TEACHING TECHNIQUES USED AND TYPES AND COGNITIVE LEVELS OF PROFESSOR QUESTIONING DURING COLLEGE OF AGRICULTURE CLASS SESSIONS

THESIS
Presented in Partial Fulfillment of the Requirements for the Degree of Masters of Science in the Graduate School of The Ohio State University

By

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* * * * *

The Ohio State University 2005

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ABSTRACT

"Many traditional instructional approaches respond ineffectively to the learning needs and life situations of today's college students" (Weimer, 2003, p. 49). Professors must therefore evaluate the teaching techniques being used in their college classrooms. In addition, according to Lewis and Smith (1993), students need to be challenged at higher levels of cognition during class sessions. Thus, by understanding the types and cognitive level of questions asked during class sessions professors can more effectively challenge students' thinking.

The purpose of the study was to determine the individualized and group teaching techniques used by professors in a college of agriculture, and to identify the types and cognitive level of questions used during observed class sessions. The teaching techniques employed by the professors during class sessions were measured using a researcher-developed instrument. Frequencies were recorded for each individualized and group teaching technique observed. To capture the type of questions being asked during class sessions, the researcher made note of all managerial, rhetorical, closed, and open-type questions asked by each professor. Using the Newcomb and Trefz (1987) model, the researcher recorded the cognitive levels of content-related questions asked by professors.
Twenty-one class sessions were videotaped in twelve professors’ classes. Group teaching techniques were observed 149 times compared to nine observations of individualized teaching techniques. Lecture and discussion were the most often used teaching techniques, accounting for 82% of the observed teaching techniques.

Types of questions were determined using Blosser’s (2000) classification system. Closed questions were the most frequently asked type of question during observed classes. Closed questions are those that have a limited number of possible “correct” answers.

The cognitive level of each question was determined using the Newcomb-Trefz model (1987). Questions were asked mainly at the remembering level of cognition. Remembering level questions require rote memorization.

Professors in this study are using group and individualized teaching techniques and types of questions to varying degrees and at various levels of cognition. Since the questions and techniques that professors use in their classrooms affect the degree to which students receive, and thus process and transfer content to other learning situations (Newcomb, McCracken, Warmbrod, & Whittington, 2004), professors using multiple techniques and types of questions enhance opportunities for students to engage more richly in the content. Consequently, by studying professors’ use of teaching techniques and types and cognitive level of questions, professors become aware of the potential for more fully engaging students during class sessions. Recommendations therefore include teaching professors to use group teaching techniques such as cooperative learning, role play, and demonstrations to cognitively engage students. Further recommendations
include teaching professors to use rhetorical and open-type questions to encourage
deep thinking.
Dedicated to my wife, Joy
ACKNOWLEDGMENTS

I wish to thank my adviser, Dr. M. Susie Whittington, for her support in this endeavor. I appreciate all of the time and effort you put into correcting my errors. I am grateful for all of the energy you put into working with me to complete this research.

I want to also take time to thank Dr. Joseph A. Gliem for being part of my committee. Your continued support of me throughout my time at The Ohio State University is appreciated. You were never too busy to answer any of my questions, no matter what time of day I called upon you. I also would like to thank Dr. Gliem for instructing me in several of my research-related courses. Without the information you taught me, I would have never been able to start such a document.

I am also grateful to my wife, Joann Ewing, for helping me with various aspects of this document including data entry and editing.
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CHAPTER 1
INTRODUCTION

Several reports in the 1980s questioned the quality of undergraduate education and identified the need for instructional improvement (Paulsen & Feldman, 1995). Boggs (1995) stated, “There is a disturbing feeling that our colleges are not as effective as they need to be” (p. 24). Boggs supported his statement by pointing out that students from the early 1900s were much different than students of the late 1900s, but the same instructional methods are still being used to teach today’s students. Bess (1998) noted that stakeholders in higher education want to see quality from their institution. “A critical purpose of postsecondary education is to prepare students for their future professional lives” (Thompson, Licklider, & Jungst, 2003, p. 133). To meet this purpose, students’ critical thinking abilities must be improved.

“Teachers are being asked to develop more than the basic skills in their classrooms” (Lewis & Smith, 1993, p. 131). These skills include higher order thinking, problem solving, and other reasoning-related skills. No matter how it is said, however, the goal of this type of teaching is student achievement at the higher levels of cognition. For a student to perform at the higher levels of cognition, they must first be challenged at such levels. “Research can and should assist faculty in their efforts to nurture students’ abilities to think critically” (p. 741).
Teaching Thinking

Weimer (2003) stated, “Students rarely arrive at postsecondary institutions with well-developed learning skills or as empowered, confident learners, which in part explains the popularity and effectiveness of first-year seminars and transition-to college-programs” (p. 54). Whittington (2003) stated:

If it is believed that lifelong learning is a necessity, the need to teach students to think is not an option in Colleges of Agricultural Sciences classrooms. A need exists to study Colleges of Agricultural Sciences teaching and whether the current teaching contributes to students’ ability to think. (p. 5)

Whittington and Bowman argued, the higher the level of cognition at which a student performs, the more the learning experience will be enhanced, as well as help prepare the student to contribute to society beyond their formal school years (as cited in Whittington, 2003). Teachers need to ensure that they are presenting content in a manner such that students are processing the material at the highest possible level of cognition. Palmer (2003) believed that educators do not teach pure content, but rather teach students how to learn content. Palmer (2003) stated, “The methods we use to help students learn are part of what they learn” (p. 287).

Cano (as cited in Edwards & Ramsey, 2004) believed that instructors needed to change their instructional practices to help their students achieve at higher levels of cognition. These changes included creating learning environments that pushed students to work at higher levels of cognition through the instruction that they were receiving. By giving students assignments that required reflection rather than just memorization,
teachers were instructing students to analyze, synthesize, and evaluate information at cognitive levels higher than knowledge and comprehension. Gabbert, Johnson, and Johnson said there was a need to investigate how instructional approach and learning outcomes are related (as cited in Cockrell, Caplow, & Donaldson, 2000).

Assessing Teaching

Pascarella (2001) pointed out, “A third approach to identifying institutional excellence in undergraduate education is to try to assess the practices and processes within a college or university that we know are linked to important cognitive and noncognitive outcomes” (p. 22). Kuh (2001) wrote, “Sooner or later, colleges and universities are either going to demonstrate what students are learning or some external entity will impose its own approach” (p. 12). Thus, much research is being conducted that examines student learning and techniques to enhance undergraduate education.

Bess (1998) believed that institutions need to examine what they are currently doing to make certain they are meeting the needs of their stakeholders including, “... a more intense reexamination of the tried and true methods of instruction...” (p. 3). “Many traditional instructional approaches respond ineffectively to the learning needs and life situations of today’s college students” (Weimer, 2003, p. 49). When a teacher focuses on one type of presentational method (lecture for example), it can actually make it harder for the student to understand the material being presented (Travis, 2003).
Purpose and Objectives of the Study

The purpose of this study was to determine the individualized and group teaching techniques used by professors and to identify the types and cognitive levels of questions used during class sessions taught by selected professors in the College of Food, Agricultural, and Environmental Science (CFAES) at The Ohio State University.

The following research questions guided the study:

1. What individualized and group teaching techniques were used and how often were the techniques used by professors during class sessions as measured by the teaching techniques classification instrument?

2. What types of questions did professors ask during class sessions as measured by Blosser’s (2000) classification system?

3. At what level of cognition were professors questioning students during class sessions as measured by the Newcomb-Trefz model?

Definition of Terms

Closed-type questions – questions with a limited number of responses (Blosser, 2000).

Group teaching techniques – the teaching techniques that are appropriate for providing instruction to a group of students in the same setting (Newcomb, McCracken, Warmbrod, & Whittington, 2004).

Individualized teaching techniques – the teaching techniques that are appropriate for providing instruction to an individual student, allowing for independent decision making of the student (Newcomb, McCracken, Warmbrod, & Whittington, 2004).

Managerial-type questions – questions used to facilitate classroom operations, discussion (Blosser, 2000).
Open-type questions – questions with a number of acceptable answers (Blosser, 2000).

