DESCRIBING COGNITIVE LEVEL OF INSTRUCTOR DISCOURSE, ATTITUDES, AND ASPIRATIONS, AND STUDENT CONTENT RETENTION DURING A SECONDARY ANIMAL SCIENCE UNIT OF INSTRUCTION

THESIS

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By

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ABSTRACT

The purpose of this study was to describe the instructor’s cognitive level of discourse, attitude toward teaching at higher cognitive levels, and aspiration to teach at higher cognitive levels, during an animal science unit of instruction. The researchers also sought to describe student immediate, short-term, and long-term cognitive retention of class session content, following an animal science unit of instruction. A descriptive, observational case study methodology was selected.

One high school agricultural science instructor was videotaped while teaching an Agricultural Science I class of 12 freshman students. The instructor taught 18 one-hour lessons that compiled an animal science unit of instruction. Four instruments were used to describe instructor characteristics and student immediate, short-term, and long-term cognitive retention.

Results of the study were used to provide evidence that the teacher had a positive attitude toward teaching at higher cognitive levels, aspired to teach at higher cognitive levels, but used lower cognitive levels of classroom discourse. In addition, student immediate, short-term, and long-term cognitive retention of content taught during an animal science unit of instruction was measured by multiplying the score on the final unit exam by the cognitive weighted score of the final unit exam. The mean student immediate cognitive retention score was 75%.
Student short-term cognitive retention was measured by multiplying the score of the final unit exam taken 42 days after the unit of instruction was taught by the cognitive weighted score of the final unit exam. The mean student short-term cognitive retention score was 78% (the mean difference between the test taken immediately after the unit and the test taken 42 days after the unit was 3%). However, student long-term cognitive retention was measured by multiplying the score of the final unit exam taken 182 days after the unit of instruction was taught by the cognitive weighted score of the final unit exam. The mean student long-term cognitive retention score was 74% (the mean difference between the test taken 42 days after the unit and the test taken 182 days after the unit was -4%). The mean difference between the test taken immediately after the unit and the test taken 182 days after the unit was -0.8%.
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Conceptual Framework for Studying Cognitive Levels of Teaching and Learning
CHAPTER 1
INTRODUCTION

A need for instructional improvement surfaced through several reports in the 1980s and questioned the quality of undergraduate education (Paulsen & Feldman, 1995). Berger (1998) suggested that all teachers re-focus their efforts to change the way students interact with information by saying that,

An increasing number of teachers, from kindergarten through college, have altered lesson plans to include the art of thinking. Many others are being trained so they can shift the classroom emphasis away from just giving pupils information, and more toward making them think about the issues raised by that information. (p. 1)

“There is almost unanimous agreement that the single most important determinant of both knowledge and skill retention is the amount or degree of initial learning” (Farr, 1987, p. 5). Therefore, research should be conducted to assess the “level of cognition of instruction and student performance in agricultural education on a broader, more comprehensive level” (Cano, 1990, p. 79).

According to Farr (1987), “there is surprisingly and disappointingly little in the literature of practical use to the learning and retention of the broad range of complex,
real-world ‘cognitive’ tasks” (p. 1). Farr also notes that knowledge is forgotten and skills deteriorate when they are not put to use or practiced. “All in all, we need to know a great deal more of useful information about the factors which promote long-term retention and retard ‘decay’ (Farr, 1987, p. 2).

“Most instructional strategies are aimed at improving the particular learning outcome of an acquisition stage, i.e., the mastery of some material or skill. If these strategies consider the two additional learning outcomes of retention and transfer at all, they are usually only secondary considerations” (Farr, 1987, p. 29).

**Statement of the Problem**

Teachers are held accountable for the success of their students, often measured by standardized testing. The real value for students, and society, comes when students can retain information for longer periods of time, by learning it in a way that engages them at all levels of Bloom’s Taxonomy. Public education should be preparing students to use the knowledge they are gaining to become productive citizens in their communities. More information is needed to know how teaching and assessing at all levels of cognition will improve student retention of content and transfer of learning.

**Purpose of the Study**

In this descriptive study, the researchers sought to describe instructor behaviors and student retention of classroom content. The purpose of this study was to describe the instructor’s discourse, attitude, and aspiration toward teaching at higher cognitive levels during an animal science unit of instruction, and to describe student immediate,
short-term, and long-term cognitive retention of content. Specifically, the following research objectives guided the study:

1. To describe the cognitive level of discourse of a high school instructor during an animal science unit of instruction.
2. To describe the attitude of a high school instructor toward teaching at higher cognitive levels during an animal science unit of instruction.
3. To describe the aspiration of a high school instructor for teaching at higher cognitive levels during an animal science unit of instruction.
4. To describe student immediate, short-term, and long-term retention of content following an animal science unit of instruction.
5. To describe student immediate, short-term, and long-term cognitive retention following an animal science unit of instruction.

Limitations of the Study

Selecting only one subject, for only one unit of instruction, limits the ability to generalize the results of this study. Additionally, with only 12 students in the Agricultural Science I class, there were only retention scores for this small group of students.

Classroom videotapes were used by the researchers as opposed to live observations; this limited the ability to fully understand the context and conditions of the learning environment. A third limitation was that the researchers did not write the final exam that was administered to the students to measure retention of content. The
array of cognitive levels of questions on the final exam was not selected by the researchers to cover all levels of Bloom’s Taxonomy.

Another limitation to this study was that the instructor announced the occurrence of the second unit exam. The students were instructed to study their animal science notes to prepare. The researchers did not intend for the second exam to be announced, which likely altered student final exam scores, therefore potentially altering their student cognitive retention scores.

Definition of Terms

*Cognitively Weighted Tests 1, 2, & 3* – Cognitively weighted test #1 represents student immediate cognitive retention. Cognitively weighted test #2 represents student short-term cognitive retention. Cognitively weighted test #3 represents student long-term cognitive retention. Each question on the unit exam was multiplied by a weighted factor, created by Pickford (1989), to create a cognitive weighting for the test.

*Higher Cognitive Levels* – The upper four levels in Bloom’s Taxonomy of educational objectives in the cognitive domain (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956). The levels are labeled application, analysis, synthesis and evaluation.

*Instructor Aspiration* – The cognitive level of Bloom’s Taxonomy at which the instructor desires to deliver discourse.

*Instructor Attitude* – Feelings the instructor has toward teaching at higher cognitive levels during class sessions.

*Instructor Discourse* – The verbal statements spoken by instructors during class sessions.
Lower Cognitive levels – The lower two levels in Bloom’s Taxonomy of educational objectives in the cognitive domain (Bloom et al., 1956). The levels are labeled knowledge and comprehension.

Student Content Retention – A student’s ability to recall information and correctly answer test questions after the initial teaching of the content.

Student Cognitive Content Retention – The difference between a student’s initial test score and follow-up test score(s), accounting for levels of Bloom’s Taxonomy.

Student Immediate Cognitive Retention – The amount of content knowledge, weighted cognitively, that was retained by students one day after the unit of instruction was taught.

Student Immediate Retention of Content – The amount of content knowledge that students remembered one day after the unit of instruction had been taught as evidenced by student responses on a teacher-developed final unit exam.

Student Long-Term Cognitive Retention – The amount of content knowledge, weighted cognitively, that was retained by students 182 days after the unit of instruction was taught.

Student Long-Term Retention of Content – The amount of content knowledge that students remembered 182 days after the unit of instruction had been taught as evidenced by student responses on a teacher-developed final unit exam.

Student Short-Term Cognitive Retention – The amount of content knowledge, weighted cognitively, that was retained by students 42 days after the unit of instruction was taught.
Student Short-Term Retention of Content – The amount of content knowledge that students remembered 42 days after the unit of instruction had been taught as evidenced by student responses on a teacher-developed final unit exam.

Operational Definitions of Terms

Cognitively weighted tests 1, 2, & 3 – Multiplying the student’s unit exam score by the cognitive weighting of the test equals the student’s cognitive retention score. Each test item was evaluated for its placement on the Pickford Scale (1989), then the point value was multiplied by a cognitive weighting to create the cognitively weighted test score.

Instructor aspiration – An aspiration score was derived by counting the number of chips that the instructor placed on each quadrant of the instrument to represent the percentage of discourse at each cognitive level desired across the time of instruction.

Instructor attitude – A score was derived based on the number of items on the instrument multiplied by the weight of the Likert scaled response. The possible range was 50-300 based upon the instructor responding with all ones or all fives.

Instructor discourse - The FTCB was designed to measure the frequency of the presence of each listed cognitive behavior during a six-minute observation period, using a frequency count and percentages of frequency at each level of cognition.

Student immediate cognitive retention – The amount of content knowledge cognitively retained by students immediately after the unit of instruction, as evidenced by each student’s final unit exam score multiplied by the cognitively weighted score of the final unit exam.
Student immediate retention of content – The amount of knowledge that the student retained immediately after the unit of instruction, as evidenced by the final unit exam score.

Student long-term cognitive retention – The amount of content knowledge cognitively retained by students 182 days after the unit of instruction, as evidenced by each student’s final unit exam score multiplied by the cognitively weighted score of the final unit exam.

Student long-term retention of content – The amount of knowledge that the student retained 182 days after the unit of instruction, as evidenced by the final unit exam score.

Student short-term cognitive retention – The amount of content knowledge cognitively retained by students 42 days after the unit of instruction, as evidenced by each student’s final unit exam score multiplied by the cognitively weighted score of the final unit exam.

Student short-term retention of content – The amount of knowledge that the student retained 42 days after the unit of instruction, as evidenced by the final unit exam score.
CHAPTER 2
REVIEW OF RELATED LITERATURE

Cognitive Levels of Teaching and Learning

Discourse

According to Halpern & Hakel (2003), lectures are not the best teaching tool to promote deep learning. Many lecture-based learning environments are associated with multiple-choice tests, which “tap only lower-level cognitive processes” (Halpern & Hakel, 2003).

