

Faculty Perceptions of Cognitive Skills Enhanced in Undergraduate Agriculture Courses

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The mission of a land-grant institution college of agriculture encompasses the function ". . . to teach such branches of learning related to agriculture and mechanic arts . . ." (Morrill Act, 1862). In order to fulfill its mission, the University of Missouri-Columbia College of Agriculture further delineated its role and responsibility for resident instruction as follows: "Goals include providing relevant scientific and practical knowledge of the agricultural and food sciences, cultivation of interdisciplinary problem-solving skills, and a capacity to pursue life-long learning and adaptation to change" (University of Missouri-Columbia, College of Agriculture, 1986).

During the fall semester of 1987, College of Agriculture administrators appointed a task force to examine and make recommendations to improve the experiences of undergraduate students. The task force was further instructed to identify relevant issues and develop appropriate recommendations through which the experiences of undergraduate students could be enhanced. The task force identified subcommittees and directed each to identify and examine a specific aspect of the undergraduate student experience. One subcommittee chose to examine the extent to which students in the College of Agriculture were being challenged to develop their thinking abilities.

Business and professional people have for over a decade noted that college graduates frequently lack elementary problem solving and decision making skills. Ruggiero (1988) suggested that teaching students to think required more than the mere possession of knowledge. He noted that effective instruction should focus on the application of knowledge to problems and issues within each discipline.

At The Ohio State University, Newcomb and Trefz (1987) concluded that rote learning was the predominant focus of instruction in the College of Agriculture. Newcomb and Trefz further recommended that agricultural faculty members should examine the extent to which learning is distributed across the levels of cognition in their courses. Costa (1985) suggested that higher level cognitive abilities may be enhanced by adjusting the methods through which instruction is provided to students.

This study was directed toward an assessment of faculty perceptions of cognitive skills and abilities which were enhanced in undergraduate courses in the College of Agriculture at the University of Missouri-Columbia. The information collected was to provide baseline data from which recommendations for im-

proving the cognitive abilities of agriculture students could be made.

Purpose and Objectives

The purpose of this study was to assess the perceptions of College of Agriculture faculty members regarding the degree to which the cognitive skills of students were enhanced through undergraduate courses. Specific objectives developed to guide this research effort were as follows:

1. To assess the degree to which undergraduate course assignments, tests, quizzes, and projects in the College of Agriculture enhanced the cognitive abilities of students.
2. To determine if a difference existed in the level of cognition enhanced in upper and lower division courses in the College of Agriculture.

Procedures

Instructors of all College of Agriculture courses taught on the University of Missouri-Columbia campus during the fall and winter semesters of the 1987-88 academic year were included in the population. The schedule of courses for the two semesters revealed 268 course offerings. Courses identified as Problems, Readings, and Research were not included. Only undergraduate level courses (i.e. courses numbered less than 400) were included. Seventeen academic departments were identified in the College of Agriculture which had courses listed in the schedule.

A survey form was constructed to collect information needed to assess the perceptions of instructors of undergraduate courses regarding the development of cognitive skills. Six hierarchical categories of cognitive skills including: knowledge, comprehension, application, analysis, synthesis, and evaluations (Bloom, et al., 1956) formed the basis from which 36 items were incorporated into the survey instrument. Six items were included for each of the six categories of cognition. Respondents were asked to indicate the extent to which the assignments, quizzes, tests, and projects in their courses required students to utilize order thinking skills. Responses were coded: 1 = never; 2 = seldom; 3 = sometimes; 4 = usually; and 5 = always. Additional information was requested from the responding instructors to facilitate analysis of the data. Teacher educators and state agricultural education supervisors examined the instrument and judged it to be valid.

Individual instruments and a cover letter were mailed to the chairperson of each department asking them to distribute the survey forms to their respective faculty members. After two weeks, a second letter was sent to the department chairs asking them to encourage faculty members in their department who had not yet

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responded, to do so at their earliest convenience. After another two week period, a letter and a second instrument were mailed directly to faculty members who had not yet responded to encourage them to complete the survey.

Questionnaires were received from 224 of the 268 instructors which results in an 83.6 percent response rate. Responses collected were viewed as a time and place sample since the resulting recommendations would have implications for future courses. Responses from all instructors were used to estimate the reliability of the data collection instrument. A Cronbach's alpha procedure was used and produced a reliability coefficient of .979 for the overall instrument. A comparison of early and late respondents revealed no differences in their responses to the dependent variables and the data collected were assumed to be representative of the target population.

Analysis of Data

Means and standard deviations were computed for each of the six categories of cognition as well as a total mean score. Analysis of variance and Scheffe's post hoc tests were used to identify differences in the categories of cognitive skills which were enhanced in College of Agriculture courses. T-tests were used to identify differences in means between upper and lower division courses.

Results

Table 1 contains the category means and the results of the analysis of variance and Scheffe's post hoc test for the six categories examined in this study.

Table 1: Differences in the Level of Cognitive Skills Enhanced in Undergraduate Courses.

Category	Mean	SD	F	p	
Knowledge	3.36	A*	0.72	7.98	0.001
Comprehension	3.14	AB	0.72		
Application	3.31	A	0.76		
Analysis	3.24	A	0.68		
Synthesis	2.94	B	0.78		
Evaluation	3.19	AB	0.79		
Total	3.18		0.58		

* Categories with letter designations in common are not significantly different at the .05 level.

Examination of the data revealed that knowledge received the highest and synthesis received the lowest mean rating of the six cognitive skill categories. The knowledge, application, and analysis categories received mean ratings which were significantly higher than the synthesis category. Standard deviations did not vary widely across the six categories of cognition.