Rhetorical-type questions – questions used to reinforce a point; does not expect (or want) a response (Blosser, 2000).

Limitations of the Study

Selection of professors by chairpersons, and then professors volunteering to participate in the study, at one large land grant university, limits the ability to generalize beyond the sample of 12 professors in this study.

Professors were aware, beforehand, of the date of the observations, thus possibly allowing time for change from their normal teaching routine. These dates were not chosen randomly, but rather to meet the schedule of the researcher and the professor of each class.

Two visits were completed to each participating professor’s class, except for three professors, due to conflicts in scheduling with the researcher and professor. These three professors were visited only once during the 10-week data collection period. Ideal conditions would allow for more class session observations of the participating professors.

Summary

King (1993) stated,

Engaging our students in such active learning experiences helps them to think for themselves - - to move away from the reproduction of knowledge toward the production of knowledge
- - and helps them become critical thinkers and creative problem solvers so that they can deal effectively with the challenges of the twenty-first century. (p. 34)

Halpern and Hakel (2003) stated,

We need to always remember that we are teaching toward some time in the future when we will not be present — and preparing students for unpredictable real world “tests” that we will not be giving — instead of preparing them for traditional midterm and final exams. (p. 38)

The results of this study will aid in discovering the individualized and group teaching techniques being used by professors in College of Food, Agricultural, and Environmental Sciences class sessions, the types of questions, and the cognitive level of questioning utilized by those professors. Understanding that which is occurring in college of agriculture classrooms, as advocated by researchers (Whittington, 1991; Bowman, 1995; McCormick, 1998), will enhance student learning in those classrooms.
CHAPTER 2
REVIEW OF RELATED LITERATURE

Bloom’s Taxonomy

Bloom, Englehart, Furst, Hill, and Krathwohl (1956) defined higher order thinking as application, analysis, synthesis, and evaluation; the four levels of Bloom’s hierarchy above the two lower levels of knowledge and comprehension. Knowledge, the lowest level of cognition, requires an individual to recall and remember facts and situations. Comprehension, the next level in Bloom’s hierarchy, is described as demonstrating a general understanding of the content. These two lower levels of cognition are necessary in the thinking process to lay the foundation from which to proceed cognitively. However, the four higher levels of cognition, when “reached”, will challenge students beyond knowledge and comprehension in the following ways. Application is the process of using information gained in one situation to solve a problem or problems in other situations. Analysis involves taking the information at hand and working with it in a way that the learner notes relationships and then organizes these relationships in meaningful ways. The next level, synthesis, requires learners to assess the component parts of the given information and to formulate it into a new whole. The highest level of cognition, as described by Bloom et al. (1956), is
evaluation. Evaluation is the level at which the learner makes judgment about the material presented.

One of the most common uses of Bloom's Taxonomy has been to classify objectives and test items (Krathwohl, 2002). Bloom et al. (1956) stated that the taxonomy was designed for classifying "... student behaviors which represent the intended outcomes of the educational process" (p. 12). The authors of the taxonomy believed that student behaviors could be seen and classified in a variety of classes and levels of education (Bloom, et al., 1956). Bloom, et al. (1956) focused on the cognitive domain of learning because cognitive behaviors, as opposed to affective behaviors, are exhibited with "... a rather high degree of consciousness on the part of the individual exhibiting the behavior, while the behaviors in the affective domain are much more frequently exhibited with a low level of awareness on the part of the individual" (p. 19).

Challenges to Bloom's Taxonomy

Although Bloom advocates that the division between higher level and lower level cognitive processing lies between the comprehension and application levels, other researchers advocate that the division between lower level cognitive processes and higher level cognitive processes is not clear. McKeachie (2002) stated that lower level cognitive processes include knowledge, comprehension, and application, while Wilen (1987) stated that knowledge is the only process in the lower level category of Bloom’s Taxonomy. King (1993) identified application, analysis, and evaluation as the higher level cognitive processes in Bloom’s Taxonomy.
Krathwohl (2002) participated in revising Bloom’s Taxonomy where the authors changed Bloom’s “knowledge” category to “remember” because the word “knowledge”, according to Krathwohl (2002) “... embodied both noun and verb aspects” (p. 213). The verb aspect of an objective is the cognitive process, where as the noun portion of the objective is the subject matter content (Krathwohl, 2002).

Many teachers are aware that Bloom’s Taxonomy embodies six levels, but research (Ennis, 1981; Wood, 1977) has shown that teachers often have difficulty identifying, and agreeing on the proper categorization of a question, especially at the higher levels of the taxonomy (as cited in Marzano, 1993). Seddon (1978) pointed out that the higher the number of persons classifying the objective, the higher the number of disagreements that were found. Kreitzer and Madaus (as cited in Nordvall & Braxton, 1996) found that the level of agreement increased when the raters were extensively trained.

Hunkins (1989) wrote that some students may require a lower level of cognition to solve a certain problem compared to another student, if the first student has had extensive work in that particular area. Thus, categorizing an objective by a level of Bloom’s Taxonomy may be beneficial for understanding cognitive level, but it may not be the same for every individual in a class. Marzano (2001) stated, “... the hierarchical structure of Bloom’s Taxonomy simply did not hold together well from logical or empirical perspectives” (p. 9). Anderson (1999) also argued that the categories do not form a “... cumulative hierarchy in all cases” (p. 8).
Teaching Methods

Doyle and Carter (1987) described the *means of instruction* as teaching methods. They identified several forms of teaching methods including: lecture, recitation, discussion, questioning, small group work, independent study, review, programmed instruction, and computers. Gregory (2001) believed that using a variety of teaching techniques enables students to continue developing their own thinking abilities, compared to one continuous method of teaching. Doyle and Carter (1987) also believed that the core of effective teaching was choosing the proper teaching method. Child and Williams (1996) believed that teachers' practices discouraged students to willingly become involved in the class, but rather the student was "forced" to participate. Even though teacher training is often focused on student-centered practices, many university classes use lecture as the major method of teaching (as cited in Kain, 2003).

Mitchell, Knobloch, and Ball (2004) found that exemplary teaching professors commonly exhibited certain behaviors in their teaching. For example, exemplary professors demonstrated differentiation of instruction. These professors were able to recognize their students’ knowledge level, and various learning styles, and then were able to use a variety of methods for instruction. By differentiating their instruction, these professors were reaching the individual differences among learners in their classrooms. The researchers also found that these professors were able to motivate their students, thus encouraging them to think critically during class.
Teaching Techniques

Newcomb, McCracken, Warmbrord, and Whittington (2004) believed teachers needed to vary their teaching techniques depending on the situation. Group teaching techniques are used when the information to be presented must be understood by all learners and can be taught in the group setting. The group teaching techniques outlined by Newcomb, McCracken, Warmbrord, and Whittington (2004) were lecture, discussion, demonstrations, field trips, role-play, resource people, and cooperative learning.

"Not only should teachers use a variety of group teaching techniques but they should also use individualized teaching techniques" (Newcomb, McCracken, Warmbrord, & Whittington, 2004, p. 151). Individualized teaching techniques are used when working individually or in small groups to optimize student learning. The individualized teaching techniques outlined by Newcomb, McCracken, Warmbrord, and Whittington (2004) were supervised study, experiments, independent study, and information sheets, assignment sheets, and skill sheets.

Teaching Methods and Cognition

Tsui (2002) believed that formal education places too much effort into covering the content, when more time should be spent teaching students how to think. Tsui (2002) believed that the focus on lecture as the main approach to teaching was due in part to a felt need to cover the course material; the instructors felt pressed for time. Student-centered pedagogies such as classroom discussion take more time during class compared to more teacher-centered methods, like lecture, but students are more likely to comprehend and remember ideas if they are active in creating understanding (as cited in
Tsui, 2002). Halpern stated, “The ability to think critically is almost always listed as one of the desirable outcomes of undergraduate education” (as cited in Halpern, 1993, p. 270).

