

HIGHER ORDER THINKING OPPORTUNITIES PROVIDED BY PROFESSORS IN COLLEGE OF AGRICULTURE CLASSROOMS

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Abstract

Accomplishing higher order thinking requires analysis or understanding of the new situation, a background of knowledge of methods which can be readily utilized, and some facility in discerning the appropriate relations between previous experience and the new situation (Bloom, 1956). Mastering the higher order thinking of which Bloom speaks is one of the most significant activities of life. How are professors in a College of Agriculture performing? A variety of instruments including an aspiration survey, and attitude scale, a demographic form, and an assessment instrument were used in a study of 28 purposefully selected faculty members from each of eight departments/schools in a College of Agriculture to examine relationships among the variables. It was found that professors aspired classroom discourse to be balanced across the levels of cognition. However, a preponderance of discourse occurred at the lower levels of cognition, regardless of the course level or subject area. Do professors desire to change the cognitive level of discourse in their classrooms? As agricultural educators, important responsibilities include educating colleagues on current teaching issues. The issue of teaching critical thinking must be addressed in today's learning environment. There is every reason why agricultural educators should be leading this trend, considering the diverse directions agriculture has taken.

At the heart of the definition of a fully developed person in today's society is the capacity for an individual to think critically. Moreover, where average consumers are wearing more computing power on their wrists than existed in the entire world before 1961 (Pritchett, 1994), and where change may be the only constant (Jones, 1992), the ability to think critically is essential.

What does it mean to think critically? Various components of the concept have been studied by numerous researchers (as cited by Brookfield, 1987): logical reasoning abilities (Hallet, 1984; Ruggiero, 1975); reflective judgment (Kitchener, 1986); assumptions (Scriven, 1976); tests of meaning (Hullfish & Smith, 1961); analytical and argumentative capacities (Ennis, 1962); attitudes of thought (D'Angelo, 1971); distinguishing bias from reason (O'Neill, 1985); and, the use of thought as progress toward a goal (Halpern, 1984). The component of critical thinking studied in this extensive line of inquiry, "higher order thinking", was defined by Bloom (1956).

Bloom argued that accomplishing higher order thinking required analysis or understanding of the new situation, a background of knowledge of methods which could be readily utilized, and some facility in discerning the appropriate relations between previous experience and the new situation. According to Brookfield (1987), mastering the higher order thinking of which Bloom speaks is one of the most significant activities of life.

Public press articles in the past decade, such as those reported in the New York Times, have stated "the public schools have discovered the importance of critical thinking, and many of them are trying to teach children how to do it" (Hechinger, 1987, p. 27). Educational journals, public and academic conferences, and funding agencies have dedicated energy to the issue of teaching students to think. Thus, the need to teach higher order thinking skills is apparent.

The American higher education system, however, has been accused of failing to encourage

students to think. Freire, as early as 1970, criticized educators for being "bankers of knowledge" -- simply depositing information to be withdrawn when needed. Nearly 15 years later, Halpern (1984) wrote, "Traditionally, instruction in how to think has been a neglected component in American education" (p.ix).

How is higher education performing? In a study of college professors, Miller (1989) found that a preponderance of oral presentations by teachers typically reflected thinking at the lower levels of cognition. Fisher and Grant (1983) found that discourse in college courses was predominantly at the lowest levels of cognition, regardless of the kind of institution, course level, subject area, or length of topic or session.

Teaching for Higher Levels of Thinking

In 1973, Axelrod wrote that how the instructor handles the subject matter is more important than the subject matter itself. Whittington (1991) suggested that the way in which the curriculum is taught, and not that the curriculum contains more "rigor", would make the difference in developing the thinking ability of students. In 1993, Paul stated that, "The best way to stimulate the thinking of students is to have a thinking person in front of them."

The power to think and solve problems should be the student outcome desired by professors. Achieving that desired outcome may depend, ultimately, on the ability of professors to demonstrate thinking and problem solving, and cognitive skills for students, during class sessions.

A Theory for Research in Cognitive Levels of Teaching

The Taxonomy of Educational Objectives: Cognitive Domain, developed by Bloom et al. (1956), was built on a theory of varying levels of

cognitive complexity (knowledge, comprehension, application, analysis, synthesis, and evaluation). Using Bloom's Taxonomy as a framework for classifying levels of thinking provides focus and direction for teachers interested in improving the quality of learning in their classrooms (Newcomb & Trefz, 1987; Cano, 1988).

In 1987, Newcomb and Trefz, in consultation with an author of Bloom's Taxonomy, developed a four-level model of the Taxonomy (Figure 1). The model was designed to be readily grasped by audiences outside the education arena.

