

farmer problems by staff members is a natural outgrowth of professional concern outside the classroom. As an example, staff members at Northwestern State University at Natchitoches, Louisiana give advice only to local farmers that request assistance.

Interest by state university staff members in dissemination of research results has encouraged extension programs for farmers. Considerable liaison is also apparent between staff personnel and high school vocational agriculture and F.F.A. programs. Extension courses and conferences are also being initiated at several larger state universities. The need for effective coordination between public institutions is readily apparent. In Wisconsin, extension-type programs are offered by the State University System, the Area Vocational Schools (which represent a separate system) as well as the primary program offered through University Extension of the University of Wisconsin System. Dr. Gary Rohde of WSU-River Falls and I have accepted 10 percent extension marketing appointments with University of Wisconsin Extension starting July 1, 1971. The extension appointments as well as continuing research exemplifies the willingness of the University of Wisconsin to recognize and work with the State Universities.

Summary and Conclusions

The historical and current emphasis in state college and university programs has been and is on undergraduate teaching. Program growth and enrollment patterns reflect the emergence of

state universities. Research has been closely linked to senior study and graduate programs. Extension developments to date are limited.

State university program growth and respectability is a matter of record in many states. The scope of programs attempted has sometimes been greater than budget and staff. The positive historical role of land grant universities is also a matter of record. Frequently, the printed media and other media only recognize the teaching and other programs of land grant universities. Career information brochures and some films suggest that only land grant universities exist.

The relationship between land grant universities and state universities is critical. Too frequently, the relationship has been troubled with the result being mutual avoidance. The research and educational needs of a progressive agricultural industry require more meaningful cooperation in every state where dual educational systems exist. Educational accountability and responsibility demand this cooperation.

Much progress has been made in the past 15 years toward this greater cooperation, but much more needs to be done in order to achieve full use of monies, facilities and personnel in fulfilling the goals of higher agricultural education.

"Adapted from a speech presented at the American Institute of Cooperation, Colorado State University, August 1971 by John Cottingham; Head, Department of Agricultural Industries, Wisconsin State University-Platteville, Platteville, Wisconsin.

A BEHAVIORAL OBJECTIVE-CENTERED APPROACH TO TEACHING

Roy G. Arnold
Department of Food Science and Technology
University of Nebraska-Lincoln

INTRODUCTION

Recent emphasis on the use of behavioral objectives in teaching prompted the author to experiment with a behavioral objective-centered teaching method, wherein student learning activities were totally directed by stated behavioral objectives. The method was used in teaching a sophomore-junior level course in Dairy Products Technology.

The primary goal in experimenting with the behavioral objective-centered approach was to promote greater student participation in class discussion. Attempts to promote meaningful discussion in previous courses were generally ineffective. Students commonly were not prepared, and discussions soon became one-sided or "pseudo-lecture" presentations. A means of encouraging students to come to class prepared for discussion was needed.

Several secondary goals evolved as the method was developed. These included promotion of greater student responsibility in the learning process, reduction of emphasis on "material" to be covered, and reduction of proportion of teaching by the lecture method.

The prominent role of behavioral objectives in the method was the result of a belief in their value in communicating expectations to students.

Additional assumptions were 1) that learning occurs outside the classroom and 2) that students were willing to try different approaches to learning.

BEHAVIORAL OBJECTIVE-CENTERED METHOD

Lists of behavioral objectives and appropriate references were provided to students on a weekly basis. Each set of objectives was restricted to the specific topic of discussion for the week. An example of one week's set of objectives is shown in Table 1.

Objectives were stated behaviorally, that is, in terms of how the student must demonstrate successful mastery of the objectives. Books by Mager¹ and Popham and Baker² were consulted for information relative to the wording of behavioral objectives.

The class schedule was rearranged from three 50-minute periods to a single 80-minute session per week. The students' responsibilities during the week between successive class meetings were to master the stated objectives. Reorganization of the class schedule was based on the assumption that time spent searching out and organizing material would result in learning at least equal to that which occurs during lecture presentations.

Weekly class meetings began with a 15-20 minute quiz, followed by directed class discussion. The weekly quiz was adopted at the suggestion of students to provide incentive to come to class prepared for discussion. Class discussion was directed along the lines of the behavioral objectives, but frequently went beyond these limits.

The laboratory portion of the course supplemented the weekly assignments with appropriate resource material, such as slides, demonstrations, observation of pilot plant operations or field trips.

The final examination consisted entirely of problem solving or situation-response type questions, requiring application of knowledge gained during the semester. One-half of the examination was written, and the other half was an individualized, oral examination.

Student performance was evaluated on the basis of weekly quizzes (40%), class discussion (20%), laboratory (20%), and final examination (20%, equally divided between oral and written portions).

RESULTS AND DISCUSSION

Student Performance

Grade point averages (GPA) of students entering the course ranged from 1.96-3.76 on a 4.0 scale, with a mean GPA of 3.02. Course grades earned by students ranged from 2.5-4.0, with a mean of 3.63. Grades earned were generally higher than the students' cumulative grade averages, and were higher than grades earned by other students in previous sections of the course.

Course Evaluation

Student evaluation of the course was obtained at mid-semester and at the end of the semester. Table 2 presents a tabulation of student responses to a series of positive and negative statements regarding the course. Comments relative to strong points and suggested improvements are listed in Table 3.

A great majority of the students liked the method, and believed that they had worked harder, learned more, and had a greater level of mastery of material than in "typical" lecture courses. One student consistently took an opposite view, however. This student was an honors student, and expressed the opinion that, "A college course provided an opportunity to learn from the knowledge and experience of a professional in the field, whereas written material could be read any time."

