alternative.

Environmental conditions are important to the success of a sensory evaluation program, according to the guidelines developed by the ASTM Committee E-18 on Sensory Evaluation of Materials and Products (32). Conditions to prevent biased results or reduced panelist sensitivity include a quiet, odor-free room with an atmosphere of comfort and relaxation so that participants can concentrate on product evaluations; neutral colors in the off-white category; controlled/balanced lighting; air control including 72 degrees F, 45 to 50 percent humidity, purity, pressure, and flow rate; and booths or tables large enough so that each panelist has room to evaluate products and record his evaluation. Use of the room for other types of meetings should be controlled so that an odor-free environment can be maintained for sensory testing (32).

Presentation of Samples. The presentation of samples to panelists was described by Larmond (31). To obtain meaningful results, samples received by each panelist must be typical of the product. Since panelists are influenced by irrelevant characteristics of the samples, every effort should be made to make the samples from different treatments identical in all characteristics except the one being judged. Serving utensils should be chosen that do not impart any taste or odor to the product. Identical containers should be used for each sample so that no bias will be introduced from this source.

The order of presentation of samples to each panelist should be randomized or balanced to avoid problems such as positional bias, the convergence effect, and the contrast effect. The code assigned to the samples should not give any hint of the identity of the treatments and the code itself should not introduce any bias (31).

Rinsing the mouth between samples with taste-neutral water at room temperature is recommended. Evaluation of fatty foods can require crackers, apples, celery, or bread for removing flavor from the mouth. Whatever is chosen, the panelist should consistently follow the same procedure after each sample (31).

## Program Management

Training of panelists for sensory evaluation is determined by the type of problem and the testing to be done, according to Peryam and Swartz (12), who refined methods of difference testing for the field of flavor measurement. They believed that panelists should be thoroughly familiar with the particular difference test being used and then receive a specific set of instructions.

The flavor profile method of flavor analysis, described by Caul (15, 16), requires extensive training for panelists. The initial training program includes background material and an introduction to the profile technique. Demonstrations by experienced panels and practice sessions for the trainees are a part of the initial training program. A second phase of the training includes periodic discussions and reviews held with novice panels after they begin to apply the profile method to flavor problems in their laboratories. This phase is followed by a counseling service in which the trained panels guide trainee panels by working jointly with them on problems. The entire training session extends from six months to a year.

The Institute of Food Technologist's Sensory Testing Guide (17) for panel evaluation of foods and beverages

listed types of tests used in sensory evaluation and indicated whether panel training was needed. Training processes were not described.

Civille and Szczesniak (28) stated that training involves familiarization with the basic concepts of flavor and texture. The authors developed guidelines for training a texture profile panel which included introducing the panel to an organized body of information, and using examples and reference samples so that the group could express a common experience by the use of common terminology. Training for texture profiling usually involved two weeks of daily orientation sessions of two to three hours, followed by six months of hourly practice sessions four to five times a week. The authors recommended that after a panel has been trained, attention should be directed to maintenance of the panel's motivation, objectivity, and high standards of performance.

The type and amount of training necessary for panelists will depend on the problem, the amount of time available, and the size of the budget, according to Martin (27). Training should increase sensitivity and memory, permit more precise subjective judgments, and produce results that are uniform from trial to trial.

Rainey (33) recommended an orientation session as an introduction to the sensory program and as an essential step for potential panelists. Panelists must understand the importance of training to the success of the program. An explanation of time commitment, screening, and training procedures is required. An orientation program is described that included a definition of sensory evaluation, qualifications for a panelist, and brief descriptions and demonstrations of sensory testing methods to generate interest.

Panelist motivation is addressed by Stone and Sidel (30). The authors listed several guidelines that they have found to be useful and included the following: the person in charge of sensory testing should not suggest that sensory testing involves right or wrong answers; panelists should be rewarded for participation; participation should be acknowledged on a regular basis, directly or indirectly; memos acknowledging special assistance should be included in panelists' personnel files; and management should express recognition of sensory evaluation as a contributor to company success. Stone and Sidel (30) warn of difficulties of sustaining panelist motivation if the frequency of participation is high, such as once or twice each day.



Jellinek (8) has organized a program for a 10 day sensory evaluation training course to enable industry, universities, or research institutions to teach sensory evaluation. The program can be used as a basic framework for an in-house course, completed in about three to four months with one session a week, or can be taught as an external course over a ten day period.

The most suitable time of day for testing products depends upon the number of tests and the length of time required (8). Generally, panelists are more sensitive when slightly hungry. Panelists should not come to the test in a hurry, since annoyance or excitement has a negative influence on the ability to concentrate. Late morning or one to one and a half hours after lunch are recommended times for testing products.

Several steps exist in setting up a training program to ensure that employees participate and get the most out of the training, and that skills and knowledge they acquire will be supported after the training is completed. Zemke and Gunkler (34) emphasize the importance of executive support of the program, which may be expressed through a letter or executive memo from the chairman of the board, the president of the company, or the manager of the department, acknowledging that the person is about to

undertake an endeavor that is of significance for the organization and for the individual personally.

According to Rainey (35), reference standards play an important role in the training of a sensory evaluation panel. They help panelists develop terminology used in describing products, determine intensities, anchor end points of attribute scales, and explain the actions of ingredients such as salt. The use of reference standards may shorten training times by obtaining panel agreement about terminology.

