students they fail. The younger faculty member must be assured of full support from his superiors or he may be unable to withstand this pressure.

The "Stick" or "Carrot"

It is, of course, easy to succumb and make the conventional demands on students. In our case, it would involve breaking the class into discussion groups of 25 students and assigning term papers, and so on. This would require 500 teaching assistants at $4,000 each, for a total of $200,000. We wish we could have one-tenth of this support. This raises the obvious question, should we have large courses that make little demand on the students? Should we use a carrot or a stick? Should one be able to graduate in "awareness"? Obviously we do not support the last statement. We can go too far, but the simple fact is that the "stick" approach in traditional science training for non-science majors has not worked. We believe that the "carrot" approach is likely to be much more successful. Please note that the carrot approach does not mean an "easy A." We adjust the grading level, making it difficult to earn an A yet not difficult to pass. Students can take the course on a "pass-fail" basis if they wish and we do not know which students elect this option.

The concept of an "awareness" course has other ramifications. We set up Food Science and Nutrition 101 as a freshman course for non-science majors. We soon found that we were attracting seniors in the "hard" sciences. After several years, even our own food science and nutrition majors wanted to take the course as an extra. They said it was the only place they could get an overview of the whole field. That was a compliment we failed to anticipate. Other departments were not so complimentary, particularly when we discussed, for example, the realities of food production versus environment. They are also concerned when we draw the bulk of the students.

Faith in the Approach

We believe that our approach to teaching science to nonmajors is a good one. We had enough faith to launch a second course (FS&N 102, World Food Habits) which attracts about 800 per year. Our faith extended to a third course (FS&N 140, Basic Nutrition), which currently has 1,800 students per year and is growing rapidly. The interest in human nutrition is gratifying and we like to think that we are contributing to a very necessary public education program. Our students will remember what they have learned and, we hope, be better informed on nutrition and food supply. We hope we are also helping to combat the spread of misinformation. It is a tremendous job and we should start now.

THE WORLD FOOD PROBLEM

A "Course" of Action for the Future

T. P. Labuza

Abstract

The world food situation, though confusing, has an impact on consumer food choices because of costs and feelings toward consumption of certain products. Through misinformation from the media and self-appointed activists, the consumer is further misled to believe that processed food has no place in today's world. This article discusses some of these concerns and points to courses of action that teachers in the field of agriculture can use to better communicate the facts to the average consumer. A discussion of the basis for a college level food consumer course is also given.

In recent years the consumer has been deluged with so many warnings about his food that he faces a major dilemma every time he goes to the market to purchase food. He has heard that cyclamates cause cancer, that diethylstilbestrol (DES) which is used for beef cattle is a possible carcinogen, that pesticides and PCB's have been found in food, that canned foods are being recalled because of botulism, that swordfish contains mercury, and that filth such as rodent hairs and insect fragments is allowed in some of his foods. The growing list of potentially dangerous additives has led the consumer to question the quality of the food supply along with the ethics of the food industry which supplies it. These questions are generally raised (perhaps blown up is a better choice of words) by activists and the press — people who usually have little professional knowledge of nutrition and food processing.

Concern for food safety is exacerbated by the periodic pronouncements of many activist organizations, legislators, and authors of popular books concerning the nutritional quality of the U.S. diet. Many groups decry the loss of nutrients during processing. Medical practitioners recommend drastic reductions in meat, egg, and milk consumption because of a purported link between

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cholesterol and heart disease, or reductions in sugar intake because of its role in dental caries and hypoglycemia. Activist groups ask for food boycotts because of unfair labor practices, use of grain for animals, and high food prices. High cost is a touchy question. Consumers cannot understand the high prices. They have lost faith in government and industry regulations and feel cheated by untrue or unethical advertisements as well as prices. New horrors of the miserable world food situation are constantly being exposed to arouse consumer backing of proposals for government legislation. People are told to eat less meat so that they can save the starving millions, and then they are told that it just doesn't work that way. All these factors have understandably caused the consumer to be wary of the food industry and of any food that is not within his immediate control.

Why Has This Happened?

