2015

Analyzing agricultural education student teachers' critical thinking skills through blogs in an online community of practice

Taylorann Kalin Clark
Iowa State University

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by

Taylorann Kalin Clark

A thesis submitted to the graduate faculty

in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

Major: Agricultural Education

Program of Study Committee:
Thomas H. Paulsen, Major Professor
Robert A. Martin
Patricia M. Carlson

Iowa State University

Ames, Iowa

2015

TABLE OF CONTENTS

FIGURES

TABLES

ACKNOWLEDGMENTS

All glory to God for my journey and accomplishments here at Iowa State. It is God who provides me the abilities to be where I am today, and it is Him who allowed me to have this wonderful opportunity. It is my hopes that I can return to His Kingdom the passion for agriculture, perseverance, and loyalty he has provided me throughout my collegiate career.

I have such great appreciation for all of the countless hours my major professor, Dr. Paulsen, spent encouraging me as an undergraduate, student-athlete, and as a graduate student. Thank you for all of the edits and feedback you have provided me. I will be looking forward to more advice as I venture out as a beginning agriculture teacher. A special thanks also goes out to Dr. Martin and Dr. Carlson for being a part of my graduate committee and providing valuable and thoughtful insight and recommendations to make this research beneficial to our profession. I'd like to sincerely thank Dr. Martin for being my student teaching supervisor and for providing great feedback and advice throughout the experience.

I have great appreciation for all the teachers, coaches, mentors, and Christian leaders I have had along the way who have inspired me to become an educator. I must not go without recognizing the unwavering support I have had from my family over the years, and especially during this past year when I thought helping with the softball team, planning a wedding, getting married, and taking a honeymoon all while taking a full course load and beginning my thesis would be a breeze…I thought wrong. Thank you Dad for giving me the opportunity to love agriculture and teaching me patience, wisdom and how to drive trucks and farm equipment without blowing an engine…a third time.

Thank you mom for always being positive when it seemed impossible, and for making countless trips to support me at all of my sporting events and academic ceremonies. Words cannot express the gratitude I owe the two of you. My siblings also deserve thanks. I admire you, Tyson, for your hard work, wit, and athletic leadership—I always watched how you lead your teams, and I aspired to do the same. My sister is always putting others before herself, and often knows what I am going to say before I ever say it. Thank you, Tiara, for always supporting me and my pursuits. To my grandparents, aunts and uncles, cousins and friends who have supported my every dream!

Finally, I owe my greatest appreciation to my husband. Chuck, thank you for being patient with a very impatient person over the past few months…okay, maybe the last year. You are always quick to forgive and have supported my dreams since day one. I hope I can show you the patience and understanding you have given me as I pursued this degree.

ABSTRACT

The purpose of this thesis was to explore the critical thinking demonstrated within student teacher blog posts as student teachers discussed and reflected in an online community of practice during their student teaching experiences, and to determine the critical thinking demonstrated within student teaching blog posts as the blog posts related to the Interstate New Teacher Assessment and Support Consortium (InTASC) standards. The objectives of the thesis were to: (1) determine the frequency and the average level of critical thinking exhibited by Iowa State University agricultural education student teachers' reflections through blog posts in an electronic community of practice, (2) determine the relationship, if any, between the number of blogs posted by each student teacher and the average level of critical thinking displayed by student teachers within the blog posts, (3) determine the frequency in which student teacher blog posts related to the ten InTASC standards, and (4) determine the relationship, if any, between the average level of critical thinking displayed within student teacher blog posts and the frequency with which those blog posts related to the InTASC standards.

Twenty-one agricultural education student teachers at Iowa State University comprised the convenience sample during the fall of 2013 and spring 2014. Provisional coding and simultaneous coding were utilized to analyze student teacher blog posts; frequencies, percentages, and Spearman's rho were calculated.

Overall, student teacher blog posts were at the lower-order levels of critical thinking. Student teachers did not utilize blogging and the community of practice in a manner that has recently been researched to enhance critical thinking skills. There was no relationship between the number of blog posts a student teacher posted and that student

teacher's average level of critical thinking. Student teachers' blog posts most often related to Professional Development and Ethical Practices and related to Content Knowledge least often. The average level of critical thinking demonstrated per InTASC standard decreased with an increase in the number of blog posts that related to that standard.

It is recommended that the University supervisors continue to facilitate student teachers throughout the student teaching experience. University supervisors should incorporate rubrics and question prompts to assist as student teachers provide meaningful feedback to their peers and develop critical thinking skills. It is also important to gain student teachers' perspectives when coding to ensure that the researcher is coding consistently with student teachers' blog posts discussions in a community of practice. A weekly focus group would help ensure truthful, rich data. Finally, it is recommended that further research be done to add to the baseline results obtained in this study.

CHAPTER I. INTRODUCTION

The goal of teacher professional development is to find a connection between theory and practice. However, theory and practice are often coined as two separate concepts (Berggren & Soderlund, 2011; Cochran-Smith, 2001; Pena & Almaguer, 2012). Berggren and Soderlund (2011) recognized that rigor, use of theory, and maintenance of academic standards have are receiving renewed attention. In order to connect theory and practice, teachers must remain aware of their experiences, reflect on those experiences, and be willing to experiment with new concepts (Berggren & Soderlund, 2011). The student teaching experience for pre-service teacher candidates serves as the connection between the "theory learned in [the] teacher preparation program and its practical application in the classroom" (Pena & Almaguer, 2012, p. 26). No matter the discipline, a teacher's understanding of educational theory has no benefit if it is not pursued through practice in the classroom. This chapter provides a background that establishes the need for critical thinking as pre-service teachers engage in transferring theory to practice. A statement of the problem, description of the research objectives, definition of terms, and the significance of the study are provided in this chapter.

Background and Setting

The theory, knowledge, and skills gained through coursework are the responsibility of university teacher preparation programs, and it is the secondary school that provides the field setting where pre-service teachers apply this knowledge (Perry & Power, 2004). The student teaching experience is then viewed as the bridge of application between theory, knowledge, and skills that were gained at the institution (Britzman,

1991). Pre-service teachers who can bridge theory and practice will then become more effective teachers as they develop throughout their professional career.

An effective teacher is one who wears many hats; one who has developed expertise of content, but acquires diverse professional skills. An effective teacher is one who reflects (Berggren & Soderlund, 2011; Bonney & Sternberg, 2011; Norris & Ennis, 1989; Pena & Almaguer, 2012; Perry & Power, 2004; Yang, 2009), is able to implement various pedagogical strategies (Darling-Hammond, 2000), communicates effectively (Garrison, Anderson, & Archer, 2001; Santrock, 2011), understands student development (Council of Chief State School Officers, 2011), employs skills that will keep them up-to-date (Partnership for 21st Century Skills, 2009) in this ever-advancing technological society (Santrock, 2011), and is a critical thinker (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956; Norris & Ennis, 1989; Partnerships for 21st Century Skills, 2009; Scriven & Paul, 1987).

Critical thinking is one of the many important skills of an effective teacher. Critical thinking is a necessary skill for an individual's professional and personal development. Teaching and requiring the use of cognitive skills in higher education has become increasingly popular and important as educators prepare pre-service teachers for real-world issues (Flores, Matkin, Burbach, Quinn, & Harding, 2010; Partnership for 21st Century Skills, 2009; Rudd, Baker, & Hoover, 2000; Whittington, 1995; Whittington & Newcomb, 1993). More specifically, teacher education has found purpose in introducing critical thinking as a part of the curriculum and instruction process (Moss & Lee, 2010; Odom, Shehane, Moore, & McKim, 2014; Perry, 2014; Tsui, 2002). As pre-service teachers utilize critical thinking in developing mini-teaching lessons or presentations for

undergraduate courses, it is important that pre-service teachers be able to transfer those higher-level skills to the student teaching experience and further professional settings (Paul & Elder, 2006; Pena & Almaguer, 2012; Perry & Power, 2004). University instructors and supervisors work to ensure that pre-service teachers will aim to meet educational objectives founded in critical thinking.

Instruction and assessment methods have recently been altered to meet the skill set students need in order to be successful in the 21st century (Perry, 2014). With the advances in Web 2.0 technologies, university instructors and supervisors are better able to monitor pre-service teacher progress throughout undergraduate courses and into the student teaching experience (Szabo & Schwartz, 2011). Agricultural education student teachers at Iowa State University are assessed and evaluated based upon educational standards presented through an e-portfolio. The culminating e-portfolio is a collection of work that shows pre-service teachers' "mastery of skills, knowledge, and understanding" (Iowa State University Agricultural and Life Sciences Education, 2011, p. 1) of the Iowa Teacher Education Licensure Standards. This is the essential assessment component that demonstrates agricultural education student teachers' achievement in bridging the gap between theory and practice.

These educational standards are used to determine student teachers' proficiency as effective and highly qualified teachers for accreditation in the profession. As pre-service teachers transfer theory into practice during the student teaching experience, critical thinking skills are essential to these teachers' likelihood of achieving proficiency in the standards. The purpose of this study was to explore student teacher levels of critical

thinking and student teacher discussion of InTASC standards in blog posts housed in an electronic community of practice.

Statement of the Problem

Critical thinking skills are deficient among college graduates (Flores et al., 2010). As pre-service teachers are encouraged to think critically during the preparatory stages of teacher education, it should be the expectation that university supervisors identify when and how often pre-service teachers merge theory with practice during their field experience (Perry & Power, 2004). It is important for agricultural education student teachers to think critically; "therefore, a need exists to assess those skills in college students and examine whether they have acquired these skills through their college experiences" (Odom et al., 2014, p. 218). In essence, it is valuable for university supervisors to be able to observe critical thinking skills and also necessary to constructively critique pre-service teachers when they are not practicing these skills.

Purpose and Objectives

The purpose of this study was to describe the frequency in which student teachers utilized higher-order thinking skills, as identified by Bloom's Taxonomy of Educational Objectives (Anderson & Krathwohl, 2001; Bloom et al., 1956), in an electronic community of practice used to support the student teaching experience. In addition, this study sought to identify the relationship between the number of student teacher posts and the average level of critical thinking demonstrated, as well as identify the InTASC standards associated with authentic student teacher blog posts during the student teaching experience.

This research aligns with the American Association for Agricultural Education's National Research Agenda Priority Area 4: Meaningful, Engaged Learning in All Environments. "Learners in all agricultural education learning environments will be actively and emotionally engaged in learning, leading to high levels of achievement, life and career readiness, and professional success" (Doerfert, 2011, p. 21). More specifically this research priority area suggests that research in agricultural education "examine[s] various meaningful learning environments in assorted agricultural education contexts for their impact on specific cognitive, affective, and psychomotor learning outcomes" (Doerfert, 2011, p. 9). This study is aligned with the recommendation to "assess various learning interventions and delivery technologies to increase problem-solving, transfer of learning, and higher order thinking across all agricultural education contexts" (Doerfert, 2011, p. 9). The following objectives guided this study:

1. Determine the frequency and the average level of critical thinking exhibited by Iowa State University agricultural education student teachers' reflections through blog posts in an electronic community of practice.
2. Determine the relationship, if any, between the number of blogs posted by each student teacher and the average level of critical thinking displayed by student teachers within their respective blog posts.
3. Determine the frequency in which student teacher blog posts related to the ten InTASC standards.
4. Determine the relationship, if any, between the average level of critical thinking displayed within student teacher blog posts and the frequency with which those blog posts related to the InTASC standards.

Significance of the Study

Being able to transfer theory to field experience is important for student teacher development. This study will seek to determine student teachers' ability to think critically through discourse and potentially impact the manner in which university supervisors facilitate student teachers through online environments. This study will also identify the InTASC standards discussed by student teachers during the student teaching experience and which of those standards elicited higher-order thinking. Through analysis of the results, this study will provide feedback for future use of blogs and communities of practice as means for peer interaction and collaboration, as well as supervision in these environments during the student teaching experience.

Definition of Selected Terms

Definitions of key terms used in this study are as follows.

1. Bloom's Taxonomy of Educational Objectives – a set or classification of educational objectives based upon levels of knowledge which a person implies through thought and action (Bloom et al., 1956).
2. Communities of Practice –groups "bound together by shared expertise and passion for a joint enterprise…[that] share their experiences and knowledge in free-flowing, creative ways that foster new approaches to problems" (Wenger & Snyder, 2000, pp. 139-140).
3. Critical Thinking – "a reasoned, purposive, and introspective approach to solving problems or addressing questions with incomplete evidence and information and for which an incontrovertible solution is unlikely" (Rudd et al., 2000, p. 5).

4. Florida Taxonomy of Cognitive Behavior – "a framework for observing and recording the cognitive behaviors of teachers and students in the classroom" (Brown, Ober, Soar, & Webb, 1970, p. 37.1); based upon Bloom et al.'s (1956) Taxonomy.
5. Higher-order Thinking – "occurs when a person takes new information and information stored in memory and interrelates and/or rearranges and extends this information to achieve a purpose or find possible answers in perplexing situations" (López & Whittington, 2001, p. 22); knowledge or skills determined to be at the *Analysis, Synthesis,* or *Evaluation* levels of Bloom et al.'s Taxonomy (Duron, Limbach, & Waugh, 2006).
6. InTASC (Interstate New Teacher Assessment and Support Consortium) Model Core Teaching Standards – "standards [that] outline the common principles and foundations of teaching practice that cut across all subject areas and grade levels and that are necessary to improve student achievement" (Council of Chief State School Officers, 2011, p. 3); the Model Core Teaching Standards "articulate what effective teaching and learning looks like in a transformed public education system" (Council of Chief State School Officers, 2011, p. 3).
7. Lower–order Thinking – knowledge or skills determined to be at the *Knowledge, Comprehension, or Application* levels of Bloom et al.'s Taxonomy (Duron et al., 2006).
8. Practical Inquiry Model—a model developed by Garrison, Anderson and Archer (2000) that allows researchers to analyze critical thinking in text-based communication utilizing content analysis.

9. Weblog – is a contraction of web log, often referred to as a ‘blog’; an Internet-based platform in which users can post text, images, or video-based material for others to view; users may facilitate an information exchange and a collaboration network to support teaching and learning processes (Cakir, 2013).

Thesis Organization

This thesis is divided into six chapters: introduction, literature review, comprehensive methods, two research papers that address the objectives of the study in greater detail, and general conclusions, implications, and recommendations. This introduction outlines critical thinking and the importance for pre-professionals to bridge the gap between theory and practice. Chapter Two summarizes the literature regarding cognitive development and critical thinking, the theoretical framework for this study, critical thinking assessment, critical thinking in higher education, and the incorporation of Web 2.0 technologies as a means for collecting critical thinking data. Chapter Two also provides the background and importance of evaluating student teachers based upon educational standards. Chapter Three details the research methods utilized. Chapter Four is a research manuscript that reports the frequency of critical thinking skills demonstrated by student teachers’ blog posts during the student teaching experience. Additionally, Chapter Four demonstrates the relationship between the number of blogs posted by each student teacher and the average level of student teacher critical thinking demonstrated in the blog posts. Chapter Five addresses the frequency of InTASC teaching standards discussed in student teacher blog posts and the cognitive presence student teachers demonstrated in those blog posts. Chapter Six addresses the general conclusions, implications, and recommendations of this study. The need for additional research in this

field is identified. The appendices include the IRB approval document, the critical thinking analysis instrument used in this study, InTASC standard descriptions, and permissions to use figures in this study.

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CHAPTER II. LITERATURE REVIEW

This chapter discusses the literature related to critical thinking in higher education and pre-service teacher assessment. The chapter is divided into the following sections: theoretical framework, a review on cognition and critical thinking, critical thinking in higher education, agricultural education teacher preparation and critical thinking, critical thinking in online environments, and accreditation for agricultural education student teachers. Chapter Two will begin with the theoretical framework from which this study was based. The chapter will then describe the background of cognition and provide context for the concept of critical thinking—a cognitive behavior, as conceptualized in the higher education setting. It will then highlight observation tools commonly used to analyze, assess, and measure critical thinking.

Chapter Two will then transition into a discussion of the presence of critical thinking in online environments and pre-service assessment during the student teaching experience. The purpose of this study was to explore student teacher levels of critical thinking and student teacher discussion of InTASC standards, in blog posts housed in an electronic community of practice.