According to Wittrock (1986), research has been conducted to explain how teachers or instructional processes directly contribute to student achievement. Alternate research exists that teachers influence that which students think, believe, feel, say or do, which ultimately affects their achievement. Therefore, besides teaching methods, there are several other possible influences on student achievement, including: student background knowledge, perceptions of instruction, attention to the teacher, motivation and attribution for learning, affective processes, and ability to generate interpretations and understandings of instruction (Darling-Hammond, 2006; Kline, 2002; Sprinthall, Sprinthall, & Oja, 1994).
Students today are being asked to memorize information learned in classrooms, as well as store logical thoughts. As early as 1937, Welborn and English wrote, “Logical memory is generally regarded as one end of a series at the other end of which is ‘rote’ memory for purely nonsensical, entirely disconnected material” (p. 1). Welborn and English also suggested that logical memory is retained for a longer period, and loss is more gradual, than rote memory over interval trials lasting a total of 100 days. Welborn and English went on to say that, “It has probably always been recognized that connected material may be learned more quickly than unconnected material of the same general character, though the fact has influenced learning theory strangely little” (p. 2).

“Insofar as meaningful verbal learning is concerned, the evidence similarly indicates that the stability and clarity of the anchoring ideas are positively related to the learning and retention of similar materials” (Ausubel, Stager, & Gaite, 1969, p. 61). The authors suggested that students who have previous knowledge of what they are memorizing have a greater retention of the material than those who are unfamiliar with the material.

To help form mental associations, Whittrock (1986) recalled a study where, Wittrock and Goldberg (1975) found that high imagery words facilitated memory among elementary school children and college students. Prior to age 8 or 9, children seemed to have a production deficiency; that is, they used images given to them by others, but could not, upon request, construct them to facilitate their own learning and memory (p. 307).
Within agricultural education, Reaves, Flowers, and Jewell (1993), noted that learning activities should require students to be active in their learning. They found that students who were “taught by writing-to-learn activities appeared to have lower scores on the initial achievement test, but higher scores on the retention test administered three weeks later than did students taught by lecture and discussion methods” (p. 37).

**Attitude and Aspirations of Teaching at Higher Levels**

“Although Americans today are more highly educated than ever before, they are not necessarily better educated” (Tsui, 2002). Generally, researchers agree that teachers have an impact on student instruction. “In brief, learning from teaching is not automatic. It occurs primarily through the active and effortful information processing by students who must perceive and interpret teachers’ actions for them to influence achievement” (Wittrock, 1986, p. 298).

To assist learners in comprehension and knowledge acquisition, a teacher must lead the learner to build cognitive associations (Wittrock, 1986). Additionally, Gregory (2001) believed that using a variety of instructional methods helped students develop their own thinking abilities, as compared to using one style of teaching.

“Teaching that aims at deep learning, not merely coverage of material, requires sophisticated judgment about how and what students are learning, what gaps in their understanding need to be addressed, what experiences will allow them to connect what they know to what they need to know, and what instructional adaptations can ensure that they reach common goals” (Darling-Hammond, 2006, p. 10). Adding complicated assessments to the student and teacher interactions can influence how subject matter is
taught, since, “Teaching for retention during a single academic term to prepare students for an assessment that will be given to them in the same context in which the learning occurs is very different from teaching for long-term retention and transfer” (Halpern & Hakel, 2003, p. 38).

Teacher Cognitive Behavior

Retention

“Asking learners to recall particular pieces of the information they’ve been taught often leads to ‘selective forgetting’ of related information that they were not asked to recall. And even if they do well on a test taken soon after initial learning, students often perform less well on a later test after a longer retention interval” (Halpern & Hakel, 2003). Additionally, Halpern and Hakel (2003) explained that,

The underlying rationale for any kind of formal instruction is the assumption that knowledge, skills, and attitudes learned in this setting will be recalled accurately, and will be used in some other context at some time in the future. We only care about student performance in school because we believe that it predicts what students will remember and do when they are somewhere else at some other time. Yet we often teach and test as though the underlying rationale for education were to improve student performance in school. (p. 38)

Teaching techniques have been evaluated to see if they have an impact on student achievement. However, within agricultural education, there have been few definitive conclusions. Boone (1990) stated that the problem-solving approach to teaching increases student retention of knowledge. In additional agricultural education studies (Dyer & Osborne, 1999; Flowers & Osborne, 1987), contrary evidence was
found that the problem-solving method of teaching was no more or less effective than traditional instructional methods in regards to its impact on student retention of knowledge. Outside of agricultural education, Lucas, Postma and Thompson (1975) found that the students being taught with a simulation-gaming technique increased their scores on the second test, with the researchers expecting their retention level to decrease as time elapsed.

“Aristotle’s model of memory was based on the principle of associating ideas in order, one to another, and in storing these ideas as images in long-term memory, which one could retrieve by recalling one of them; and that would lead successively to each subsequent idea in the sequence” (Wittrock, 1986, p. 306). Another early principle of learning and memory indicated that one could increase learning and memory when the information to be learned was stored with previous experience. Consequently, public speakers were taught to create relationships between familiar items in their homes with the talking points in their presentations. Currently, association is used as a simple memory tool, yet the tenet of associating new information to existing knowledge is important for comprehension (Wittrock, 1986).

According to Halpern and Hakel (2003), “The single most important variable in promoting long-term retention and transfer is ‘practice at retrieval’” (p. 38). Students need to generate responses to problems and questions, with little help, repeatedly and in different contexts, until the students become fluent and able to be successful in different situations (Halpern & Hakel, 2003). In a 2006 study by Karpicke and Roediger, it was found that, “repeated testing during learning enhanced retention relative to repeating studying, although study and test trials produced the best retention” (p. 151).
Retrieval cues can be used to assist learners in remembering stored information. Retrieval cues can be images, words, or often are words that evoke mental images for the learner (Wittrock, 1986). “Although they have not often been used to facilitate comprehension, imagery techniques, which involve spatial juxtaposition of ideas and objects, have potential value for facilitating understanding” (Wittrock, 1986, p. 307).

Retrieving information from memory is important for students across content disciplines. According to Wittrock (1986), in a study of 52 undergraduate students, “With Spanish vocabulary words, Raugh and Atkinson (1975) increased college students’ retention from 28% to 88% by use of the keyword imagery mnemonic” (p. 307).

However, students can become confused when asked to retrieve information. Hakel and Halpern (2003) noted that remembering and studying stored information helped to strengthen the memory, but also weakened the information that was not being studied, because the less studied information was deemed less important. Instructors might cause students to forget the main points of a class session by sending the message that they will be “testing for the footnotes,” to emphasize that everything needs to be memorized. Students, in this case, might continually retrieve and study the minor points of class at the cost of the main lesson.

Cognitive Retention

Tsui (2002) revealed that critical thinking skills need to be developed in students so they are able to solve problems in the future. The researcher indicated that classrooms with greatest student involvement in classroom activities reported more growth in critical thinking.
Cognition Research in Agricultural Education

Numerous research studies (Newcomb & Trefz, 1987; Cano, 1988; Pickford, 1988; Miller, 1989; Pickford & Newcomb, 1989; Cano, 1990; Whittington & Bowman, 1994; Whittington, 1995; Whittington, Stup, Bish, & Allen, 1997, Whittington, 2003; Ewing, 2006; Beck, 2009) related to instructor discourse and cognition have been conducted in the past twenty years. Miller (1989) believed that many factors influenced student level of cognition. Among those were the instructor’s cognitive expectations for the course and the instructor’s interest and previous experience. Porter and Brophy (1988) advocated that an instructor’s ability to address both low and high levels of cognition aid in promoting higher levels of student thinking. Cano (1988) examined the cognitive level of instruction in production agriculture programs in Ohio. Findings from the research were used to show that nearly 30 percent of the instructional objectives were written at the creating and evaluating levels of the Newcomb-Trefz model. The creating and evaluating levels of the model are considered to require higher levels of cognitive thought (Newcomb & Trefz, 1987).

Pickford (1988) and Pickford and Newcomb (1989) examined the cognitive level of instruction and found that a majority of instruction was at lower levels of cognition. Whittington (1995) found that professors sought to teach at all levels of cognition, but much of the discourse was at lower levels of cognition. Whittington, Stup, Bish, and Allen (1997) examined the thinking opportunities provided by professors through cognitive discourse. A majority (80%) of the classroom discourse was found to be at the knowledge and comprehension levels of cognition. Whittington and Bowman (1994) assessed the cognitive level of instruction of faculty members in a
college of agriculture and found that instructors were mainly teaching at the remembering level of cognition. However, many of the instructors aspired to teach at both lower and higher levels of cognition. Therefore, professors must examine what is occurring in their classrooms (Whittington, 2003), if they are to meet the increasing demands for providing a quality undergraduate education and improve their teaching (Boyer, 1990).

**Conceptual Framework for Cognition Research**

Piaget (1970) theorized that teachers can have little impact on the maturation influence of student cognitive development, but that teachers can provide exploration, observation, testing, and information organization, all of which are likely to alter thinking processes. In addition, teachers, it is theorized, can impact the social transmission influence, learning from others, depending on the stage of cognitive development the student has reached (Whittington, Foster, Falk, Beck, & Bookman, 2009). Consequently, if instructors use methods, techniques, and strategies that engage students at higher cognitive levels, students are more likely to embrace the content at a deeper level, leading them to retain the content longer, and to transfer the content to other scenarios across the life span.

An on-going line of inquiry was designed to study instructor, student, and learning environment variables that explain student cognition during class sessions (Whittington, et al, 2009). Whittington, et al., along with Beck (2009), described the levels of cognition at which a high school agriculture delivered content, and the cognitive level at which students retained content. The current study is designed to
consider the affective domain of the instructor (see Figure 2.1); the attitude and the aspiration of the instructor could effect his/her awareness of the learning environment as lessons are planned and taught. In addition, the content delivery, including discourse, contributes to the students’ engagement or lack of engagement during class sessions. In Figure 2.1, the conceptual framework guiding the study is illustrated.

Figure 2.1: Conceptual Framework for Studying Cognitive Levels of Teaching and Learning.
Summary

“Two of the most important educational goals are to promote retention and to promote transfer (which, when it occurs, indicates meaningful learning),” (Mayer, 2002, p. 226). Educators, however, are unclear about how to achieve these educational goals, in every child. Based on the research discussed, students who were taught by instructors who used higher cognitive techniques, have the potential for higher achievement. Repetition of the content to be learned increased student retention of knowledge.