Sternberg (2002) described how students could be taught more effectively by teaching for successful intelligence as follows: Students are able to learn at higher levels when the teacher employs multiple methods, because each student learns in different ways. Using multiple methods enables students to take advantage of their strengths while learning the material at hand (Sternberg, 2002). Barr and Tagg (1995) pointed out that the college purpose should not be instruction, but instead, finding a way to produce learning using any method that works. Thus, the learning paradigm uses whatever teaching approaches are needed to help students learn in a particular environment. Teaching methods that use multiple techniques and require the student to be active in their learning are likely to be more effective in increasing student thinking skills compared to single methods that allow the student to be passive (Halpern, 1993). Information is growing in many areas at such a fast pace that it is impossible to lecture to students about all there is to know in a particular field of study. Instead teachers should have students actively take part in thinking through problems (Mangurian, Feldman, Clements, & Boucher, 2001). Guskin (1994) stated that teachers want students to be able to develop the ability to compare and contrast material and to make judgments on important issues. These are higher level skills according to Bloom’s Taxonomy. Teaching strategies should contribute to content knowledge in both breadth and depth, as well as help to develop the student’s metacognitive ability (Thompson, Licklider, & Jungst, 2003).
Mayer (2002) stated, “Two of the most important educational goals are to promote retention and to promote transfer (which, when it occurs, indicates meaningful learning)” (p. 226). Research (Barr & Tagg, 1995; Boggs, 1995; Guskin, 1994; Chickering & Gamson, 1987) shows that students retain information better if they are active in their learning (as cited in Mangurian, Feldman, Clements, & Boucher, 2001). Classroom discussion aids in the development of critical thinking skills by allowing students to think through their ideas and work on them verbally (Tsui, 2002).

**Teacher-Directed Instruction**

Researchers (King, 1993; Boggs, 1995; Tsui, 2002) have found that lecture is currently the most common method of teaching. Guskin (1994) reported that lecture or lecture/discussion was the main method being used in the accumulation of information and knowledge in higher education. Guskin (1994) believed that this strategy could be improved by incorporating technology into the classroom allowing the teacher to act more as a guide to help the student find the information, rather than just lecture to the students. Lecture requires skills similar to that of an actor, requiring the teacher to know the “script”.

Lecturing is neither inherently good nor bad. It has been and remains one of the chief strategies of the college teacher. What is wrong with lecturing is that it is often done poorly. And it is done poorly because most college teachers don’t understand the complexity involved in the transmission and reception of information. (Davis, 1976, p. 39)
Discussion, on the other hand, requires that the teacher is able to manage or facilitate the interactions of the group (Bess, 1998). Guskin (1994) believed faculty members needed to spend class time using small group discussion, or even individually spend time with students, so students are able to benefit from discussion-type learning experiences.

Shulman (2000) stated:

Although lectures have dominated teaching in universities, the fact is, since the creation of the medieval university, we have understood that to teach something requires that one be able to not only explain it verbally, but also to engage in a disputation or discussion about it. (p. 132)

"Illusory learning", as Shulman (2000) calls it, is the problem encountered when a student appears to know something, but they really do not. However, when students are able to discuss or carry on a conversation about a topic, then they are demonstrating to the teacher that they really do understand the material (Shulman, 2000).

Students need the opportunity to practice what they are learning in class. Davis (1976) advocated professors using one or more teaching strategies beyond lecture to improve their level of teaching. In Mangurian, Feldman, Clements, and Boucher (2001) researchers used techniques that engaged students as active learners in the classroom. Thus the researchers concluded that lecture was used less than 10 percent of the time in the observed classrooms. However, lecture was used to introduce new topics, clarify problems, or refocus the students' attention. Simich-Dudgeon (1998) found that much
of classroom verbal interaction was teacher-controlled instead of collaborative, even though there seemed to be benefits to collaborative activities.

**Teaching Methods and Agriculture**

One approach to teaching that has been advocated in agricultural education is the problem-solving approach. Boone (as cited in Edwards & Ramsey, 2004) stated that the problem-solving approach to teaching increases student retention of knowledge. Others in agricultural education (Dyer & Osborne, Torres & Cano, Flowers & Osborne; as cited in Edwards & Ramsey, 2004) have argued that the problem-solving approach allows students to process information at higher levels of cognition when compared to the subject matter approach to teaching. Torres and Cano (1995) believed that by implementing the problem-solving approach, in conjunction with various teaching techniques, like cooperative learning, a teacher would excel at teaching at higher levels of cognition. These researchers also encouraged others to determine the extent to which the problem-solving approach aids in the cognitive ability of students in the agricultural education setting. Problem-based learning encourages students to work at higher levels of cognition because of the processes required to find an answer. Students are often required to use application and evaluation skills to work through the problem, rather than just recall of facts, thus gaining life-long skills to be applied in the future (Woods, 1994).
Learner-Centered Instruction

Slavin found that group-based activities can be effective in increasing student achievement (as cited in King, 1993). Wulff, Nyquist, and Abbott (as cited in Cockrell, Caplow, & Donaldson, 2000) found that collaborative groups promoted higher levels of student achievement. Gabbert, Johnson, and Johnson (as cited in Cockrell, Caplow, & Donaldson, 2000) found that working in collaborative groups allowed students to develop their reasoning skills. Using the collaborative learning approach allows students to form their own understanding of knowledge (Cockrell, Caplow, & Donaldson, 2000).

Boggs (1995) suggested a new paradigm or model that focused on the learner and student learning, rather than the teacher or the institution. Thompson, Licklider, and Jungst (2003) stated, “In an active and collaborative learning environment, we have used specific instructional techniques, identifying similarities and differences strategies, to enhance students’ thinking and learning skills” (p.133). When students participate in guided collaborative exercises, their knowledge level is expanded. Identifying similarities and differences was one strategy found by Marzano, Pickering, and Pollack (as cited in Thompson, Licklider, & Jungst, 2003) that accomplished the goal of expanding students’ knowledge levels. The approach requires students to generate structures that allow them to think about the similarities and differences between two topics. This is one example of requiring students to use prior knowledge or instructor knowledge to work towards higher levels of cognition in Bloom’s Taxonomy. The two paradigms Boggs discussed were the Instruction Paradigm, where the teacher mainly
lectures, and the Learning Paradigm, where the learner is exposed to more active methods of learning.

"The Learning Paradigm does not prohibit lecturing, for example. Lecturing becomes one of the many possible methods, all evaluated on the basis of their ability to promote appropriate learning" (Barr & Tagg, 1995, p. 15). Barr and Tagg (1995) explained that much of the Instruction Paradigm focuses on delivery of information by an instructor to passive students, followed by students recalling the information for testing purposes. In terms of cognitive level required by students, the Instruction Paradigm employs Bloom’s lower cognitive levels.

In a learner-centered classroom, Weimer (2003) describes five key areas that must be addressed. These areas are: the balance of power, role of the teacher, responsibility for learning, function of content, and purposes and processes of evaluation. Weimer (2003) pointed out that while sharing the power in a classroom does not directly cause learning, it does influence student motivation within that classroom. The teacher’s role in a learner-centered classroom is one of guide or facilitator. As the guide, the teacher provides direction, but the students are required to work hard and form their own understanding. Teachers also need to make the classroom environment one that motivates students to become responsible for their own learning. King (1993) stated that professors in a learner-centered classroom are facilitators rather than people dispensing knowledge for students to gather.

The role of the teacher is to provide opportunities that will allow all students to build upon previous experiences and make connections, not one of imparting knowledge to “blank slates” or passive learners. King (1993) advocated modifying
existing teaching methods by including active-learning activities in the lesson. Used correctly, these activities allow for students to analyze, synthesize, and evaluate material, instead of just hearing the information. The teacher in the learner-centered classroom acts as a facilitator rather than a dispenser of knowledge (Lynch & Harnish, 1998). “Too often, students today are treated as if they are expected to be passive recipients of information and knowledge, even though we know that the most effective learning occurs when students are active learners” (Guskin, 1994, p. 24-25).