Bloom's Taxonomy	Newcomb-Trefz Model
Knowledge	Remembering
Comprehension	Processing
Application	
Analysis	
Synthesis	Creating
Evaluation	Evaluating

Figure 1. A Comparison of Bloom's Taxonomy and the Newcomb-Trefz Model

Purpose and Research Questions

The purpose of this descriptive-correlational study was to describe the aspired cognitive level of instruction and the assessed cognitive level of instruction and to determine the relationship of these variables to attitude toward teaching at higher cognitive levels among selected faculty members in the College of Agriculture at the University of Idaho. The study was an in-depth examination and compilation of 28 case studies. Specific research questions were:

1. At what level of cognition do participants aspire to teach?

2. At what level of cognition are participants actually teaching?
3. Among participants, what is their attitude toward teaching at higher cognitive levels?
4. What are the relationships between aspired cognitive level of instruction, actual cognitive level of instruction, attitude toward teaching at higher cognitive levels, and demographic information?

Procedures

Population and Sample

The target population for this study was 187 faculty members in the College of Agriculture at the University of Idaho. The accessible population was faculty members on campus in Moscow who had a teaching appointment on the general funds budget and who were teaching at least one undergraduate course during Fall/Spring Semesters, 1993/1994.

Knowing this study would require 15 hours of researcher-time per participant, 14 participants per semester could be studied. In an attempt to hold numerous variables constant, interviews were conducted with department chairs to determine faculty members who were "good teachers" as evidenced by interest in improving teaching, exit interview comments by students, attendance at teaching seminars, and student evaluations of teaching. Faculty members from each of eight departments/schools in the College of Agriculture, who taught freshman through senior level courses, were purposefully selected.

Instrumentation

Three instruments used in this study -- a demographic instrument, an aspired cognitive level of instruction instrument, and an attitude toward teaching at higher cognitive levels instrument -- were developed by the researcher and validated by a panel of experts. Reliability was established

using data from a pilot study of 25 College of Agriculture faculty members (68% return rate). On the 50-item, six-point Likert-type attitude instrument, Cronbach's alpha generated a reliability coefficient of $r = .86$. A test/retest procedure was adopted to establish reliability of the aspiration methodology; the coefficient indicated reliability.

Additionally, the cognitive level of classroom discourse (the formal speech or conversation delivered during class) was described by employing the Florida Taxonomy of Cognitive Behavior (FTCB) (Webb, 1970). The FTCB utilized 55 categories of observable behaviors indicative of the various cognitive levels identified by Bloom's Taxonomy. Validity for this instrument was based upon its direct development from Bloom's Taxonomy and the support generally given to this hierarchy of cognitive behaviors. Reliability for this instrument was established by coding audio-tapes of lectures and establishing Spearman Rho reliability coefficients. Intra-rater reliability was approximately $r = .96$. Inter-rater reliability between previous researchers and the two researchers in this study was approximately $r = .98$.

Participants were observed and audio-taped during six randomly selected class sessions, approximately every two weeks, but avoiding the first ten days and the final ten days of the semester. Participants were aware of the days the researchers would be in attendance. The observations were split evenly between two raters.

Data Collection

Aspired cognitive level of instruction, and attitude toward teaching at higher cognitive levels were measured, and demographics were collected during a participant meeting held the first week of Fall/Spring Semesters. During the meeting, participants received an introduction to the theory and an explanation of the instrumentation utilized in the study, after which, the preliminary instrumentation was completed.

To determine aspired cognitive level of instruction, participants placed 10 chips, in proportion to their aspired cognitive level of instruction, on each of four quadrants on a posterboard marked remembering, processing, creating, and evaluating (Newcomb & Trefz, 1987). The proportion of chips placed on each quadrant was recorded as a portion of one hundred, thus, revealing the aspired level, in percentages, at each level of cognition.

Results

Aspired Cognitive Level of Instruction

Participants aspired to have one-third (30%) of their in-class discourse at the remembering level and aspired for just under one-fourth (24%) of their discourse to be presented at the processing level. Aspirations for discourse at the creating level ranged from 0 to 50% while aspiration at the evaluating level ranged from 0 to 60%.

Assessed Cognitive Level of Instruction

The discourse of participants in this study was assessed to be approximately 98% at the remembering and processing levels (remembering = 43%, processing = 55%). Participants' discourse was approximately 1.5% at the creating level with a range of 0 to 6%. Evaluating level discourse was assessed at less than 1%.

Discrepancy Between Aspired Levels and Assessed Levels

Regardless of the aspired level of discourse at the remembering level, between 25%-60% of the participants' discourse occurred at the remembering level. All participants achieved a higher percentage of discourse at the processing level than the proportion to which they aspired. No one was assessed as having greater than 6% of their discourse at the creating level, no matter what their aspiration. Participants failed to reach their aspiration for discourse at the evaluating level by as

much as 60%.

Relationship Between Aspiration and Assessment

Correlation coefficients between aspired cognitive level of instruction and assessed cognitive level of instruction revealed that those who aspired higher percentages of instruction at the remembering level taught less at the higher cognitive levels. There was a moderate association (Davis conventions, 1971) between aspiration for higher percentages of instruction at the processing level and delivering higher percentages of discourse at the evaluating level ($r = .35$). A moderate negative correlation existed between aspiration for more instruction at the evaluating level and teaching at that level ($r = -.37$).

Attitude Toward Teaching at Higher Cognitive Levels

Participants completed a 50-item Likert scale instrument designed to measure their attitude toward teaching at higher cognitive levels. The mean score on the attitude instrument was 232 (range = 181 to 266). A six-point scale would afford a low score of 50 and a high score of 300. Therefore, the mean score indicated that participants held attitudes which favored teaching at higher cognitive levels.