The following research objectives guided this study:

5. Determine the frequency and the average level of critical thinking exhibited by Iowa State University agricultural education student teachers' reflections through blog posts in an electronic community of practice.
6. Determine the relationship, if any, between the number of blogs posted by each student teacher and the average level of critical thinking displayed by student teachers within their respective blog posts.

7. Determine the frequency in which student teacher blog posts related to the ten InTASC standards.
8. Determine the relationship, if any, between the average level of critical thinking displayed within student teacher blog posts and the frequency with which those blog posts related to the InTASC standards.

Theoretical Framework

Approaches to instructional strategies can be classified as constructivist or direct instructional (Santrock, 2011). "A focus on meaningful learning is consistent with the view of learning as knowledge construction, in which students seek to make sense of their experiences" (Anderson & Krathwohl, 2001, p. 65). Constructivist learning, or meaningful learning, requires that instructors require more of students by eliminating instructional methods that simply present factual knowledge and move towards assessments that demand students practice more than simple recall and recognition of factual knowledge (Bransford, Brown, & Cocking, 1999; Lambert & McCombs, 1998).

The constructivist approach, unlike direct instruction, is learner-centered and emphasizes teachers as facilitators, rather than direct instructors (Santrock, 2011). A constructivist believes that individuals should actively construct their own knowledge and understanding, encouraged by the teacher to explore the world around them, discover, reflect, and think critically (Bonney & Sternberg, 2011). In today's educational society, the constructivist approach emphasizes collaboration and working with peers to construct knowledge and understanding (Slavin, 2011; Wentzel & Watkins, 2011).

The process of knowledge acquisition and understanding are those of cognition. Cognitive development is the process of change that occurs in a child's thinking abilities,

intelligence level, and language development (Santrock, 2011). Cognitive development is what allows a learner to memorize, solve problems, be creative, and communicate effectively (Santrock, 2011). Cognitive processes are demonstrated through skills and behaviors such as: defining a term, paraphrasing a story, predicting an outcome, creating a model, or evaluating a case study (McCormick & Whittington, 2000). Cognition can be better described as *thought*. There are four main cognitive approaches to learning: social cognitive theory, information processing theory, cognitive constructivism, and social constructivism (Santrock, 2011).

The social cognitive view originated with Albert Bandura's (1986) belief that the environment in which a child lives and learns, and his/her observations of others, have a direct influence on a child's cognitive abilities. The information processing approach, conceptualized by Donald Broadbent (1958), emphasizes the notion that children manipulate, monitor, and strategize their use of information (Santrock, 2011). Following in the footsteps of John Dewey and William James, two of the primary philosophers in cognition during the mid-twentieth century, were Jean Piaget and his theory of cognitive constructivism and Lev Vygotsky and his theory of social constructivism. Piaget (1954) theorized cognition from a constructivist view and determined that children learn best when they actively construct knowledge by transforming and reorganizing previous knowledge. Conversely, Vygotsky (1962) believed knowledge is constructed through social interaction. Piaget's views, which focused on the learner as an individual, proposed that education acts to refine the cognitive skills a child already possesses (Piaget, 1954). Due to the social nature of the present study, the emphasis of cognitive development as it relates to knowing and understanding will follow Vygotsky's theory of social

constructivism. Key processes of the social constructivist view include the zone of proximal development (ZPD), language, dialogue, and cultural tools (Santrock, 2011). The central role of education in Vygotsky's theory will be developed further.

Social constructivism emphasizes the importance of social interaction on learners' cognitive development. This theory is reflected in Vygotsky's (1978) concept of the ZPD. This is a term for a range of learning tasks, from those that are too difficult for the learner to complete without assistance, to so simple that the skill can be completed by the learner working independently (Santrock, 2011). Support is offered in the form of scaffolding to the learner, based upon their ZPD or current learning capabilities. As the learner begins a new task, he/she may need direct instruction; as the student's competence progresses, less assistance should be required (Santrock, 2011). By asking probing questions, a teacher may scaffold learners to help them think more critically (MacKnight, 2000; Wang & Hsua, 2008).

Finally, Vygotsky (1962, 1978) believed in transforming the classroom with tools that give attention to learners' culture, ZPD, scaffolding, and shared activities (i.e., collaboration). Vygotsky (1978) also believed that communication was critical to student learning. As education becomes increasingly dependent upon technology, how might Vygotsky's social constructivism appear in today's educational settings? In light of technology and teacher education, Vygotsky's ideas are relevant because he introduced the notion of scaffolding via the ZPD, a concept that has been used in software development (Jost, 1999).

As computers increase out methods and rates of communication, one would assume Vygotsky's support for Web 2.0 technologies, which are used to enhance

communication and collaboration in teacher education today (Jost, 1999). With competing theories on how educational approaches should be structured, educators have worked to determine the best conditions in which learning should take place. Benjamin Bloom and his colleagues acknowledged the need to create a Taxonomy of Educational Objectives (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956) that would guide the goals and needs of classroom educators (Hilgard, 1996). This taxonomy provided cognitive outcomes expected of teachers and learners in an educational environment.

Bloom's Taxonomy of Educational Objectives

Bloom et al. (1956) created a classification system for the cognitive domain. Later revisions of the taxonomy include a second and third domain, affective and psychomotor (Anderson & Krathwohl, 2001). The main purpose in creating such a taxonomy was to better facilitate communication, in particular to enhance the exchange of ideas and materials among people in education research and curriculum development (Bloom et al., 1956). The taxonomy acts as an aid in coining more precise definitions for terms such as *thinking* and *problem solving* (Bloom et al., 1956). Educational objectives serve as a means of classifying instructional methods, teacher behaviors, and intended student behaviors (Bloom et al., 1956). The Taxonomy of Educational Behaviors is organized in a hierarchical manner of six major categories:

Knowledge is the most basic level of cognitive behavior, in which one stores information and can later recall the ideas, material, or phenomena initially learned (Bloom et al., 1956). "Learners come into any instructional setting with a broad array of knowledge, their own goals, and prior experiences in that setting, and they use all of these

to ‘make sense’ of the information they encounter” (Anderson & Krathwohl, 2001, p. 38).

Comprehension, the second level in the taxonomy, relates to a student’s ability to take presented materials or ideas and demonstrate them through the use of a variety of oral, written, or symbolic communication skills (Bloom et al., 1956). “Although the term ‘comprehension’ has been frequently associated with reading…the use to which it is being put here is a somewhat broader one in that it is related to a greater variety of communications than that encompassed by written verbal materials” (Bloom et al., 1956, p. 89).

Application, the third level requires those skills and abilities from the lower cognitive levels, but requires greater critical thinking skills and behaviors than the previous categories. It requires that the learner utilize a plan or process to solve problems (Anderson & Krathwohl, 2001, p. 77). “The application category follows this rule in that to apply something requires comprehension of the method, theory, principle, or abstraction applied” (Bloom et al., 1956, p. 120).

Analysis, the fourth level, emphasizes the deconstruction of comprehended material into its components and how constituent parts are related and organized (Bloom et al., 1956). Learners may use communication as a means of distinguishing facts from opinions, or identify a conclusion from the statements through which it is supported (Brown, Ober, Soar, & Webb, 1970). Bloom et al. (1956) determined that analysis may “[shade] into evaluation, especially when we think of critical analysis” (p. 144).

Synthesis requires creativity by the learner, in which the learner assembles pieces of a greater pattern or structure in order to form a whole. This level is where the learner

may exhibit creative behavior "within the limits set by particular problems, materials, or some theoretical and methodological framework" (Bloom et al., 1956, p. 162).

Evaluation is the final level of Bloom's Taxonomy. "Evaluation is defined as the making of judgments about the value, for some purpose, of ideas, works, solutions, methods, material, etc." (Bloom et al., 1956, p. 185). Ewing and Whittington (2007) suggested that "learners must make judgments based on criteria in order to determine an answer, whether or not there is a set answer" (p. 92). At this level, the learner may utilize criteria or standards for placing judgments as to whether or not the methods or materials are effective or accurate in their application (Bloom et al., 1956).

It is important to remember that this taxonomy is organized in a hierarchical step structure, in that each increase in category requires the skills and knowledge needed for the previous category, and then some. For example, because *Knowledge* requires a student to remember, *Comprehension* is being able to communicate what was remembered. Table 2.1 provides a synopsis of Bloom et al.'s (1956) Taxonomy of Educational Objectives.

Table 2.1

Note. Definitions adapted from Bloom et al. (1956) and activities adapted from McCormick and Whittington (2000).

A Synopsis of Bloom's Taxonomy of Educational Objectives

Cognitive Level	Definition	Activity
Knowledge	Storing of information and recalling ideas, material or phenomena	List, define, label, and match
Comprehension	Communication of learned information	Explain, paraphrase, summarize, rewrite, and give examples
Application	Putting a method, theory, or principle into practice	Compute, demonstrate, use, predict, discover, and solve
Analysis	Deconstruction of comprehended material into its components and recognition of how those components are related and organized	Differentiate, discriminate, relate, diagram, and distinguish
Synthesis	Expression of creativity through construction of a whole pattern or structures, given the pieces or parts which constitute the whole	Create, compose, produce, and develop
Evaluation	Placing judgment on the value or effectiveness of materials or methods	Justify, compare, contrast, evaluate, interpret

Anderson and Krathwohl (2001) have since revised Bloom et al.'s (1956) original Taxonomy of Educational Objectives. Of the major changes, *Knowledge* was renamed *Remembering*, *Comprehension* was changed to *Understanding,* and *Synthesis* was converted to *Create.* Additionally, the top two levels (*Synthesis* and *Evaluation*) were changed. *Evaluate* became the fifth level of cognitive behaviors and *Create* became the highest level.

The team that revised the original Taxonomy determined that the Taxonomy should not be unidimensional; instead, it should consist of two dimensions: knowledge and cognitive processes (Krathwohl & Anderson, 2010). This led the team to utilize verbs

for category names rather than nouns. Thus the reasoning *Synthesis* became *Create*. The top two levels were inverted because, "create describes the active processes of constructing meaning and…plans of action that need to be carried out" (Krathwohl & Anderson, 2010, p. 64). Figure 2.1 shows a comparison of Bloom et al.'s (1956) Taxonomy and the revised Anderson and Krathwohl (2001) Taxonomy.

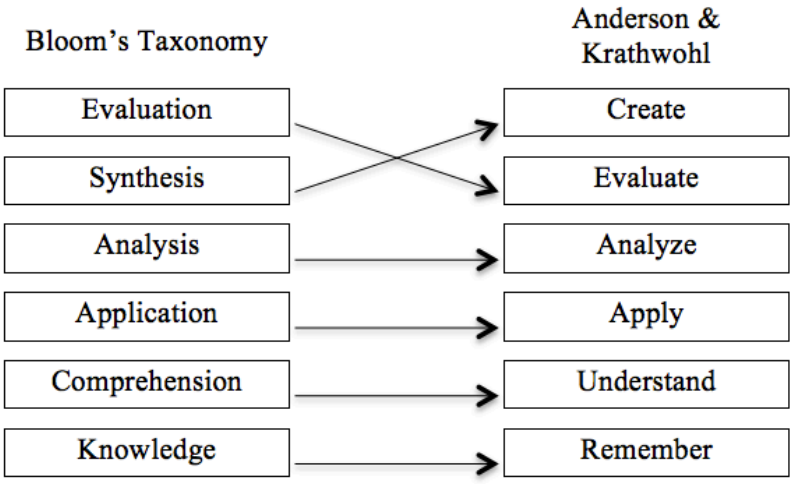

Figure 2.1. Comparison of Bloom et al. (1956) and Anderson and Krathwohl's (2001) Taxonomy of Educational Objectives.

Critical Thinking

Effective teachers should demonstrate the ability to think critically, a skill that many employers expect of their employees (Hart Research Associates, 2013; Partnerships for 21st Century Skills, 2009; Santrock, 2011). Higher-order knowledge attainment and application are cognitive processes that are often associated with research and literature pertaining to critical thinking (Garrison, Anderson, & Archer, 2001). The development of these cognitive processes is what allows a person to think critically. Therefore, if effective teachers are expected to have the skills and abilities to think critically, how then can one determine the cognitive development in order to do so? Many attempts have been

made to coin a precise definition of critical thinking that would be widely accepted (Sanders & Moulenbelt, 2011) among researchers, educators, and psychologists, and to provide a description of what processes and outcomes determine the ability of one to think critically. However, this common definition has yet to be agreed upon, and identifying its parameters remains an important task for researchers and writers.

Active thought is a form of thinking – the manipulation and transformation of information into memory (Santrock, 2011). "We think to form concepts, reason, think critically, make decisions, think creatively, and solve problems" (Santrock, 2011, p. 301). Halpern (2003) claimed that problem-solving and decision-making are examples of cognitive processes involved in critical thinking. Garrison et al. (2001) stated that critical thinking is "the acquisition of deep and meaningful understanding as well as content-specific critical inquiry abilities, skills, and disposition" (p. 8). Halpern (2003) defined critical thinking as goal-oriented and with a purpose. O'Hare and McGuinness (2009) contributed a key concept of critical thinking, expressing that it may occur when one challenges another person's opinion. Scriven and Paul (1987) stated that critical thinking involves analyzing information gathered through reflection.

According to Norris and Ennis (1989), critical thinking can best be defined as "reasonable and reflective thinking that is focused upon deciding what to believe or do" (p. 3). Duron, Limbach, and Waugh (2006) determined those who utilize critical thinking have the ability to analyze and evaluate information. In addition to the aforementioned processes and outcomes of critical thinking, more specific abilities and skills can be recognized in those who think critically. Possin (2008) used *competencies* to describe behaviors in which critical thinking may occur: "identifying reasons or

arguments…taxonomizing arguments as deductive or inductive…critically reviewing definitions and analyzing concepts" (p. 204).

Higher-order Thinking vs. Lower-order Thinking

Duron et al. (2006) found that many of the cognitive skills associated with critical thinking aligned with the original Bloom's Taxonomy of Educational Objectives. They then generalized the Taxonomy into two categories with regards to critical thinking abilities, a higher-order and a lower-order (Duron et al., 2006; Lewis & Smith, 1993; Ulmer, 2005). Ulmer (2005) noticed that the difference between higher- and lower-order thinking is affected by learners' prior knowledge, reasoning "what may require higher-order thinking by one learner may require lower-order thinking by another learner" (p. 20). As critical thinking requires an increased ability of cognitive processes, higher-order thinking would be those skills or behaviors at the analysis, synthesis, or evaluation levels of Bloom et al.'s Taxonomy (Duron et al., 2006). The term higher-order thinking became prevalent when the need was discovered to create a term that encompassed the broader aspects of problem solving, creative thinking, decision making, reasoning and critical thinking (Lewis & Smith, 1993). Lower-order thinking comprises the lower three levels of the hierarchy, which include knowledge, comprehension, and application (Duron et al., 2006). Figure 2.2 displays higher- and lower-order levels of critical thinking.

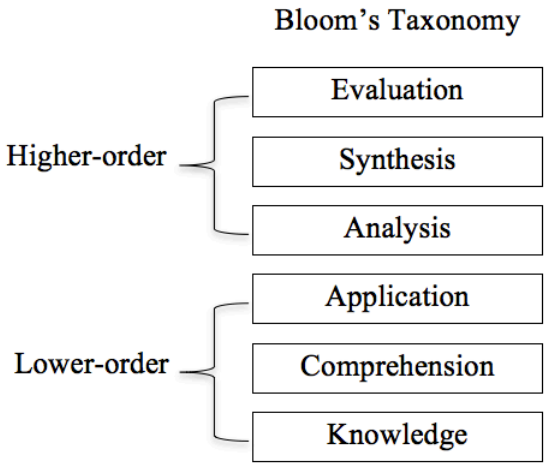

Figure 2.2. Higher- and lower-order thinking skills categorized by Duron et al. (2006).

Though critical thinking is not a new concept, there is continuing interest among educators and psychologists (Ball & Garton, 2005; Bensley, Crowe, Bernhardt, Buckner, & Allman, 2010; Ewing & Whittington, 2007; Ewing & Whittington, 2009; Garrison et al., 2001; Halpern, 2003; O'Hare & McGuinness, 2009). As educators find interest and importance in incorporating critical thinking in their classroom, it is appropriate to find a manner in which to assess the presence and impact of critical thinking in students' behaviors, abilities and skills.