#### Current Applications of Sensory Evaluation

##### Business and Industry

Sensory evaluation is receiving recognition and is being used in industry, government, and the universities in the United States and abroad (36). Applications are numerous and include setting standards for the classification of raw materials, ingredients, and finished products and for guidelines for quality assurance to which products must conform initially and during handling and storage. An important use is the formulation of new foods or modification of existing products, such as special diet products for low-sodium, low-cholesterol, or lactose-free regimes, while maintaining desirable sensory characteristics.

Sensory evaluation, correlated with chemical, physical, and instrumental measures, develops faster, more reproducible estimates of sensory properties. At the consumer level, sensory evaluation is used to determine the importance of sensory properties for acceptance or rejection, preference, and degree of liking of a product in relation to other product attributes. In the laboratory, discriminative tests are used for detection or deletion of ingredients. At the analytical level, human responses are quantified to understand the mechanisms of perceptions (36).

A small processing operation in Olathe, Kansas, used sensory evaluation to link together operations, product development, quality control, and marketing (37). In quality control programs, sensory evaluation is a powerful resource that can be used to assess product integrity and assure that the product shipped is what the company intends to make. Sensory evaluation can be used to evaluate raw ingredients, packaging materials, and customer complaints (38). The sensory program within a multiplant international organization can be used for development and maintenance of standards, field audits, and product and process information (39).

An effective quality assurance program must embrace all available means of testing, and sensory evaluation is

one of the most important of these. According to Reece (40), incoming inspection of raw and packaging materials, in-process controls, final product inspection, and product surveillance are aided by the use of sensory evaluation. Routine maintenance of product quality is monitored using sensory evaluation techniques at the Quaker Oats Company (41).

Problems related to a product's shelf life are of interest to food product companies. Storage studies of perishable or semi-perishable food products were conducted using sensory evaluation techniques (42).

Sensory evaluation has important links with marketing and market research, according to Jacqueline Pearce, senior group leader, The Sensory Evaluation Department of the Quaker Oats Company (43). The process has an important problem solving function in production and operations aspects of a business. At the Pillsbury Company (44), sensory evaluation prevents pitfalls in the transition from the laboratory development of a new product to the actual production startup.

#### Foodservice Operations

The objective of a project in a hospital foodservice, conducted by McMahon (45), was to train foodservice personnel in sensory evaluation methods so that they could

monitor quality control standards of food products served to clients at St. Joseph's Hospital in Lexington, Kentucky. Nineteen employees, including clinical dietitians, the assistant foodservice manager, diet technicians, diet aides, and supervisors, attended a course composed of six one hour sessions. Topics for the classes were initial screening, aroma and flavor, order of appearance, aftertaste and amplitude, intensities, evaluation of products used at the hospital, and evaluation of a complete patient tray.

McMahon (45) reported that the participants developed an understanding of the basic principles of sensory evaluation and communication terminology, which was demonstrated by close correlations in ratings of the final tray evaluations by foodservice personnel. She emphasized that the final food product, as served to the client, should be the key to production standards developed for the foodservice, but sensory aspects are often evaluated subjectively or neglected in favor of standards for purchasing. Training in sensory evaluation would enable the persons responsible for end product evaluation to communicate consistently about sensory aspects of food and identify problem areas objectively, so that the foodservice department could establish a consistently high standard of quality in the finished product.

Consumer acceptance of menu changes can be predicted through the use of taste panels, according to Skelton (46). A process to assure consistent quality, a major goal of foodservice operators, should include sensory evaluation. Consumer-panel members need no training. Quality control and product development panel members need some elementary training for product development and quality control. Properly designed, executed, and analyzed sensory tests can be used to help solve foodservice problems such as maximizing quality in recipe development, determining shelf-life storage time and temperature, making optimum substitutions of ingredients for food products, and controlling product consistency (46).

Product evaluation, which is designed to assure the production of consistent and high quality menu items, is an important part of a foodservice quality control program, according to Spears and Vaden (5). Large foodservice organizations commonly operate quality control laboratories where sensory testing is conducted during the development of new menu items.

#### Recommendations for the Future

According to Tilgner (21), people will continue to rely upon sensory assessments even when objectivized measurements are available. Experience had shown a great

need for education on matters of sensory assessment and understanding of the difficulties involved in controlling sensory quality. Tilgner (21) said education is needed, not only in the technical areas concerned with food production, but particularly in the nontechnical areas, such as among administrative board members and advertising and sales departments, including the point of sale in retail shops.

Today the consumer has more opportunity to have new sensory experiences consistent with greater affluence, increased mobility, and changing lifestyles (7). While sensory skills can be developed through repetitive exposure to a product, that skill cannot substitute for scientifically organized panels of experienced and/or trained subjects. It would appear that an educational program might be desirable to effect some changes.

A major goal identified for the American School Food Service Association (2) is to improve the quality and acceptability of school food and nutrition programs. Evaluation of sensory quality of menu items by foodservice personnel prior to the service of the meal was recommended.

The foodservice industry will be developed by and dependent on the managers of tomorrow, according to Minor (47). He asserted that it is imperative for students to

receive effective education and training in the principles of food science so that their efforts as foodservice leaders will enable them to attain or surpass present foodservice standards. He presented an outline for a course used to teach food flavor evaluation to college and university foodservice students.

Trained taste panels and appropriate sensory instruments are required for accurate measurement of time and temperature effects on the sensory qualities of foods as they enter a foodservice system. These procedures are used as controls for food processing and holding within the system (48).