There are two major reasons for the loss of contact between consumers and food producers and processors. The first is a misunderstanding on the part of the consumer of the whole food processing and marketing system. Before the 1940s most foods were prepared in the home. The homemaker supplied all the changes through kitchen processing. However, with the onset of World War II and the limited food supply and prevailing conditions, food processing was transferred to a food industry. The food industry quickly became an unknown black box in which farm produce was converted to food. Science and technology were tapped to solve the practical problems this food industry faced within this black box. The increased technology widened the distance from the average consumer because he did not understand it. This gave rise to activists who exaggerated the risks of the products coming out of this black box, and this in turn gave rise to publications from within, extolling the benefits the processing industry produced for America. In this exchange, both the risks and the benefits of commercial food processing were greatly exaggerated. There was no balanced or impartial view, no one who said, "We have these risks and these benefits and you make a choice."

For the sake of argument, consider an unrelated example: The risk of death from driving a car is one in five thousand over the period of a year. The benefit of driving a car is easy and fast transportation. The public has accepted the technology of the automobile because it believes the benefits outweigh the risks. Processed foods also have benefits and risks. For example, there have been five deaths from botulism in the past 50 years from commercially canned foods. However, these foods are more convenient and, ironically, safer than home-canned foods, which have caused at least five deaths per year from botulism. Nitrites in hot dogs present approximately a one-in-fifty-million risk of developing cancer in the consumer. The benefits of adding nitrites to hot dogs are improved flavor and color and greater shelf-life, compared with fresh meat, and prevention of growth of the organism that causes botulism.

Why has the consumer not been told of both the risks and the benefits and allowed to make his own choices? Rather, the consumer has been frightened, as happened in the cyclamate scare when the activists urged the government to step in to "protect" him. Numerous scares such as this are destroying faith in the food industry because the information concerning benefits is not readily circulated to balance the risk information.

Lack of Nutrition Education

The second major reason for this loss of contact between consumers and food producers and processors is the lack of nutrition education. In the 1940s when thousands of young men were given army physical examinations, it was discovered that many nutritional deficiencies existed in the United States. Various groups decided to combat these deficiencies with nutrition education and several methods of teaching the public better eating habits were introduced. The simplest and easiest approach was that of setting up food commodity groups and establishing eating patterns by telling the consumer to choose a certain number of servings from each commodity group. The most common example of this educational tool is the "Basic Four" whose commodity groups are: (1) meats and fish, (2) dairy products, (3) fruits and vegetables, and (4) breads and cereals. This form of education permeated the primary and secondary schools and is still used in much the same way today.

However, because of the transfer of food processing from home to industry, because of changed eating habits with more nonhome food consumption, and because of the desire for convenience items, commodity-group nutrition education is no longer valid. While this "adding machine" approach may have worked in the 1940s, it does not really teach nutrition information in terms of today's foods. The consumer's lack of accurate knowledge about nutrition and food processing has brought about the crisis the public now perceives. The public does not know how to make choices regarding food, and it does not fully understand good nutritional habits. This is evidenced by the more than 60 million people who are clinically obese, and by failure to understand the implications of the world food situation on the U.S. market.

Crisis Intervention

What is being done to correct the situation? Proposing a simple cure for such a complex problem in the space of one journal article is of course impossible. However, there are presently many new developments in industry, legislation, and education that promise some solutions.

The government has passed two new laws on package labeling and advertising which it hopes will serve to educate the public. The Food and Drug Administration has instituted nutritional labeling requirements on some foods, particularly those that make nutritional claims. This law would require calories, protein, carbohydrate and fat contents, and percentages of vitamin A, vitamin

C, thiamine, riboflavin, niacin, calcium, and iron per serving to be listed on the package. Labeling foods in this way has the potential of increasing consumers' level of nutrition knowledge considerably.

As an outgrowth of the FDA's nutritional labeling law, the Federal Trade Commission has proposed regulations concerning advertising on television, radio, and in the press. The FTC regulations may follow the FDA guidelines and could have the same impact. However, many reports suggest that consumers do not know how to properly use the information provided on these labels.[1] For instance, assume that there are two brands of canned peas, one with 30 percent of the recommended daily allowance of vitamin C per serving, the other with 35 percent. The one with the higher percentage costs 5 cents more per can. Which is more important, the 5 percent or the 5 cents? Or is the 35 percent vitamin C content of the peas important if you had a glass of orange juice for breakfast that day? Without the proper nutrition background, many consumers are falling into the "more is better" syndrome with regard to nutrients.