Improving Teaching

Many faculty members at the university level have been prepared to perform the role of researcher, but have not been prepared as an expert in pedagogy, delivery, and evaluation; requirements to be successful in teaching (Bess, 1998). “Pedagogy is the forgotten subject in higher education” (Stevens, 2001, p. 373). “Few teachers feel that they have either the intellectual or professional grasp of teaching that they have of the curriculum” (Gregory, 2001, p. 69).

Travis (1995) believed faculty must consistently strive for the improvement of instruction and learning. Lynch and Harnish (1998) noted that teachers should be striving to …“critically examine their practice, seek to expand their repertoire, deepen their knowledge, sharpen their judgment and adapt their teaching to new findings, ideas and theories” (p. 53). Wilen (1987) stated, “One of the first steps in the instructional improvement process is to gather data on current behavior and skills as displayed in the classroom setting” (p. 176). Bowman (1995) stated that barriers to teaching at higher levels of cognition included: lack of creativity on the part of the instructor, lack of
commitment to reading and self-education on the part of the student, students are seldom challenged to work at higher levels of cognition until later in college careers, and that it is not easy for students or faculty to engage in higher cognitive level activities.

Weimer (as cited in Travis, 2003) listed the following faculty development programs as ways to help instructors improve their instruction; workshops, discussion groups, classroom observation, and microteaching. These programs afford opportunities for instructors to reflect upon their own instruction as well as the instruction of others. Using information from the faculty development programs, teachers can transform their instruction in ways that will benefit their students. Chickering and Gamson mention the fact that faculty can aid in student learning by using better teaching practices (as cited in Guskin, 1994). Chickering and Gamson’s research concluded that faculty that use good practices are those who; encourage students and faculty, encourage cooperation among students, encourage active learning, give prompt feedback, emphasize time on task, communicate high expectations, and respect the diverse talents and learning styles of students (as cited in Guskin, 1994).

Tsui (2002) felt there was a need to modify current pedagogies to be more effective and efficient. Teachers are busy and they need information that will better their teaching in formats that are easy to understand and use (Travis, 2003). Thompson, Licklider, and Jungst (2003) encouraged learner-centered approaches to teaching in secondary settings to meet the needs of all learners. Three instructor-influenced interactions found by Smith to positively impact critical thinking ability were: encouragement and praise of student ideas, the amount and cognitive level of student
participation in class, and the amount of interaction among students during class (as cited in Tsui, 2002).

**Using Questioning Techniques in Class Sessions**

“All learning begins with questions. Questions cause interaction: thought, activity, conversation, or debate” (Chuska, 1995, p. 7). Nordvall and Braxton (1996) included questioning in a group of class processes that could be evaluated to examine academic quality. Belland, Belland, and Price (1971) found that the most common instructional interaction was teacher questioning. Marzano (1993) pointed out that teachers use questioning techniques to enhance the thinking of students. According to Marzano (1993), questioning is the “... most frequently used classroom method of enhancing thinking ...” (p. 154). Sanders (1966) stated, “... teachers can lead students into all kinds of thinking through careful use of questions ...” (p. 1-2). Sanders (1966) encouraged teachers to prepare questions that would create the types of thinking that were appropriate for that course.

Stiggins, Rubel, and Quellmalz (1988) identified oral questions during class as a way for teachers to stimulate thought and as a way to gather evidence on student development. Teachers use questions to control what is happening in their classrooms, including stimulating the level of thinking that occurs (Blosser, 2000). Teachers that use a variety of questioning techniques influence student achievement (Wilens, 1991).

Simich-Dudgeon (1998) identified a typical questioning pattern in classrooms as; question – response – evaluation. This form of questioning often does not provide feedback to the student or give the student a chance to reflect on their response. Rather
than this type of question, Simich-Dudgeon suggested using a combination of factual-recall questions and higher cognitive questions to make sure students are not just memorizing information. Sanders (1966) talked of using the “Taxonomy of Questions” to make the classroom environment better by finding out if the teacher is asking questions at appropriate levels and frequencies. Belland, Belland, and Price (1971) believed that if questioning was an important teacher behavior, then it was important to evaluate and analyze those questions being asked.

McCartin and Mees (1969) stated, “. . . knowledge questions elicit a high rate of response, which may give the teacher a feeling of accomplishment, rapport, and success, but which may have little value in terms of developing the children’s thinking skills” (p. 4). Wilen (1987) noted teachers that used effective questioning techniques to encourage interaction during class aided in student achievement. Chuska (1995) stated, “Questions that ask for higher-level thinking will increase student participation” (p. 17). Wilen (1991) reported that, “The frequency of teacher questions and student learning are positively related” (p. 21). Wilen (1991) reported that “. . . Wilen and White concluded that more research is needed on the role of questions and questioning within the broader context of classroom interaction” (p. 8).

Classifying Types of Questions

Teachers can use classification systems to make certain they are improving higher order thinking skills. Wilen (1987) reported,

Most observation instruments are tallysheets or checklists of one form or another. They can be used to record data such as
the cognitive level of questions asked by a teacher and

students, the frequency of such behaviors . . . and techniques

such as the use of probing after students' responses. (p.176)

Wilen (1991) surmised that teachers use questions to deal with both instructional and
managerial tasks.

Blosser (2000) identified questions as falling into one of four categories; managerial-type questions, rhetorical-type questions, open-type questions, and closed-type questions. Managerial-type questions are used to deal with class routine. Blosser (2000) stated, "Rhetorical questions are used by teachers to reinforce a point or for emphasis" (p. 4). Open-type questions are those that can have many answers while closed-type questions are those that have a specific or limited number of possible responses. Students need to be asked a variety of questions, especially those that develop higher order thinking skills, if they are to successfully solve real life problems (Blosser, 2000).

Cognitive Level of Questioning

Learning behaviors and activities that occur in the classroom can be classified to help the teacher realize if the objectives are being met. Newcomb and Trefz (1987) developed a taxonomy, simplifying the six levels in Bloom's Taxonomy of Educational Objectives: The Cognitive Domain (1956), which can be used in determining the effectiveness of planning, instruction, and assessment.

The Newcomb-Trefz Model identifies the knowledge level of Bloom's Taxonomy as remembering (See Figure 1). The remembering level requires no
understanding of the information, only recall. The next level in the Newcomb-Trefz Model is called *processing* and it combines the *comprehension*, *application*, and *analysis levels* of Bloom’s Taxonomy. The processing level requires the learner to use facts to reach answers for given situations. *Creating*, the next level in The Newcomb-Trefz Model, requires the development, or making, of some product. The final level of the Newcomb-Trefz Model is *evaluating*. When operating at the evaluating level, learners must make judgments based on criteria to determine an answer, whether there is a set answer or not.

<table>
<thead>
<tr>
<th>Bloom’s Taxonomy</th>
<th>The Newcomb-Trefz Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>Remembering</td>
</tr>
<tr>
<td>Comprehension</td>
<td>Processing</td>
</tr>
<tr>
<td>Application</td>
<td></td>
</tr>
<tr>
<td>Analysis</td>
<td></td>
</tr>
<tr>
<td>Synthesis</td>
<td>Creating</td>
</tr>
<tr>
<td>Evaluation</td>
<td>Evaluating</td>
</tr>
</tbody>
</table>

Figure 1

*A Comparison of Bloom’s Taxonomy, and The Newcomb-Trefz Model*

**Summary**

Researchers in teacher education have begun to evaluate cognitive theory in education (Keefer, 2002). “In the last decade, both these concerns about faculty members’ ability to teach today’s students and advances in the cognitive sciences have led to a new interest in learning” (Weimer, 2003, p. 49). The area of cognition is
multifaceted. Understanding teaching practices’ influence on student cognition, and its relationship to student achievement, will be valuable to effectively teaching all students.

Cano (1990) recommended that further research be conducted pertaining to level of cognition as it relates to the instructor, thus possibly giving some indication as to why students may or may not be achieving at various levels of Bloom’s Taxonomy. In addition, Whittington, Lopez, Schley, and Fisher (2000, p. 16) added, “Once this cognitive relationship between professors and students is more concretely established, educators can effectively assist faculty and students in enriching the teaching-learning process in college classrooms”. Using various teaching practices, a teacher may be able to reach more students and challenge them at higher levels of cognition.