According to Gray (49), a major component of the development process for achieving a winning menu in the foodservice industry is the organization of a taste test panel. Impartial panel members should have a broad range of foodservice experience.



## METHODOLOGY

### Development of Course

#### Course Content

A course to teach basic concepts of sensory evaluation to foodservice personnel was developed. Experiences were based on those used by Caul (14), Jellinek (8), and Continental Can Company (49), to train panel members in industry and the laboratory. The course of study was simplified and shortened to meet the constraints of a foodservice operation. A foodservice director would have difficulty obtaining highly specialized equipment and ingredients, and procedures such as preparation of concentration series for basic threshold testing are time-consuming and would not be feasible for use in a foodservice operation.

Sensory experiences were developed from objectives written for the course (Appendix A). A list of topics and summary of objectives follows.

Topic	Objectives
1 Introduction to Sensory Evaluation	<ul style="list-style-type: none"><li>-Identify parts of sensory system.</li><li>-Recognize interdependence of senses.</li><li>-Identify uses of sensory evaluation in food service.</li><li>-Recognize importance of color in food acceptance.</li></ul>

- Identify persons who can serve as sensory panelists.
  - Practice personal habits necessary for panelists.
  - Identify physical factors important in choosing a sensory evaluation location.
- 2 The Olfactory System
- Identify parts of olfactory system.
  - Recognize role of olfactory system.
  - Identify and describe 10 odorants.
  - Recognize that odors can interfere with or cancel each other.
  - Recognize that the sense of smell becomes fatigued but recovers rapidly.
  - Compare differences in odor strength with changes in temperature, dilution, medium, or coatings.
- 3 The Gustatory System.
- Identify parts of gustatory system.
  - Identify contribution of gustatory system to perceived flavor of food.
  - Identify four basic tastes: sweet, sour, salt, bitter.
  - Rank intensities of sweetness using references.
  - Use tasting methods suitable to sensory evaluation.
  - Identify and describe five additional odorants.
- 4 Flavor
- Define flavor.
  - Describe temperature effects on flavor.
  - Describe textural effects on flavor.
  - Develop appropriate sensory evaluation vocabulary.
  - Identify odors of spices and herbs.
- 5 Texture and Mouthfeel
- Define texture.
  - Identify and describe textural components of foods.
  - Recognize importance of texture in sensory evaluation.
  - Experience chemical aspects of mouthfeel.
  - Describe mouthfeel aspects of foods.

- |   |  |
|---|--|
| 6 Texture:<br>Mechanical<br>Characteristics           | -Identify primary and secondary mechanical textural properties of foods.<br>-Rank reference foods on standard hardness,fracturability, adhesiveness, viscosity, and chewiness scales.<br>-Recognize overlapping meanings of terms used in textural sensory evaluation. |
| 7 Texture: Order<br>of Appearance                     | -Identify geometrical characteristics of texture.<br>-Identify order of appearance of textural characteristics of food products.<br>-Describe order of appearance of textural characteristics of food products.  |
| 8 Aftertaste,<br>Amplitude,<br>Order of<br>Appearance | -Detect aftertaste of food products.<br>-Describe aftertaste of food products.<br>-Describe amplitude of food products.<br>-Compare amplitudes of food products.<br>-Identify order of appearance of flavors.<br>-Describe order of appearance of flavors.             |

Score sheets were developed for testing to be done in the classes. Tests included preference, difference, and order of appearance; score sheets can be found in Appendix B.

#### Course Format

The course, consisting of eight 30 minute classes, was planned to be completed in one month.

Thirty minute sessions, the usual length of employee in-service classes and meetings, minimize interruption of work in the foodservice facility. The

classes were scheduled to meet twice each week to aid in retention of information.

While participants were encouraged to attend each of the classes, sessions were structured so that it would be possible to attend and understand any individual session. All sessions were conducted by the same instructor to promote continuity and reinforcement of learning.

Foodservice directors have little time to direct toward the planning and setting up of in-service training. For this reason, minimal preparation and cleanup times were major considerations in the development of this course. The researcher obtained or prepared all samples and products used in the course. Supplies and equipment were adapted from those used in the laboratory and were obtained from local sources including a supermarket, a hospital, and the sensory laboratory at Kansas State University. Lists of resources used for the course may be found in Appendix C.

#### Site

Derby Food Center at Kansas State University was selected as the site for the classes. The facility provides foodservice for 1850 students and is used as a teaching center by the Department of Hotel, Restaurant, Institution Management and Dietetics in the College of

Human Ecology. The food service staff, 65 civil service workers, includes supervisors, cooks, bakers, and personnel in the ingredient room, salad, service, and sanitation areas. Permission to conduct the classes was received from the foodservice director at Derby Food Center.

### Participants

Potential participants were identified from all areas and levels of employees and included personnel in main production, salads, bakery, service, and sanitation. Educational levels of employees ranged from limited learners to those with college degrees. From this group, fifteen were selected by the foodservice director with the assistance of supervisors in each area.

Two weeks before the classes began, letters were sent from the foodservice director to the fifteen people who were selected to attend the sessions, describing the course, providing the schedule, and encouraging them to attend. Eleven of these people were able to attend the first meeting.

### Scheduling

Scheduling a series of in-service classes so that each participant can attend all the classes is difficult.