Edwards (2004) recommended that research be conducted to evaluate how agricultural education might best serve students in enhancing science, mathematics, reading skills, and knowledge. Cano (1990) suggested that research should investigate the relationship between the level of cognition of instruction and student performance in agricultural education. Myers and Dyer (2006) recommended that further research goals should include finding the effect of teaching methods on student attitude and long-term and short-term content knowledge retention.
CHAPTER 3

METHODS

Problem Setting

The purpose of this study was to describe the instructor’s cognitive level of discourse, the instructor’s attitude toward teaching at higher cognitive levels, and the instructor’s aspiration to teach at higher cognitive levels, during an animal science unit of instruction. The researchers also sought to describe student immediate, short-term, and long-term cognitive retention of class session content. Therefore, the researchers contacted a current high school agricultural science teacher to be the potential subject, and requested his cooperation in the study via telephone. The subject verbally agreed to be videotaped, daily, during an approximate three-week animal science unit of instruction that he taught to his ninth grade agricultural science class of 12 students.

The class was taught March 27 through April 25 from 9:17 a.m. to 10:17 a.m., Monday through Friday at Cory Rawson High School. Cory-Rawson High School is a comprehensive high school in the rural community of Rawson, which is located in northwest Ohio with a population of 465.

The subject chose one twelfth grade student to set-up and take-down the digital video camera every day before and after the agricultural science class. The researchers
wrote a protocol for the teacher to read on the first day that the camera was placed in the classroom (see Appendix A) to explain to the students that the class would be recorded, but that it would have no effect on the class or their evaluation. Students’ identities were not important to the study, so the camera was set-up in the back of the classroom and not operated to focus on any specific student. The high school teacher assigned numbers to each student to help remove student identities from written materials.

The researchers discussed with the teacher, in detail, how to set up the camera as well as other details of the study. Attitude and aspiration toward higher cognitive levels of teaching instruments were also administered immediately following the three-week unit.

At the conclusion of the animal science unit of instruction, the teacher administered a paper and pencil unit exam. The researchers wrote a protocol for the teacher to read on the day that the test was given (see Appendix B). The teacher graded the exams and recorded the student grades by student number. The teacher handed the graded tests back to the students two days after they took the test. He announced the class average and then had each student read a test question and answer until all multiple choice and fill-in-the-blank questions were read. The teacher then asked specific students to read their answers to the short-answer questions, which he felt were exemplary answers. The teacher collected the tests, made copies of them, and handed the copies back to the students to keep.

To assess the students’ intermediate-term retention of the content during an animal science unit of instruction, on the last day of school, six weeks after the initial exam was taken, the test was administered again to the students. Prior to giving the test
the second time, the teacher announced that the students’ final exam would cover the animal science unit of instruction. The teacher stated that the students should study the notes, slides, and other information from the unit. After the students took the exams, they were graded by the same teacher with the same key, and the scores were again recorded by student number.

To assess the students’ long-term retention of the content during the animal science unit of instruction, the students took the final exam again after returning to school from summer vacation, three months after the first exam was administered. The teacher gave no forewarning that the students would be taking the test, but each student received five dollars as an incentive to take the test. The exams were again graded by the same teacher with the same key and scores were recorded by student number.

**Population and Sample**

The subject was a male agricultural science teacher, who had taught at Cory-Rawson High School for two years. Previous to his employment at Cory-Rawson High School, he was a student at The Ohio State University. He graduated with a Bachelor’s of Science Degree in Agriculture, majoring in Agricultural Education with a minor in Production Agriculture. He also spent one year at the university taking graduate classes in agricultural education.
Instrumentation

*FTCB Instrument*

*Reliability*

Pickford (1988) wrote that reliability of the FTCB was dependent upon the rater’s utilization of the instrument. In this study, the researchers rated the teacher by videotaping the classes, then using the FTCB to assess the teacher by observing the videotapes at a later date. The researcher received training from a co-investigator with extensive training in the use of the FTCB. Training involved an explanation of the instrument followed by practice evaluating a videotaped lesson. The trainer was present during the first practice rating to answer questions for the researchers. The Pearson Product-Moment Coefficient was calculated using the SPSS statistical program (Whittington, 1991).

*Validity*

The FTCB is based upon Bloom’s Taxonomy (1956). Therefore, it is argued that the FTCB is content valid given that Bloom’s Taxonomy is generally supported as a way to identify behaviors of teachers and students at various levels of cognition (Miller, 1989).

Collection of FTCB Instrument

*Cognitive Level of Teacher Discourse*

By watching a videotaped class session and completing the Florida Taxonomy of Cognitive Behavior (Webb, 1970), the researcher determined the cognitive level of teacher discourse. The researcher used six-minute observation intervals as set by the
FTCB guidelines. A checkmark was made in the appropriate box when behaviors were heard or observed during each six-minute time period to categorize the observed instructor behavior (see Appendix C). Each category was checked only once for each six-minute observation period, even if the behavior was observed more than once during the time period. Any behavior observed, which represented more than one category, was given a checkmark for all categories that applied.

The cognitive level of teacher discourse was calculated using the process employed by Pickford (1988). A weighting system was implemented to give items written at higher levels of cognition more weight due to the cognitive level of processing required to perform the task. The weighting factors were developed by two researchers (Newcomb & Trefz, 1987) who possessed expertise in the area of cognitive levels of teaching and learning. The weighting factors are consistent with the general support given to the hierarchical nature of Bloom’s Taxonomy (1956). The cognitive weighting factors used for instructor discourse in the study are displayed in Table 3.1.
<table>
<thead>
<tr>
<th>Level of Cognition</th>
<th>Weighting Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>.10</td>
</tr>
<tr>
<td>Translation</td>
<td>.20</td>
</tr>
<tr>
<td>Interpretation</td>
<td>.25</td>
</tr>
<tr>
<td>Application</td>
<td>.30</td>
</tr>
<tr>
<td>Analysis</td>
<td>.40</td>
</tr>
<tr>
<td>Synthesis</td>
<td>.50</td>
</tr>
<tr>
<td>Evaluation</td>
<td>.50</td>
</tr>
</tbody>
</table>

Note: Bloom et al. (1956), Newcomb & Trefz (1987), Pickford (1988).

Table 3.1: Cognitive Assessment of Instructor Discourse

During each class session, the total number of cognitive behaviors that the instructor displayed was recorded using the FTCB. The total number of observations was summed to give an overall frequency at each cognitive level for the teacher. A percentage of teaching behaviors was then determined for each cognitive level of teacher discourse. The cognitive weighting factor for each level of cognition was then multiplied by the percentage for each level of cognition to yield a cognitive weighted score for teacher discourse at each level of cognition. The cognitive weighted scores for teacher discourse at each level of cognition were then summed to yield a total cognitive weighted score for teacher discourse during each class session.

Analysis of FTCB Instrument

Using the Florida Taxonomy of Cognitive Behavior (FTCB), a research assistant watched video recordings of all 18 days of the unit of instruction. In using the FTCB,
the researcher used six-minute observation periods. Each time a cognitive behavior was observed it was categorized by making a check mark in the appropriate box for the given time period. If the observed behavior represented more than one category, all categories that were involved were checked. In any given observation period, each category was checked only once, even if more than one observation of that cognitive behavior had been observed.

Responses were entered into the computer at the end of the collection period. For each variable in the study, measures of central tendency and frequency distributions were generated and then used to describe the sample in the study.

Cognitive level of discourse was calculated using the process employed by Pickford (1988). For each class observation, a calculation was made of the total number of times that cognitive behaviors occurred during each observation period for each of the 55 categories within the seven levels of the FTCB (see Appendix C). Percentages for each level were calculated for each class observation by dividing the frequencies at each level by the total number of frequencies (Whittington, 1991).

Attitude Instrument

*Development of Attitude Instrument*

The teacher’s attitude toward teaching at higher cognitive levels was measured using a six-point Likert-type scale developed by Whittington (1991), found in Appendix D. Seventy-four items were written for initial review of the questionnaire, and 32 items were deleted after further review. The new 45-item instrument was presented to a panel of experts to assess face and content validity. Five items were added. Therefore, the 50-item questionnaire was used in this research.
Reliability

Reliability was established using a pilot test of 25 faculty members (Whittington, 1991). After two mailings, 17 professors had not returned their instruments for a 68% return rate (Whittington, 1991).

The data were analyzed using SPSS/PC+. Cronbach’s alpha was selected as the reliability measure since this instrument was a summated scale which required a test for internal consistency. Kuder-Richardson 21 was another choice but was not selected because it does not generate a correlation matrix for reliability of each item. Negative items were reverse scored (Whittington, 1991).

Cronbach’s alpha for the 50-item questionnaire was established at $r = .83$. There were no out-lying coefficients in the item analysis; the lowest coefficient was $r = .81$ and the highest was $r = .84$. Thus, the questionnaire presented to the instructors for the study contained 50 items and a Cronbach’s alpha of $r = .83$ (Whittington, 1991).

Validity

Dr. L.H. Newcomb, Dr. Marilyn Trefz, and Dr. Charles Miller served as the panel of experts to validate the instrument. These researchers had previously studied levels of cognition at The Ohio State University. They were asked to examine the instrument for content validity and item clarity. The instrument was thoroughly examined (Whittington, 1991).

Collection of Attitude Instrument

The Likert scale ratings were summed to yield a score which represented the attitude toward teaching at higher cognitive levels. Since there were 50 items in the questionnaire, the lowest possible score, if all items were completed was 50. The
highest possible score if all items were completed was 300. The score was then correlated with other variables in the study. Sixteen items were stated negatively and thus were reverse scored (Whittington, 1991).

Aspiration Instrument

Development of Aspiration Instrument

An instrument was designed by the researcher to collect data regarding the extent to which instructorss aspire to teach at higher cognitive levels. The researcher, based on previous research (Newcomb and Trefz, 1987; Pickford, 1988; Miller, 1999) determined the information that needed to be collected. For example, Pickford (1988), and Miller (1989), had studied student variables extensively, but had not concentrated on instructor variables. It seemed appropriate at this point in the programmatic study of levels of cognition to examine thoroughly the instructor variables; one variable was “aspire to teach at higher cognitive levels.”