The approach to teaching can challenge students to work at higher levels, thus prepare them to transfer the learning to other situations beyond the classroom. Teachers and teacher educators must prepare students for the task of working through problems, not just memorizing facts. Learner-centered classrooms are those that enable students to perform at the necessary higher levels of cognition. The practices or methods that teachers use in their classrooms affects the level at which students will receive, and thus process the information for use later in life. Teachers who use learner-centered practices allow their students to work collaboratively to build knowledge and learn from one another (Thompson, Licklider, & Jungst, 2003).
CHAPTER 3

METHODS

Problem Setting

The purpose of this study was to determine the individualized and group teaching techniques used by professors during class sessions and identify the types and cognitive level of questions asked by professors during class sessions. The researcher cooperated with the Associate Dean for Resident Instruction to acquire college support to conduct the study in every department of the College of Food, Agricultural, and Environmental Sciences at The Ohio State University. A letter from the Dean was received by all (N=8) department chairs in the college describing the study and asking for their participation. The researcher then met with the department chairs, explained the study and asked them to nominate three faculty members from their department who were deemed “good” teachers. Individual appointments were scheduled, with those who were nominated, to explain the study and to seek their participation. One hundred percent of the nominated professors agreed to participate in the research study. Selected professors were contacted by telephone and invited to participate in the study. During the call professors were informed of the importance of the study, the timeline of the study, and the events that would be taking place in their classrooms. Professors were encouraged to contact the researcher via e-mail with further questions or concerns.
Population and Sample

Twelve selected faculty members from seven departments (Agricultural, Environmental, and Development Economics; Animal Sciences; Food, Agricultural, and Biological Engineering; Horticulture and Crop Science; Human and Community Resource Development; Natural Resources; and Plant Pathology) of the College of Food, Agricultural, and Environmental Sciences (CFAES) participated in this study. Nominated professors voluntarily chose to participate or not participate in the research study. The researcher attempted to visit each participating professor two times. Table 1 indicates the number of actual visits to each professor.

<table>
<thead>
<tr>
<th>Professor</th>
<th>Number of Classroom Visits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professor A</td>
<td>2</td>
</tr>
<tr>
<td>Professor B</td>
<td>2</td>
</tr>
<tr>
<td>Professor C</td>
<td>2</td>
</tr>
<tr>
<td>Professor D</td>
<td>1</td>
</tr>
<tr>
<td>Professor E</td>
<td>2</td>
</tr>
<tr>
<td>Professor F</td>
<td>2</td>
</tr>
<tr>
<td>Professor G</td>
<td>2</td>
</tr>
<tr>
<td>Professor H</td>
<td>1</td>
</tr>
<tr>
<td>Professor I</td>
<td>2</td>
</tr>
<tr>
<td>Professor J</td>
<td>2</td>
</tr>
<tr>
<td>Professor K</td>
<td>2</td>
</tr>
<tr>
<td>Professor L</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 1

Frequency of Visits to Each Participating Professor's Classroom
The participating professors provided their course syllabus, all tests, quizzes, assignments, and other projects that were used to calculate the course grade during the quarter.

Research Design

This research study was descriptive in nature. Three instruments were used to answer the following research questions:

1. What individualized and group teaching techniques were used and how often were the techniques used by professors during class sessions as measured by the teaching techniques classification instrument?

2. What types of questions did professors ask during class sessions as measured by Blosser’s (2000) classification system?

3. At what level of cognition were professors questioning students during class sessions as measured by the Newcomb-Trefz model?

INSTRUMENTATION

Measuring Professor Teaching Techniques

The teaching techniques used by professors during class sessions were measured using a researcher-developed instrument. The techniques were listed as either individualized teaching techniques or group teaching techniques. Individualized teaching techniques included; experiments, independent study, information sheets, skill sheets, and supervised study (Newcomb, McCracken, Warmbrod, & Whittington, 2004). Group teaching techniques included; lecture, discussion, demonstrations, field
trips, role-play, resource people, and cooperative learning (Newcomb, McCracken, Warmbrod, & Whittington, 2004).

Validity for this instrument was based upon its direct development from Newcomb, McCracken, Warmbrod, and Whittington’s (2004) discussion related to group and individualized teaching methods. After a three week period, reliability for the instrument was established by watching a sample video for a second time and recording each teaching technique that was observed. The Pearson product-moment coefficient was then calculated. The intra-rater reliability for the type of teaching method used was $r_{(3 \text{ weeks})} = .50$. Inter-rater reliability was not established because the researcher completed the analysis of all data, individually.

**Measuring Types of Professor Questioning**

While reviewing the videotapes of professors’ lectures, the researcher made note of all managerial, rhetorical, closed, and open-type questions asked by each professor during a class session. Blosser’s question classification system was used as a guide in identifying each type of question. Blosser (2000) outlined a system for categorizing questions for the benefit of understanding the type of questions being asked during class. Each question asked during the class sessions were categorized into one of four categories. The four categories, as listed by Blosser (2000), were managerial, rhetorical, closed, and open. Totals for each of the categories were calculated and the frequencies were recorded.

Validity for this instrument was based upon its direct development from Blosser’s (2000) research related to types of questions. After a three week period,
reliability for the instrument was established by watching a sample video for a second time and recording the type of question for each question asked during a class session. The Pearson product-moment coefficient was then calculated. The intra-rater reliability for the types of professor questioning was \( r_{(3 \text{ weeks})} = .88 \). Inter-rater reliability was not established because the researcher completed the analysis of all data, individually.

**Measuring Cognitive Level of Professor Questioning**

The cognitive level of professor questioning was categorized using the Newcomb-Trefz model. This model, based on previous research (Bloom, et al., 1956), was used to determine the cognitive level of the questions asked during each class session. Using a list of words developed by Newcomb and Trefz (1987) to define the cognitive levels, the researcher determined the cognitive level of content-related questions asked by professors. A percentage of questions asked at each level of cognition was then determined by dividing the number of content-related questions at each level by the total number of content-related questions asked by the professor during a class session.

Validity for this instrument was based upon its direct development from Bloom's Taxonomy and the support generally given to the hierarchy of cognitive behaviors. After a three week period, reliability for the instrument was established by watching a sample video for a second time and recording the level of cognition for each question asked that elicited a cognitive response. The Pearson product-moment coefficient was then calculated. The intra-rater reliability for the cognitive level of
professor questioning was \( r_{(3\text{weeks})} = .67 \). Inter-rater reliability was not established because the researcher completed the analysis of all data, individually.

DATA COLLECTION

Measuring Professor Teaching Techniques

The types and frequencies of group teaching techniques and individualized teaching techniques used by professors during class sessions were recorded. The teaching techniques examined, as listed by Newcomb, McCracken, Warmbrod, and Whittington (2004) were: Individualized teaching techniques – supervised study, experiments, independent study, information sheets, and skill sheets; Group teaching techniques – Lecture, cooperative learning, demonstration, field trip, resource people, discussion, and role-play.

Measuring Types of Professor Questioning

While reviewing the videotape, the researcher made note of all managerial, rhetorical, closed, and open-type questions asked by each professor during class sessions. Each question was classified in the appropriate category using the criteria outlined by Blosser (2000).

Measuring Cognitive Level of Professor Questioning

The cognitive level of professor questioning was evaluated using a list of words related to the Newcomb-Trefz model. This list of words, based on previous research
(Bloom, et al., 1956), was used to determine the cognitive level of the Newcomb-Trefz model to which each question was categorized.
CHAPTER 4

RESULTS

Chapter four contains the findings related to the research questions that guided this study. The purpose of this study was to determine the individualized and group teaching techniques used by professors during class sessions, and to identify the types, and the cognitive level of questions asked by professors during class sessions.

This chapter presents the findings related to the study, which was designed to answer the following research questions:

1. What individualized and group teaching techniques were used and how often were the techniques used by professors during class sessions as measured by the teaching techniques classification instrument?

2. What types of questions did professors ask during class sessions as measured by Blosser’s (2000) classification system?

3. At what level of cognition were professors questioning students during class sessions as measured by the Newcomb-Trefz model?