State law requires that civil service employee training must occur within work periods; consequently classes were scheduled from 1:30 to 2:00 pm, the only time available for both early and late shift employees. This followed the daily 1:00 pm menu meetings and preceded the 2:00 pm coffee break, but was difficult for bakery personnel who were preparing yeast breads for dinner. Foodservice employees work on weekends, so they have scheduled days off during the week. Because of the two week work cycle, Wednesday was the only day that most of the employees were present, and was selected as one day for classes. However, this day was often used by the Department of Housing for employee meetings or workshops so that the schedule was adjusted for these events.

Reminders were given to participants on the day before the first class, which was held on November third. At the request of the employees, the second class was rescheduled so that a larger number could attend. Remaining dates were adjusted because of holiday events.

#### Facilities

The room used for classes was away from employee traffic, quiet, clean, neutral in color, and well lighted, as suggested by Caul (14). The classroom was equipped with comfortable chairs and tables, and was heated to 70

degrees F. The area was usually free of the odors of food being prepared or served (31). The room was used primarily for special events, so tables and chairs could be arranged to provide a classroom atmosphere and left in place for more than one class. The room arrangement is described in Appendix D, and each participant's cover was set up as diagrammed in Appendix E. Audiovisual equipment including a chalkboard, overhead projector, and a screen were readily available, and equipment for sample preparation and holding was nearby.

## RESULTS AND DISCUSSION

### Course Content:

Although people attending the classes had no previous sensory training, they were enthusiastic and responsive to the introduction to sensory evaluation. The course included the definition and scope of sensory evaluation and its application to foodservice. Descriptive flavor and texture analysis were not introduced because a comprehensive program using the flavor profile method requires careful selection and thorough training of panel members that lasts from 6 to 12 months, conditions not possible in a foodservice facility (14, 28). All planned content was included but minor adjustments in classes were necessary because some experiences required more time than expected, numbers attending varied, and some sessions started five to ten minutes late.

Components of the sensory system were identified. Importance and application of the process in the foodservice operation became apparent to class members as they evaluated food products. As skill in flavor perception developed, students learned to understand their own sensitivity to flavors. Participants reviewed mouthfeel factors and experimented with the effects of textural



characteristics on perceived sweetness. Textural components of foods were differentiated and the students learned to use reference scales for characteristics, such as hardness, to describe a product. Order of appearance of textural qualities and flavor components were introduced. Intensity and amplitude were the final components of sensory evaluation that were included in the course.

#### Participants

A total of fifteen employees at Derby Food Center participated in the course for one or more sessions. Attending the classes were 4 bakers, 4 cooks, 3 service supervisors and employees, 1 person each from the salad department, the ingredient room, and sanitation, and the dietitian responsible for menu planning and development. In some cases, substitutes were sent when a person was unable to attend because of scheduling problems.

Review and repetition were utilized to train those employees who were absent from a previous session. Food-service employees attended as many of the sessions as their schedules permitted and participated successfully in activities planned for their training in sensory evaluation techniques. Employees' skill and confidence in identifying and differentiating aromas, flavors, and textural factors increased during the course. At the con-

clusion of the course, participants were able to list and describe flavor and textural characteristics of a product.

#### Scheduling

The course was planned to be taught twice a week for four weeks. Because of special events and holidays, the course extended over a period of five weeks. When classes took place twice a week, there seemed to be greater retention of previously discussed material. Also, attendance was better because class members and their supervisors remembered to include the sessions in their schedules. Set-up time was decreased because it was possible to leave the room arranged during the week. The room was used for special functions each weekend.

Thirty minutes, the usual length of time for inservice employee training sessions at Kansas State University, worked well for the completion of planned learning experiences. When class were delayed because employees were late, time for discussion was reduced.

Scheduling classes so that each participant could attend all sessions proved to be almost impossible. With the two week work cycle, employees had days off that changed from week to week and varied from employee to employee. Only one employee was able to attend all eight

sessions. Five employees attended six or more sessions. Mean attendance for the course was seven (Appendix E).

#### Preparation and Clean-up

Preparation and clean-up time for each session required approximately one hour. Number of students, availability of resources, number of procedures requiring precise weighing or measuring, and assistance by class members in the set-up and clean-up of facilities influenced the amount of time needed by the teacher for preparation and cleanup.

Collection and preparation of odorant bottles required the greatest amount of time. Odorants, such as oil of orange and anise, were used for initial odor recognition. Crushed herbs, including oregano, coriander, and thyme, were used in the second phase of odor recognition. These products were readily available, required little preparation, and were of interest to persons who prepare or serve food products.

Precision of weighing and measuring was required for some of the samples. For example, preparation of basic taste samples for the identification of sweet, sour, salt, and bitter were prepared using sugar, vinegar, salt, and caffeine. The recommended experiment used to illustrate the influence of viscosity on perceived sweetness of a

product used varying concentrations of carboxymethylcellulose. For this project, three samples of vanilla pudding, prepared with varying amounts of cornstarch, were used to illustrate this point successfully. When available, food products from the serving lines such as cookies, angel food cake, and cheese soup were used. The instructor prepared the basic taste samples and the puddings, but this could be assigned to foodservice personnel. Clean-up, organized so that class members disposed of materials from their own place-settings, required from 10 to 20 minutes.

## RECOMMENDATIONS

Based on the findings from the project, the following recommendations are made:

### Course Content

1. Evaluate the effectiveness of this course utilizing appropriate pretests and posttests.
2. Implement this course in other foodservice facilities including hospitals, nursing homes, schools, colleges and universities, in-plant, and restaurants.
3. Develop a self-instructional teacher's manual so that a person in foodservice management could become familiar with content and teach the course in his or her facility.
4. Administer a follow-up questionnaire to participants to evaluate on-the-job use of sensory techniques.
5. Emphasize the use of reference standards in the course.