The participant was asked to express the cognitive level of instruction to which he aspired for his course. Thus, the instrument designed for gathering the necessary data required the participant to record, in percentages of 100, the level to which he aspired to speak, write test items, quizzes, and assignments, cumulatively across the unit of instruction (Whittington, 1991).

Reliability

Since this instrument was a self-report type scale, where each item measured a variable “percentage at each level”, a test/retest procedure was utilized to determine reliability of the instrument. The researcher was not attempting to find internal consistency; therefore no alphas were calculated (Whittington and Newcomb, 1993).
The subject of this research was asked to place one to ten chips on a poster board drawn into quadrants, labeled remembering, processing, creating, and evaluating: the four levels of cognition in the Newcomb-Trefz model used in this study. The cognitive level at which they hoped to speak, write test items, quizzes, and assignments was then recorded as a percentage of one hundred. See Appendix E for the instrument and the materials designed to measure aspired level of instruction. Seven days later, the teacher was retested using the same instrument. No significant differences were found between the two collection points (Whittington, 1991).

Validity

Dr. L.H. Newcomb and Dr. Charles Miller were two of the experts who served on the panel of experts to establish face and content validity of the instrument. Three researchers, who had previously studied levels of cognition, examined the instrument. The other member of the panel was Dr. Emmalou Norland, an expert in instrumentation. The panel of experts concluded that the instrument and method would yield a valid measure of aspired cognitive level of instruction (Whittington, 1991).

Collection of Aspiration Instrument

The cognitive level to which instructors aspired to teach was determined through personal interviews between the researcher and the participant. The data collection was preceded by a review of Bloom’s (1956) levels of cognition. The teacher was also introduced to the Newcomb-Trefz model since this model represents Bloom’s Taxonomy in a manner that is easy to interpret.
The development of The Aspiration Instrument included using The Newcomb-Trefz Model, which describes cognitive behavior. The Newcomb-Trefz Model uses four major categories (remembering, processing, creating, and evaluating) rather than the six categories of Bloom’s Taxonomy or the seven categories of the FTCB. The major difference is that in the Newcomb-Trefz model, translation, interpretation, application, and analysis are combined into “processing” (Pickford, 1988). Table 3.2 visually portrays a comparison of the three models, which assisted the researchers in development and selection of The Aspiration Instrument.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>Knowledge</td>
<td>Remembering</td>
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<tr>
<td>Comprehension</td>
<td>Translation</td>
<td>Processing</td>
</tr>
<tr>
<td></td>
<td>Interpretation</td>
<td></td>
</tr>
<tr>
<td>Application</td>
<td>Application</td>
<td></td>
</tr>
<tr>
<td>Analysis</td>
<td>Analysis</td>
<td></td>
</tr>
<tr>
<td>Synthesis</td>
<td>Synthesis</td>
<td>Creating</td>
</tr>
<tr>
<td>Evaluation</td>
<td>Evaluation</td>
<td>Evaluating</td>
</tr>
</tbody>
</table>


Table 3.2: A Comparison of Bloom’s Taxonomy, the Florida Taxonomy of Cognitive Behavior, and the Newcomb-Trefz Model.
An explanation of the levels of cognition, and the models used to portray the levels, was necessary to establish a common framework for the participant in the study and for the researchers. Following a brief explanation of the models involved in classifying the cognitive levels of instruction, the teacher was asked to report the cognitive level to which he aspired to teach.

The participant did this by placing one to ten chips in one of four quadrants labeled remembering, processing, creating, and evaluating. The process was repeated for discourse, written test items, quizzes, and assignments. Using the instrument “Aspired Cognitive Level of Instruction” developed by Whittington (1991), the researcher recorded the number of chips on each quadrant as a percentage. These data were collected prior to the teacher beginning the unit of instruction.

Analysis of Aspiration Instrument

The aspired cognitive level of teaching was analyzed in four categories, including discourse, written test items, quizzes, and assignments. Each category was examined at four levels of cognition: remembering, processing, creating, and evaluating (Whittington, 1991).

Unit Exam Instrument

Development of Unit Exam Instrument

The researcher requested that the teacher in this study develop and use a test that would have been used had they not been part of this study. The five-page test, see Appendix F, included 31 questions, for a total of 90 possible points. The first section included 10 matching questions, worth two points each. The second section was
identification, having 12 total items, worth two points each. These first two sections provided word banks. Section three had five questions requiring short-answer responses, worth six points each. The final section was multiple-choice, providing four probable options for each of the four questions. Each multiple-choice question was worth four points.

Analysis of Unit Exam Instrument

Tests, quizzes, and assignments were analyzed using a process developed by Pickford (1988). For tests, quizzes, and assignments, separately, the total number of items at each level was divided by the total number of items to obtain a percentage of items at each level of cognition. The unit exam became cognitively weighted tests #1, #2, and #3, each with a total point value of 1080.

Summary

This study was conducted during March 2008 to describe a high school agriculture instructor’s cognitive level of discourse, the instructor’s attitude toward teaching at higher cognitive levels, and his aspiration to teach at higher cognitive levels during an animal science unit of instruction. The researchers also sought to describe student immediate, short-term, and long-term cognitive retention of class session content.

The researchers worked with one teacher in a rural high school. The instructor spent 18 one-hour class sessions teaching an animal science unit. Each of the 18 class sessions was videotaped. Teacher attitude toward teaching at higher cognitive levels was assessed with the Attitude Instrument; teacher aspiration was assessed with the
Aspiration Instrument; and teacher discourse was collected using the FTCB Instrument. Additionally, the fourth instrument used in this research was to collect student knowledge of content. The 12 students took a final unit exam immediately after the unit was taught, 42 days after the unit was taught, and 182 days after the unit was taught. The student cognitive retention scores were developed from multiplying the final unit exam score by a cognitive weighting scale (Pickford & Newcomb, 1989).
CHAPTER 4
RESULTS

Objectives

The objectives guiding this descriptive study were:

1. To describe the cognitive level of discourse of a high school teacher during an animal science unit of instruction.
2. To describe the attitude of a high school teacher toward teaching at higher cognitive levels during an animal science unit of instruction.
3. To describe the aspiration of a high school teacher for teaching at higher cognitive levels during an animal science unit of instruction.
4. To describe student immediate, short-term, and long-term retention of content following an animal science unit of instruction.
5. To describe student immediate, short-term, and long-term cognitive retention following an animal science unit of instruction.

Describing the Cognitive Level of Discourse

The cognitive level of discourse, over the 18 days of the animal science unit of instruction, was assessed using the Florida Taxonomy of Cognitive Behavior (FTCB).

Results from the FTCB are located in Table 4.1.
<table>
<thead>
<tr>
<th>Class Sessions</th>
<th>Knowledge</th>
<th>Comprehension</th>
<th>Application</th>
<th>Analysis</th>
<th>Synthesis</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
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<td>5.9</td>
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<td>16.2</td>
<td>2.6</td>
</tr>
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<td>28.1</td>
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<td>7.7</td>
<td>26.6</td>
<td>14.6</td>
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<td>7.9</td>
</tr>
<tr>
<td>7</td>
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<td>19.0</td>
<td>6.2</td>
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<td>23.9</td>
<td>16.2</td>
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<td>19.9</td>
<td>20.2</td>
<td>3.2</td>
</tr>
<tr>
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</tr>
<tr>
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<td>8.2</td>
<td>20.0</td>
<td>18.0</td>
<td>3.2</td>
</tr>
<tr>
<td>14</td>
<td>26.1</td>
<td>18.5</td>
<td>7.8</td>
<td>22.5</td>
<td>20.4</td>
<td>4.7</td>
</tr>
<tr>
<td>15</td>
<td>25.6</td>
<td>20.3</td>
<td>8.3</td>
<td>28.1</td>
<td>15.8</td>
<td>1.9</td>
</tr>
<tr>
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<td>29.7</td>
<td>24.1</td>
<td>8.1</td>
<td>21.2</td>
<td>12.7</td>
<td>4.1</td>
</tr>
<tr>
<td>17</td>
<td>27.0</td>
<td>19.9</td>
<td>9.6</td>
<td>18.9</td>
<td>17.8</td>
<td>6.8</td>
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<tr>
<td>Mean</td>
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<td>20.34</td>
<td>7.71</td>
<td>22.58</td>
<td>16.43</td>
<td>4.74</td>
</tr>
</tbody>
</table>

Table 4.1 Percent Cognitive Level of Teacher Discourse as Measured using the Florida Taxonomy of Cognitive Behavior by Class Session

As can be seen in Table 4.1, on the first day of the unit, the instructor taught one fourth of the time at each of the knowledge, comprehension and analysis levels of Bloom’s Taxonomy. The instructor taught nearly one-fourth to one-third of the class sessions at the knowledge day, nearly every day except the last day of the unit of instruction. The range for evaluation level of instruction was 2.9 on the first day of the unit, and 7.9 on the sixth day of the unit. The instructor taught no content at the
application level of the last day of the unit. During the 18 days of the animal science unit, the teacher taught at the two lowest forms of cognition 46.93% of the time.

Describing Teacher Attitude Toward Teaching at Higher Cognitive Levels

The attitude score for the teacher in this study was 253 points out of a possible 300 if all items on the instrument were completed. The attitude score was calculated by summing the product of the teacher’s level of agreement with items on the Likert scale, with the frequency of his responses. The teacher selected ‘slightly disagree’ three times; chose ‘slightly agree’ eight times; chose ‘moderately agree’ 23 times; and chose ‘strongly agree’ 16 times. Therefore, according to The Attitude Instrument, the teacher moderately agreed with statements that indicated a more positive attitude toward teaching at higher cognitive levels.

Describing Teacher Aspiration Toward Teaching at Higher Cognitive Levels

The level of cognition to which the teacher aspired to teach was collected using four aspects of instruction: In-class discourse, written test items, quizzes, and assignments. Measures were collected by cognitive levels of remembering, processing, creating and evaluating (Newcomb & Trefz, 1987). The data are presented in Table 4.2. As can be seen in Table 4.2, the instructor aspired to write tests that primarily assessed learning at the processing level of cognition. The instructor wanted his quizzes to assess learning, 60% of the time, at the remembering level, while the instructor indicated that no quiz items would be written at the application level. The instructor aspired to design assignments that were collectively written at higher levels since one-third each would
be processing, creating, and evaluating. The instructor aspired for his discourse to be nearly two-thirds at the processing and creating levels during class sessions.