Critical Thinking Assessment

Ennis (1993) stated that it is important to know the purpose for which a critical thinking test is to be used when selecting, criticizing, or developing a critical thinking assessment. There are many reasons for assessing critical thinking, but no one test or assessment meets each purpose for assessing critical thinking (Ennis, 1993). The following are reasons for assessing critical thinking as suggested by Ennis (1993):

> (1) Diagnosing the levels of students' critical thinking, (2) giving students feedback about their critical thinking prowess, (3) motivating students to

> be better at critical thinking, (4) informing teachers about the success of their efforts to teach students to think critically, (5) doing research about critical thinking instructional questions and issues, (6) providing help in deciding whether a student should enter an educational program, and (7) providing information for holding schools accountable for the critical thinking prowess of their students (pp. 180-181).

Critical thinking in education has been assessed both through paper-based instruments and observation. Ennis (1993) recognized some of the common assessment tools used to assess critical thinking: the California Critical Thinking Skills Test, the Cornell Critical Thinking Test, the Ennis-Weir Critical Thinking Essay Test, and the Watson-Glaser Critical Thinking Appraisal, to name a few. Perry, Retallick, and Paulsen (2014) identified four domains of the Critical Thinking Assessment Test: "(a) evaluate and interpret information, (b) problem solving, (c) effective communication, and (d) critical thinking" (p. 208). Other than the Ennis-Weir Critical Thinking Essay Test, the aforementioned assessments may not accurately assess critical thinking skills due to their multiple-choice formats (Fawkes, O'Meara, Webber, & Flage, 2005; Perry, 2014). This being said, there is still debate as to which practices most effectively cultivate and assess critical thinking (Perry, 2014).

Differing from multiple choice, essay, or other paper-based critical thinking assessment instruments, observation techniques have also been used to determine the level of critical thinking used by educators and students in the classroom setting. The Florida Taxonomy of Cognitive Behavior (FTCB) is one example (Brown et al., 1970). The FTCB is based on Bloom et al.'s (1956) Taxonomy of Educational Objectives.

As higher education moves towards offering more courses online or delivering some portion of courses through a Web 2.0 medium, there is a need for tools that can assess critical thinking in such an environment. As university courses utilize asynchronous online discussions, engagement in cognitive processes such as critical thinking may be a desired outcome (Perkins & Murphy, 2006). However, it remains unclear as to how one can determine if critical thinking occurs in asynchronous online discussions (Perkins & Murphy, 2006). In critical inquiry research, Garrison et al. (2001) utilized the Practical Inquiry Model (PIM) to assess cognitive presence in an online environment.

Given the situation in which a person desires to assess critical thinking, it is necessary to select the tool most appropriate for the environment in which the subject is situated. A tool to assess text-based communication—the PIM—is presented, as well as an introduction of the analysis instrument selected for use in the present study—FTCB.

Practical Inquiry Model

The facilitation of higher-order learning in online environments may be reinforced through the utilization of a tool to assess discourse and reflection (Garrison et al., 2001). Though it is important to assess critical thinking as both a process and an outcome in education, "it is the process of critical thinking that is of particular importance in terms of asynchronous text-based communications technology" (Garrison et al., 2001, p. 12). That is where Garrison et al. (2001) were able to utilize content analysis, the concept of a Community of Inquiry, and the PIM to determine cognitive presence in transcriptions of text-based dialogue in computer-mediated communications.

The Community of Inquiry assumes that through the interaction of three essential elements—cognitive presence, social presence, and teaching presence—a worthwhile educational experience will occur (Garrison, Anderson, & Archer, 2000). Though of the three elements in the model, cognitive presence is the most fundamental element to success in higher education (Garrison et al., 2000), social and teaching presences are needed to compliment the development of cognition (MacKnight, 2000; Vygotsky, 1978; Wenger & Snyder, 2000).

The methodology and implementation of PIM, as described by Garrison et al. (2001), is as follows. PIM works in a manner that allows researchers to code participants' text-based communications, assessing cognitive presence through content analysis. Descriptors, indicators, and examples for each of the four phases of the PIM can be used to guide the researcher in coding segments of text-based communication. The sequence of the four phases of the critical inquiry processes include: a triggering event in which a problem is posed, exploration in which the learner searches for information, integration in which the student constructs meaning from the previous phases, and resolution in which the student resolves the problem (Liu & Yang, 2012).

Each phase of the PIM has an adjective that characterizes the processes that occur in each phase: evocative, inquisitive, tentative, and committed (Garrison et al., 2001; Liu & Yang, 2012). The descriptors listed prior, in addition to indicators and socio-cognitive processes, "provide sufficient information to facilitate reliable categorization" (Liu & Yang, 2012, p. 472) for the researchers who code the text-based messages. The PIM is displayed in Figure 2.3.

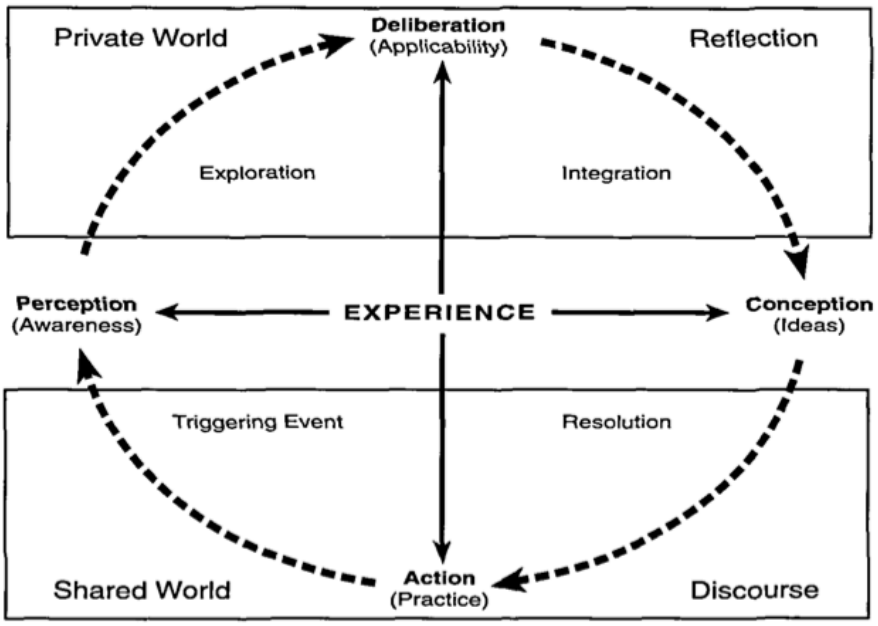

Figure 2.3. Practical Inquiry Model. From Garrison, Anderson, and Archer, 2001, p. 9. Reprinted with permission.

The initial phase of critical thinking is analyzed using the Practical Inquiry Model at the triggering event phase (lower left quadrant of PIM in Figure 2.3). At this phase, the researcher uses the provided indicators—recognizing the problem and sense of puzzlement—to determine the level of critical thinking in students' text-based messages. The socio-cognitive processes that serve as examples for this phase are: presenting background information that leads to a question, asking questions, or posting messages that lead discussions in a different/new direction. The second phase is exploration (upper left quadrant). In this phase, participants "shift between the private, reflective world of the individual and the social exploration of ideas" (Garrison et al., 2001, p. 10). When the student reaches the end of this divergent phase, he/she begins to determine what information is relevant to the issue or problem. Six indicators guide the researcher in

determining the socio-cognitive processes of this phase. Garrison et al. (2001) offered three examples of those indicators and the associated socio-cognitive processes:

> 1) Divergence—within the online community: many different ideas/themes presented in one message, 2) Information exchange: personal narratives/descriptions/facts (not used as evidence to support a conclusion), and 3) Leaps to conclusions: offers unsupported opinions (p. 15).

Integration (upper right quadrant) is the third phase of the Practical Inquiry Model, in which students construct meaning from the ideas generated from the previous phase. Garrison et al. (2001) noted this phase to be the most difficult to detect from the teaching or research perspective. A key indicator of this phase is "connecting ideas, synthesis" (Garrison, 2001, p. 16), in which students use various sources to integrate information. The fourth and final phase of the model is resolution. A message coded at this level begins to move towards real world application, minimizing the amount of socio-cognitive processes that would be acknowledgeable to the coder.

Though this model offers to organize data in quantifiable data sets and serves as a baseline measure of students' critical thinking in text-based communication, reasons for not using this model in the present study are described in Chapter Three.

Florida Taxonomy of Cognitive Behavior

Utilizing Bloom et al.'s (1956) Taxonomy, Brown et al. (1970) developed the Florida Taxonomy of Cognitive Behavior (FTCB). This tool was created to assess the

cognitive level of discourse instructors used in the higher education classroom (López & Whittington, 2001). The FTCB was originally designed to categorize the observed cognitive behaviors of classroom instructors in six-minute intervals (Ulmer, 2005). As the behavior listed on the FTCB was observed, the observer marked the corresponding box within the cognitive level. Regardless of the amount of time a behavior was observed in the allotted six minutes, it would only be recorded once per interval.

The FTCB uses 55 observable behaviors categorized under the cognitive levels of Bloom et al.'s (1956) Taxonomy, however, minor differences are recognized between the educational objective levels of Bloom's Taxonomy and the cognitive levels of the FTCB. *Knowledge,* as identified by Bloom et al., is represented by two categories on the FTCB: "knowledge of ways and means of dealing with specifics" (Brown et al., 1970, p. 37-3) and "knowledge of universals and abstracts" (p. 37-3). Within this level of cognitive behavior, 17 sub-categories specify observable behaviors. *Translation* and *Interpretation* are the FTCB representative categories for Bloom et al.'s (1956) *Comprehension* level. Translation and Interpretation appear as sub-levels of Bloom et al.'s (1956) Taxonomy, but this is the only category where the FTCB utilizes specific sub-levels within the instrument. There are 16 specific observable behaviors for this level on the FTCB. For *Application*, four observable behaviors are listed; for *Analysis*, eleven observable behaviors are listed; for *Synthesis*, nine observable behaviors are listed; and for *Evaluation*, two observable behaviors are listed. Table 2.2 compares the cognitive levels of Bloom et al.'s (1956) Taxonomy and Brown et al.'s (1970) FTCB. The complete FTCB is found in Appendix B.

Table 2.2

Comparison of Cognitive Levels of Bloom et al.'s (1956) Taxonomy and the FTCB (Brown et al., 1970)

Level	Bloom's Taxonomy	FTCB	FTCB Example Descriptors
1	Knowledge	Knowledge	Recognizes a symbol Gives steps of process, describes method
2	Comprehension	Translation Interpretation	Restates in own words Gives reason (tells why)
3	Application	Application	Applies previous learning to new situation
4	Analysis	Analysis	Infers purpose, point of view, thoughts, feelings Distinguishes fact from opinion
5	Synthesis	Synthesis (Creativity)	Reorganizes ideas, materials, processes Produces a plan/proposed set of operations
6	Evaluation	Evaluation	Evaluates information from evidence

Critical Thinking in Higher Education

The Partnership for 21st Century Skills (2009) describes critical thinking to be one of many skills, fields of knowledge, or areas of expertise that students are expected to master in order to succeed in their future careers and lead fulfilling lives. In a recent study conducted by the Hart Research Associations (2013), it was found that 82% of employers felt that colleges should place more emphasis on critical thinking and analytical reasoning skills. Consistent with these suggestions, Paul and Elder (2006) stated that in order to develop confidence in reasoning, it is critical for young professionals to adopt critical thinking abilities. If the ability for an employee to think critically is highly desired, it then becomes the responsibility of higher education to

encourage students to develop these cognitive processes. This concern also weighs heavily in teacher education programs. By immersing teacher candidates in field experiences, they will be better prepared through the processes of purposeful reflection and construction of practical knowledge (Pena & Almaguer, 2012; Perry & Power, 2004).

Agricultural Education Teacher Preparation and Critical Thinking

Agricultural educators have defined critical thinking as "a reasoned, purposive, and introspective approach to solving problems or addressing questions with incomplete evidence and information for which an incontrovertible solution is unlikely" (Rudd, Baker, & Hoover, 2000, p. 5). Pre-service teachers in agricultural education should observe and practice critical thinking so these cognitive skills can be transferred to their future students (Henderson, 1983). The ability to think critically across the curriculum has been established as a significant outcome in higher education (Moss & Lee, 2010; Odom, Shehane, Moore, & McKim, 2014; Perry, 2014; Tsui, 2002). Though critical thinking has become an anticipated outcome in higher education, students in colleges of agriculture have been found to have insufficient critical thinking skills (Flores, Matkin, Burbach, Quinn, & Harding, 2010; Rudd et al., 2000). Critical thinking is one of the many skills that effective pre-service teachers should acquire. It is important for pre-service agriculture teachers to think critically; "therefore, a need exists to assess those skills in college students and examine whether they have acquired these skills through their college experiences" (Odom et al., 2014, p. 218).

Whittington and colleagues at Ohio State University have researched cognitive levels of higher education faculty and students in agriculture departments (Ewing &Whittington, 2009; Ewing & Whittington, 2007; McCormick & Whittington, 2000;

Whittington, 1995; Whittington et al., 1997; Whittington & Newcomb, 1993). Whittington and her colleagues' work focused primarily on the cognitive level of professor discourse in college classrooms, leading to conclusions that instructors in agricultural colleges taught at lower-order cognitive levels (Whittington et al., 1997; López & Whittington, 2001).

After observing a college professor, López and Whittington (2001) determined that the professor demonstrated behaviors at Bloom et al.'s (1956) knowledge levels nearly half the time of instruction. The students in the same course were observed to think and behave at lower-order levels of critical thinking. Though research exists on professor and student critical thinking during class sessions in higher education, little is known about teacher educator practices with regards to instruction and assessment; more specifically, the influence that those practices have on pre-service teachers' attitudes towards utilizing higher levels of cognitive skills should be researched further (Ball & Garton, 2005).

Cano and Martinez (1991) suggested it is important that agricultural educators "challenge students to develop cognitive abilities and critical thinking abilities at higher levels via the instruction they provide" (p. 28). In a study of the cognitive levels of instruction and student performance in production agricultural programs, Cano and Newcomb (1990) found that agricultural teachers wrote instructional objectives at higher cognitive levels than previous literature suggested (Gall, 1970; Kirts & Stewart, 1983). In finding that the students' cognitive levels were higher than in previous studies, Cano and Newcomb (1990) suggested that teachers need to determine if the cognitive level of instruction is appropriate for the cognitive levels of all learners.

Critical Thinking in Online Environments

The present research study aims to explore Web 2.0 technology and social constructivism in the context of moving teacher education from theory to practice, with an interpretive and collaborative approach. Teacher preparation programs are increasingly implementing technological strategies to enhance the quality of student learning (Gilbert & Dabbagh, 2005; Godwin-Jones, 2003; Liaw, Chen, & Huang, 2008; Paulsen, Smith, & Anderson, 2014; Tweeten, Paulsen, & Anderson, 2014; Vonderwell, 2002). Technology has been implemented into learning environments to offer a means of reflection through asynchronous discussion (Gilbert & Dabbagh, 2005; Szabo & Schwartz, 2011; Wang & Hsua, 2008; Yang, 2009). Asynchronous discussion allows a student time to reflect and contribute to an online discussion in a manner that is most convenient to them, "after they have formulated their thoughts" (Garrison et al., 2000, p. 97). As student teachers participate in an authentic learning experience at a distance from university supervisors and peers, technology offers the opportunity to enhance the learning process in an environment outside of the classroom through online discussions or blogs (Szabo & Schwartz, 2011). The student teacher is challenged to use constructivist practices within online learning environments, such as blogging, in a manner that offers high-quality educational experiences that promote critical thinking (Gilbert & Dabbagh, 2005; Szabo & Schwartz, 2011).

Weblogs

Teacher preparation programs use technology to enhance the quality of learning (Gilbert & Dabbagh, 2005; Vonderwell, 2002). Asynchronous discussion occurs in online environments as Web 2.0 users communicate among a community of users who have

common interests. Asynchronous discussions commonly occur through e-mail, list serves or online discussions (Gilbert & Dabbagh, 2005), such as weblogs. Though popular in today's advancing technological world, students may not understand the purpose of an educational weblog.