Rainey (35) states that reference standards play an important role in developing appropriate terminology and may reduce the amount of training time.

6. Evaluate products and menu items produced within the facility in sessions following the eight planned classes to provide follow-up for the sensory evaluation training.

## Format

### 7. Increase pretraining strategy.

When the decision is made by management to use the program, pretraining strategies should begin. The persons chosen to attend should be notified far enough in advance to make scheduling adjustments. A letter of support from the foodservice director or the chief executive officer will let the persons selected to attend know that the endeavor is important to the organization and to the addressee personally. Copies of this letter should go to the person's direct supervisor, informing that person of the course and of its importance (34).

### 8. Orient participants.

Zemke and Gunkler (34) recommend using a trainee self-assessment quiz to prepare the trainee by giving that person an overview of the content and some insight into what will be included in the course.

9. Provide course notebooks or folders for each class member with course information, score cards, and extra reading suggestions.

10. Use follow-up letters to discuss ways that the individual can apply the newly acquired knowledge, techniques, and skills on the job.

11. Develop self-instruction modules to supplement group instruction that would be available for individuals who are unable to attend all the sessions.
12. Utilize learning centers for supplemental experiences, "make-up" information, or readings.
13. Increase class periods to forty-five minutes, if the time is available, to permit more discussion, which is important in the development of students' descriptive vocabulary; or organize the material into a series of four one-hour classes, if this format is preferred.
14. Investigate computer-assisted instruction.

Classes could be planned with samples on trays, available for students to work on an individual basis, utilizing computer instruction. Group experiences, which are essential for the development of a descriptive vocabulary, should be included.

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## APPENDIXES

## APPENDIX A

### Outline of Sensory Evaluation Course

## SESSION 1: INTRODUCTION TO SENSORY EVALUATION

### Objectives

The participant will:

1. Identify parts of sensory system.
2. Recognize interdependence of senses.
3. Identify uses of sensory evaluation in foodservice.
4. Recognized importance of color in food acceptance.
5. Identify persons who can serve as sensory panelists.
6. Practice personal habits necessary for panelists.
7. Identify physical factors important in choosing a sensory evaluation location.

### Class Outline

- I. Introduction to sensory evaluation
  - A. Purpose of the class
  - B. Examples of sensory evaluation
    1. Taste a food product
    2. List senses involved
- II. Definition of sensory evaluation
- III. Illustration of uses of sensory evaluation in food service
  - A. Procurement or production choices
    1. Preference test of two similar food products
    2. Evaluation of results
  - B. Storage decisions
    1. Triangle test of food product
    2. Evaluation of results
  - C. Production evaluation
    1. Color-flavor identification test
    2. Evaluation of results
- IV. Selection of panelists
- V. Requirements of panelists
- VI. Physical requirements for sensory testing

## SESSION 2: THE OLFACTORY SYSTEM

### Objectives

The participant will:

1. Identify parts of the olfactory system.
2. Recognize role of olfactory system.
3. Identify and describe 10 odorants.
4. Recognize that odors can interfere with or cancel each other.
5. Recognize that the sense of smell becomes fatigued but recovers rapidly.
6. Compare differences in odor strength with changes in temperature, dilution, medium, or coatings.

### Class Outline

- I. Introduction to olfactory system
  - A. Uses of olfaction
  - B. Complexity of odors
- II. Identification of parts of olfactory system
  - A. Nasal passages
  - B. Olfactory region
- III. Identification of odorants
  - A. Techniques for use of odorants
  - B. Identification or description of odorants
  - C. Discussion of odorants
- IV. Comparison of differences in strengths of odors with changes in carrier.
  - A. Temperature
  - B. Dilution
  - C. Medium
  - D. Coatings



### SESSION 3: THE GUSTATORY SYSTEM

#### Objectives

The participant will:

1. Identify parts of the gustatory system.
2. Identify contribution of gustatory system to perceived flavor of food.
3. Identify four basic tastes: sweet, sour, salt, and bitter.
4. Rank intensities of sweetness, using references.
5. Use tasting methods suitable to sensory evaluation.
6. Identify and describe five additional odorants.

#### Class Outline

- I. Introduction to gustatory system
  - A. Basic tastes
  - B. Accessory tastes
  - C. Contribution of flavor to taste
- II. Identification of parts of gustatory system.
  - A. Location of tastebuds in mouth
  - B. Physiology of tastebuds
- III. Identification of basic and accessory tastes
  - A. Techniques for tasting
  - B. Identification of basic tastes
  - C. Discussion of basic tastes
- IV. Ranking of intensities of sweetness
  - A. Use of references
  - B. Tasting to rank according to sweetness
  - C. Discussion of rankings
- V. Identification of odorants

## SESSION 4: FLAVOR

### Objectives

The participant will:

1. Define flavor.
2. Describe temperature effects on flavor.
3. Describe textural effects on flavor.
4. Develop appropriate sensory evaluation vocabulary
5. Identify odors of spices and herbs.

### Class Outline

- I. Introduction to flavor
- II. Definition of flavor
- III. Illustration of temperature effects on flavor
  - A. Rating of temperature effects on aroma
  - B. Rating of temperature effects on flavor
  - C. Description of flavor of food product
  - D. Discussion of temperature effects
  - E. Discussion of perceived flavors
- IV. Identification of odors of spices and herbs used as seasonings.