<table>
<thead>
<tr>
<th>A. Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. remembering</td>
</tr>
<tr>
<td>2. processing</td>
</tr>
<tr>
<td>3. creating</td>
</tr>
<tr>
<td>4. evaluating</td>
</tr>
<tr>
<td>5. Total</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B. Quizzes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. remembering</td>
</tr>
<tr>
<td>2. processing</td>
</tr>
<tr>
<td>3. creating</td>
</tr>
<tr>
<td>4. evaluating</td>
</tr>
<tr>
<td>5. Total</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C. Assignments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. remembering</td>
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<tr>
<td>2. processing</td>
</tr>
<tr>
<td>3. creating</td>
</tr>
<tr>
<td>4. evaluating</td>
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<tr>
<td>5. Total</td>
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</table>

<table>
<thead>
<tr>
<th>D. Discourse</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
<td>2. processing</td>
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<tr>
<td>3. creating</td>
</tr>
<tr>
<td>4. evaluating</td>
</tr>
<tr>
<td>5. Total</td>
</tr>
</tbody>
</table>

Table 4.2 Teacher Aspiration Toward Teaching at Higher Cognitive Levels
Describing Student Immediate, Short-Term, and Long-Term Cognitive Retention

Throughout Chapter 4, cognitively weighted test #1 represents student immediate cognitive retention. Student immediate cognitive retention was measured using the final unit exam score taken immediately after the unit was taught, multiplied by the cognitive weighted score of the exam. Cognitively weighted test #2 represents student short-term cognitive retention. Student short-term cognitive retention was measured using the final unit exam score taken 42 days after the unit was taught, multiplied by the cognitive weighting of the exam. Cognitively weighted test #3 represents student long-term cognitive retention. Student long-term cognitive retention was measured using the final unit exam score taken 182 days after the unit was taught, multiplied by the cognitive weighting of the exam.

Describing Student Immediate Cognitive Retention

The mean immediate cognitively weighted test score, out of 1080 points, was 807 points (sd = 114). The mean percent immediate cognitively weighted test score was 75% (sd = 11%). The median percent immediate cognitively weighted test score was 76%, and the mode was 75%. The minimum percent immediate cognitively weighted test score was 57%, and the maximum was 88%. These scores indicate that students scored 75% on their final unit exams immediately after the unit was taught. The range of scores was 57% to 88%.
**Describing Student Short-Term Cognitive Retention**

The mean short-term cognitively weighted test score, out of 1080 points, was 840 points (sd = 80). The mean percent short-term cognitively weighted test score was 78% (sd = 7%). The median percent short-term cognitively weighted test score was 80%, and the mode was 81%. The minimum percent short-term cognitively weighted test score was 63%, and the maximum was 88%. These scores indicate that students scored 78% on their final unit exams 42 days after the unit was taught. The range of scores was 63% to 88%.

**Describing Student Long-Term Cognitive Retention**

The mean long-term cognitively weighted test score, out of 1080 points, was 798 points (sd = 183). The mean percent long-term cognitively weighted test score was 74% (sd = 17%). The median percent long-term cognitively weighted test score was 73%, and the mode was 89%. The minimum percent long-term cognitively weighted test score was 47%, and the maximum was 97%. These scores indicate that students scored 74% on their final unit exams 182 days after the unit was taught. The range of scores was 47% to 97%.

**Describing Student Immediate, Short-Term, and Long-Term Cognitive Retention and Changes in Cognitive Retention**

The means of the cognitively weighted test scores, respectively, were 807 (sd = 114), 840 (sd = 80), and 798 (sd = 183) out of 1080 total points. The mean changes in
the cognitively weighted test scores, respectively, were 32 (sd = 183), -41 (sd = 75), and -9 (sd = 139).

<table>
<thead>
<tr>
<th>Student</th>
<th>Cognitively Weighted Test Score #1</th>
<th>Cognitively Weighted Test Score #2</th>
<th>Cognitively Weighted Test Score #3</th>
<th>Change in Cognitively Weighted Test Scores 1 &amp; 2</th>
<th>Change in Cognitively Weighted Test Scores 2 &amp; 3</th>
<th>Change in Cognitively Weighted Test Scores 1 &amp; 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>821</td>
<td>788</td>
<td>961</td>
<td>-32</td>
<td>173</td>
<td>140</td>
</tr>
<tr>
<td>2</td>
<td>810</td>
<td>875</td>
<td>821</td>
<td>65</td>
<td>-54</td>
<td>11</td>
</tr>
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<td>810</td>
<td>907</td>
<td>756</td>
<td>97</td>
<td>-151</td>
<td>-54</td>
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<td>32</td>
<td>97</td>
<td>130</td>
</tr>
<tr>
<td>7</td>
<td>929</td>
<td>875</td>
<td>929</td>
<td>-54</td>
<td>54</td>
<td>0</td>
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<td>8</td>
<td>950</td>
<td>864</td>
<td>1004</td>
<td>-86</td>
<td>140</td>
<td>54</td>
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<td>745</td>
<td>551</td>
<td>130</td>
<td>-194</td>
<td>-65</td>
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<td>10</td>
<td>853</td>
<td>842</td>
<td>670</td>
<td>-11</td>
<td>-173</td>
<td>-184</td>
</tr>
<tr>
<td>11</td>
<td>670</td>
<td>680</td>
<td>508</td>
<td>11</td>
<td>-173</td>
<td>-162</td>
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<td>734</td>
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<td>Mean</td>
<td>807</td>
<td>840</td>
<td>798</td>
<td>32</td>
<td>-41</td>
<td>-9</td>
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</tbody>
</table>

Table 4.3 Cognitively Weighted Test Scores and Changes in Cognitively Weighted Test Scores

In table 4.3, the raw cognitively weighted scores for each student, as well as the changes in points between the three tests are shown. As can be seen, Student 7 scored the highest on Cognitively Weighted Test #1, but did not score the highest on the follow-up tests. Student 9 scored the lowest on Cognitively Weighted Test #1, #2, and next to the lowest on #3. The highest change score was Student 5 between tests #2 and #3, while the lowest change was Student 7 with no change in scores between tests #1 and #3.
Table 4.4 Percentage of Change in Cognitively Weighted Test Scores

In Table 4.4, the percentage of change in cognitively weighted test scores, in percentages for each student are shown. The mean test scores, respectively, were 75% (sd = 11%), 78% (sd = 7%), and 74% (sd = 17%). The minimum percentages, respectively, were 57%, 63%, and 47%. The maximum percentages, respectively, were 88%, 88%, and 97%. The mean percentage of change between tests 1 and 2 was 3% (sd = 7%), tests 2 and 3 was -4% (sd = 13%), and tests 1 and 3 was -0.8% (sd = 9%). The minimum changes, respectively, were -8%, -20%, and -17%.

<table>
<thead>
<tr>
<th>Student</th>
<th>Cognitively Weighted Test Score #1 (%)</th>
<th>Cognitively Weighted Test Score #2 (%)</th>
<th>Cognitively Weighted Test Score #3 (%)</th>
<th>Change in Cognitively Weighted Test Scores 1 &amp; 2 (%)</th>
<th>Change in Cognitively Weighted Test Scores 2 &amp; 3 (%)</th>
<th>Change in Cognitively Weighted Test Scores 1 &amp; 3 (%)</th>
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<tbody>
<tr>
<td>1</td>
<td>76</td>
<td>73</td>
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<tr>
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<td>75</td>
<td>81</td>
<td>76</td>
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<tr>
<td>3</td>
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<td>84</td>
<td>70</td>
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<td>81</td>
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<td>8</td>
<td>88</td>
<td>80</td>
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<td>57</td>
<td>69</td>
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<td>71</td>
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<tr>
<td>Mean</td>
<td>75</td>
<td>78</td>
<td>74</td>
<td>3</td>
<td>-4</td>
<td>-0.8</td>
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</tbody>
</table>
In Table 4.5, central tendency statistics are shown for the cognitively weighted test scores, changes in cognitively weighted test scores, cognitively weighted test score percentages, and percentage change in cognitively weighted test scores. The mean test scores, out of 1080 total points, were 807 (sd = 114), 840 (sd = 80), and 798 (sd = 183), respectively. The mean test score changes, respectively, were 32 (sd = 75), -41 (sd = 139), and -9 (sd = 101). The mean percentage test scores were 75% (sd = 11%), 78% (sd = 7%), and 74% (sd = 17%). The percentage of change in the test scores, respectively, were 3% (sd = 7%), -4% (sd = 13%), and -0.8% (sd = 9%).

The median cognitively weighted test scores, out of 1080 points, were 815, 859, and 788, respectively. The median changes in cognitively weighted test scores, respectively, were 22, -43, and 5. The median cognitively weighted test score percentages, respectively, were 76%, 80%, and 73%. The median changes in percent cognitively weighted test scores were 2%, -4%, and 1%, respectively.

The mode cognitively weighted test scores, out of 1080 total points, were 810, 875, and 961, respectively. The mode changes in cognitively weighted test scores, respectively, were 65, -173, and -54. The mode percent cognitively weighted test scores, respectively, were 75%, 81%, and 89%. The percent changes in the cognitively weighted test scores, respectively, were 6%, -16%, and -5%.

The minimum cognitively weighted test scores, out of 1080 total points, were 616, 680, and 508, respectively. The maximum of the cognitively weighted test scores, respectively, were 950, 950, and 1048. The minimum changes in cognitively weighted test scores, respectively, were -86, -216, and -184. The maximum changes, respectively, were 162, 173, and 140. The minimum percent cognitively weighted test scores,
respectively, were 57%, 63%, and 47%. The maximum percent test scores, respectively, were 88%, 88%, and 97%. The minimum percent changes in the cognitively weighted test scores, respectively, were -8%, -20%, and -17%. The maximum percent changes in test scores, respectively, were 15%, 16%, and 13%.