Web 2.0 technologies, weblogs—a contraction of web blog and often called a blog—and microblogs, have recently received a lot of interest in higher education (Halic, Lee, Paulus, & Spense, 2010; Wang & Hsua, 2008). One of the most utilized Web 2.0 tools, blogs first appeared in the late 1990s (Matheson, 2004). A person uses a blog to publish writings, images, videos or video links for others to view via Web 2.0 technologies. Blogging has recently become popular as a versatile medium as it requires low technological skill levels and low costs to maintain (Cakir, 2013; Halic et al., 2010). Blogs are designed in a manner that allows readers to view an entire history of what a person has published to that blog (Wang & Hsua, 2008; Luik, Voltri, Taimalu, & Kalk, 2011). This feature makes it easier for supervisors or instructors to monitor individual learning progress and keep a record of the individuals' reflections (Killeavy & Moloney, 2010; Wang & Hsua, 2008). Blogs are convenient for producing and sharing student reflections and "offer an audience for students' writing within the safety of a learning community thus offering opportunities for collaborative learning" (Robertson, 2011, p. 1628). Yang (2009) stated that blogs are a great tool for pre-service and student teachers to demonstrate growth and changes as they build a learning community. It is becoming more common to witness the use of blogs as a tool that supports student teacher reflection (Walker, 2005; Williams & Jacobs, 2004).

As blogs allow users to exchange ideas and share experiences, they become an optimal setting for social constructivist learning (Ferdig & Trammell, 2004). Blogs serve as a tool for small group learning community discourse, and allows students the "opportunit[y] to socialize, interact and enter into dialogue, seek support and assistance, and express feelings and emotions" (Luik et al., 2011, p. 166). Reflection during the student teaching experience is critical and an important part of active learning (Cakir, 2013), which may occur through a blog. Recent research has indicated that journal writing and self-reflection recorded in a blog may increase the depth of a learner's critical thinking (Sessa, Matos, & Hopkins, 2009). Online discussions provide students with the power to identify their own knowledge gaps, explore the perspectives of other students involved, and negotiate the meaning of content that arises through the discussion (Haavind, 2006).

Many studies have been conducted to investigate the use of blogs in educational settings. Yang (2009) examined how blogs encouraged reflection in the higher education setting; Chuang (2008) explored the utilization of blogs as e-portfolios in teacher education; and Wang and Hsua (2008) focused research on the use of blogs in in-class discussions. Top, Yukselturk, and Inan (2010) researched the use of blogs by student teachers. Of the beneficial features of blogs, student teachers determined ease of use, interactivity, the ability to link to other documents, and the capacity to support teaching outside class hours to be the highest rated features (Top et al., 2010).

Though blogging serves as an environment that may foster higher-order learning, recent research shows that online environments are not being utilized to their full potential. When online discussions were evaluated for critical thinking in a study of

online learners in higher education, it was found that 75% to over 80% of students' online postings (Garrison et al., 2001; Gilbert & Dabbagh, 2005) were at the lower levels of Bloom et al.'s (1956) Taxonomy (i.e. knowledge, comprehension, application). Yang (2009) determined that as student teachers reflected through blogs, there were more descriptive than critical reflections. Conversely, in a study conducted by Szabo and Schwartz (2011), online discussion forums increased critical thinking skills and initiated higher-order thinking in pre-service teachers. The structure of online discussions and question prompts may be key reasons that students' postings reflect relatively low levels of critical thinking (Bradley, Thom, Hayes, & Hay, 2008). "By using collaborative online discussions, teacher candidates have the opportunity to gain a deeper understanding of learning" (Pena & Almaguer, 2012, p. 26). The development of student teachers' abilities to think critically through collaborative, interactive, and critical reflection is fundamental to their professional careers (Pena & Almaguer, 2012).

Communities of Practice

Blogs can often be housed in a community of practice (CoP). A CoP is a group of people who share similar experiences and discuss them together in order to "foster new approaches to problems" (Wenger & Snyder, 2000, p. 139-140) and develop professional skills (Killeavy & Moloney, 2010; Wenger & Snyder, 2000; Yang, 2009). CoPs used in educational settings are composed of private or public discussion boards that allow inservice teachers and pre-service teachers the opportunity to reflect through blog posts and asynchronous communication (Walker, 2005; Williams & Jacobs, 2004; Yang, 2009). CoPs allow students to explore knowledge and share information (Godwin-Jones, 2003). CoPs also support collaborative learning, thus enriching learning performance for

a students' individual construction of knowledge and sharing of group knowledge (Liaw et al., 2008).

Leading researchers in communities of practice, Jean Lave and Etienne Wenger, described a naturally occurring community of practice to be one that highlights the importance of learning being situated in authentic practice contexts (situated learning) or practice environments (CoPs) (Lave & Wenger, 1991). As Wenger (1998) described a social theory of learning as a "conceptual framework from which to derive a consistent set of general principles and recommendations for understanding and enabling learning" (p. 2), he acknowledged four premises that are fundamental to the nature of knowledge and learning:

> (a) [W]e are social beings, a central aspect of learning, (b) knowledge is a matter of competence with respect to valued enterprises, (c) knowing is a matter of being actively engaged in the world, and (d) meaning is ultimately what learning is to produce (pp. xv-xvi).

Wenger (1998) used these assumptions in determining that the focus of a social theory of learning is that learning occurs as a part of social participation. Participation is being active "in the practices of social communities and constructing identities in relation to these communities" (p. xvi). The components that characterize this sort of social participation as a process of learning are meaning, practice, community, and identity (Wenger, 1998):

> 1) *Meaning*: a way of talking about our (changing) ability—individually and collectively—to experience our life and the world as meaningful.

2) *Practice:* a way of talking about the shared historical and social resources, frameworks, and perspectives that can sustain mutual engagement in action.

3) *Community:* a way of talking about the social configurations in which our enterprises are defined as worth pursuing and our participation is recognizable as competence.

4) *Identity:* a way of talking about how learning changes who we are and creates personal histories of becoming in the context of our communities (p. 5).

The components of a social theory of learning are designed in such a manner that any of the peripheral components could be exchanged with learning, the central component, and the model would still have meaning in the context of learning (Wenger, 1998). Since the mid-twentieth century when Vygotsky developed his theory of social constructivism, educators and psychologists continue to find evidence that learning and knowledge develop through social interaction. As Wenger (1998) stated, "a social theory of learning must therefore integrate the components necessary to characterize social participation as a process of learning and knowing" (p. xvi). Everyone belongs to a community of practice whether it be at home, school, work, or through hobbies (Wenger, 1998). Figure 2.4 displays the four components of a social theory of learning.

Figure 2.4. Components of a social theory of learning: an initial inventory. From Wenger, E. (1999). *Communities of Practice: Learning, meaning, and identity.* New York, NY: Cambridge University Press, p. 5. Copyright Cambridge University Press, 1998. Reprinted with permission.

Wenger (1998) believed that if people continue to view knowledge as being stored in the brain, our instructional methods should continue to mirror that of a teacher standing before a classroom of students. Rather, Wenger argued that if educational professionals can train themselves to think of the development of knowledge primarily as active participation in social communities, then the traditional teaching methods no longer appear productive. Instead, educators should go beyond traditional teaching methods and provide students with meaningful practices by providing resources through which students can enhance their participation, work in relevant learning environments, and discuss and reflect within their learning communities (Wenger, 1998). A social theory of learning then becomes more than just an academic enterprise, it becomes important to our daily actions—not just for teachers, students, and parents, but to

spouses, health practitioners, managers, workers, citizens, and policy makers (Wenger, 1998). Through these actions, educators are not only fostering their own learning, but the learning of those "in [their] relationships, [their] communities, and [their] organizations" (Wenger, 1998, pp. xix-xx).

Communities of practice have a place in higher education and in the professional education fields. In the realm of higher education, pre-service teachers involved in a community of practice may cultivate meaning as "an experience of identity…[learning] is not just an accumulation of skills and information, but a process of becoming" (Wenger, 1998, p. 215). A pre-service teacher's performance through practice is expected to mirror that of experienced teachers (Cuddapah & Clayton, 2011). Therefore, the CoP offers a space for pre-service teachers to communicate with others in a similar position, to discuss areas of personal strengths and weaknesses (Cuddapah & Clayton, 2011). Wenger (1998) emphasized that learning is situated in the social engagement of the learners, or a "joint enterprise" (p. 73). Finally, as pre-service teachers grow from meaningful experiences and as a part of a community, they begin to take on a new identity (Cuddapah & Clayton, 2011; Wenger, 1998).

Though a community cannot be forced, Hoadley (2012) offers a technique in which technology can be used to foster a learning-oriented community of practice: users must have connectivity. If users do not identify the central members of an already existing group, it is important that they locate others who share similar practices. Hoadley (2012) believes that educators must then help student learners fix themselves into "supportive authentic contexts, or create quasi-authentic contexts in which they can 'do' the knowledge that is desired; mere regurgitation is not enough" (p. 290). Collaborative

learning increases interest among participants and also promotes critical thinking (Gokhale, 1995).

Cultivating Critical Thinking through Blogs and Communities of Practice

Though previous researchers have noted the ability for asynchronous discussion to be a means for support of higher-order thinking, there is limited evidence that suggests text-based communication through computer technology can support the development and practice of higher-order thinking (Garrison et al., 2000). In finding that computer technology is able to enhance higher-order thinking, it would then be appropriate to monitor online communication in order to facilitate a meaningful educational experience (Garrison et al., 2000). In an attempt to increase reflection, articulation, and social negotiation, all components of higher-order thinking, higher education faculty are using asynchronous communication technologies to enhance course discussions (Gilbert & Dabbagh, 2005). It is essential to integrate critical thinking skills into online discussions so that students are challenged intellectually and are presented with relevant learning experiences (Pena & Almaguer, 2012).

The student teaching experience helps pre-service teachers take the theory learned in teacher preparation programs and apply it in the classroom (Pena & Almaguer, 2012). "Prospective candidates are encouraged to make connections and realize the relationship between the theoretical ideas they are taught and their relevance and function in the classroom" (Pena & Almaguer, 2012, p. 26). Instructors can influence the performance of students in online asynchronous discussions (Giacumo, Savenye, & Smith, 2013). Researchers have identified methods that instructors can implement in online environments to assist pre-service teachers developing their critical thinking abilities.

Though often used as a means of assessing text-based communication, the concept of Communities of Inquiry and the PIM may be of assistance when developing critical thinking in online environments (Garrison et al., 2001). See Figure 2.3 for a review of the PIM.

PIM - Triggering Phase

The triggering phase of the PIM serves as the initiation phase of critical inquiry in which a problem emerges. An instructor may present a problem that becomes the triggering event to the learner (Garrison et al., 2001; Liu & Yang, 2012). The teacher is expected to guide students in critical thinking by posing an issue or problem for the students to solve and to keep students' focus on the intended outcomes (Garrison et al., 2001). Potts (1994) used strategies for teaching critical thinking that can be adopted in teacher preparation programs. Consistent with the suggestions of Garrison et al. (2001), Potts (1994) more specifically identified a *building categories* strategy for teacher preparation programs that insists pre-service teachers use inductive reasoning to categorize information, utilizing discovery over rote memorization. Pena and Almaguer (2012) suggested, "if educators want [pre-service teachers] to use their critical thinking skills, they must require it" (p. 31). In agricultural education, hands-on, real world problem-based learning has been and remains the norm (Henderson, 1983). Potts' (1994) *finding problems* strategy suggests that it is imperative that the problems presented in the classroom resemble those that the learners—pre-service teachers—will face in real life.

PIM - Exploration Phase

The second phase of the critical inquiry process of the PIM is exploration, in which learners move from critical reflection of the problem at hand to a deeper

exploration of information relevant to the problem (Garrison et al., 2001). Here is where learners engage in discourse and determine what is pertinent to solving the problem; questioning, brainstorming, and the exchange of information describe behaviors in the exploration phase. Writing, questioning, and collaboration are techniques used to increase higher-order thinking skills (Marzano, 1993; Paul & Elder, 2006). The exploration phase is evident when students begin to utilize critical thinking in online environments. Here, the instructor can encourage pre-service teachers to challenge one another's thoughts and opinions (Garrison et al., 2001), utilizing asynchronous discussion to its full potential.

PIM - Integration Phase

The third phase of the PIM occurs when the learner constructs meaning from the information and ideas organized in the previous phase and communicates these ideas within the community of inquiry (Garrison et al., 2001). An active teaching presence is critical in this phase of learning, in order to provide prompting questions, diagnose misconceptions, and to model the critical thinking process (Garrison et al., 2001). Garrison et al. (2001) stated that students in this phase are often comfortable and will require a teacher's presence to motivate them towards advanced stages of critical thinking and cognitive development. Garrison et al. (2001) and Giacumo et al. (2013) also suggested the influence that a rubric may have on cognitive performance. Garrison et al. (2001) more specifically stated that students may be more likely to use critical thinking skills if they are able to utilize a rubric based upon Bloom et al.'s (1956) Taxonomy.

MacKnight (2000), Wang and Hsua (2008) and Santrock (2011) suggested that faculty continue to facilitate disciplined discussions by keeping discussions on topic and by asking probing questions that hold learners accountable. In a study of students' higher-

order learning in asynchronous discussion when provided with prompts and a rubric, Giacumo et al. (2013) found that students contributed more to discussions and demonstrated an increase in writing quality. Additionally, MacKnight (2000) suggested that "infusing these questions in the minds of students, encouraging full participation, and periodically summarizing what has or needs to be done" (p. 39) may encourage critical thinking. Furthermore, "in monitoring discussions or group work activity, faculty must engage in a line of questioning that will continue to drive an idea" (MacKnight, 2000, p. 39), further developing students' critical thinking skills and abilities. Duron et al. (2006) also noted the positive impact divergent questioning can have on student teachers' critical thinking skills. Since interactions among students can happen via the Internet, instructors can easily monitor student interactions (Cakir, 2013).

Just as Vygotsky focused on the scaffolding approach for adolescents in education, MacKnight's (2000) suggestions for facilitation in higher education stands to be disproven as a necessary element in moving higher education students towards critical thinking. Vygotsky's (1978) ZPD may still be relevant to scaffolding for learners of all ages. Facilitation may guide instructors in determining each students' ZPD as they play an active role in the online learning environment by asking probing questions and encouraging critical thinking. If facilitation direct from the instructor is not an option on a regular basis, Hoadley (2012) offered that it is important that users have connectivity and the capability to identify the central member of an already existing group in order to share similar experiences.

PIM - Resolution Phase

During resolution, the final stage in the PIM, the student attempts to reach a consensus on the solution or new knowledge with those in the Community of Inquiry (Garrison et al., 2001). Potts (1994) recognized that physical environment can facilitate critical thinking. How does this community of learners learn best? What sorts of physical elements (i.e., visual aids) are available to encourage critical thinking? "Faculty have the responsibility of shaping online discussions and establishing the classroom culture to support them" (MacKnight, 2000, p. 39). MacKnight recognized social skills that will guide students in online activities and in the development of critical thinking: "The students must ask the right questions, be willing to listen to one another, help each other learn, respect and build upon each other's ideas, and think in new ways" (MacKnight, 2000, p. 39). By creating a positive, educationally stimulating environment, students may be more willing to participate in online discussions and more accepting to others' sharing of knowledge.

Instructors and facilitators have a critical role in guiding students to critical thinking in online environments. Students can become more "effective critical thinkers who can easily move between both worlds of teaching: theory and practice" (Pena & Almaguer, 2012, p.31), if they receive supportive facilitation in online environments. Wang and Hsua (2008) offer general suggestions based on their research that can help students understand the purpose of asynchronous discussions; instructors should offer training sessions in order to demonstrate appropriate blogging procedures and explain the advantages of blogging. Concisely, "critical thinking can be fostered through the use of

effective higher order thinking, probing, and reflective questioning skills" (Pena & Almaguer, 2012, p. 26), particularly in online environments.

In conclusion, instructors can positively impact students' performance in online asynchronous discussions (Giacumo et al., 2013; MacKnight, 2000; Thompson & Savenye, 2007). Asynchronous discussion through online portals allows students to provide and accept more reflective feedback. It then becomes critical that students utilizing asynchronous discussions focus concerns on the impact of their feedback and ask thoughtful, critical questions of themselves and others. In addition to instructor facilitation, it must be recognized that students in higher education are at an educational level where they hold the primary responsibility for their studies (Gilbert & Dabbagh, 2005; Szabo & Schwartz, 2011). Though the PIM is a model for higher education students in general, it is applicable to pre-service and student teachers.