## SESSION 5: TEXTURE AND MOUTHFEEL

### Objectives

The participant will:

1. Define texture.
2. Identify and describe textural components of foods.
3. Recognize importance of texture in sensory evaluation.
4. Experience chemical aspects of mouthfeel.
5. Describe mouthfeel aspects of foods.

### Class Outline

- I. Introduction to texture and mouthfeel
- II. Definition of texture and mouthfeel
- III. Illustration of textural aspects of food products
  - A. Recognition of textural aspects
  - B. Discussion of textural aspects
- IV. Illustration of viscosity on perceived sweetness
  - A. Ranking of perceived sweetness
  - B. Discussion of effect of viscosity
- V. Illustration of chemical aspects of mouthfeel
  - A. Experience of mouthfeel aspects
  - B. Description of mouthfeel aspects

## SESSION 6: TEXTURE-MECHANICAL CHARACTERISTICS

### Objectives

The participant will:

1. Identify primary and secondary mechanical textural properties of foods.
2. Rank reference foods on standard hardness, fracturability, adhesiveness, viscosity, and chewiness scales.
3. Recognize overlapping meanings of terms used in textural sensory evaluation.

### Class Outline

- I. Introduction to mechanical textural characteristics
  - A. Classes of textural characteristics
  - B. Properties of mechanical textural characteristics
    1. Primary
    2. Secondary
- II. Illustration of scaling of mechanical components of foods
  - A. Scaling of hardness
  - B. Identification of other mechanical components of foods
    1. Fracturability
    2. Adhesiveness
    3. Viscosity
    4. Chewiness
- III. Illustration of terms with overlapping meanings

## SESSION 7: TEXTURE-ORDER OF APPEARANCE

### Objectives

The participant will:

1. Identify geometrical characteristics of texture.
2. Identify order of appearance of textural characteristics of food products.
3. Describe order of appearance of textural characteristics of food products.

### Class Outline

- I. Identification of geometrical characteristics of texture
  - A. Illustration of particle size and shape
  - B. Illustration of particle shape and orientation
- II. Identification of order of appearance of textural characteristics
  - A. Establishment of technique for textural evaluation of food product
  - B. Sampling of food product to identify textural characteristics in order of appearance
- III. Description of textural characteristics in order of appearance

## SESSION 8: AFTERTASTE, AMPLITUDE, ORDER OF APPEARANCE

### Objectives

The participant will:

1. Detect aftertaste of food products.
2. Describe aftertaste of food products.
3. Describe amplitude of food products.
4. Compare amplitude of food products.
5. Identify order of appearance of flavors.
6. Describe order of appearance of flavors.

### Class Outline

- I. Definition and illustration of aftertastes of food products
  - A. Tasting for identification of aftertastes
  - B. Description of aftertastes
- II. Definition of amplitude of food products
- III. Illustration of amplitude of food products
  - A. Tasting of food products for amplitude
  - B. Comparison of amplitudes of food products
- IV. Identification of order of appearance of flavors of food product
  - A. Establishment of technique for flavor evaluation in order of appearance of food product
  - B. Sampling of food product to identify flavor characteristics in order of appearance
- V. Description of flavor characteristics of food product in order of appearance

APPENDIX B

Score Sheets for Sensory Evaluation Course

# Score Sheets for Sensory Evaluation Course

<u>Test Sheet</u>	<u>Class</u>	<u>Section</u>
1. Preference Test	1	IIIA1
2. Triangle Test	1	IIIB1
3. Odor Recognition	2	IIIB
4. Odor vs. Flavor by Mouth	2	IVB & D
5. Recognition of Taste Factors	3	IIIB
6. Intensity of Sweetness	3	IVB
7. Temperature Effects on Flavor and Aroma	4	IIIA,B,C
8. Effect of Viscosity on Perceived Sweetness	5	IVA
9. Texture: Firmness	6	IIA
10. Order of Appearance of Textural Characteristics	7	IIB



Test Sheet 1

PREFERENCE TEST  
CHOCOLATE CHIP COOKIES

Taste each of the chocolate chip cookies beginning with the cookie on your left. Which cookie do you prefer?

Sample\_\_\_\_\_

Test Sheet 2

TRIANGLE TEST

In front of you are three coded samples. Two samples are the same and one is different. Taste them, starting from the left. Circle the code number of the sample that is, in your opinion, different from the other two.

898

356

267

Test Sheet 3

ODOR RECOGNITION

Purpose: to familiarize ourselves with the aromas and to train our odor memory.

Procedure: Smell each bottle carefully. If you do not immediately recognize the aroma, sniff three times. Immediately close the bottle. Complete the chart by describing and naming the odor if you can. If you cannot recognize the odor, try a description.

<u>SampleNumber</u>	<u>Odor Recognition</u>	<u>Odor Description</u>
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		

Test Sheet 4

ODOR (SNIFFING) VS. FLAVOR BY MOUTH

Evaluate each product first by sniffing alone, then by tasting.

Describe or rate the intensity of the odor and flavor of each.

- ) ( Threshold  
1 Slight  
2 Medium  
3 Strong

<u>Intensity</u>	<u>Comments</u>
Hard Candy_____	_____
Vanilla Wafer_____	_____
Vanilla Extract_____	_____

Test Sheet 5

RECOGNITION OF TASTE FACTORS

Samples are taken into the mouth in sips and moved around in such a way that all parts of the tongue are exposed to them. Concentrate and note the areas of the tongue where each taste is perceived.