Instructor's Viewpoint

Use of the method resulted in meaningful class discussion of material. Students asked many questions about material and the significance of the information. Discussion frequently went beyond the limits of the objectives to include additional points of interest students had discovered in the reading material.

From observation of the students, I am convinced that the students in the course learned more, remembered more, and had greater confidence in what they had learned, as compared to students in previous sections of the course. Questions asked by students in class and on field trips revealed a depth of understanding of material that was not apparent previously. In my judgment, improved student performance reflects 1) clearer understanding of expectations and 2) greater knowledge of material resulting from the students' own efforts in searching out and organizing information.

Although the method was used in a small class (13 students), it could be adapted to larger classes by dividing the group into smaller sections for weekly class meetings. Discussion groups should not exceed 25 students to permit active participation by each student.

Experimenting with behavioral objective-centered teaching has enhanced my understanding of behavioral objectives and my appreciation of the rationale for their use in teaching, as recently outlined by Stewart³. The weaknesses of objectives used in the course became apparent as the course progressed. Many of the objectives needed to be restated in truly "measurable" terms. Additional higher-level objectives are needed.

SUMMARY

A behavioral objective-centered teaching method was used experimentally in a sophomore-junior level Dairy Products Technology course. Principal features of the course format were weekly distribution of sets of objectives and appropriate reference lists to students, and rearrangement of the class schedule from three lecture sessions per week to a single weekly meeting for quiz and discussion.

Greater participation in class discussion resulted. Students generally liked the method. Most of the students believed they had worked harder and learned more than in "typical" lecture courses.

Table 1. Example of Weekly Set of Objectives

Lesson 8: Cheese - Part I, Principles of cheese manufacture

A. References

1. Modern Dairy Products, by Lincoln M. Lampert, Chemical Publishing Co., New York, 1970, p. 295-322.
2. Newer Knowledge of Cheese. National Dairy Council, Chicago, Illinois, 1967, p. 17-27.
3. Cheese, by Lucius L. Van Slyke and Walter V. Price. Orange Judd Publishing Company, Inc., New York, 1952. Ch. 10, 11, 12 and 13.
4. Laboratory for this week: demonstration and slides of cheesemaking operations.

B. Objectives: Student should be able to

1. Explain in writing the general principles involved in the manufacture of cheese (i.e., list all steps involved in the stepwise conversion of milk into a cheese, and explain the purpose of each step).
2. Explain the purpose and describe the details of the optional

- process of treating milk with hydrogen peroxide prior to cheesemaking.
3. List and describe the specific steps involved in the manufacture of cheddar cheese. Indicate typical times, temperatures, concentrations, etc., where they are critical to successful cheddar cheese manufacture.
4. Describe the changes that occur during ripening or curing of cheese.
5. List at least ten possible defects of cheddar cheese (flavor, body, appearance), and explain the cause of each.
6. List and explain the principles of at least four recent advances in the automation of the cheddar cheesemaking process.
7. Describe the nutritional value of cheese.
8. Describe the legal provisions for sale of cheese made from raw milk, and explain the rationale for these provisions.
9. Define, identify, or explain:
 - a) Rennin
 - b) Cheese knives
 - c) Typical yield of cheddar cheese
 - d) Annatto
 - e) Cheddaring
 - f) Whey
 - g) Milling

Table 2. Tabulation of Student Responses to Statements Regarding Course

Statement	Responses*				
	SA	A	U	D	SD
1. I am forced by the methods used in this class to spend too much time on material.			1	7	5
2. I remember the material in this class because of the method used.	3	7	1	1	1
3. The materials presented in this class are well organized.	1	10	2		
4. Instructions concerning what is expected of me to prepare for tests were not clear.			1	10	2
5. I prefer a lecture course to the approach used in this course.	1		3	5	4
6. The relationship between time spent in preparation and credit earned was fair.	4	6	2		1
7. Class discussions were informative.	2	9	1	1	
8. This course was challenging.	1	8	1	2	1
9. The method used in this course makes me work harder.	4	6		2	1
10. Compared to a "typical" lecture course, I learned a greater amount of material.	2	8	2	1	
11. Compared to a "typical" lecture course, I had a higher level of mastery of material.	1	10	1	1	
12. I liked the teaching method used in this course.	6	5	1	1	

* SA Strongly agree D Disagree
 A Agree SD Strongly disagree
 U Undecided

Table 3. Student Comments Relative to Strong Points and Needed Improvements

- A. Strong Points of Course:
- Important material is emphasized and learned.
 - Less class time and much more applied study time.
 - Greater retention of information as compared to listening to a lecture where certain points easily missed.
 - Harder to get behind in a course like this than a lecture course.
 - Less pressure on students.
 - More personal motivation and initiative for learning and searching out material.
- B. Suggested Improvements:
- More reading, perhaps on special project.
 - More library copies of resource material (reserve).
 - Opportunities for individual research into specific areas.

- 1 Robert F. Mager, *Preparing Instructional Objectives* (Palo Alto, California: Fearon Publishers, Inc., 1962).
- 2 W. Mames Popham and Eva L. Baker, *Establishing Instructional Goals* (Englewood Cliffs, N. J.: Prentice Hall, Inc., 1970).
- 3 Don Stewart, "The Changing Role of the Educator: A Behavioral Learning Systems Approach to Instruction", *The Journal of the National Association of Colleges and Teachers of Agriculture* 15(1): 4-10, 1971.