Relationships: Aspiration and Attitude

Table 1 shows that as attitude toward teaching at higher cognitive levels increased, proportion of discourse at the remembering level decreased. Also, as attitude toward teaching at higher cognitive levels increased, extent of discourse at the creating level increased.

Table 1. Relationship Between Aspiration and Attitude Toward Teaching at Higher Cognitive Levels

Level of Cognition	Association (r)
Remembering	-.33
Processing	-.14
Creating	.36
Evaluating	.03

Relationships: Assessment and Attitude

A low negative relationship between assessed cognitive level of instruction and attitude toward teaching at higher cognitive levels existed at the remembering level (Table 2); as attitude toward teaching at higher cognitive levels increased, discourse at the remembering level decreased. Low relationships were found at the processing, creating, and evaluating levels.

Table 2 : Relationship Between Assessment and Attitude Toward Teaching at Higher Cognitive Levels

Level of Cognition	Association (r)
Remembering	-.23
Processing	.22
Creating	.19
Evaluating	.20

Relationships to Characteristics

Attitude toward teaching at higher cognitive levels was positively related to the number of previous education courses completed by the participants, holding a teaching certificate or credential, and number of teaching workshops and seminars attended. Attitude toward teaching at higher cognitive levels was negatively associated with age, years of university teaching experience, and holding tenure.

Conclusions

1. Participants in this study primarily aspired for their discourse to be balanced across the levels of cognition.
2. The faculty members in this study conducted discourse primarily at the remembering and processing levels of cognition.
3. The participants in this study aspired to teach at cognitive levels higher than those at which they were assessed.
4. Regardless of the cognitive level to which faculty members in this study aspired to conduct discourse, they actually conducted discourse at about the same level as each other.
5. Participants in this study held favorable attitudes toward teaching at higher cognitive levels.
6. Faculty members in this study who possessed more favorable attitudes toward teaching at higher cognitive levels wanted less discourse at the remembering level.
7. Participants who held a more favorable attitude toward teaching at higher cognitive levels taught more at the evaluating level.
8. Faculty members who had experienced more educational activities held more favorable attitudes toward teaching at higher cognitive levels.

Discussion

The participants in this study taught courses in various subject matter and they taught the courses to freshman through senior level students. However, professors conducted classroom discourse at cognitive levels lower than creating and evaluating levels of cognition, regardless of the course level or subject matter. This issue is consistent with a concern of Fisher and Grant (1983) who also found that discourse in college

courses was predominantly at the lowest levels of cognition, regardless of the course level or subject area.

The data from this study show that professors conduct discourse at lower levels of cognition 98% of the time. These data are consistent with Pickford (1988) and Miller (1989) who reported that professors conducted 94% and 98%, respectively, of their discourse at lower levels. Should these high percentages of lower level discourse be accepted as “normal” and unable to be changed?

Perhaps professors have not been taught appropriate methods for reaching creating and evaluating levels in their classroom discourse. Possibly, professors feel time constraints for re-evaluating and re-writing lesson plans that reach creating and evaluating levels of cognition, in which case, frustration may be a problem. Professors may simply feel apprehension toward making vast changes in their teaching in an attempt to attain higher cognitive levels when the theory is still being developed. A full understanding does not exist of the long-term effects for students taught at higher cognitive levels.

Recommendations

1. Professors should make changes in their current teaching to reach the cognitive levels to which they aspire for their instruction.
2. Based upon the relationships between teaching activities and attitude toward teaching at higher cognitive levels, professors should be encouraged to attend teaching workshops, seminars, and teaching methods classes. Perhaps new faculty should be required to enroll in a teaching methods course, one aspect of which would be designed to enhance ability to reach higher cognitive levels in classroom discourse.
3. Educating teachers regarding their cognitive

level of instruction is necessary if change is to occur. Teachers aspire to teach at higher cognitive levels because they theoretically see the benefits of teaching at higher cognitive levels, but they are not reaching the aspired levels. The problem, therefore, could be the lack of knowledge of techniques and methods used to model higher cognitive levels of instruction. Workshops and seminars need to be developed and offered to those faculty who desire changes in their cognitive level of teaching.

4. As agricultural educators, important responsibilities accruing to faculty in agricultural education, not only include preparing preservice teachers of secondary agriculture and extension personnel, but also educating colleagues in colleges of agriculture on current teaching issues. The issue of teaching higher order thinking skills must be addressed in today's learning environment. Every reason exists for agricultural educators to lead this trend, considering the diverse directions agriculture has taken.
5. Agricultural educators who possess the capability to prepare persons for teaching at higher cognitive levels will be called upon by university and college-wide teaching committees, curriculum committees, and planning committees to offer valuable input into the enhancement of teaching.

Recommendations for Further Research

1. Exploring the barriers to teaching at higher cognitive levels.
2. Examining variables, other than the teacher, which influence cognitive levels reached in the classroom.
3. Establishing a clear positive effect between level of instruction and long-term learning and transfer of learning.

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