<u>Sample Codes</u>	<u>Taste Quality</u>	<u>Sample Codes</u>	<u>Taste Quality</u>
U	_____	V	_____
T	_____	S	_____
L	_____	M	_____
E	_____	F	_____
K	_____	J	_____
N	_____	I	_____
O	_____	P	_____
R	_____	Q	_____

Test Sheet 6

INTENSITY OF SWEETNESS

Taste each of the samples, then record the sample code and your evaluation of the intensity of the sample.

Intensity scale

- 1    Very weak
- 2    Weak
- 3    Medium-strong
- 4    Strong
- 5    Very strong

Sample code

Intensity

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Test 7

TEMPERATURE EFFECTS ON FLAVOR AND AROMA

BEVERAGES

Please rate the aroma (Use letter A) and flavor (Use letter F) intensity of each sample. Indicate your evaluation by checking the point that best describes the intensity of the sample.

Code _____	Code _____	Code _____
_____ Very strong	_____ Very strong	_____ Very strong
_____ Strong	_____ Strong	_____ Strong
_____ Mod. strong	_____ Mod. strong	_____ Mod. strong
_____ Mod. weak	_____ Mod. weak	_____ Mod. weak
_____ Weak	_____ Weak	_____ Weak
_____ Very weak	_____ Very weak	_____ Very weak
_____ Tasteless	_____ Tasteless	_____ Tasteless

---

Description

Description

Description

Test 8

EFFECT OF VISCOSITY ON PERCEIVED SWEETNESS

Taste each of the samples, beginning with the sample on your left. Rank the samples in order of sweetness.

Sweetest \_\_\_\_\_

\_\_\_\_\_

Least sweet \_\_\_\_\_



Test 9

TEXTURE: FIRMNESS

Technique for evaluating hardness

For solids, place food between the molar teeth and bite down evenly, evaluating the force required to compress the food. For semi-solids, measure hardness by compressing the food against palate with tongue.

List the samples in order of hardness, beginning with least and working toward most hardness.

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_
7. \_\_\_\_\_
8. \_\_\_\_\_
9. \_\_\_\_\_

Please evaluate the firmness of these frankfurter samples.

Evaluate in the following order: \_\_\_\_\_

Make vertical lines on the horizontal line to indicate your rating of the firmness of each frankfurter. Label each vertical line with the code of the sample it represents.

---

Test 10

ORDER OF APPEARANCE OF TEXTURAL CHARACTERISTICS \*

<u>Stages</u>	<u>Description</u>
1. Prior to mastication: geometrical, moisture and fat characteristics perceived before the first bite (as it touches lips).	
2. First bite: mechanical and geometrical characteristics perceived on first bite.	
3. Masticatory phase: characteristics perceived during chewing.	
4. Residual phase: changes occurring during chewing such as rate and type of breakdown.	
5. Swallow: ease of swallowing and description of residue remaining in mouth.	
6. Amplitude: represents overall impression of product. How appropriate are the character notes and intensities at various stages of mastication.	

Reference (28)

## APPENDIX C

### Resources for Sensory Evaluation Course

# FOOD PRODUCTS FOR SENSORY TESTING

Class	Section	Food product	Quantity needed
1	IB	Crisp cookies(such as sugar or peanut butter)	1 per panelist
1	IIIA1	2 kinds of cookies that are made by different companies.	1 of each per panelist
1	IIIB1	1 product such as bread that has been frozen and an identical item that has not been frozen.	1 piece that has been 2 pieces that have not been frozen per panelist
2	IVA	Red fruit drink, frozen or canned.	1/4 cup per panelist
4	IIIA		
2	IVB	Vanilla extract	1/2 tsp. per panelist
2	IVB	Vanilla wafers	2 per panelist
2	IVB		
6	IIA	Lemon drops	2 per panelist
5	IIIA	Angelfood cake	1 piece per panelist
5	IVA	Vanilla pudding, made with three levels of thickening	2 tablespoons each sample per panelist
5	VA	Redhots(Cinnamon candy)	5 per panelist
		Mints	2 per panelist
		Vinegar, white or cider	1/2 teaspoon per panelist
		Soda water	1/4 cup per panelist
		Horseradish or hot peppers	1/4 teaspoon per panelist
6	IIA	Cream cheese	1/2" cube per panelist
		Egg white, hard cooked	1/2" piece per panelist
		Frankfurter	1/2" slice per panelist
		Cheese, American	1/2" cube per panelist
		Green olives, pimento removed	1 per panelist
		Peanuts, cocktail	2 per panelist
		Carrots, fresh	1/2" slice per panelist
		Almond, shelled	1 per panelist
6	IIB1	Graham cracker	1 per panelist
		Peanut brittle	1 piece per panelist
6	IIB2	Marshmallow topping	2 teaspoons per panelist
		Peanut butter	1 teaspoon per panelist
6	IIB3	Condensed milk	1 tablespoon per panelist

6	IIB4	Rye bread Gum drops	1/8 slice per panelist 1 per panelist
7	IA	Confectioners sugar Cottage cheese Orange Granulated sugar	1 teaspoon per panelist 1 tablespoon per panelist 1 section per panelist 1 teaspoon per panelist
7	IIA	Pound cake, sponge cake, brownie, or cookie	2" square per panelist
8	IA	Diet drink with saccharin	1/4 cup per panelist
8	IIIA	Whipped cream:(for 1 cup cream) without sugar or vanilla with sugar(2-3 tablespoons) with sugar and vanilla(+ 1/2 teaspoon vanilla)	2 tablespoons per panelist 2 tablespoons per panelist 2 tablespoons per panelist
8	IIIA	Cream soup from foodservice such as cheese soup	1/4 cup per panelist
8	IVB	Chocolate chip cookie	1 or 2 per panelist
1 - 8		Distilled water for rinsing mouth.	