<table>
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<th>Student</th>
<th>Mean</th>
<th>Median</th>
<th>Mode</th>
<th>Standard Deviation</th>
<th>Minimum</th>
<th>Maximum</th>
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<td>810</td>
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<td>680</td>
<td>950</td>
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<td>788</td>
<td>961</td>
<td>183</td>
<td>508</td>
<td>1048</td>
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<td>Change in Cognitively Weighted Test Scores 1 &amp; 2</td>
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<td>22</td>
<td>65</td>
<td>75</td>
<td>-86</td>
<td>162</td>
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<td>Change in Cognitively Weighted Test Scores 2 &amp; 3</td>
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<td>-43</td>
<td>-173</td>
<td>139</td>
<td>-216</td>
<td>173</td>
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<td>Change in Cognitively Weighted Test Scores 1 &amp; 3</td>
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<td>-54</td>
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<td>75</td>
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<tr>
<td>Cognitively Weighted Test Score #2 (%)</td>
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<td>81</td>
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<td>63</td>
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</tr>
<tr>
<td>Cognitively Weighted Test Score #3 (%)</td>
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<td>73</td>
<td>89</td>
<td>17</td>
<td>47</td>
<td>97</td>
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<tr>
<td>Change in Cognitively Weighted Test Scores 1 &amp; 2 (%)</td>
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<td>6</td>
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<td>-16</td>
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<td>-20</td>
<td>16</td>
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<tr>
<td>Change in Cognitively Weighted Test Scores 1 &amp; 3 (%)</td>
<td>-0.8</td>
<td>1</td>
<td>-5</td>
<td>9</td>
<td>-17</td>
<td>13</td>
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</table>

Table 4.5 Central Tendency Statistics for Cognitively Weighted Tests
CHAPTER 5

CONCLUSIONS

Previous researchers recommended that teachers create learning situations that teach students at higher levels of cognition (Cano & Newcomb, 1990). In addition, Myers and Dyer (2006) recommended that further research be conducted on the effect of teaching methods to student attitude and long-term and short-term content knowledge retention. The purpose of this study was to describe the instructor’s cognitive level of discourse, and attitude toward teaching at higher cognitive levels, and aspiration to teach at higher cognitive levels, during an animal science unit of instruction, and to describe student cognitive retention of content during a secondary animal science unit of instruction. The observational case study was descriptive in nature.

The objectives guiding this descriptive study were:

1. To describe the cognitive level of discourse of a high school teacher during an animal science unit of instruction.
2. To describe the attitude of a high school teacher toward teaching at higher cognitive levels during an animal science unit of instruction.
3. To describe the aspiration of a high school teacher for teaching at higher cognitive levels during an animal science unit of instruction.
4. To describe student immediate, short-term, and long-term retention of content following an animal science unit of instruction.
5. To describe student immediate, short-term, and long-term cognitive retention following an animal science unit of instruction.

The researcher worked with one teacher in a rural high school. The teacher spent 18 one-hour class sessions teaching an animal science unit to the Agricultural Science I class. Each of the 18 class sessions was videotaped. The researcher then watched the videotapes and documented the frequency of classroom discourse spent at different levels of cognition. The teacher’s attitude and aspiration to teach at higher levels of cognition during an animal science unit of instruction were collected using the Attitude Instrument and the Aspiration Instrument. Additionally, the students took a final unit exam immediately after the unit was taught, 42 days after the unit was taught, and 182 days after the unit was taught.

Conclusions Related to Describing the Cognitive Level of Discourse of a High School Teacher During an Animal Science Unit of Instruction

The teacher in this research taught a high school animal science unit of instruction at the lowest levels of cognition. The teacher spent the least amount of class time teaching at the levels of application and evaluation. From the beginning of the unit to the end of the unit, the teacher was relatively consistent in teaching the same percentage of time at the levels of Bloom’s Taxonomy.
Recommendations and Implementations Related to Describing the Cognitive Level of Discourse of a High School Teacher During an Animal Science Unit of Instruction

Teachers need instruction in implementation strategies for effective classroom discourse, and how to achieve cognitive variety in discourse across levels of Bloom’s Taxonomy. Teachers should identify the current level of discourse that is occurring in their classrooms and modify future discourse to compliment their desired learning outcomes.

Conclusions Related to Describing the Attitude of High School Teacher Toward Teaching at Higher Cognitive Levels During an Animal Science Unit of Instruction

The teacher in this study possessed an agreeable attitude toward teaching at higher cognitive levels.

Recommendations and Implementations Related to Describing the Attitude of High School Teacher Toward Teaching at Higher Cognitive Levels During an Animal Science Unit of Instruction

Teachers should engage in trainings that demonstrates teaching at higher levels of Bloom’s Taxonomy. It is also recommended that curriculum and teaching resources be designed to encourage student engagement that reaches the highest levels of cognition. Implementation of these practices should occur during teacher preparation at the university level. Professional development for current teachers should also be conducted to encourage and utilize appropriate curriculum development that stretches, purposefully, across the levels of student cognition.
Conclusions Related to Describing the Aspiration of High School Teacher Toward Teaching at Higher Cognitive Levels During an Animal Science Unit of Instruction

The teacher in this study aspired to teach across all levels of Bloom’s Taxonomy, and wanted to write assignments that challenged students at the higher levels of cognition, the highest percentage of time. The teacher aspired to use lower cognitive items to assess students when taking quizzes, as compared to using higher cognitive items when completing assignments. The teacher aspired to write tests at higher cognitive levels.

Recommendations Related to Describing the Aspiration of a High School Teacher Toward Teaching at Higher Cognitive Levels During an Animal Science Unit of Instruction

Teachers who aspire to teach across all levels of Bloom’s Taxonomy should identify where in their teaching practices they intend to have students engage at these levels of cognition. Further investigation should occur to reflect at which points during the unit of instruction the teacher hopes to have students reach different levels of cognition. More research should be conducted to see if teachers aspire to reach higher cognitive levels with their students and how many of those teachers actually push their students to those higher levels.
Conclusions Related to Student Immediate Cognitive Retention

Students were able to retain the majority of the content assessed by the final unit exam immediately following instruction. The final unit examination was written at the lowest levels of cognition.

Recommendations Related to Student Immediate Cognitive Retention

Teachers should teach content in the most appropriate way for students to learn the material at higher cognitive levels. Students learn according to the levels of cognition in which they are taught. For example, in Ewing and Whittington’s (2007) study, professor questions were mostly (43%) at the knowledge level of cognition, and 63% of the course objectives were written at the knowledge and comprehension levels of cognition. Sixty-two percent of student thoughts and questions pertaining to class content were at Bloom’s knowledge and comprehension levels of cognition (Ewing & Whittington). Teachers should also write their assessments to contain questions that require students to think at various levels of cognition.

Conclusions Related to Student Short-Term Cognitive Retention

Students were able to retain the majority of the content assessed by the final unit exam following instruction. The final unit examination was written at the lowest levels of cognition.
Recommendations Related to Student Short-Term Cognitive Retention

Teachers should teach content in the most appropriate way for students to learn the material at higher cognitive levels. For example, students correctly answered 64% of test questions at remembering, 55% at processing, 40% at creating, and 28% at evaluating levels of cognition in a study by Cano (1990). Cano found a significant relationship between the cognitive level of instruction and student cognitive performance in high school agricultural education students in this study. Teachers should also write their assessments to contain questions that require students to think at various levels of cognition.

Conclusions Related to Student Long-Term Cognitive Retention

Students were able to retain the majority of the content assessed by the final unit exam following instruction. The final unit examination was written at the lowest levels of cognition (Beck, 2009).

Recommendations Related to Student Long-Term Cognitive Retention

Torres and Cano (1995) advocated that teachers should teach at higher cognitive levels, forcing students to do more than simply restate learned facts. The researchers also stated that tests and assignments should be written at higher cognitive levels (Torres & Cano). In agreement with Torres and Cano, teachers should teach content in the most appropriate way for students to learn the material at higher cognitive levels.

Myers and Dyer (2006) found that student with less prior knowledge had higher content knowledge gain scores at the conclusion of instruction, and students with higher
science processing skill achievement prior to the instruction had higher content knowledge gain at the conclusion. Further research should be conducted to evaluate student achievement in relation to prior knowledge and skills. Teachers should also write their assessments to contain questions that require students to think at various levels of cognition. Additionally, retention tests should occur unannounced and the teacher should not further prepare students for the test. Studying for a retention test will not provide accurate retention scores.

**Conclusions Related to Changes in Test Scores**

The changes in scores from test #1 through #3 indicated that students better cognitively retained the information for the test taken 42 days after the unit of instruction, but retained less information cognitively 182 days after the unit was taught.

The maximum changes, respectively, were 15%, 16%, and 13%. The changes in scores indicated that students better cognitively retained the information for the test taken 42 days after the unit of instruction, but retained less information cognitively 182 days after the unit was taught. The loss of cognitive retention was 0.8%. The lowest and highest single student changes were between tests 1 and 2 (Beck, 2009).

**Discussion**

Teachers should teach at all levels of Bloom’s Taxonomy in the classroom to help develop deep understanding of content, and to increase content retention. The teacher in this study, most often, taught at the knowledge and comprehension levels of Bloom’s Taxonomy, but did not regularly reach the levels of synthesis and evaluation.
Teaching and assessing students at higher levels of Bloom’s Taxonomy more often may help students retain the content better, at higher levels of cognition, and for a longer amount of time.

Research suggests that when higher cognitive levels of teaching are used, students retain knowledge longer. In this study, the teacher primarily used lecture and discussion which are considered lower cognitive levels of teaching. The teacher also assessed the students primarily at the knowledge level on the final unit exam (Beck, 2009). The question is, therefore, if the final unit exam was written at higher cognitive levels, and the teacher taught at lower cognitive levels, would the student final unit exam scores have been lower? Research should be conducted to answer this question.

Based on the findings of this study, the students retained a majority of the animal science content over 182 days. There was a mean of -0.8% change in cognitive retention between the first unit exam taken and the third unit exam taken. The range of scores on final unit exam #3 was much wider than the range of scores on final unit exams #1 and #2. Research should be conducted to investigate the reason for this change in range of scores. A future study might include additional tests over a longer period of time.