Professor Teaching Techniques

Independent study and supervised study were the only individualized teaching techniques (Newcomb et al., 2004) used by professors during class sessions observed as part of this study. Professors also used six different group teaching techniques (Newcomb et al., 2004) including: cooperative learning, demonstration, discussion, lecture, resource people, and role-play. Frequencies and percentages for each group
teaching and individualized teaching technique used during the 21 class sessions were recorded and are listed in Table 2.

<table>
<thead>
<tr>
<th>Teaching Technique</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Individualized Teaching Techniques</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experiments</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Independent Study</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>Information Sheets</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Skill Sheets</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Supervised Study</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Group Teaching Techniques</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooperative Learning</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Demonstration</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Discussion</td>
<td>59</td>
<td>38</td>
</tr>
<tr>
<td>Field Trip</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lecture</td>
<td>70</td>
<td>44</td>
</tr>
<tr>
<td>Resource People</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Role-Play</td>
<td>8</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 2

*Frequency and Percent of Teaching Techniques Used During Class Sessions*

Individualized teaching techniques were used a total of nine times: Independent study was observed eight times, supervised study was observed once, while experiments, information sheets, and skill sheets were not used by professors during the observed class periods. Group teaching techniques were used 149 times during the observed class sessions: cooperative learning was used seven times, demonstration was
used three times, discussion was used 59 times, lecture was used 70 times, resource people were utilized twice, role-play was used eight times while field trips were not observed.

**Types of Professor Questions**

As can be seen in Table 3, professors asked a total of 761 questions during the 21 class sessions observed. The most common type of question found to be asked during selected college of agriculture classes was closed-type questions \((n=317)\) which were asked nearly 42% of the time. One professor asked three closed-type questions while another professor asked 87 \((\text{range} = 84)\) questions.

Rhetorical \((n=184)\) and managerial-type \((n=158)\) questions were asked the next most frequently. One professor asked two rhetorical-type questions while another professor asked 30 \((\text{range} = 28)\). Rhetorical-type questions accounted for approximately 24% of the professors’ questions. One professor asked two managerial-type questions while another asked 40 \((\text{range} = 38)\). Managerial-type questions accounted for nearly 21% of the questions asked by professors during observed class sessions.

Open-type questions were asked with the least frequency during class sessions \((n=102)\). One professor asked no open-type questions while another asked 39 \((\text{range} = 39)\). Open-type questions accounted for approximately 13% of the questions asked by professors during class sessions.
<table>
<thead>
<tr>
<th>Type of questions</th>
<th>Frequency</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Range</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managerial</td>
<td>158</td>
<td>2</td>
<td>40</td>
<td>38</td>
<td>20.8</td>
</tr>
<tr>
<td>Rhetorical</td>
<td>184</td>
<td>2</td>
<td>30</td>
<td>28</td>
<td>24.2</td>
</tr>
<tr>
<td>Closed</td>
<td>317</td>
<td>3</td>
<td>87</td>
<td>84</td>
<td>41.7</td>
</tr>
<tr>
<td>Open</td>
<td>102</td>
<td>0</td>
<td>39</td>
<td>39</td>
<td>13.4</td>
</tr>
<tr>
<td>Total</td>
<td>761</td>
<td></td>
<td></td>
<td></td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 3

*Frequency of Question Types (Blosser, 2000)*

**Cognitive Level of Professor Questioning**

Managerial-type questions were not included in the review of cognitive level of questions, since these questions were asked for the purpose of classroom management, and therefore did not elicit student cognitive thought. Also, several of the rhetorical-type questions were not examined due to the same criterion.

Excluding all managerial (158) and those rhetorical-type questions (18) that did not elicit cognitive levels of student thought, 585 questions were included in the data analysis for cognitive level of professor questions. Table 4 shows the frequency and percentage of questions asked at each level of cognition during class sessions.
<table>
<thead>
<tr>
<th>Cognitive level</th>
<th>Frequency</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Range</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remembering</td>
<td>248</td>
<td>4</td>
<td>58</td>
<td>54</td>
<td>32.6</td>
</tr>
<tr>
<td>Processing</td>
<td>198</td>
<td>1</td>
<td>45</td>
<td>44</td>
<td>26</td>
</tr>
<tr>
<td>Creating</td>
<td>26</td>
<td>0</td>
<td>7</td>
<td>7</td>
<td>3.4</td>
</tr>
<tr>
<td>Evaluating</td>
<td>113</td>
<td>0</td>
<td>36</td>
<td>36</td>
<td>14.8</td>
</tr>
<tr>
<td>Total</td>
<td>585</td>
<td></td>
<td></td>
<td></td>
<td>76.9</td>
</tr>
<tr>
<td>Excluded questions</td>
<td>176</td>
<td></td>
<td></td>
<td></td>
<td>23.1</td>
</tr>
<tr>
<td>Overall Total</td>
<td>761</td>
<td></td>
<td></td>
<td></td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 4

Frequency and Percentage of Questions asked at each Cognitive Level

Nearly 33% of the questions assessed for cognitive level were asked at the remembering level (n=248; range=54). Processing questions (n=198; range=44) accounted for 26% of the total questions asked during the class sessions. Approximately 15% of the questions asked during class sessions were asked at the evaluating level (n=113; range=36) of cognition. The remaining 3.4% of the questions were asked at the creating level (n=26; range=7) of cognition. The range was calculated for each level of cognition. The ranges of 54, 44, 7, and 36 were found for remembering, processing, creating, and evaluating, respectively.

Table 5 shows the frequency for type of question. Table 6 shows the percentage for each cognitive level asked by each professor during the observed class sessions. Professor A asked mostly managerial-type (n=24) questions and zero open-type questions. Professor A asked questions mainly at the remembering (50%) level of cognition.
Professor B asked mostly closed-type questions (n=36) and the main level of cognition recorded was remembering (70%).

Professor C asked mainly closed-type questions (n=87) and the 37% of the questions were asked at the processing level of cognition.

Professor D asked 40 managerial-type questions, 30 rhetorical-type questions, 18 closed-type questions, and 39 open-type questions. The questions asked by professor D were mostly at the processing (54%) level of cognition.

Professor E asked 17 rhetorical-type questions and 13 closed-type questions. Professor E asked 59% of the questions at the remembering level of cognition.

Professor F asked 29 rhetorical-type questions and 23 open-type questions, with 32% at the remembering level of cognition and 38% of the questions at the evaluating level of cognition.

Professor G asked 22 managerial-type questions, 11 rhetorical-type questions, 11 closed-type questions, and zero evaluating questions. Professor G asked a majority (68%) of the questions at a processing level of cognition.

Professor H asked two managerial-type questions, 11 rhetorical-type questions, three closed-type questions, and zero evaluating questions. Professor H asked a majority (61%) of the questions at the evaluating level of cognition.

Professor I asked three managerial-type questions, 13 rhetorical-type questions, 15 closed-type questions, and two evaluating questions. Professor I asked 48% of the questions at the remembering level of cognition and 28% of the questions at the processing level of cognition.
Professor J asked seven managerial-type questions, 19 rhetorical-type questions, 50 closed-type questions, and 1 open-type question. Professor J asked 56% of the questions at the remembering level of cognition, 33% at the processing level of cognition, zero percent at the creating level of cognition, and 11% at the evaluating level of cognition.

Professor K asked 13 managerial-type questions, 25 rhetorical-type questions, 51 closed-type questions, and three open-type questions. 78% of the questions were asked at the remembering level of cognition, 19% of the questions were asked at the processing level of cognition and 3% of the questions were asked at the creating and evaluating levels of cognition.