The food industry itself is beginning to realize its responsibility for educating the public about food. Many nonprofit scientific organizations supported by food scientists and food industry personnel are implementing public information programs through which they distribute pamphlets, fact sheets, and press releases in an effort to help the consumer understand food processing and distribution. The Expert Panel of the Institute of Food Technologists recently stated, in one of their scientific status summaries: "A massive educational effort is needed, and it is the responsibility of every group and agency concerned with consumers' nutritional welfare. The educational effort must be the shared responsibility of educators, food producers and manufacturers, professional societies, government agencies, physicians, and consumer groups."

The single most important solution to the current nutrition crisis is to launch a comprehensive educational program for grades K-12 that would teach both nutrition and food technology in an integrated fashion. Required courses with qualified teachers and adequate textbooks are a prerequisite. This will eventually lead, albeit slowly, to balanced public information. Our children, who are eventual consumers, must learn to sift the information they hear or read with a discerning eye so they will not be frightened by sensationalism. A deeper and more scientific treatment than the common Basic Four is needed for this program.

In addition, college courses at the introductory level should be conducted especially for nonscience and education majors. Since college campuses have evolved into primary centers of activism, college students can have an important initial impact on the food crisis if they can be reached with balanced information about the total picture. These introductory food science courses will eventually be extensions of the primary and secondary school programs — something to remove the myths concerning food composition and what happens during processing; something to give a base for making wise decisions about food choices; something to help the students evaluate their eating habits.

The 1974 report of the National Academy of Science on Chemicals and Health describes the dangers we face now because this educational base is lacking: "If the public is exposed to too many vivid accounts of nonexistent or very minor threats to health, its attention will be misdirected, its priorities will be confused, its responsiveness to important messages will be decreased. If the public is exposed to too few . . . or too weak . . . accounts of threats of intermediate or large size, especially those where individuals can choose to reduce their own risk, we lose important opportunities for better health. Balanced public information is crucial."

Course Content

To provide the balanced information needed, a nutrition and food technology course must include the following areas of emphasis:

1. Nutritional biochemistry—basics and status of the science.
2. Vitamins and minerals.
3. Energy and metabolism—the calorie controversy.
4. Fats in the diet.
5. Food processing—how and why it is done.
6. Food safety—microbiological problems.
7. Food legislation—additives, laws, and testing.
8. Food labels.
9. Health and food—dieting, diseases, food fads.
10. World food situation.

In recent years many food science and agriculture-related departments have developed courses of this kind because of the stress on many college campuses in regard to the world food situation, food additives, food laws, and the other concerns discussed above. These courses have the immediate benefit of making available the needed information and, in addition, they help the departments who teach them by recruiting transfer students and by making the department and the fields of food science and agricultural engineering more visible.

In this writer's experience, the courses presented at most American colleges have begun by studying world food problems, but have branched out to include the other areas of current interest such as food fads and food additives. Some of the more prominent and popular college nutrition and food processing courses and their instructors are: World Food, Dr. F. Clydesdale, University of Massachusetts; Man and His Food, Dr. R. Morse, Rutgers University; Man and His Food, Dr. H. Appledorf, University of Florida; Food for Thought, Dr. T. Labuza, University of Minnesota; Man's Food, Dr. P. Addis, University of Minnesota.

Many other schools either have established similar courses or are in the process of doing so. Enrollments in these courses range from between 100 to 2,000 per year,

[1] L. E. Klinger, Food Product Development, June 1974, pp. 30-40.

so they are reaching large segments of the student population. The remainder of this paper describes the author's efforts in establishing such a course at the University of Minnesota in the hope that it will be helpful to those who wish to design a similar course elsewhere.

Target Student Population

Our department already had a course entitled "Man's Food," which dealt with the world food situation. However, the class was primarily designed for and taken by agriculture and applied science majors. I wanted to reach the history, mathematics, and education majors and the other liberal arts students who didn't even know what food science meant. In addition, because the agriculture campus is isolated from the main campus, and difficult for the liberal arts people to reach, I decided to establish a new course, "Food for Thought," based on the main campus. The topical outline and the objectives for the course are shown in Exhibit 1. A typical schedule for the course is shown in Exhibit 2 to illustrate the areas discussed.