Accreditation for Agricultural Education Student Teachers

So far one aspect of preparing effective and highly qualified teachers has been discussed in detail—critical thinking. However, critical thinking alone will not satisfy the accreditation requirements to be certified as a professional teacher, as several other skills and abilities are necessary (Council of Chief State School Officers (CCSSO), 2011; CCSSO, 2015; Santrock, 2011). However, if pre-service teachers consistently display critical thinking skills and abilities, this will guide them in meeting graduation and certification requirements of accreditation agencies. The remainder of this chapter explains the accreditation process of agricultural education student teachers and the role critical thinking skills have in enhancing agricultural education student teacher achievement of the InTASC standards.

There has been increasing interest in holding teacher preparation programs accountable (Wilson, 2014). Teacher preparation programs have a set of standards upon which pre-service teachers are assessed, determining their effectiveness as a teacher. Darling-Hammond and Bransford (2005) explained that educational philosophy can influence the success and effectiveness of pre-service teachers. This notion remains true in agricultural education teacher preparation programs. Stripling and Barrack (2013) considered the proposed outcomes of a baccalaureate agricultural education program in consideration of Darling-Hammond and Bransford's notion. These outcomes "encompass the essential professional knowledge, technical knowledge, and general knowledge competencies that should be included in a baccalaureate agricultural education program" (Stripling & Barrack, 2013, p. 67). As colleges and universities prepare pre-service teachers, a set of standards have been established to assist in assessing pre-service teachers' competence and ability to work in the education profession. Recently, teacher competencies have been defined in terms of standards.

The development of performance-based assessment for teacher certification (Moss & Lee, 2010) began in 1987, with the establishment of the National Board for Professional Teaching Standards (NBPTS) and the Interstate New Teachers Assessment and Support Consortium (InTASC). Each has defined standards based upon what teachers should know and be able to do (Olson & Wyett, 2000; Ryan, Metcalf-Turner, & Larson, 2002). The NBPTS have been adapted for inservice teacher standards. The InTASC standards are a framework for beginning teacher licensure and certification, describing what a beginning teacher should know and how they should be able to perform when they first walk into a classroom (Hostetler, 2002; Olson & Wyett, 2000; Ryan et al., 2002).

Iowa State University agricultural education pre-service teachers are required to meet twelve standards, which have been crosswalked with the InTASC standards developed in Appendix F (Crawford, 2014). These standards are the same standards that other education majors at the University are required to meet, established by the Iowa State University School of Education (2015). Agricultural education pre-service teachers have to prove proficiency in each standard, with an artifact from an undergraduate course and artifacts from the student teaching experience. Each of these artifacts are then assessed and evaluated by the University supervisor assigned to each pre-service/student teacher. It is then the University supervisors' responsibility to approve student teachers' ability as highly qualified and effective teachers in agricultural education (Paulsen, n.d.; Paulsen, 2014).

InTASC Standards

InTASC is a "consortium of state education agencies and national educational organizations dedicated to the reform of the preparation, licensing, and on-going professional development of teachers" (CCSSO, 2015, para. 2). According to Olson & Wyett (2000), "the InTASC standards have been widely adopted" (para. 5). Each standard is based upon performance, essential knowledge, and critical disposition measures. This combination of "knowledge, dispositions, and performances…probe the complexity of the teacher's practice" (p. 6). *Performances* are those actions in which a teacher can be observed and assessed during instruction. *Essential knowledge* is the expertise a teacher must demonstrate for effective practice. *Critical dispositions* indicate habits, actions, and moral commitments critical to the professional roles a pre-service teacher assumes. The standards are summarized as per the descriptions provided by the

CCSSO's (2011) *InTASC Model Core Teaching Standards: A Resource for State Dialogue*. Table 2.3 displays a synopsis of InTASC standards.

Table 2.3

Note. See Appendix F for the full table.

Synopsis of InTASC Standards and Descriptions (CCSSO, 2011)

InTASC Standard	Standard General Description
Learner Development	Teacher understand how learners grow and develop and instructs appropriate to learners' development
Learning Differences	Teacher understands individual differences and diverse cultures
Learning Environments	Teacher creates environments that support collaborative learning, positive social interaction, and self-motivation
Content Knowledge	Teacher understands and demonstrates mastery of central concepts pertinent to his/her discipline
Application of Content	Teacher engages learners in critical thinking, creativity, and problem solving as it relates to discipline content
Assessment	Teacher uses multiple methods of assessment in assessing student learning
Planning for Instruction	Teacher plans instruction that supports every student
Instructional Strategies	Teacher utilizes a variety of instruction strategies to encourage learners in understanding and application of the content
Professional Learning and Ethical Practice	Teacher engages in ongoing professional learning and values ethical choices
Leadership and Collaboration	Teacher is involved in leadership roles and collaborates with learners, families, colleagues, and community members

Standard #1: Learner Development

This standard requires that pre-service teachers demonstrate knowledge and understanding of how "learners grow and develop" (CCSSO, 2011, p. 10), recognizing that student learning and individual development may vary across "cognitive, linguistic,

social, emotional, and physical areas" (CCSSO, 2011, p.10). An effective teacher is one who modifies instruction to meet the learners' needs, takes into account the strengths and interests of the learners, and collaborates with families, colleagues, and the community to promote learner development (CCSSO, 2011). Respect, commitment, responsibility and morale are dispositions expected of a teacher who satisfies the requirements of Standard #1 (CCSSO, 2011). Three performance measures, four essential knowledge measures, and four critical dispositions highlight this standard.

Standard #2: Learning Differences

A teacher who meets Standard #2 understands that each learner is different and diverse, and uses this knowledge to create an inclusive learning environment to help each learner meet high standards (CCSSO, 2011). An effective teacher is one who creates, adapts, and delivers instruction that meets the needs of diverse learners and provides methods for learners to demonstrate their learning in various ways (CCSSO, 2011). The teacher "makes appropriate and timely provisions for individual students with particular learning differences or needs [and] brings multiple perspectives to the discussion of content, including attention to learners' personal, family, and community experiences and cultural norms" (CCSSO, 2011, p. 11). This standard requires that a teacher evaluate and support learners' proficiency in English, as well as access resources, specialized assistance and services to meet differences or needs of the learners in his/her classroom (CCSSO, 2011). An effective teacher who meets this standard in all students' potential, respects various skills, abilities, talents, and interests, and makes learners feel valued (CCSSO, 2011). This standard is composed of six performance measures, five essential knowledge measures, and four critical dispositions.

Standard #3: Learning Environments

A teacher who fulfills this standard "works with others to create environments that support individual and collaborative learning, and that encourage positive social interaction, active engagement in learning, and self-motivation" (CCSSO, 2011, p. 12). This standard is highlighted by eight performance measures that focus on teachers' ability to collaborate with learners, families, and colleagues to build a positive, safe learning environment, extend learner interaction with those in the local and global settings, and manage the learning environment in a manner that captures student attention (CCSSO, 2011). The teacher is thoughtful, organized, appropriately allocates resources, utilizes verbal and nonverbal communication, and can apply technologies effectively (CCSSO, 2011). Five essential knowledge measures and five critical dispositions are achievement criteria for Standard #3.

Standard #4: Content Knowledge

The purpose of this standard is to measure the effectiveness of a teacher and his/her understanding of the content and tools of inquiry as they pertain to their courses (CCSSO, 2011). The effective teacher is able to create learning experiences to make the fundamentals of the "discipline accessible and meaningful for learners to assure mastery of the content" (CCSSO, 2011, p. 13). A teacher who effectively displays Standard #4 uses many ways to represent and explain key concepts of the discipline and encourages learners to question and analyze ideas from diverse perspectives so that the learners, too, master the content (CCSSO, 2011). The teacher recognizes when learners have misconceptions about the content that interfere with learning and effectively evaluates and modifies instructional resources and curriculum materials appropriate for the delivery

of content (CCSSO, 2011). Finally, the teacher has a knowledge and understanding of how to access and effectively distribute school or district resources in which he/she can evaluate learners' content knowledge (CCSSO, 2011). Nine performance measures, five essential knowledge measures, and four critical dispositions highlight this standard.

Standard #5: Application of Content

In meeting Standard #5, the teacher can "connect central concepts and use differing perspectives to engage learners in critical thinking, creativity, and collaborative problem solving related to authentic local and global issues" (CCSSO, 2011, p. 14). The effective teacher implements projects that require students to draw knowledge from across disciplines, apply content knowledge to real world problems, and facilitate learners in utilizing tools and resources to maximize student learning (CCSSO, 2011). Eight performance measures, eight essential knowledge measures, and three critical dispositions comprise this standard.

Standard #6: Assessment

For this standard, "the teacher understands and uses multiple methods of assessment to engage learners in their own growth, to monitor learner progress, and to guide the teacher's and learner's decision making" (CCSSO, 2011, p. 15). The effective teacher balances the assessment methods used in the classroom, provides learners feedback of their progress, minimizes sources of bias that may "distort assessment results" (CCSSO, 2011, p. 15), and uses assessment data to identify learners' needs and modify learning experiences based upon that data (CCSSO, 2011). The teacher prepares the learners for the requirements of assessments and makes appropriate accommodations for learners with disabilities or language learning needs (CCSSO, 2011). There are nine

performances measures for this standard, seven essential knowledge measures, and six critical dispositions.

Standard #7: Planning for Instruction

An effective teacher meets Standard #7 by planning for instruction that supports every students' goals by utilizing knowledge of content, curriculum development, cross-disciplinary skills, and pedagogy (CCSSO, 2011). The six performance standards suggest that the teacher be able to create learning experiences appropriate for curriculum goals and content standards (CCSSO, 2011). The teacher must effectively choose strategies and resources that differentiate instruction for individual learning styles (CCSSO, 2011). The teacher is able to demonstrate knowledge and skills in multiple ways, and base instruction upon "formative and summative assessment data, prior learner knowledge, and learner interest" (CCSSO, 2011, p. 16). Efficiency in Standard #7 is also demonstrated by collaboration with professionals who have specialized expertise (e.g., special educators, librarians, media specialists) to design learning experiences that will meet unique learning needs (CCSSO, 2011). Seven essential knowledge measures and four critical dispositions highlight this standard.

Standard #8: Instructional Strategies

Standard #8 states that an effective teacher utilizes multiple instructional strategies in order to encourage learners and develop learners' content knowledge (CCSSO, 2011). A teacher "engages all learners in developing higher order questioning skills and metacognitive processes" (CCSSO, 2011, p. 17). An instructional strategist uses a variety of instructional strategies in order to develop and grow learners' communication skills through speaking, listening, and writing (CCSSO, 2011). A critical

disposition key to this standard is that the teacher is committed to implementing new and emerging technology in order to promote student learning (CCSSO, 2011). Nine performance measures, six essential knowledge measures, and four critical dispositions comprise this standard.

Standard #9: Professional Learning and Ethical Practices

This standard suggests that effective teachers engage in ongoing professional development, evaluating themselves based upon the evidence gained from his/her choices and actions (CCSSO, 2011). The teacher "actively seeks professional, community, and technological resources…as supports for analysis, reflection, and problem-solving" (CCSSO, 2011, p. 18). The teacher continually reflects on his/her personal biases in order to deepen his/her understanding of gender, ethnic, and cultural differences, build stronger relationships, and create relevant learning experiences (CCSSO, 2011). "The teacher understands the expectations of the profession including codes of ethics, professional standards of practice, and relevant law and policy" (CCSSO, 2011, p. 18). This standard is highlighted by six performance measures, five essential knowledge measures, and four critical dispositions.

Standard #10: Leadership and Collaboration

A teacher who has mastered Standard #10 "seeks appropriate leadership roles and opportunities to take responsibility for student learning, to collaborate with learners, families, colleagues, other school professionals, and community members to ensure learner growth, and to advance the profession" (CCSSO, 2011, p. 19). The teacher identifies common goals as a part of a school-wide effort to build a shared vision (CCSSO, 2011). An effective teacher generates meaningful research on education issues

and policies and takes on leadership roles at the school, district, and state level to advocate for learners, school, community and profession (CCSSO, 2011). Critical to meeting this standard, the teacher gives and is open to feedback on practice, and works with other school professionals to facilitate learners (CCSSO, 2011). Eleven performances measures, four essential knowledge measures, and five critical dispositions highlight this standard.

Summary

Online learning environments may serve to enhance higher-order thinking skills if facilitated appropriately. Though many researchers, writers, and educators have worked to coin a precise definition for critical thinking, there is one yet to be developed that is widely accepted. Over half a century ago, Benjamin Bloom and his colleagues were among the top researchers in cognition. They developed a system in which critical thinking could be classified. The classification that Bloom et al. (1956) developed is still used today, with modifications by Anderson and Krathwohl (2001). There are many ways to assess critical thinking, dependent upon the goals of the researcher. One such way to observe online learning environments is the Florida Taxonomy of Cognitive Behavior (FTCB). Originally designed for classroom observation, the FTCB outlines 55 descriptors that guide the observer in classifying the level of cognitive behaviors of students and instructors.

Higher education is being pushed by employers to develop more graduates with critical thinking skills: the agricultural education teacher preparation program at Iowa State University is under the same critique. Across all disciplines, standards act as assessment measures in which pre-service teachers are evaluated in order to determine

their success at reaching a highly qualified status. These assessment measures outline very specific outcomes expected of pre-service teachers, two of them being the skills and abilities sought by employers – critical thinking and reflection. The standards which assess pre-service teachers are known as InTASC standards; Iowa State University School of Education bases their teacher education standards on the InTASC criteria.

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CHAPTER III. METHODS

Bloom, Engelhart, Furst, Hill, and Krathwohl's Taxonomy of Educational Objectives (1956) is valuable for recognizing specific attributes of the levels in which teachers and learners critically process content. Bloom's Taxonomy of Educational Objectives recognizes six levels of cognitive abilities and skills: knowledge, comprehension, application, analysis, synthesis, and evaluation. As discussed in Chapter II, these levels assist researchers in determining the critical thinking displayed by students (Brown, Ober, Soar, & Webb, 1970). Through the instrumentation of the Florida Taxonomy of Cognitive Behavior (Brown et al., 1970) and the descriptions of InTASC standards, student teachers' blog posts were analyzed in this study.

In other research studies and literature reviews, terms such as critical reflection, analytical reasoning, divergent thinking, formal operational skills, and creative problem solving have been used interchangeably to describe cognitive processes of learners (Henderson, 1983; Yang, 2009). For the purposes of this study, critical thinking will be used to describe those higher-level cognitive processes. Contents of this chapter include a description of the participants, instrument reliability and validity, details of data collection methods, and data analysis procedures.

Objectives of the Study

The purpose of this study was to explore student teacher levels of critical thinking and student teacher discussion of InTASC standards, in blog posts housed in an electronic community of practice. Blog posts were analyzed using the FTCB. The following research objectives guided this study:

1. Determine the frequency and the average level of critical thinking exhibited by Iowa State University agricultural education student teachers' reflections through blog posts in an electronic community of practice.
2. Determine the relationship, if any, between the number of blogs posted by each student teacher and the average level of critical thinking displayed by student teachers within their respective blog posts.
3. Determine the frequency in which student teacher blog posts related to the ten InTASC standards.
4. Determine the relationship, if any, between the average level of critical thinking displayed within student teacher blog posts and the frequency with which those blog posts related to the InTASC standards.

Population and Sample Design

The population of this study consisted of student teachers who utilized an electronic community of practice to blog during the student teaching experience. This study utilized a convenience sample due to the accessibility and cooperation of the Agricultural Education Department at Iowa State University. The study was employed with all agricultural education student teachers at Iowa State University during the fall of 2013 and spring of 2014 ($N = 21$). The two semester student teaching experiences were identical with regards to length of required time in the classroom (14 weeks), and expected student learning outcomes based upon the InTASC standards (2015). Each student teacher in the study taught at a different agricultural education program at the secondary level in Iowa; therefore, each student teacher had a different cooperating teacher.

Rights and Welfare of the Participants

Appropriate IRB approval was obtained through the Office of Responsible Research at Iowa State University (Appendix A). A research assistant removed all identifying information from the coding documents before the researchers began the study. Student teachers were randomly assigned a code number in order to for the data to be organized.