Professor L asked a total of 33 questions with 20 of these being open-type questions. 55% of the questions asked by professor L were at the evaluating level of cognition, 26% were asked at the processing level, 19% were asked at the remembering level, and zero percent were asked at the creating level.
<table>
<thead>
<tr>
<th>Professor</th>
<th>Managerial</th>
<th>Rhetorical</th>
<th>Closed</th>
<th>Open</th>
</tr>
</thead>
<tbody>
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<td>Professor A</td>
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<td>5</td>
<td>17</td>
<td>0</td>
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<tr>
<td>Professor B</td>
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<td>4</td>
<td>36</td>
<td>7</td>
</tr>
<tr>
<td>Professor C</td>
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<td>18</td>
<td>87</td>
<td>5</td>
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<td>18</td>
<td>39</td>
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<td>11</td>
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<td>Professor I</td>
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<td>13</td>
<td>15</td>
<td>2</td>
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<tr>
<td>Professor J</td>
<td>7</td>
<td>19</td>
<td>50</td>
<td>1</td>
</tr>
<tr>
<td>Professor K</td>
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<td>51</td>
<td>3</td>
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<td>Professor L</td>
<td>6</td>
<td>2</td>
<td>5</td>
<td>20</td>
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</table>

Table 5

*Frequency of Question Type by Individual Professor*
<table>
<thead>
<tr>
<th>Professor</th>
<th>Cognitive level of question (Percent)</th>
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<tr>
<td></td>
<td>Remembering</td>
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<tr>
<td>Professor A</td>
<td>50</td>
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<tr>
<td>Professor B</td>
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<td>Professor C</td>
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<td>Professor D</td>
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<td>Professor E</td>
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<td>Professor F</td>
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<td>Professor J</td>
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<td>Professor K</td>
<td>78</td>
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<td>Professor L</td>
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</tbody>
</table>

Table 6

*Cognitive Level of Question Asked by Individual Professor*
Summary

Both individualized and group teaching techniques were used in the College of Food, Agricultural, and Environmental Sciences class sessions. However, three of the five examined individualized teaching techniques were not observed during any class sessions. Individualized teaching techniques were observed a total of nine times ($n = 6\%$) during the observations. All but one of the group teaching techniques, field trips, were observed during the class sessions. Of the seven group teaching techniques, lecture and discussion combined for over 86% of the total group teaching techniques observed. These two teaching techniques also combined for over 81% of all teaching techniques observed during observations of classes in the College of Food, Agricultural, and Environmental Sciences.

The most frequently asked type of question during class sessions was closed-type questions ($n = 42\%$). Closed-type questions were asked with almost twice the frequency of any other type of question. Rhetorical-type questions were asked with the next greatest frequency ($n=184$). Managerial and open-type questions were asked with lesser frequencies of 158 and 102, respectively.

The cognitive level of questions asked during observed class sessions were mainly concentrated at the remembering and processing levels of cognition. These are the two lowest levels of cognition, according to the Newcomb-Trefz model (1987). The combined percentage for questions asked at these levels of cognition was 58.6%. The next highest frequency of question asked, by level of cognition, observed for professor questioning was evaluating at 14.8%. Newcomb and Trefz (1987) identified this as the highest level of cognition. Four professors asked 90 of the 113 evaluating questions.
Five professors asked the remaining 23 evaluating questions. Three of the professors asked zero evaluating questions during the observed class sessions. The least frequently observed cognitive level of professor questioning was creating. Creating level questions accounted for 3.4% (n=26) of professors' cognitive level of questioning. Seven professors asked at least one creating level question during the study, with the maximum number of questions asked by a single professor in this category being seven.
CHAPTER 5

CONCLUSIONS

Summary

Researchers (Stevens, 2001; Paulsen & Feldman, 1995; Boggs, 1995) have reported that teaching at the university level has not changed with the times, and there is a need for improvement in current trends. Since questioning is a major component of instruction, changes in questioning strategies could influence university teaching. Blosser (2000) believed teachers must analyze the types of questions asked during instruction to reach students at higher levels of cognition. The purpose of this study was to determine the individualized and group teaching techniques used by professors during class sessions, as well as, identify the types and cognitive level of questions used in courses taught by selected professors in the College of Food, Agricultural, and Environmental Science (CFAES) at The Ohio State University. The following research questions guided the study:

1. What individualized and group teaching techniques were used and how often were the techniques used by professors during class sessions as measured by the teaching techniques classification instrument?

2. What types of questions did professors ask during class sessions as measured by Blosser’s (2000) classification system?

3. At what level of cognition were professors questioning students during class sessions as measured by the Newcomb-Trefz model?

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The researcher cooperated with the Associate Dean for Resident Instruction to acquire college support to conduct the study in every department of the College of Food, Agricultural, and Environmental Sciences at The Ohio State University. Twelve selected faculty members from seven departments (Agricultural, Environmental, and Development Economics; Animal Sciences; Food, Agricultural, and Biological Engineering; Horticulture and Crop Science; Human and Community Resource Development; Natural Resources; and Plant Pathology) of the College of Food, Agricultural, and Environmental Sciences (CFAES) agreed to participate in this study after being nominated by their department chairs.

Three instruments were used in this research study to explore and address the research questions. Teaching techniques employed by professors during class sessions were measured using a researcher-developed instrument. The teaching techniques were listed as either individualized teaching techniques or group teaching techniques. To identify the types of questions being asked during class sessions, Blosser’s (2000) question classification system was used. While reviewing videotapes of professors’ lectures, the researcher noted all managerial, rhetorical, closed, and open-type questions asked by each professor during class sessions. The cognitive level of professor questioning was categorized using the Newcomb-Trefz model. This model, based on previous research (Bloom, et al., 1956), was used to determine the cognitive level of the questions asked during each class session. Results showed that independent study and supervised study were the individualized teaching techniques (Newcomb et al., 2004) used by professors during class sessions observed as part of this study. Professors also used six different group teaching techniques, (Newcomb et al., 2004) including;
cooperative learning, demonstration, discussion, lecture, resource people, and role-play. Group teaching techniques were used with greater frequency when compared to individualized teaching techniques. Lecture and discussion were the most often used group teaching techniques.

During class sessions, professors asked a total of 761 questions during the 21 class sessions observed. The most frequently asked type of question was closed-type questions (n = 42%).

Excluding all managerial (158) and those rhetorical-type questions (18) that did not elicit cognitive levels of student thought, 585 questions were included in the data analysis for cognitive level of professor questions. Most questions (32.6%) were asked at the remembering level of cognition. Remembering is the lowest level of cognition, according to the Newcomb-Trefz model (1987).

Conclusions Related to Teaching Techniques

Professors in the College of Food, Agricultural, and Environmental Sciences (CFAES) relied mainly on lecture and discussion to deliver their content during class sessions. Other group teaching techniques (cooperative learning, resource people, role-play, and demonstration) were seldom used. Individualized teaching techniques were seldom used during class sessions.

Implications Related to Teaching Techniques

Researchers (Tsui, 2002; Sternberg, 2002; Barr & Tagg, 1995; Halpern, 1993) advocated using multiple teaching methods for reaching all students. Giving students
the opportunity to auditorily and visually experience content presented in more than one way, enables students to understand the material presented. Thus, if professors are using multiple teaching techniques to actively engage students, opportunities to truly reach higher levels of cognition are gained. Teachers that use the same method of teaching for the entire class may reach one student with the information, but another may not understand the information that was just presented.

**Recommendations Related to Teaching Techniques**

Professors need to engage students in the lesson as active participants rather than allow them to sit as passive recipients of information. Professors seeking to avoid Shulman’s (2000) “illusory learning”, when students say they know, but they really do not, need to present material in a way that allows students to process information to form their own understanding. Professors need to pull what is inside the student out, allow them to work on it, and then put it back into the student to form their own understanding (Shulman, 2000). By actively engaging the students in this way, professors can see that the students understand, and that they can use the information being taught.

**Conclusions Related to Type of Questions**

Professors in the College of Food, Agricultural, and Environmental Sciences asked primarily closed-type questions to deliver content during class sessions. Managerial, rhetorical, and open-type questions were rarely used.
Implications Related to Type of Questions

Professors who are using various question types during class are enabling their students to practice a wide range of thought processes. If a professor continually uses one particular type of question, students' thinking may not be challenged at the higher cognitive levels (Blosser, 2000).