After much paper work, the course was accepted to fulfill the science requirement for liberal arts majors, thereby giving the needed enrollment. Students at the University of Minnesota are required to take two science courses during their first two years. An added benefit of having the course accepted as a science distribution course is that it is now published in the College of Liberal Arts bulletin, rather than only in the Institute of Agriculture bulletin. The new course is not allowed for food science or nutrition majors. Because of the popularity of this course, the department has had two additional food science and nutrition courses accepted as science distribution credits.

Exhibit 1
FOOD SCIENCE AND NUTRITION 1-012

Title of Course: Food for Thought - FScN 1-012 (4 cr.) - Spring
Prerequisites: None
Students for Whom Intended: Any student who desires some knowledge as to what foods are, how they are processed, and how they are utilized by the body.
Objectives:

1. To provide the student with information from which he can develop sound nutritional guidelines for himself.
2. To provide the student with information as to the reasons why food is processed, and how it is processed.
3. To give the student guidelines in analyzing the effectiveness of nutritional claims for special food and diets.

Topical Outline:

1. Nutritional requirements of man and the physiology of digestion.
2. General aspects of the processing of foods.
3. Food deterioration and food poisoning.
4. Social and legal aspects of foods including an analysis of food fads.
5. The world food malnutrition problem.

Class Activities and Outside Preparation:
Lecture and discussion with some assigned reading in a general text. Two quizzes. Term paper due on the analysis of student's one-week dietary survey of his/her own food consumption pattern in comparison to NRC recommendations.
Requred Texts:
Food for Thought. 1974. Theodore P. Labuza. AVI Publishing Co., Inc. Westport, Conn.
Supplemental Texts:
Food for Life. 1965. R. W. Gerard, editor. Univ. Chicago Press.
The Family Guide to Better Food and Better Health. 1972. Ronald Deutsch. Bantam Books, New York.
Course Mechanics:
One quiz - 30%; Final exam - 45%
Dietary Survey - 25% - Incomplete if not handed in
Optional Term Paper (15 pages minimum) on some food fad or unusual food experience for 1 credit (1 credit of special problems for lab distribution - FScN 1-012x) - You must contract with the instructor before registering for 1-012x.
Instructor:
Dr. Theodore P. Labuza, Department of Food Science & Nutrition, Meat Science Laboratory, St. Paul Campus, Room 136f, 373-1077.
Home - #777-1875
T.A. - Brian Laing - 242 MSL
Pat Lindgren - 136 MSL (376-3417)

Exhibit 2
COURSE OUTLINE
Food for Thought - FScN 1-012
Dr. T. P. Labuza
MWF, Owre 15

Date	Lecture	Content
3/31	1	Introduction and Mechanics - Preparation of Dietary Survey
		TOPIC I — NUTRITION OF MAN
4/2	2	Nutritional Adequacy
4/4	3	Energy — Metabolism and Requirements
4/7	4	Carbohydrates, Fiber
4/9	5	Fats and Cholesterol
4/11	6	Proteins, Water and Oxygen
4/14	7	Vitamins
4/16	8	Vitamins
4/18	9	Minerals and Digestion
4/21	10	QUIZ I
		TOPIC II — FOOD PROCESSING
4/23	11	Food Preservation Theory
4/25	12	Preservation by Heat
4/28	13	Refrigeration of Perishable Foods
4/30	14	Freezing of Foods
5/2	15	Dehydration of Foods
5/5	16	Fermentation of Foods
5/7	17	Chemical Deterioration of Foods — Rancidity and Browning
5/9	18	Microbial Food Poisoning
5/9		DIET SURVEY DUE (3-PAGE PAPER)
5/12	19	Chemical Additives in Foods — Preservatives and Fortification
5/14	20	Food Labels — Ingredients/Nutrients/Dating
		TOPIC III—LEGAL AND SOCIAL ASPECTS OF FOOD
5/16	21	Food and Drug Laws
5/19	22	Food Additives—Testing, the Risk/Benefit Ratio
5/21	23	Food Additives — Recent Problems
5/23	24	Natural Toxicants in Foods
5/26		HOLIDAY — MEMORIAL DAY
5/28	25	The American Diet
5/30	26	Theories of Overweight
6/2	27	Fad Diets
6/4	28	World Food Problems and Quiz Review
6/6		FINAL EXAM