In a study conducted by Chuang (2008), student teachers expressed concerns about having a blog open to the public, where community members or school employees could read student teacher opinions and comments about their cooperating teacher or school. This study avoided such controversy by housing student teacher blog posts in a private discussion board in which the University Supervisor invited only the student teachers to be a part of the group. All blog posts were housed in a private Community of Practice discussion board hosted by the National Association of Agricultural Educators (NAAE). Iowa State University agricultural education student teachers were required to blog bi-monthly and post to the discussion forum weekly as the only Community of Practice requirements for the student teaching experience. For the remainder of the study, blogs and discussions posted on the communities of practice will be referred to as blog posts.

Instrument Selection

In this study, the FTCB was utilized to analyze critical thinking abilities of agricultural education student teachers' blog posts in an online community of practice because of its foundation in Bloom's Taxonomy (López & Whittington, 2001). Use of this instrument was chosen over that of the Practical Inquiry Model (Garrison, Anderson,

& Archer, 2001). The extensive research in critical thinking focused around Bloom's Taxonomy and the 55 descriptors on the FTCB (as compared to 15 initial indicators on the PIM) provided for more descriptive behavioral examples for the researcher to refer during the coding periods of this study. Though the FTCB was originally designed for physical observation assessment of critical thinking, it provides more descriptors in guiding the researcher to select the appropriate text-based communicative behavior of the student teacher.

More specifically, the Practical Inquiry Model does not warrant the researcher to code "submessage level units" (Garrison et al., 2001, p. 17). Again, this provides fewer categories and descriptors under which cognitive presence may be recognized. In a study conducted by Garrison et al. (2001), the interrater reliability between coders was low compared to the suggestions of Riffe, Lacy, and Fico's (1998) chance-corrected reliability figures. However, the justification for such low reliability measures was due to the new coding system, which had not been used extensively (Garrison et al., 2001). The present study sought to utilize methodology that was credible and has previously been used in multiple studies, warranting the FTCB as the instrument of choice for this study.

Objectives One and Two

Prior to instrument selection, advice from English professors at Iowa State University was sought. In order to assess and analyze student teacher discourse, it was important to have a reliable and valid tool. Upon meeting with the English professors and discussing the purpose and objectives of this study, there was no suggested resource that was used in the English department to assess or analyze critical thinking in English student teacher writing or journal reflections. The FTCB was presented to the English

professors for suggestions for implementation and use. After explanation of the instrument and how it was going to be used, the English professors supported the notion of using the FTCB to analyze student teacher discourse. However, one professor warned against the use of the term *critical thinking assessment* and instead suggested using *critical thinking analysis*, to clarify that a score would not be assigned to the student teachers in this study as it would in a typical critical thinking assessment.

Instrumentation Validity and Reliability

Bloom et al.'s (1956) Taxonomy of Educational Objectives is widely accepted in educational research as a means of categorizing learning behaviors into levels of cognition. The FTCB was directly derived from Bloom's Taxonomy (Ulmer, 2005). Based on these two assertions, Miller (1989) stated, "the FTCB can be considered valid in light of the support generally given to Bloom's Taxonomy as a means of identifying specific behaviors in the various levels of cognition" (p. 43). The validity for the FTCB instrument was based upon its direct development from Bloom's Taxonomy (Ball & Garton, 2005; López & Whittington, 2001; Miller, 1989; Whittington, 1991; Whittington & Newcomb, 1993).

It should be noted that the FTCB details observable example actions that would display a specific level of critical thinking. It is often more difficult to determine the actions of the student teacher through assessing discourse (Garrison et al., 2001). Due to the qualitative nature of the data in this study, instrument reliability was established using peer review (Johnson & Christensen, 2014). As suggested by Johnson and Christensen (2014), the researcher discussed the process of coding and interpretations of the data with a peer reviewer throughout the course of the study. Johnson and Christensen (2014)

called this special type of peer review a *critical friend*. Creswell (2007) recognizes this sort of external check of the research process as peer debriefing. The peer asks challenging questions about the methods, meanings, and interpretations of the researching who is coding the data.

Though this study did not utilize a true intra-class correlation (ICC) reliability coding procedure (Hallgren, 2012), a similar procedure was followed with the critical friend. An intra-class correlation is a statistic used for assessing the interrater reliability of interval, ratio, or ordinal variables (Hallgren, 2012). An ordinal variable may be that such as the hierarchical manner of critical thinking levels coded in this study. Hallgren (2012) stated that ICCs are appropriate for studies that utilize two or more coders; "all subjects in a study are rated by multiple coders, or when only a subset of subjects is rated by multiple coders and the rest are rated by one coder" (p. 9). Furthermore, "Cohen's (1960) kappa quantifies IRR based on all or nothing agreement; ICCs incorporate the magnitude of the disagreement to compute IRR estimates, with larger-magnitude disagreements resulting in lower ICCs than smaller-magnitude disagreements" (Hallgren, 2012, p.9). However, when Hallgren depicts the total number of subjects being coded by researchers, it appears to be a small number of subjects. Due to the magnitude of the number of codes and that codes were not initially organized by subjects, it was decided that it would be most convenient to use a critical friend instead of the ICC process.

The researcher provided the critical friend with randomly selected student teacher posts, the assigned corresponding codes, the specific FTCB code number, and detailed notes for the critical friend. The critical friend was asked to code randomly selected posts. The critical friend then checked the assigned codes with those of the researcher. If

discrepancies existed, the researcher and peer reviewer discussed the differences based on their notes. Sankey and Foster (2012) used a similar procedure when they employed a content analysis of teaching philosophy statements. Discrepancies were most notably between either two higher-order levels or two lower-order levels, appearing less often across lower- and higher-order levels.

Objectives Three and Four

The InTASC standards were used to code blog posts according to which standard the student teachers discussed in each blog post. The InTASC standards provided definition of terms and a rich description of standard components that were regularly consulted during coding. The InTASC standard descriptions were used as a guideline for the researchers' coding. The InTASC standard descriptions are not a research instrument.

Data Collection

Researchers have recently moved away from measuring interaction quantitatively (e.g., number of posts) to more qualitative measures (e.g., quality of posts) (DeWever, Schellens, Valeck, & Van Keer, 2006), since an increase in number of posts does not necessarily mean an increase in quality of learning (Vonderwell, 2002). These more qualitative measures are often studied in relation to critical thinking (Walker, 2004).

As a component of the regular classroom requirement, student teachers were required to make weekly posts to discussion forums and bi-monthly blog posts to the Communities of Practice (CoP) private discussion board during the fourteen weeks of their student teaching experience. Student teacher blog posts were located in a private NAAE CoP. Iowa State University supervisors and a research assistant monitored this CoP. At the end of the fall and spring semesters, the research assistant copied all blog

posts and pasted them into an Excel file. Along with each post, a code number was randomly assigned to each student teacher for confidentiality and the date of the blog post was recorded and printed for manual coding.

Data Analysis

This study interpreted qualitative data from a quantitative perspective. Creswell and Plano Clark (2011) and Tashakkori and Teddlie (2003) determined that mixed methods studies comprehensively explore the manner in which qualitative data can be transformed into quantitative data to determine descriptive measures (i.e. frequencies and percentages) and for survey instrument development.

Objectives One and Two

Once the blog posts were secured in an Excel file after each semester, all posts were numbered (N=1,016). Some methodologists recommend that the researcher determine the choice of coding method prior to the study, "to harmonize with [the] study's conceptual framework paradigm, and to enable an analysis that directly answers your research questions and goals" (Saldaña, 2013, p. 62). In this case, provisional coding was used, as each level of critical thinking was a predetermined category anticipated from the literature review (Saldaña, 2013) and previous research findings (Bradley, Thom, Hayes, & Hay, 2008; Garrison et al., 2001; Gilbert & Dabbagh, 2005; Walker, 2004).

The Florida Taxonomy of Cognitive Behavior (Brown et al., 1970) was used to analyze and code student teachers' blog posts. Blog posts were manually coded as one of six levels of critical thinking, based on Bloom et al.'s (1956) Taxonomy and the FTCB (Brown et al., 1970): knowledge, translation, interpretation, application, analysis, synthesis, and evaluation. Any post coded as translation or interpretation was changed to

Comprehension to satisfy the original Bloom's Taxonomy (see Figure 1). To ensure that the data collector coded postings in a manner that was consistent with Bloom's Taxonomy and the FTCB, Bloom's Taxonomy and FTCB was studied regularly and consulted during the coding process. Each post was coded twice at four-week intervals and compared. Critical thinking levels assigned to blog posts from the first coding interval were compared with corresponding codes from the second coding interval and entered into an Excel file. Corresponding blog posts that were not coded at the same level of critical thinking were recoded for a third time after a four-week interval. Posts that were not consistently coded at the same level of critical thinking after the third coding interval were not used in the study. Intrarater reliability was established as excellent for the present study (α=.93) by coding the blog postings three times at four-week intervals (Weir, 2005). An intrarater reliability code of zero indicated no reliability while a code of 1.0 indicated perfect reliability (Weir, 2005). The usable codes (n = 942) were then copied to a new Excel file.

The blog posts were then sorted based upon the relationships being studied. Three Excel sheets were utilized to keep the data separated: total blog posts at each level of critical thinking, total blog posts per student teacher, and total blog posts at each level of critical thinking per student teacher. This allowed the researcher to determine the correlation between the number of total blog posts each student teacher posted, and the frequency with which the student teacher posted at each level of critical thinking. The average level of critical thinking for each student teacher was determined. Because the data was ordinal (Urdan, 2010) with critical thinking being coded among six hierarchical levels, each level was given a multiplier (1: Knowledge, 2: Comprehension, 3:

Application, 4: Analysis, 5: Synthesis, 6: Evaluation). The multiplier is similar to that of using a weighted system as suggested by Miller (1989) and Newcomb & Trefz (1987). The total number of blog posts at each level of critical thinking was multiplied by the appropriate multiplier, then divided by the total number of posts, resulting in the average level of critical thinking per student teacher.

The total number of posts and the average level of critical thinking were entered into IBM SPSS Version 22.0, and Spearman's rho was calculated to determine correlational relationships between the number of posts and the average level of critical thinking per student teacher. Spearman's rho was the statistical procedure of choice because of the small sample size in this study and because the parametric alternative of Pearson's r assumes a randomized sample. Preliminary analyses were performed to ensure normality. Although data may not have demonstrated true linearity and displayed a more curvilinear relationship, with the small sample that was used it was decided to leave all data points for analysis (Pallant, 2013).

Objectives Three and Four

Each blog posted by the student teachers was also coded for the InTASC standards. Simultaneous coding (Miles & Huberman, 1994; Saldaña, 2013) was used to code blog posts for InTASC standards. Simultaneous coding "is the application of two or more different codes to a single qualitative datum, or the overlapped occurrence of two or more codes applied to sequential units of qualitative data" (Saldaña, 2013, p. 80). Saldaña (2013) cautioned researchers that simultaneous coding may contribute to indecisiveness if it is used excessively, and the researcher should justify the rationale for its use. The rationale behind using simultaneous coding of InTASC standards in student teacher blog

posts was due to the interconnectedness of InTASC standards and the situations in which multiple standards may arise as a student teacher posts to the discussion forum. In the instance of classroom management and student misbehavior, the student teacher may also recognize that particular students mature and develop at a differing rate than that of their peers. In this situation, two standards are addressed: Learning Environment and Learner Development. Moreover, the blog posts coded for Objectives Three and Four were not renumbered after originally numbered for the coding process for objectives one and two. Rather the blog posts assigned numbers for Objectives One and Two were the same for coding InTASC standards. This was done so that the researcher could determine any correlational relationship between the blog posts discussing specific InTASC standards and the level of critical thinking of those blog posts.

Therefore, total posts (*N*=1,016) were coded for InTASC standards. Again, the researcher referenced the CCSSO's *InTASC Model Core Teaching Standards: A Resource for State Dialogue* (2011) during the coding process. Because student teachers may have discussed more than one standard in a blog post, the coder recorded all standards discussed in each post. Several blog posts had more than one standard coded. Some blogs were general statements and did not relate to any of the standards; therefore, they did not receive an InTASC standard code. The total number of InTASC codes (*N*=1,632) exceeded that of the actual posts. Posts were coded for InTASC standards three times, at four-week intervals. If a standard was recognized as a part of a blog post, but was not coded during the first coding trial, the standard code was added to the blog post. After the three four-week coding intervals, the coder added any additional standards that were recognized as being discussed as a part of the blog posts. All blog posts were

manually coded for InTASC standards and copied into an Excel file. In order to determine correlational relationships between critical thinking and InTASC standards, only the posts in which critical thinking levels were agreed upon (*n*=942) were used. Usable codes for standards were determined (*n*=1,474).

In order to determine if a correlational relationship existed, the average level of critical thinking per each of the ten InTASC standards discussed was calculated. All usable blog posts (*n*=942) were copied to a separate Excel file. The level of critical thinking per post, per standard, was calculated. Spearman's rho was calculated in SPSS to determine whether or not there was a correlation between the average level of critical thinking per standard and the number of blog posts that discussed that standard. Preliminary analyses were performed to ensure normality. Data demonstrated true linearity (Pallant, 2013). Table 3.1 shows the total number of blog posts, total number of codes assigned to the blog posts, and the usable codes.

Table 3.1

Note. Usable codes are those remaining after eliminating blog post codes that were not agreed upon after three four-week coding periods. These remaining codes were used in any correlational statistical procedure.

Summary of Blog Posts Coded for Critical Thinking and InTASC Standards

Component Being Coded	Total Posts	Total Codes	Usable Codes	%
Blog posts coded for critical thinking	1016	1016	942	92.72
Blog posts coded for standards	1016	1632	1474	90.32

Limitations

There are limitations to this study based on its design. There should be no generalizations of this study's findings for populations outside the convenience sample presented. The instrumentation should be dealt with carefully in other such studies. With the adaptation of technology in higher education, it is necessary to find an instrument to assess critical thinking in discourse, perhaps an instrument that can be utilized by untrained instructors or supervisors. Whittington (1991) received training in the FTCB before utilizing the instrument as a part of her study. The researcher was not trained on the FTCB prior to this study. This lack of training could provide insight as to the usability of the instrument for untrained educators to use in order to assess critical thinking in discourse. However, the lack of training on the FTCB may limit the implications and recommendations of the study. Further, this study may be of relevance to teacher educators who have similar opportunities in teacher preparation.

Gass and Mackey (2012) noted the disadvantage of convenience sampling, in that it is likely to be biased, and therefore should not be assumed as a representation of the population. In analyzing student teachers' blogs and discussion forum posts, it should be recognized that the researchers' bias may have influenced the interpretation of the data and the conclusions and recommendations drawn from this study. Without being able to observe a student [teacher's] body language and emotion, it may be difficult to recognize cues that would normally be seen in a face-to-face setting, which may also set the stage for misunderstandings and misinterpretations that could occur in online discussions (Vonderwell, 2002); therefore, careful consideration was taken when analyzing each blog post.

Summary

Agricultural education student teachers at Iowa State University (*N*=21) comprised the convenience sample for this study. Student teachers during the fall of 2013 and spring of 2014 were required to write a bi-monthly blog post and a weekly post to a private discussion board housed in the NAAE's electronic Community of Practice (CoP). The purpose of this study was to identify the cognitive levels (or critical thinking) of student teachers' blog posts, and to determine the relationship between the number of blog posts each student teacher posted and that student teacher's average level of critical thinking.

This study utilized the Florida Taxonomy of Cognitive Behavior (FTCB) (Brown et al., 1970) to provisionally code student teachers' blog posts in an electronic community of practice for critical thinking. The validity of the FTCB is due to its development directly from Bloom et al.'s (1956) Taxonomy of Educational Objectives. Reliability for the FTCB was established by peer review; intrarater reliability was established as excellent by coding the blog posts three times at four-week intervals. IBM SPSS Version 22.0 was used to identify the relationship between the number of blog posts and the average level of critical thinking.

This study also served to identify which InTASC standards were discussed in the online CoP during the student teaching experience. Simultaneous coding was used to code the student teacher blog posts. The researcher utilized the CCSSO's InTASC descriptions in order to code blog posts. IBM SPSS Version 22.0 was used to determine the number of blog posts discussing each distinct standard and the average level of critical thinking of those standards.