A larger study should be conducted to collect information from more subjects, in more classrooms, in more communities (Beck, 2009). The study should include classes comprised of students with varying levels of previous knowledge of the subject matter; their previous knowledge should be documented. A unit of instruction could be uniform for teachers in the study to guide them to purposefully instruct students at various levels of cognition. Potentially, a quasi-experimental study could be designed where multiple
teachers teach the same content, teaching different percentages of Bloom’s Taxonomy, and final assessments could measure student retention at separate levels of Bloom’s Taxonomy. The researcher should write the final unit exam, to include questions at varying levels of cognition. The teachers should neither develop the test, nor prompt students to study before they take the additional tests. Finally, future research should examine how student variables contribute to student retention of content.

The final unit exam contained 29 questions written at the knowledge level (Pickford & Newcomb, 1989), and two questions written at the interpretation level (Pickford & Newcomb, 1989). In a future study, the researcher should write the final unit exam to contain questions at various cognitive levels.

Summary

While teachers have been aware of Bloom’s Taxonomy (1956) for over 50 years, some teachers need to purposefully use the different levels in the classroom for student learning. Knowledge and comprehension were the most used levels of Bloom’s Taxonomy in this study, even though the teacher aspired to teach across all levels of Bloom’s Taxonomy in all aspects of the learning environment. Teachers should focus on building upon the levels of cognition to better teach students, and then assess the students at all levels of Bloom’s Taxonomy.

Students were assessed at the knowledge level 87% of the time on the final unit exam, and at the interpretation level 13% of the time, creating an emphasis on low levels of student cognition. Primarily, students were only tested for memorization of facts, and not assessed for a thorough understanding of the content. Students retained
the content taught with little cognitive retention loss using this test format across the two re-tests. Teachers should focus on assessing students at varying levels of cognition to match the preparation of the students.

Further, teachers should continually assess student achievement and retention at various cognitive levels. New research should be conducted to evaluate time spent using teaching techniques in relation to student cognitive retention. A great contribution to teaching will be to understand how teaching at various levels of Bloom’s Taxonomy impacts student retention of content when students are assessed across all levels of cognition. A further contribution will be the extent of transfer of content knowledge given the cognitive levels in which it was originally delivered to the learners.
LIST OF REFERENCES


Ewing, J. C., & Whittington, M. S. (in press). Describing the cognitive level of professor discourse and student cognition in college of agriculture class sessions. Journal of Agricultural Education.


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APPENDIX A

CAMERA SET UP PROTOCOL
DIRECTIONS FOR CAMERA

A. Setting up the tripod
1. Unzip long black bag and remove tripod. Set the tripod on the ground with the head up.
2. Lift the lever to rotate the head up.
3. Unsnap all “c-snaps” at the bottom of the metal tubes (three total). They are color coded red.
4. Separate the legs, making sure that the tripod stays level and does not slip on the floor. It should be stable and placed securely in position.
5. Loosen knobs on each leg and lengthen the legs to approximately the same length. Tighten the knobs (total of six). The height should be around 4 ft. (Knobs: righty tightly, lefty loosely)
6. Level the tripod using the small green level bubble on the top of it.
7. Unzip the blue camera case and remove video camera.
8. When looking at the bottom of the camera, there is a black “plate” screwed to the bottom.
9. Slide the square bottom of the black plate on the bottom of the camera into the square that is on the top of the tripod from the back. Be sure that the plate is centered on top of the tripod and clicks into place.
10. Use the small lever on the right to tighten the camera to the head of the tripod. The camera should be secure on top of the tripod.

B. Setting up the Video Camera
1. Position the camera so that the lens end (with lens cap) is facing away from you. You should be looking at the back of the camera.
2. Remove the power supply from the camera case (in the small green tabbed compartment on the front of the camera bag).
3. Plug the cord from the camera into the power supply, and plug the electrical plug into an electrical outlet.
4. Remove the lens cap from the front (by pinching gently).
5. Turn the camera on by rotating the large knob forward to the green square. This knob is located on the left side of the camera. A red power light will turn on.
6. Open the DV tape slot by pushing forward on the “eject” button under the handle on top of the camera directly behind the large red button. This opens the tape slot. This is automatic, so do not force it open.
7. Place the specific day’s DV tape into the inside slot. Insert the tape green side down, spools to the inside.
8. Close the inside slot, then the outside slot gently.
9. Use the “W/T” button to zoom. This is on the front right side of the camera.
10. Position the camera and zoom out to view as much of the classroom as possible. The W/T button should not be used because the camera will always need to be as zoomed out as possible.
11. Turn the “view finder” switch on top to “far.”
12. Push the large red “Start/Stop” button on the top of the camera to begin recording. A red light will flash when the camera is recording. Be sure to begin recording 3 minutes before class starts, and leave it recording 3 minutes after the class ends.

13. Three minutes after class ends, push the “Start/Stop” button to stop recording.

D. Putting the Camera Away

1. Remove the DV tape by opening the tape slot and closing the inside and outside slots.

2. Place sticker with the day number written on it onto the tape after the tape is used. Be sure to return the DV tape to the correct case (the day on the tape and on the case should be the same).

2. Turn the knob on the left side of the camera to the OFF position.

3. Place lens cap back on the camera lens.

4. Unplug the power source from the camera.

5. Use the small lever on the right side of the head to loosen the camera.

6. Remove the camera from the tripod by holding the red button on the left side of the head.

7. Put the camera away. Be sure to wrap up the battery cord neatly.

8. Put the tripod away.

E. Daily Tape Routine

1. Choose any unrecorded tape to use for each day.

2. There are enough tapes for each day, so use a different tape each day.

3. Begin recording about 1 minute before class.

4. After class, write on the cassette:
   
   Day (number 1-15)
   
   Date (ex. 3-17-08)

5. Write this info on the spine and face of the case, and on the sticker.

6. Be sure to put the sticker on the cassette so it won’t be used again.

7. Slide the green square, on cassette, to SAVE.
APPENDIX B

FIRST DAY PROTOCOL
“As you might have noticed, there is a video camera set up in the back of the classroom. It will be here for the next month or so because I have agreed to let The Ohio State University videotape me teaching your class. This will in no way affect you, your grades, or the way that I will teach.”
APPENDIX C

THE FLORIDA TAXONOMY OF COGNITIVE BEHAVIOR
The Florida Taxonomy of Cognitive Behavior

1.1 Knowledge of specifics

1. Reads
2. Spells
3. Identifies something by name
4. Defines meaning of term
5. Gives a specific fact
6. Tells about an event

1.2 Knowledge of ways and means of dealing with specifics

7. Recognizes symbol
8. Cites a rule
9. Gives chronological sequence
10. Gives steps of process, describes method
11. Cites trend
12. Names classification system or standard
13. Names what fits given system or standard

1.3 Knowledge of universals and abstracts

14. States generalized concept or idea
15. States a principle, law, theory
16. Tells about organization or structure
17. Recalls name of principle, law, theory

2.0 Translation

18. Restate in own words or briefer terms
19. Gives concrete examples of an abstract idea
20. Verbalizes from a graphic representation
21. Translates verbalization into graphic form
22. Translates figurative statements into literal statements or vice versa
23. Translates foreign language to English or vice versa
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<tr>
<td>4.0 <strong>Application</strong></td>
<td>30. Applies previous learning to new situations</td>
<td>31. Applies principle to new situation</td>
<td>32. Applies abstract knowledge in a practical situation</td>
<td>33. Identifies, selects and carries out process</td>
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<tr>
<td>5.0 <strong>Analysis</strong></td>
<td>34. Distinguishes fact from opinion</td>
<td>35. Distinguishes fact from hypothesis</td>
<td>36. Distinguishes conclusion from statements which support it</td>
<td>37. Points out unstated assumption</td>
<td>38. Shows interaction or relation of elements</td>
<td>39. Points out particulars to justify conclusions</td>
<td>40. Checks hypotheses with given information</td>
<td>41. Distinguishes relevant from irrelevant statements</td>
<td>42.Detects error in thinking</td>
</tr>
</tbody>
</table>
6.0 Synthesis (Creativity)

45. Reorganizes ideas, materials, processes
46. Produces unique communication, divergent idea
47. Produces a plan, proposed set of operations
48. Designs an apparatus
49. Designs a structure
50. Devises a scheme for classifying information
51. Formulates hypotheses, intelligent guesses
52. Makes deductions from abstract symbols, propositions
53. Draws inductive generalization from specifics

7.0 Evaluation

54. Evaluates something from evidence
55. Evaluates something from criteria

APPENDIX D

ATTITUDE INSTRUMENT
Teacher’s Attitude Toward Teaching at Higher Cognitive Levels

Agricultural and Extension Education
The Ohio State University
2120 Fyffe Rd.
Suite 203 Agricultural Administration Building
Columbus, OH 43210

Code:_____
**Part I**

**Directions:** For each of the following items, please indicate the degree to which you agree or disagree with each statement by circling one of the numbers following each statement.