## ODORANT LIST

1. Oil of peppermint or peppermint extract
2. Oil of lemon, lemon extract, or fresh lemon peel
3. Anise extract or ground anise seeds
4. Orange extract, oil of orange, or fresh orange peel
5. Oil of cinnamon
6. Vanilla extract
7. Liquid smoke
8. Garlic (fresh clove, cut, or garlic powder if fresh)
9. Ginger (fresh)
10. Cloves, ground
11. Bay leaf, crushed
12. Almond extract
13. Caraway seed, ground
14. Onion, fresh
15. Cumin seed, crushed
16. Cocoanut flakes
17. Rosemary, crushed
18. Thyme, crushed
19. Basil, crushed
20. Tarragon, crushed

Note: Other spices or herbs may be used as desired.

## EQUIPMENT AND SUPPLIES

### EQUIPMENT:

Overhead projector  
Screen

### Alternative:

Chalkboard  
Large newsprint tablet

### SUPPLIES:

Placemats(or waxed paper):	8 x number of participants.
Styrofoam cups:	8 x number of participants.
Small paper plates(6 inch)	12 x number of participants.
Medicine portion cups	48 x number of participants.
Juice glasses	4 x number of participants.
Spoons	4 x number of participants

#### APPENDIX D

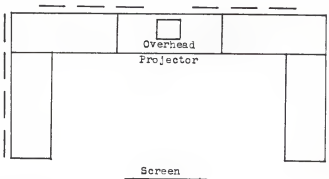
Room Arrangement for Sensory Evaluation Course



# ROOM ARRANGEMENT FOR SENSORY EVALUATION CLASSES

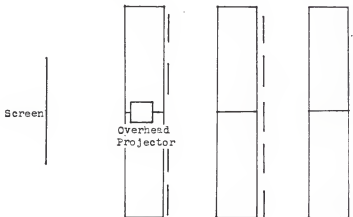
## Alternative 1

Scale: 1 cm. = 1 foot



## Alternative 2:

Scale: 1 cm. = 1 foot



## APPENDIX E

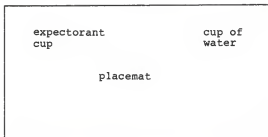
Place Setting for Sensory Evaluation Course

BASIC PLACE SETTING:

Placemat of neutral color

Styrofoam cup of water that  
is distilled or filtered to  
be odorless and flavorless

Expectorant cup that may be  
paper or styrofoam.



APPENDIX F  
COURSE ATTENDANCE

# COURSE ATTENDANCE

	Class								Total
	1	2	3	4	5	6	7	8	
Participant 1	x	x	x		x	x	x	x	7
2	x	x	x						3
3	x	x	x	x		x		x	6
4	x	x	x	x	x	x	x	x	8
5	x	x	x		x	x		x	6
6	x	x	x	x					4
7	x	x	x						3
8	x				x				2
9		x		x					2
10	x	x	x	x	x		x	x	7
11		x	x				x		3
12			x		x		x		3
13					x				1
14			x		x			x	3
15							x		
Total	9	10	11	5	8	4	6	6	59

Figure 1: Attendance of participants at sensory evaluation classes

DEVELOPMENT OF A COURSE TO TEACH BASIC CONCEPTS  
OF SENSORY EVALUATION TO FOODSERVICE PERSONNEL

by

JEAN HANSON LEE

B.S., Iowa State University, 1961

M.S., Iowa State University, 1966

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AN ABSTRACT OF A MASTER'S REPORT

submitted in partial fulfillment of the  
requirements for the degree

MASTER OF SCIENCE

College of Human Ecology

KANSAS STATE UNIVERSITY  
Manhattan, Kansas

1987

## ABSTRACT

A course to teach basic concepts of sensory evaluation to foodservice personnel was developed. Objectives written for the course were used to structure course content. The course was organized into eight thirty minute sessions that included an introduction to sensory evaluation, the role of the olfactory and gustatory systems, flavor, mouthfeel, texture: mechanical and geometrical characteristics, order of appearance of texture and flavor, aftertaste, and amplitude.

The course was taught at a large residence hall food center. Participants were identified from all areas and levels of employees and included personnel in main production, salads, bakery, service, and sanitation. Fifteen people received letters from the foodservice director to attend the classes, which were scheduled to meet twice a week. A quiet, odor-free area of the dining room was used. Equipment and supplies were obtained from the foodservice facility, a hospital, and supermarkets.

The behavioral objectives that had been written for the development of learning experiences were addressed. Persons attending the classes were enthusiastic and responsive. Participants became more confident and skillful in their ability to identify, differentiate, and

describe aromas, flavors, and textural components.

Scheduling was very difficult. The course was planned to be taught twice a week for four weeks. Because of special events, meetings, holidays, and participants' days off, several classes were rescheduled, and attendance was sporadic.

Teacher preparation and clean-up time for each session depended upon the testing materials, samples, or foods required. The average amount of preparation time was one hour. An outline of the course, test forms, lists of equipment and supplies, food products, and odorants, and suggested room arrangements are provided.