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CHAPTER IV. ANALYZING STUDENT TEACHER CRITICAL THINKING THROUGH BLOGS IN AN ELECTRONIC COMMUNITY OF PRACTICE

A paper prepared for submission to the *Journal of Agricultural Education.*

Taylorann K. Clark

Dr. Thomas H. Paulsen

Abstract

Technology is becoming increasingly popular in higher education in the way students are asked to communicate and collaborate. The student teaching experience is an integral part of developing critical thinking skills in pre-service teachers. During this experience, it is important that student teachers practice the theory that they have been taught in their preparatory programs. This study determined the frequency in which student teachers posted blogs at each level of critical thinking, the relationship between the number of blogs posted by each student teacher, and student teachers' average level of critical thinking displayed in those blog posts. Six levels of critical thinking, according to Bloom's Taxonomy of Educational Objectives, were present. The Florida Taxonomy of Cognitive Behavior was used to code student teacher blog posts. Of the student teachers' blog posts (n=942), 89.5% were at lower-order levels of critical thinking, consistent with prior research. The results did not indicate a significant relationship between the number of posts per student teacher (N=21) and student teachers' average level of critical thinking. Teacher preparation programs should focus on modeling critical thinking in order for student teachers to incorporate and practice this skill during the student teaching experience.

Introduction

In many realms of professional development, theory and practice are presented as two important but separate concepts, and opportunities are rarely given to establish links between the two (Berggren & Soderlund, 2011). To effectively bridge the gap between theory and practice, teacher education must encourage awareness, reflection, and experimentation with new concepts (Berggren & Soderlund, 2011; Gallos, 2008). Teacher preparation programs must reach beyond traditional methods to immerse pre-service teacher candidates into field experiences (e.g., student teaching), and guide them in a dual process of constructing practical knowledge while integrating reflection with a purpose (Pena & Almaguer, 2012; Perry & Power, 2004).

It is important for pre-professionals to think critically in order to develop an intellectual sense of confidence in reason (Paul & Elder, 2006). Furthermore, it is important for student teachers to utilize higher-order skills that enable them to analyze, assess, and improve thinking skills (Paul & Elder, 2006). Higher-order cognitive skills, such as critical thinking, prepare student teachers to overcome challenges they may encounter during their personal lives and careers (Tsui, 2002). Critical thinking can best be defined as "a reasoned, purposive, and introspective approach to solving problems or addressing questions with incomplete evidence and information for which an incontrovertible solution is unlikely" (Rudd, Baker, & Hoover, 2000, p. 5). O'Hare and McGuinness (2009) defined critical thinking as "challenging a claim or opinion (either one's own or another person's) with the purpose of finding out what to believe or do" (p. 123). Scriven and Paul (1987) stated that critical thinking involves analyzing information gathered through reflection. "Critical thinking skills are essential and need to be fostered

as part of any teacher education program" (Szabo & Schwartz, 2011, p. 80). There are pressures to develop more pre-professionals with strong critical thinking skills in education (Berggen & Soderlund, 2011; Gallos, 2008; Paul & Elder, 2006; Pena & Almaguer, 2012; Perry & Power, 2004).

Though instructional approaches in higher education, such as student-centered learning, can positively influence students' critical thinking skills, there is still debate as to which practices most efficiently cultivate and assess critical thinking (Perry, 2014). However, due to the complexities of critical thinking and other cognitive behaviors, educators and researchers often may not agree which strategies or assessments are most effective in determining a learner's ability to think critically (Friedel, Irani, Rhoades, Fuhrman, & Gallo, 2008; Stedman & Adams, 2012; Perry, 2014). In an attempt to increase reflection, articulation, and social negotiation—components of higher-order thinking—higher education faculty are using asynchronous communication technologies to enhance course discussions and the quality of student learning (Gilbert & Dabbagh, 2005; Vonderwell, 2002).

As student teachers participate in an authentic learning experience at a distance from their university faculty and peers, technology offers the opportunity to enhance the learning process through social engagement in an environment outside of the classroom through online discussions or blogs (Szabo & Schwartz, 2011). It is essential to integrate critical thinking skills into online discussions so that students are challenged intellectually and experience relevant learning experiences (Pena & Almaguer, 2012). This opportunity for personal learning, however, poses a challenge, in that responsibility falls on the student teacher to use online learning environments in a manner that that

promotes critical thinking (Szabo & Schwartz, 2011). Though they may be keenly aware of, and perhaps active participants, in various Web 2.0 technologies, student teacher may not understand the purpose or possibilities of these technologies in education. Web 2.0 technologies—which include social networking sites, web applications, and weblogs—have recently received increased interest in higher education (Halic, Dee, Paulus, & Spense, 2010). The term weblog is a contraction of web log, often referred to as a "blog"; it is an Internet-based platform in which users can post text, images, or video-based materials for others to view. Users may facilitate an information exchange and a collaboration network to support teaching and learning processes (Cakir, 2013). Blogs are convenient for producing and sharing student reflections and "offer an audience for students' writing within the safety of a learning community thus offering opportunities for collaborative learning" (Robertson, 2011, p. 1628). "Blog[s] are considered a great tool for…student teachers to record their growth and changes as well as build a learning community" (Yang, 2009, p. 18). It is becoming more common to witness the use of blogs as a tool that supports student teacher reflection (Walker, 2005; Williams & Jacobs, 2004), which in turn may increase the depth of a student teacher's critical thinking (Sessa, Matos, & Hopkins, 2009).

Blogs can be housed in an electronic community of practice (CoP). CoPs offer teacher educators and pre-service teachers the opportunity to reflect through blog posts on public or private discussion boards (Walker, 2005; Williams & Jacobs, 2004; Yang, 2009). A CoP is a group of people "bound together by shared expertise and passion for a joint enterprise…[that] share their experiences and knowledge in free-flowing, creative ways that foster new approaches to problems" (Wenger & Snyder, 2000, pp. 139-140).

Communities of practice are diverse and problem-solving, and assist in developing professional skills (Killeavy & Moloney, 2010; Wenger & Snyder, 2000; Yang, 2009). Some refer to the community of practice as a community of inquiry, a very valuable tool for enhancing higher-order learning (Garrison, Anderson, & Archer, 2001; Halic et al., 2010). Online communities of practice can foster development of the critical thinking processes of pre-professionals, such as student teachers.

Many studies have been conducted to investigate the use of blogs in educational settings (Chuang, 2008; Top, Yukselturk, & Inan, 2010; Wang & Hsua, 2008; Yang, 2009). Though blogging serves as an environment that may foster higher-order learning, recent research shows that online environments are not being utilized to their full potential. Most notably, Garrison et al. (2001) and Gilbert & Dabbagh (2005) evaluated critical thinking in online discussions and found that 75% to 80% of students' online postings were at the lower-order thinking levels (i.e., knowledge, comprehension, application) (Duron, Limbach, & Waugh, 2006) of Bloom's Taxonomy of Educational Objectives (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956). Conversely, in a study conducted by Szabo and Schwartz (2011), online discussion forums increased critical thinking skills and initiated higher-order thinking by pre-service teachers.

The need for deeper connections and critical thinking skills can be fostered through the use of effective higher-order thinking, probing, and reflective questioning skills (MacKnight, 2000; Pena & Almaguer, 2012). The structure of online discussions and question prompts may be key reasons that student teachers' postings reflect relatively low levels of critical thinking (Bradley, Thom, Hayes, & Hay, 2008). "By using collaborative online discussions, teacher candidates have the opportunity to gain a deeper

understanding of learning" (Pena & Almaguer, 2012, p. 26). The development of student teachers' abilities to think critically through collaborative, interactive, and critical reflection is fundamental to their professional careers (Pena & Almaguer, 2012).

Wenger (1998) argued that if educational professionals can train themselves to think of the development of knowledge primarily as active participation in social communities, then traditional teaching methods no longer appear productive. Educators are not only fostering their own learning, but are fostering learning "in [their] relationships, [their] communities, and [their] organizations" (pp. xix-xx). Though a community cannot be forced, Hoadley (2012) offers techniques in which technology can be used to foster a learning-oriented community of practice. The first is that users must have connectivity; if users do not identify the central members of an already existing group, it is important that they locate others who share similar practices (Hoadley, 2012; Kimble, Hildreth, & Bourdon, 2008) to perhaps establish a new community of practice. Another technique for supporting an online community of practice is by allowing its members a private space for conversation. Further, Hoadley (2012) believes that educators must then help student learners establish themselves in "supportive authentic contexts, or create quasi-authentic contexts in which they can 'do' the knowledge that is desired; mere regurgitation is not enough" (p. 290). Finally, Gokhale (1995), Marzano (1993), and Paul and Elder (2006) suggested that student teachers should understand the purpose of collaborative learning. As blogs serve as a vehicle for users to exchange ideas and share experiences, they become an optimal setting for social constructivist learning (Ferdig & Trammell, 2004) by those who utilize collaborative learning methods. Social

constructivism has been "the most accepted epistemological position associated with online learning" (Kanuka & Anderson, 1998, p. 5).

Theoretical Framework

Since the mid-twentieth century when Lev Vygotsky (1978) developed social constructivist theory, educators, and psychologists have been seeking evidence that learning and knowledge develop through social interaction (Santrock, 2011). More recently, learning has been perceived from a "cognitive and constructivist perspective [that] emphasizes what learners know (knowledge) and how they think (cognitive processes)…as they actively engage in meaningful learning" (Anderson & Krathwohl, 2001, p. 38). Approaches to instructional strategies can be classified as constructivist or direct instructional (Santrock, 2011). "A focus on meaningful learning is consistent with the view of learning as knowledge construction, in which students seek to make sense of their experiences" (Anderson & Krathwohl, 2001, p. 65). Constructivist learning, or meaningful learning, requires that instructors require more of students by eliminating instructional methods that simply present factual knowledge and move towards assessments that demand that students practice more than simple recall and recognition of factual knowledge (Bransford, Brown, & Cocking, 1999; Lambert & McCombs, 1998).

The constructivist approach, unlike direct instruction, is learner-centered and emphasizes teachers as facilitators, rather than direct instructors. Someone who utilizes the constructivist approach believes that individuals should actively construct their own knowledge and understanding; be encouraged by the teacher to explore the world around them; and discover, reflect, and think critically (Bonney & Sternberg, 2011). In today's educational society, the constructivist approach emphasizes collaboration and working

with peers to construct knowledge and understanding (Slavin, 2011; Wentzel & Watkins, 2011).

Vygotsky's (1962) social constructivist theory emphasized the importance of social interaction on learners' cognitive development. Vygotsky believed that dialogue was critical to student learning. Vygotsky (1978) developed the concept of the zone of proximal development (ZPD) as it pertained to student learning. This is a term for a range of learning tasks, from those that are too difficult for the learner to complete without assistance, to so simple that the skill can be completed by the learner working independently (Santrock, 2011). Scaffolding is the support offered to the learner based upon their ZPD or current learning capabilities (Santrock, 2011). As the learner begins a new task, he/she may need direct instruction; as the student's competence progresses, less assistance is given (Santrock, 2011). By asking probing questions a teacher may scaffold learners to help them think more critically (MacKnight, 2000; Wang & Hsua, 2008).

Finally, Vygotsky (1962, 1978) believed in transforming the classroom with tools that give attention to learners' cultures, ZPD, scaffolding, and shared activities (collaboration). As computers and electronic communication have made their way into the 21st century culture, it would be appropriate to assume that Vygotsky would support the use of online means of interaction (Jost, 1999) and Web 2.0 technologies in developing student learning through collaboration and communication in social environments. This research aims to study student teachers' blog posts in an electronic community of practice and explore the potential of social constructivism for teacher education, with an interpretive and collaborative approach.

Purpose and Objectives

Though critical thinking has become an anticipated outcome in higher education, students in colleges of agriculture have been found to have insufficient critical thinking skills (Flores, Matkin, Burbach, Quinn, & Harding, 2010; Rudd et al., 2000). In an attempt to improve agricultural education programs, teacher educators in agricultural education have increased their focus on research and education with regards to comprehension and applying cognitive function (Boone, 1990; Cano, 1993; Dyer & Osborne, 1996; Jones & Williams, 1986; Lamm, Rhoades, Irani, Roberts, Snyder, & Brendemuhl, 2011; Parr & Edwards, 2004; Rollins, 1990). It is important for agricultural education student teachers to think critically; "therefore, a need exists to assess those skills in college students and examine whether they have acquired these skills through their college experiences" (Odom, Shehane, Moore, & McKim, 2014, p. 218).

The present study aligns with the American Association for Agricultural Education's National Research Agenda Priority 4: Meaningful, Engaged Learning in All Environments. This area suggests that research in Agricultural Education should "assess various learning interventions and delivery technologies to increase problem-solving, transfer of learning, and higher order thinking" (Doerfert, 2011, p. 9) and to "examine various meaningful learning environments…for their impact on specific cognitive, affective, and psychomotor outcomes" (p. 9). The purpose of this study was to explore student teacher levels of critical thinking in blog posts housed in an electronic community of practice. The following objectives guided this study:

1. Determine the frequency and the average level of critical thinking exhibited by Iowa State University agricultural education student teachers' reflections through blog posts in an electronic community of practice.
2. Determine the relationship, if any, between the number of blogs posted by each student teacher and the average level of critical thinking displayed by student teachers within their respective blog posts.

Methodology

Researchers have recently moved away from measuring interactions quantitatively (e.g., (in this case) by the number of blog posts) to more qualitative measures (e.g., quality of posts) (De Wever, Schellens, Valeck, & Van Keer, 2006), since an increase in the number of posts does not necessarily mean an increase in quality of learning (Vonderwell, 2002). These more qualitative measures are often studied in relation to critical thinking (Ertmer & Stepich, 2004; Lee, 2005; Walker, 2004).

This study utilized a convenience sample of student teachers (N=21) during the fall 2013 and spring 2014 semesters, due to the accessibility and cooperation of the Agricultural Education Department at Iowa State University. Agricultural education student teachers at Iowa State University were required to write weekly posts to a discussion forum and bi-monthly blog posts to a National Association of Agricultural Educators CoP private discussion board. Chuang (2008) suggested the importance of having a private discussion board in order for student teachers to openly express their thoughts and opinions. Student teachers were required to post these blogs and discussion posts during the fourteen-week period of their student teaching experience as a part of the final assessment for the student teaching experience; however, specific grades for student

teacher blog posts were not assigned. There were no specific topics or recommendations given to the student teachers as to what should be discussed in the CoP. IRB approval was obtained through the Office of Responsible Research at Iowa State University to ensure appropriate collection and use of data.

This study interpreted qualitative data from a quantitative perspective. Creswell and Plano Clark (2011) and Tashakkori and Teddlie (2003) determined that mixed methods studies explore the manner in which qualitative data can be transformed into quantitative data to determine descriptive measures (i.e., frequencies and percentages) and for survey instrument development. Bloom et al.'s (1956) Taxonomy of Educational Objectives is widely accepted in educational research as a means of categorizing learning behaviors into levels of cognition. Bloom et al.'s (1956) Taxonomy recognizes six levels of cognitive abilities and skills in a hierarchical order: *knowledge* (which requires the least cognitive processing), *comprehension*, *application*, *analysis*, *synthesis*, and *evaluation* (requires the most cognitive processing). Based on Bloom et al.'s (1956) Taxonomy, Duron et al. (2006) determined higher-order thinking to be those skills or behaviors demonstrated at the levels of analysis, synthesis, and evaluation. Thus, lower-order thinking skills would be those at the levels of knowledge, comprehension, and application (Duron et al., 2006).

Though recent revisions have been made to the original Taxonomy (Anderson & Krathwohl, 2001), a useful tool for observing critical thinking in the classroom is the Florida Taxonomy of Cognitive Behavior (FTCB) (Brown, Ober, Soar, & Webb, 1970), which is directly derived from Bloom's Taxonomy (Ulmer, 2005). The validity for the FTCB instrument was based upon its direct development from Bloom et al.'s (1956)

Taxonomy (Ball & Garton, 2005; López & Whittington, 2001; Miller, 1989; Whittington, 1991; Whittington & Newcomb, 1993). Miller (1989) stated, "the FTCB can be considered valid in light of the support generally given to Bloom et al.'s (1956) Taxonomy as a means of identifying specific behaviors in the various levels of cognition" (p. 43). The FTCB (Brown et al., 1970) with its 55 behavior descriptors, was used to analyze and code student teachers' blog posts for critical thinking.