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Moderately Disagree</th>
<th>Slightly Disagree</th>
<th>Slightly Agree</th>
<th>Moderately Agree</th>
<th>Strongly Agree</th>
</tr>
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<tbody>
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</table>

1. It would take more time than it is worth to increase my cognitive level of teaching.
   - 1  2  3  4  5  6

2. I enjoy opportunities for increasing my cognitive level of teaching.
   - 1  2  3  4  5  6

3. I want to teach in a way that allows students to see higher levels thinking exhibited.
   - 1  2  3  4  5  6

4. I would like to know more about teaching at higher cognitive levels.
   - 1  2  3  4  5  6

5. Teaching at the higher cognitive levels requires too much advanced preparation.
   - 1  2  3  4  5  6

6. Teachers need to encourage students to practice higher level thinking.
   - 1  2  3  4  5  6

7. Students can get the knowledge they need from high school by memorizing.
   - 1  2  3  4  5  6

8. Freshman level classes cannot be taught at higher levels of cognition.
   - 1  2  3  4  5  6

9. It is important for teachers to assist students in developing higher level thinking skills.
   - 1  2  3  4  5  6

10. Higher level teaching is critical to the permanent learning of students.
    - 1  2  3  4  5  6

11. I am frustrated about teaching at higher cognitive levels.
    - 1  2  3  4  5  6

12. I am excited about teaching at higher levels of cognition.
    - 1  2  3  4  5  6
<table>
<thead>
<tr>
<th>Strongly Disagree</th>
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<th>Slightly Disagree</th>
<th>Slightly Agree</th>
<th>Moderately Agree</th>
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<td>3</td>
<td>4</td>
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<td>6</td>
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</tbody>
</table>

13. Quality of students at the undergraduate level allows for higher cognitive level teaching.  
1 2 3 4 5 6

14. Teachers present too much material at the evaluating level.  
1 2 3 4 5 6

15. I want to teach at higher cognitive levels.  
1 2 3 4 5 6

16. Teachers’ objectives should be written to challenge students at higher cognitive levels.  
1 2 3 4 5 6

17. I am willing to devote more time, if needed, to grade assignments written at higher cognitive levels.  
1 2 3 4 5 6

18. I intend to substantially revise my current cognitive level of teaching.  
1 2 3 4 5 6

19. My subject matter does not lend itself to higher level teaching.  
1 2 3 4 5 6

20. Teachers encourage too much remembering.  
1 2 3 4 5 6

21. The nature of lower level courses does not require higher cognitive level teaching.  
1 2 3 4 5 6

22. Students will operate at the cognitive level at which I expect them to operate.  
1 2 3 4 5 6

23. Large classes do not lend themselves to methods which reflect higher cognitive level teaching.  
1 2 3 4 5 6

24. Modeling higher level thinking in class will not influence students to think at higher levels.  
1 2 3 4 5 6

25. Students are willing to do more than memorize.  
1 2 3 4 5 6
<table>
<thead>
<tr>
<th>Strongly Disagree</th>
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<th>Slightly Disagree</th>
<th>Slightly Agree</th>
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</tbody>
</table>

26. It is the responsibility of the student to take information from class and use it at higher cognitive levels. 

27. I am willing to spend more time on certain topics to teach them at higher cognitive levels. 

28. It is important for students to be able to process information. 

29. Students should be given more opportunities to exercise creativity. 

30. Teachers do not have the extra time needed to teach across the levels of cognition. 

31. Students, in my courses, generally are not mentally ready to be challenged at higher cognitive levels. 

32. Any subject matter can be taught at higher cognitive levels. 

33. Getting students to evaluate is an important goal of higher cognitive level teaching. 

34. Students will develop more life-long learning skills if they are taught to create and evaluate. 

35. I try to teach students to develop new ideas, products, or processes. 

36. I want to teach across the levels of cognition. 

37. Skills in evaluating will prove to be valuable to students.
<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Moderately Disagree</th>
<th>Slightly Disagree</th>
<th>Slightly Agree</th>
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<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

38. I look forward to the challenge of narrowing the discrepancies between my desired and actual teaching scores. 1 2 3 4 5 6

39. Students in my course deserve to be challenged at higher cognitive levels. 1 2 3 4 5 6

40. I try to teach students to process the information that I present. 1 2 3 4 5 6

41. I receive recognition by my co-workers for accomplishing higher cognitive level teaching. 1 2 3 4 5 6

42. The cognitive level at which I teach is adequate. 1 2 3 4 5 6

43. I could teach at higher levels of cognition, but choose not to teach at higher levels of cognition. 1 2 3 4 5 6

44. As I teach at higher cognitive levels, I expect to see students operating at higher cognitive levels. 1 2 3 4 5 6

45. The higher the level of the course, the higher the cognitive level at which the course should be taught. 1 2 3 4 5 6

46. I try to teach students to evaluate. 1 2 3 4 5 6

47. I would need help in order to teach at higher levels of cognition. 1 2 3 4 5 6

48. I have to be patient to nurture higher level thinking among students. 1 2 3 4 5 6

49. Students complain too much when they are taught at higher levels of cognition. 1 2 3 4 5 6

50. I teach students to separate fact from opinion. 1 2 3 4 5 6
PART II: DEMOGRAPHICS AND CLASS INFORMATION

DIRECTIONS: The following questions are to help us better understand you and your class. Please answer them to the best of you knowledge.

Circle or fill in the blank with the appropriate answer.

51. What is your current age? ______

52. What is your gender?  
   a. Female  
   b. Male

53. What is your level of education?  
   a. Bachelors  
   b. Masters  
   c. Specialist  
   d. Doctoral

54. At which institution(s) did you receive your teaching training?

55. Including this year, how many years have you been teaching? ______

56. List the academic areas you are certified to teach. ________________________________

57. What is the number of students in the observed class?  
   Female: _______  
   Male: _______

58. How many students of each grade level were in the observed class?  
   Freshman: _______  
   Sophomore: _______  
   Junior: _______  
   Senior: _______

59. What is the number of students with Individualized Educational Plans in the observed class? _______
Thank you for your assistance and participation!

Please return to:

Jeremy Falk
Agricultural and Extension Education
The Ohio State University
2120 Fyffe Rd.
Suite 203 Agricultural Administration Building
Columbus, OH 43210
E-mail: falk.26@osu.edu
Aspired Cognitive Level of Instruction
This questionnaire encourages you to determine the cognitive level at which you aspire to teach. Please indicate in the spaces provided, the percentage at each level of cognition at which you aspire to teach.
Using the handouts that were just reviewed, think about your tests, quizzes, assignments, and verbal instruction, then indicate in the spaces provided the percentage of your teaching which you aspire to occur at each of the levels of cognition. Each total must sum to 100%.

A. Tests
6. remembering _____
7. processing _____
8. creating _____
9. evaluating _____
10. Total 100%

B. Quizzes
6. remembering _____
7. processing _____
8. creating _____
9. evaluating _____
10. Total 100%

C. Assignments
6. remembering _____
7. processing _____
8. creating _____
9. evaluating _____
10. Total 100%

D. Discourse
6. remembering _____
7. processing _____
8. creating _____
9. evaluating _____
10. Total 100%
APPENDIX F

FINAL UNIT EXAM
Agricultural Science I

Animal Science Test

Instructions

Matching
Complete the following ten statements with the words included in the table below. You will use only ten words, two will remain after you have answered all statements. Clearly write the letter next to the statement to complete. 10 problems / 2 points each / 20 points possible

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>A</td>
<td>Broilers</td>
<td>E: Beef</td>
</tr>
<tr>
<td>B</td>
<td>Variety meats</td>
<td>F: Nutrients</td>
</tr>
<tr>
<td>C</td>
<td>Pork</td>
<td>G: Gestation</td>
</tr>
<tr>
<td>D</td>
<td>Parturition</td>
<td>H: Rumen</td>
</tr>
</tbody>
</table>

1) ____ One of the most efficient ways of converting feed stuffs into food products.
2) ____ Works in horses to allow for fermentation of plant material during digestion.
3) ____ Regurgitating, rechewing and swallowing of ingested food.
4) ____ Layers are egg-producing chickens, while ______ are meat chickens.
5) ____ The process of converting large complex nutrient molecules into simpler molecules capable of being used as food for the organism.
6) ____ The time period in which fetuses develop before birth.
7) ____ The birthing of the animal’s young.
8) ____ The number one red meat eaten in the U.S.
9) ____ Chemical substances that provide nourishment to the body.
10) ____ Organs and other by-product items that are of lower value than cuts of meat.
**Identify**
On the following diagrams please complete the blank portions by correctly identifying the digestive structure that we have learned about in class. Each box corresponds to a description below the diagram. *12 items / 2 points each / 24 points possible*

1) **Glands that moisten feed to aid with swallowing and is the first step in digestion.**

2) **A gland-lined sac that performs chemical and physical digestion. Excretes acids.**

3) **The tube from the mouth to the stomach.**

4) **Performs both digestion and nutrient absorption within its three sections.**

5) **Primary responsibility is water absorption.**

6) **What kind of digestive system is this? (name the type, not the animals)**

**Word Bank**

<table>
<thead>
<tr>
<th>Stomach</th>
<th>Small Intestine</th>
<th>Esophagus</th>
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</thead>
<tbody>
<tr>
<td>Rumen</td>
<td>Duodenum</td>
<td>Salivary</td>
</tr>
<tr>
<td>Abomasum</td>
<td>Large Intestine</td>
<td>Gizzard</td>
</tr>
</tbody>
</table>

79
1) What kind of digestive system is this? (name the type, not the animal)

2) True stomach, gastric juices act on ingesta.

3) Honeycomb, hardware stomach.

4) Full of folded tissue, absorbs water.

5) Large fermentation vat, first and largest chamber.

6) The tube from the mouth to the stomach and stomach to mouth.

**Word Bank**

<table>
<thead>
<tr>
<th>Proventriculus</th>
<th>Esophagus</th>
<th>Rumen</th>
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<tbody>
<tr>
<td>Jejunum</td>
<td>Abomasum</td>
<td>Omasum</td>
</tr>
<tr>
<td>Reticulum</td>
<td>Cecum</td>
<td>Cloaca</td>
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</tbody>
</table>

**Short Answer**
Please answer the following items as completely as possible. I do expect everything to be in complete sentences, just your answers to be complete. 5 problems / 6 pts each / 30 pts possible

1) Cattle are raised to produce two food products, name these products. Additionally, select one breed of cattle and describe two identifying characteristics of that breed.

2) The humane harvesting of animals includes the use of two tools, what are these tools? Why are these tools used and considered “humane”?

3) What are the most eaten red meats in the U.S. and how much of each do Americans consume on average each year?

4) Identify two species, that we discussed, which are considered “multi-purpose” animals. Along with identifying them, explain why they are considered this way.
5) The ruminant digestive system is highly efficient at processing cellulose from the plant-based diet these animals consume. Why is it important to process this cellulose and explain how it is processed in a ruminant.

Multiple Choice
Select the correct answer that completes the statement. There is only one correct answer for each statement. 4 statements / 4 points each / 16 points possible

_______ The ____________________ produces bile.
   a. Liver   b. gallbladder
   c. pancreas   d. small intestine

_______ The ________________ is the part of the avian digestive system that is responsible for the muscular processing of ingesta.
   a. crop   b. gizzard
   c. proventriculus   d. vent

_______ A wether, barrow, steer and gelding are terms referring to animals that have been ____.
   a. harvested   b. castrated
   c. born   d. gestated

_______ One of the six nutrients categories required for proper health is ________________.
   a. carbohydrates   b. corn
   c. fiber   d. oils