Textbook

A major problem in a course such as this is the choice of a textbook. Students enrolled in "Food for Thought" usually do not take another food science or agriculture course and are understandably reluctant to purchase an expensive nutrition book. Upon examining the textbooks available, I discovered that none covered all the areas I wanted so more than one book would be required. The first year I used a hard-cover introductory food science text and supplemented it with handouts. This was unacceptable to me and to the students who had difficulty in reading the somewhat technical portions. Hence, I have prepared a soft-cover textbook which generally follows the outline of the course and is written as a reference book (**Food for Thought**, AVI Publishing Co., Westport, Conn.). This book is written for an audience with no science background of any kind. I used this book last year and it has proved to be very useful. Other schools have also developed books to fit the format of their courses because of the same problems with the existing texts.

Course Mechanics

Large enrollments are not the usual experience for most food science or agriculture faculty, at least not for me. The first year I offered the course, more than 700 students appeared the first day to try to squeeze into a room with 400 seats. The culling process was difficult. The registration is now limited by the administrative office to two sections of 400 students each, to prevent this problem. The classes are usually filled about three-fourths of the way through the registration period, which indicates the popularity of the course. Most of the students who take the course have had it recommended to them by a friend who took it earlier. This advertising has forced me to open the second section and to offer an honors seminar.

Big numbers also present problems during quizzes and exams. It is impossible to grade 800 essay exams so one must resort to computer-graded true-false and multiple-choice quizzes. This is an added expense to the department teaching fund. Teaching assistants are necessary to help with the mechanics and track-down problems, and there is the inevitable make-up exam which requires someone's time.

With a large enrollment, one must expect a high percentage of absenteeism. The best way to handle this is by tape-recording the lectures and placing them at locations easily accessible to the students, such as main libraries. During my last class, the library reported that the tape recordings were used more than 800 times. Even with this, extra contact hours with the students are needed. I set aside five hours per week for this and my teaching assistants are also available.

One Week Diet Survey

In place of a laboratory exercise, I require the students to do a one-week diet survey; this has proved to be the most popular part of the course. The students collect data on their diets for one week and punch the information on computer cards, using a code from USDA Handbook #8. The computer center has, at my request, made available 10 sessions for teaching key punching to those who need instruction. For our purposes a single half-hour session of instruction is sufficient. When the punching is completed, the data deck is analyzed by a computer program prepared by Dr. Irving Pflug, a professor in our department. It analyzes each food item in terms of nutrients, averages the meal times, daily inputs, and weekly average of each of several key nutrients, and compares the individual's intake with the recommended daily allowance. The student then writes a paper on the value and results of this exercise. I require this as an absolute and do not give a grade to a student who fails to turn in a paper — even though reading 400 to 800 of these papers is extremely time consuming. The students have told me that this is one of the most relevant and exciting exercises they have done in their school career.

It is also difficult with a large class to entertain questions. I realize that I cannot cover all the important material, and certainly not everything the students are concerned about, but I like to try to be as helpful as possible. I ask the students to hand in written questions which I answer at the beginning of the next class period. I occasionally take questions during class. In addition, I try to incorporate any popular new items into the lecture since that is what interests the students at the moment.

As for visual aids, I use none. In fact, I even try to minimize use of the blackboard. This gives the students something of the feeling of a smaller class and the appearance of a one-to-one relationship as I talk to them. I have received many good responses on this style of presentation. To enhance the impression of a personal classroom atmosphere, I try to relate some concepts to myself, using anecdotes about my own experiences. From the evaluations I receive, this seems to be very popular with the students.

Conclusions

Although a few students have told me that this course has changed their lifestyles, I do not intend to change everyone; I only want to help the student appreciate the science of food and nutrition. Courses such as this are desperately needed and can be taught anywhere. It is becoming increasingly important for the average American to have a grasp of the real science of food as a basis for making wise decisions concerning his diet, and for understanding how his food choices will be affected by the future world economic situation. The important element in classes of this kind is the teacher; this person must be genuinely qualified in nutrition and food science or at least be willing to read the literature and learn the material. Well-trained teachers and the implementation of programs in our schools can do much to stem the tide of unsound nutritional activism and to help the average consumer make better food choices, and may also stimulate changes in food consumption patterns that eventually will benefit the world food crisis.