The data were further analyzed to determine if differences existed in the cognitive skills which were enhanced in College of Agriculture courses when classified as upper or lower division courses (i.e. lower division courses were those numbered < 200, upper division courses were those numbered > 200). Means for the six cognitive skill categories, when

computed by course level, are provided in Table 2. Significant differences were revealed in the comprehension, synthesis, and evaluation categories of cognition between upper and lower division courses. In each category, the means for the upper division courses were significantly higher than the lower division courses.

Table 2: Comparison of the Cognitive Skill Levels Enhanced in Upper and Lower Division Courses.

Category	Lower-division Mean	Upper-division Mean	t
Knowledge	3.43	3.31	1.02
Comprehension	2.90	3.23	-2.99*
Application	3.17	3.36	-1.66
Analysis	3.12	3.29	-1.58
Synthesis	2.62	3.06	-3.69*
Evaluation	3.01	3.26	-2.08*

*Significantly different category means at the .05 level.

Conclusions and Recommendations

Although further research should be conducted before definitive conclusions can be reached, there appears to be a need to assist undergraduate College of Agriculture instructors to identify methods through which students can develop skills in synthesizing information. Instructors were generally positive in their perception of the degree to which cognitive skills were enhanced in their courses. However, instructors of lower division courses were less positive regarding the development of cognitive skills in the comprehension, synthesis, and evaluation categories.

Based on the information collected, the following recommendations are offered to improve the cognitive skills of students in the College of Agriculture:

1. College of Agriculture undergraduate instructors should be encouraged to incorporate assignments, tests, quizzes, or projects in their courses which would enable students to synthesize information from a variety of sources.
2. Instructors of lower division courses should be encouraged to enhance cognitive skills in the areas of comprehension, synthesis, and evaluation.
3. Instructors of upper division courses should be encouraged to identify opportunities to enable students to synthesize information from a variety of sources.

References

- Bloom, B. S., Englehart, M. D., Furst, E. J., Hill, W. H., and Krathwohl, D. R. (1956). *Taxonomy of Educational Objectives: The Classification of Educational Goals Handbook 1: Cognitive Domain*. New York: David McKay Company, Inc.
- Costa, A. L. (editor) (1985). *Development minds: A Resource Book for Teaching Thinking*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Morrill Act. (1862). (United States Statutes at Large, Volume 12, Chapter 314, p. 503, 37th Congress).
- Newcomb, L. H. and Trefz, M. K. (1987) "Levels of Cognition of Tests and Assignments in Agriculture Courses at The Ohio State

Relationship of Cognitive Level of Instruction To Students' Cognitive Level of Achievement

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Abstract

This pilot study sought to determine instructor's cognitive level of teaching, student's cognitive level of achievement, and factors related to student cognitive achievement in three undergraduate College of Agriculture courses. All student and two instructor variables were assessed by survey instruments. The cognitive level of tests and assignments, cognitive level of teaching, and the cognitive level of achievement were evaluated using the Florida Taxonomy of Cognitive Behavior. All instructors were found to be teaching at a low cognitive level. Student cognitive achievement was most closely related to the cognitive level of tests and assignments.

Introduction

The decade of the 1980's has witnessed mounting concern in society about the quality of education from grade school through college. One of the themes considered by the National Commission on Excellence in Education pertained to students' abilities to function at the higher levels of thinking; the Commission was concerned that students develop expertise in critical thinking and problem solving (National Commission on Excellence in Education, 1983). Boyer reiterated this concern for the college level. "Clear and effective writing and critical thinking, are, we said, the most essential skills both for further education and for work." (Boyer, 1987)

Yet, with rapidly expanding technical knowledge, educators in agricultural fields face a dilemma. Kuhn (1977) summarizes this dilemma:

. . . the total mass of knowledge is so great that none of it can be learned well. Too often students are required to memorize a body of facts which are much easier to forget than to remember. Teaching for permanent learning must go beyond dissemination of information to the development of student interest and thinking abilities.

However, if agricultural educators are to address students' needs to develop higher level cognitive abilities, they must have information about factors which affect the development of these critical thinking abilities. Several studies regarding the cognitive level of courses in the College of Agriculture have been

completed through the Department of Agricultural Education at The Ohio State University. This is a report of a pilot study completed in 1988 which examined the cognitive level of instruction and factors related to student cognitive achievement in three undergraduate courses in the College of Agriculture (Pickford, 1988).

Purpose of the Study

The purpose of the study was to describe the cognitive level of instruction and explain the cognitive level of student achievement in three undergraduate College of Agriculture courses at The Ohio State University. The specific objectives were to determine:

- (1) the cognitive level of instruction at which the selected professors taught;
- (2) the cognitive level achieved by students in the selected courses;
- (3) the extent to which selected variables were related to students' cognitive level of achievement; major variables included the cognitive level of instruction, the cognitive level of tests and assignments, and instructor's cognitive expectations for the course.

Procedures

Participants in the study were eighty-three students enrolled in three undergraduate courses during Winter quarter, 1988. The classes were purposefully chosen according to instructor willingness to participate.

The cognitive level of teaching was determined by three separate classroom observations for each instructor using the Florida Taxonomy of Cognitive Behavior (FTCB) (Brown, Ober, Soar, and Webb; 1968). The FTCB was developed using the Taxonomy of Educational Objectives (Bloom et al., 1956) and is comprised of seven different cognitive levels, ordered in a cumulative hierarchy. These levels are knowledge, translation, interpretation, application, analysis, synthesis and evaluation. Cognitive weighting factors, ranging from .10 to .50, were utilized to reflect the hierarchy of the cognitive levels, with the lowest weight given to knowledge and the highest weight given to synthesis and evaluation. The cognitive weighting factors allowed the researcher to compare composite level of cognition scores among several different variables.

The cognitive level of achievement was determined using the FTCB based on performance on the final exam. The remaining student and professor

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