Recommendations Related to Type of Questions

The use of multiple types of questions is recommended during class sessions. Professors must be aware of the types of questions being used during class sessions (Blosser, 2000). The time it takes to process various types of questions will impact the way students react to future class instruction. For example, if professors ask open-type questions that require students to formulate answers on their own, rather than simply recalling information, the amount of time needed to think will be greater than a simple closed-type question that may require little or no processing. Students will begin to understand that the teacher is willing to spend time on the questions being asked, thus the student will work to process the questions and formulate answers to future questions.

Conclusions Related to Cognition Level of Professor Questions

Professors in this study primarily questioned students at the remembering level of cognition. Professors asked evaluating level questions occasionally. Creating level questions were rarely asked.
Implications Related to Cognitive Level of Professor Questions

The cognitive level of each question asked during class sessions needs to be considered by the professor. Professors that ask questions mainly at the remembering and processing levels will not be encouraging students to critically evaluate the question being asked. Lower level cognitive questions often only require students to recall information learned in the past, whereas higher cognitive level questions require students to process and potentially evaluate the subject matter.

Recommendations Related to Cognitive Level of Professor Questions

Students need to be challenged at various levels of cognition throughout the class session. Therefore, professors should not rely too heavily on any one level of cognition when questioning students. Often, remembering and processing questions need to be asked during class sessions to encourage student ideas related to the content being presented. However, the questions being asked should not stop at these levels. Students need to be required to think critically about the subject by creating their own answers and evaluating criteria pertinent to the question being raised by the professors.

Discussion

The types of questions asked during class sessions need to be well thought-out. This means professors must take the initiative and time to plan the types of questions needed during class to reach the stated objectives. A mix of types of questions may be needed to accomplish the objectives. Students who are bombarded with managerial-type questions may become bored and therefore lose interest in the topic. On the other hand,
students that do not have time to truly evaluate a rhetorical-type question, for instance, may realize that the professor was not expecting an answer. In this case students will become disengaged because they know they are not expected to participate verbally. If the question is worth asking, even rhetorically, students should be given the opportunity to process that which was asked and formulate an answer even if it is not verbalized. Professors must give all students time to process the question being asked before calling on students to answer, or before giving the answer themselves. Even if the professor was not expecting an answer, as rhetorical implies, students should be given the opportunity to develop an answer before proceeding.

Professors must begin to challenge students at the creating and evaluating levels of cognition, so that students are thinking through topics, rather than simply recalling information. Cognitive levels of questioning in the observed classes were mainly at the remembering and processing levels, often only requiring the students to recall information from past classes. When professors ask a question and half of the students' hands are raised to answer, it may be impressive, but when no "real" thinking was involved in processing the response, one wonders, "What was the purpose for the question?". Students may simply be recalling an answer to a question from memory. The real question is, "can students explain the answers just given?". If students can dialogue about the meaning behind an answer that was given, then illusory learning has been avoided (Shulman, 2000). At some point students will be expected to explain their understanding of the topic, and unless they have previously been given opportunities to dialogue about the topic, students will realize that their understanding may be
superficial. By asking students to create and evaluate, professors encourage deeper thinking and thus further develop students' lifelong skills.

Professors relied on lecture as their main technique of presentation. Using lecture, professors can efficiently deliver content to large numbers of students simultaneously. However, that does not mean the entire period should consist of lecture. Professors who lecture non-stop and yet, in a testing situation expect students to process information at the application, synthesis, or evaluation levels of Bloom’s Taxonomy, are introducing student frustration. Teaching at higher levels of cognition is possible; therefore, professors need encouraged to vary their teaching techniques, change their cognitive level of questions, and work at improving their teaching to reach this goal.

Summary

Teachers are using teaching techniques, types of questions, and cognitive level of questions to varying degrees. Group teaching techniques of lecture and discussion were seen with the greatest frequency, while individualized teaching techniques were seen sporadically at best. The main type of questions being asked during the observed class sessions was closed-type questions. Closed-type questions allow for only a limited number of “correct” responses. Remembering and processing were the primary cognitive levels witnessed in the professors’ questioning. These are the lowest two levels of cognition according to the Newcomb and Trefz (1987) model. Students were challenged least by professor questions at the creating and evaluating levels, the highest two levels of cognition according to Newcomb and Trefz.
Professors using various teaching techniques to engage learners are providing students opportunities to learn the content using more than one modality. Professors that use multiple types of questions during class sessions are allowing students to become engaged in the discussion and, thereby stay on task. On the other hand, if professors continually ask one type of question, students may lose interest and, therefore not engage in the lesson. A higher potential for engagement occurs if the professor is aware of, and understands the types of questions being asked during class (Blosser, 2000).

By understanding the level of cognition of the questions asked during class sessions, professors are able to challenge students at various levels of cognition (Newcomb & Trefz, 1987). Requiring students to operate at all levels of cognition allows students to process questions that may be presented to them in the future. Therefore, professors need to understand their current use of teaching techniques, types of questions, and the level of cognition that these questions are reaching. When professors can reflect on these three areas of teaching and make changes, learning experiences can be enhanced for the student.
LIST OF REFERENCES


Woods, D. R. (1994). *Problem-based learning: How to gain the most from PBL*. Waterdown, Ontario: Daniel R. Woods
APPENDIX A

LETTER TO ASSISTANTS
Letter to the assistants for videotaping of classes

Dear Assistant,

Thank you for agreeing to help with videotaping of class sessions for this research. I am asking that you arrive at the classroom at least ten minutes before class is scheduled to begin, unless otherwise notified. The instructor will be reminded of the date and time of the videotaping via e-mail. While taping the class, we ask that you take a wide angle of the class from the back of the room. You can zoom when necessary to capture important visual details of the class. Videotape the entire class session unless otherwise instructed by the professor. When a student is speaking you can video them instead of the professor, if the wide angle of the camera is not capturing their face. Do not record the faces of students. Return the video camera and videotape to Room 203 Agricultural Administration Building following the class.

Thank you again,

John Ewing
Graduate Research Associate
APPENDIX B

REMINDER E-MAIL TO PROFESSORS
Reminder e-mail to professors for date and time of videotaping

Dear (professor's name),

As per our phone conversation a few weeks ago, I am sending you this e-mail reminder pertaining to your participation in the teaching research study. I, or an assistant, will attend your class to videotape on (day of week), (month) (day), (year). To keep disturbance to a minimum, the assistant or I will videotape from the back of the room. If you have any questions, feel free to contact me via e-mail. Thank you again for your participation in this research study.

Sincerely,

John Ewing
Graduate Research Associate
APPENDIX C

INITIAL CONTACT OF PROFESSORS
Initial contact to individual professors

Dear (professor's name),

My name is John Ewing and I am conducting a research study, pertaining to teaching and learning, with Dr. M. Susie Whittington in the Department of Human and Community Resource Development. You have been recommended by your department chairperson to participate in this study due to your qualities as a good teacher. I am currently trying to set up 30-minute appointments for Dr. Whittington to come to your office and tell you more about the study and find out if you would be willing to participate. Dr. Whittington would like to meet with all of the participating professors within the next two weeks. Following is a list of dates and times that are currently available. If any of the time periods work for you, please e-mail me back immediately so I can put you on Dr. Whittington's calendar. Thank you and if you have any questions or concerns feel free to contact me via e-mail or phone.

(List of dates and times)

Thank you,

John Ewing
Graduate Research Associate
APPENDIX D

CONFIRMATION E-MAIL
Confirmation of 30-minute meeting with Dr. Whittington

Dear [professor's name],

Thank you for agreeing to meet with Dr. Whittington on [day of week, month, day] at [time]. She will come to your office to explain the research study that we are conducting in further detail. Thank you again for allowing Dr. Whittington to come meet with you concerning this matter.

Sincerely,

John Ewing
Graduate Research Associate
APPENDIX E

INITIAL MEETING WITH PROFESSORS
Initial 30-minute meeting in individual professor's office

During this meeting Dr. Whittington explained that the research study we were conducting would be examining teaching and learning in the College of Food, Agricultural, and Environmental Sciences. She explained that we would be visiting and videotaping their class two times during the quarter. Also, during this visit Dr. Whittington received any dates that would not work for the professors to be taped due to exams or other conflicts.