Due to the qualitative nature of the data in this study, instrument reliability was established using peer review (Johnson & Christensen, 2014). As suggested by Johnson and Christensen (2014), the researcher discussed the process of coding and interpretation of the data with a peer reviewer throughout the course of the study. Johnson and Christensen (2014) call this special type of peer reviewer a *critical friend*; Creswell (2007) recognizes this sort of external check of the research process as peer debriefing. Thus critical friend asked challenging questions about the methods, meanings, and interpretations of the researcher who is coding the data (Johnson & Christensen, 2014). During analysis, the critical friend coded randomly selected blog posts utilizing the FTCB, and compared results with those of the researcher. This assisted the critical friend in understanding the coding process and in providing feedback for the researcher prior to coding all student teacher blog posts. The critical friend's results were compared with the researcher's results, and discrepancies were discussed. Sankey and Foster (2012) used a similar procedure when they employed a content analysis of teaching philosophy statements. In the present study, discrepancies in results were most notably identified in posts coded differently within higher-order or lower-order levels; much less often were coded differently across lower- and higher-order levels. However, it should be noted that

careful consideration and detailed notes were taken to ensure consistency within the coding system.

Once the blog posts were secured in an Excel file after the end of each semester, all posts were numbered (*N*= 1,016). Some methodologists recommend that the researcher determine the choice of coding method prior to the study, "to harmonize with [the] study's conceptual framework paradigm, and to enable an analysis that directly answers your research questions and goals" (Saldaña, 2013, p. 62). Provisional coding was used because each level of critical thinking was a predetermined category anticipated from the literature review (Saldaña, 2013), and previous research findings (Bradley et al., 2008; Garrison et al., 2001; Gilbert & Dabbagh, 2005; Walker, 2004). Blog posts were manually coded at one of six levels of critical thinking, based on Bloom et al.'s (1956) Taxonomy and the FTCB (Brown et al., 1970): knowledge, comprehension, application, analysis, synthesis, and evaluation. On the FTCB, comprehension is broken into sub-categories: translation and interpretation. To ensure the blog postings were coded in a manner that was consistent with the Taxonomy and the FTCB, each were regularly studied and consulted during the coding process.

Each blog post was coded twice at four-week intervals and compared. Critical thinking levels assigned to blog posts from the first coding interval were compared with corresponding codes from the second coding interval and entered into an Excel file. Corresponding blog posts not coded at the same level of critical thinking were recoded for a third time after a four-week interval. Posts that were not consistently coded at the same level of critical thinking after the third coding interval were not used in the study. Intrarater reliability was established as excellent for the present study (α=.93) by coding

the blog postings three times at four-week intervals (Weir, 2005). An intrarater reliability code of zero indicated no reliability, while a code of 1.0 indicated perfect reliability (Weir, 2005). The usable codes (n= 942) were then copied to a new Excel file.

The blog posts were sorted. Three Excel sheets were utilized to keep the data separated: total blog posts at each level of critical thinking, total blog posts per student teacher, and total blog posts at each level of critical thinking per student teacher. The average level of critical thinking reflected in student teacher blog posts was determined. Because the data was ordinal (Urdan, 2010) with critical thinking being coded among six hierarchical levels, each level was given a multiplier (1: knowledge, 2: comprehension, 3: application, 4: analysis, 5: synthesis, 6: evaluation). The multiplier is similar to that of using a weighted system as suggested by Miller (1989) and Newcomb & Trefz (1987). The total number of blog posts at each level of critical thinking was multiplied by the appropriate multiplier, then divided by the total number of posts, resulting in the average level of critical thinking per student teacher.

The total number of posts and the average level of critical thinking were entered into IBM SPSS Version 22.0 and Spearman's rho was calculated to determine if any correlational relationships existed between the number of blog posts and average level of critical thinking per student teacher. Spearman's rho was the statistical procedure of choice because of the small sample size in this study, and because the parametric alternative of Pearson's r assumes a randomized sample, which was not appropriate for the present study (Pallant, 2013). Preliminary analyses were performed to ensure linearity (Pallant, 2013). Although data did not demonstrate true linearity and displayed a more curvilinear relationship with the small sample that was used, it was decided to leave all

data points for analysis (Pallant, 2013). Based on the design of this study, limitations should to be considered. Although results of this study should not be generalized beyond the convenience sample as participants are not representative of all student teachers, valuable information can still be obtained (Creswell, 2012).

Results

Objective One sought to determine the level of critical thinking exhibited by Iowa State University student teachers through blogs housed in an electronic community of practice. Table 4.1 provides selected examples of posts that were coded at each level of Bloom's Taxonomy of Educational Objectives utilizing specific observations listed on the FTCB.

Table 4.1

Example Student Teacher Blog Posts Coded Utilizing the FTCB (Brown et al., 1970).

Level of CT	Example Post	Observation
Knowledge	*Well, I started off my student teaching experience with three full days of in-services. During the course of those three days we covered ALICE training…the new Infinite Campus grading system, how to "teach like a pirate," and a few other important topics.*	Tells about an event
Comprehension	*Thanks for the inspiring words, because I am another detail-oriented person who struggle* [sic] *to remind myself of the larger picture, let alone my students. I should be taking notes on these thoughts so that I can read them over to remind myself every morning, haha.*	Gives reason (tells why)
Application	*At this point I'm more strict than I am the teacher full of jokes and personal conversations about outside of school, which doesn't match my personality. From my little experience so far it's more of a class by class and age issue. I've noticed that I can…micromanage less with the juniors and seniors, but that's not the case with the freshman and sophomore classes…*	Applies previous learning to a new situation
Analysis	*Does giving them a leadership role like that reward them though? For instance, they may realize I am giving them something unique and not offering it to other students…I have seen it work before, but what is your opinion on that?*	Infers purpose, point of view, feelings

Table 4.1 continued

Synthesis	*I…am currently working on a word search…to give to my Animal Science class just in case I get done early. This will have all the terms we've gone over so far and will be a good review. I'll just ask that the students keep this in their binders and pull it out if I run a few minutes fast…*	Produces a plan/proposed set of operations
Evaluation	*I thought our mid-term meeting was really great. I…enjoyed the peer reviews of our lesson plans. To be honest, I think I got more out of that than any other evaluation thus far this semester. My group had some wonderful ideas and it got me to thinking…why didn't I think of that to begin with[?] Do you ever notice that when in the thick of things, those awesome ideas are harder to come by. I wonder why that is? Is it because I am too focused on one thing and not looking at the bigger picture? When I am processing things in preparation for my lesson plans, am I really taking things I have learned before into consideration? Sometimes it feels like I am in a constant brain fart.*	Evaluates something from evidence

Student teachers' blog posts demonstrated each of the six of Bloom et al.'s levels of critical thinking. Table 4.2 identifies the number of posts (*n*=942) coded for each level of critical thinking. The student teachers' blog posts demonstrated critical thinking at the knowledge (*n*=441, 46.82%), comprehension (*n*=344, 36.52%), application (*n*=58, 6.16%), analysis (*n*=51, 5.41%), synthesis (*n*=31, 3.29%), and evaluation (*n*=17, 1.80%) levels.

Table 4.2

Frequencies and Percentages of Student Teacher Blog Posts (n=942) at each Level of Critical Thinking

Levels of Critical Thinking	*f*	*%*
Knowledge	441	46.82
Comprehension	344	36.52
Application	58	6.16
Analysis	51	5.41
Synthesis	31	3.29
Evaluation	17	1.80

Table 4.3 displays the results for Objective Two: the total number of blog posts each student teacher posted over the duration of the semester, and each student teacher's

average level of critical thinking as reflected in his/her blog posts. The highest number of posts by one individual was 97 and the lowest was eight. On a scale of one to six, with knowledge being one and evaluation being six, the highest mean level of critical thinking reflected in student teachers' blog posts was 2.73, between the comprehension and application levels. The lowest average level of critical thinking was 1.38.

Table 4.3

Note. Data is organized from highest to lowest average levels of critical thinking. *M* = the average level of critical thinking where 1 = Knowledge, 2 = Comprehension, 3 = Application, 4 = Analysis, 5 = Synthesis, and 6 = Evaluation.

Total Blog Posts (n = 942) per Student Teacher and Student Teachers' Average Level of Critical Thinking

Student Teacher	*n*	*M*	Student Teacher	*n*	*M*
1	11	2.73	12	40	1.75
2	30	2.27	13	8	1.75
3	58	2.16	14	11	1.73
4	74	2.07	15	97	1.69
5	27	2.07	16	25	1.68
6	87	2.05	17	67	1.67
7	56	2.05	18	32	1.63
8	33	2.00	19	39	1.44
9	65	1.89	20	12	1.42
10	96	1.88	21	16	1.38
11	58	1.85			

The relationship between the number of posts and the average level of critical thinking was investigated using Spearman's rho correlation coefficient. Preliminary analyses were performed to ensure no violations of the assumptions of linearity by generating a scatterplot (Pallant, 2013). Pallant (2013) suggested that a scatterplot is useful before calculating correlations because it provides an indicator of whether or not the variables in the study are related, and if they are related, the direction and magnitude

of the relationship. A scatterplot also identifies any extreme outliers in the data (Pallant, 2013). It was found that the data set displayed slight curvilinearity rather than a normal straight-line scatterplot. No statistically significant correlation (Cohen, 1988) was found between the two variables (r_s = .154, N = 21, p < .505).

Conclusions and Discussion

The first objective of this study was to determine the frequency of blog posts and average level of critical thinking exhibited by Iowa State University agricultural education student teachers through their reflections in blog posts housed in an electronic community of practice (CoP). When considering the findings of this study, we conclude that student teachers demonstrated critical thinking at the lower levels of Bloom et al.'s (1956) Taxonomy when blogging in an electronic CoP. Student teachers were anticipated to utilize higher-order thinking skills since blogs promote thoughtful reflection and a CoP serves as an environment in which these skills can be enhanced (Garrison et al., 2001; Gilbert & Dabbagh, 2005; Halic et al., 2010; Killeavy & Moloney, 2010; Vonderwell, 2002; Wenger & Snyder, 2000; Yang, 2009). However, knowledge, comprehension, and application represented 89.5% of the total blog posts, accounting for approximately ten percent more blog postings at lower-order thinking levels than findings by Garrison et al. (2001) and Gilbert and Dabbagh (2005).

Kanuka and Anderson (1998) determined that online discussion mediums are often used for "sharing [and/or] comparing of information" (p. 7). There were no specific topics for conversation predetermined by the University supervisors, and no specific guidelines as to what the student teachers were asked to discuss during the student teaching experience, only the weekly and bi-monthly requirements. Therefore, it is

reasonable to conclude that sharing and comparing (Brown et al., 1970) were the highest levels of critical thinking skills that the student teachers attained. The results also support the notion that student teachers were allowed to discuss and reflect upon whatever topic they wished at any point in the student teaching process, and respond to their peers with self-determined deadlines and levels of critical engagement. Though this is a benefit of asynchronous discussion, no expectations were established in order to encourage students to blog with a purpose and not just to meet the weekly and bi-monthly requirements.

The lack of demonstrated cognitive behaviors at the levels of analysis and synthesis could be attributed to the ideas of effort and risk (Garrison et al., 2001). Student teacher behaviors at the analysis and synthesis levels—detecting an error in their own thinking or that of their peers, inferring purpose, point of view, thoughts or feelings, or formulating hypotheses and intelligent guesses—require time of the student teacher that may not be abundant in their busy schedules. Furthermore, "it may be more risky to offer tentative solutions or hypotheses in that their ideas may be rejected" (Garrison et al., 2001, p. 20) by peers in the CoP. Some student teachers may have worked solely from the need to overcome their concerns of the student teaching experience (Fritz & Miller, 2003), which might increase the difficulty of efforts to merge theory with practice during the student teaching experience. These are possible reasons why so few blogs were at the higher level of critical thinking.

As the students minimally utilized the cognitive behaviors required to demonstrate the application, analysis, and synthesis levels of Bloom's Taxonomy, there was little reason for them to utilize evaluation levels of critical thinking. Evaluation requires that the student teacher makes "judgments about the value, for some purpose of

ideas, works, solutions, methods, [and/or] materials" (Bloom et al., 1956, p. 185). If student teachers propose lesson plan ideas, ask for suggestions on particular teaching methods, or offer classroom management ideas—behaviors of previous higher-order levels—at limited levels, there becomes little need to "evaluate based on criteria" (Ewing & Whittington, 2007) in order to determine effective or accurate application of those methods or ideas (Bloom et al., 1956). Another factor may explain why student teachers exhibited less cognitive behavior at higher-order levels. Garrison et al. (2001) stated that "collaborative learning in an educational sense is more than a mindless free-for all…interaction must be coordinated and synergistic" (p. 21), thus requiring an instructional or facilitator presence in order to attain higher-order outcomes. The University supervisors did not have an active role in the CoP in this study, which may have contributed to a lack of higher-order thinking demonstrated by student teachers.

The results are limited to the agricultural education student teachers in this study, though they add to the existing body of research regarding cognitive development in teacher education. It is difficult to determine the reasons as to why a lack of higher levels of critical thinking occurs during the pre-service student teaching experience. In relation to social constructivism (Vygotsky, 1962, 1978) and the CoP in which student teachers posted blogs (Wenger, 1998), it should be kept in mind that no learner in the CoP was an expert in agricultural education. Hoadley (2012) suggested that if learners cannot identify an expert within their CoP, they need the opportunity to share their practices with those involved. Therefore, without the proper support and input from an experienced member in the CoP, student teachers were not able to draw from the expertise of an experienced agricultural educator.

If the majority of the posts were at the lower-order level of critical thinking, it is presumed that student teachers were not able to assess, analyze, or evaluate (Brown et al., 1970) their peers' learning experiences because they hadn't experienced the same learning practice or situation. Therefore, with no expert (e.g., a University supervisor or an experienced agricultural education teacher) present in the conversation in the CoP to facilitate these interactions, the lack of higher levels of critical thinking could be attributed to the inability of students to relate their experiences to one another, a key component of an educational CoP (Kimble et al., 2008; Wenger, 1998; Wenger, McDermott, & Snyder, 2002).

Wenger (1998) described community expectations as "a way of talking about the social configurations in which participation in the community is acknowledgeable as competence" (p. 5). Those student teachers who blog considerably less than their peers, or demonstrate a low level of critical thinking, may not be participating with a complete understanding of their contribution to collaborative learning (Gokhale, 1995; Marzano, 1993; Paul & Elder, 2006). Those students who post a high number of posts or display a lower average level of critical thinking may be bored with the daily routines of student teaching or may not be challenged enough by the discussions or degree of peer collaboration in the CoP. Conversely, those students who post a lower number of blogs, or display a low level of critical thinking as compared to their peers, may be towards the end of the spectrum of their ZPD (Vygotsky, 1978) which may require facilitation or assistance in the CoP to enhance their critical thinking skills (Santrock, 2011). Additional assistance may be needed to help students maintain a level of identity (Wenger, 1998) by contributing meaningful discussion (Garrison et al., 2001; Haavind, 2006; Krathwohl &

Anderson, 2010; Liu &Yang, 2012) to the CoP by posting blog more often and at higher levels of critical thinking.

Implications

If student teachers are not consistently utilizing higher-order thinking in online environments, what does this suggest for student teachers and the Iowa State University teacher education program? Student teachers are taught how to develop educational objectives that encourage their learners to utilize higher-order thinking; however, what is being done in the teacher preparation program to demonstrate the use of critical thinking skills for student teachers? Are student teachers being taught to think critically, or have faculty adequately modeled critical thinking in a manner such that student teachers can replicate these skills during the student teaching experience and beyond? Furthermore, if critical thinking is not modeled in content or pedagogy preparation courses, where would this modeling be most appropriate, and how could faculty align coursework so that pre-service teachers progressively learn how to think critically and apply this in their future careers?

Student teachers may need more experience prior to student teaching in providing meaningful feedback to their peers. Paulsen, Smith, and Anderson (2014) determined that pre-service teachers "found peer feedback beneficial when reflecting on previously implemented lesson plans" (p. 5). These conclusions have implications for teacher education faculty, especially University supervisors who organize and structure the CoP for agricultural education student teachers. It is common that student teachers feel overwhelmed with the prospect of responding to all members of a group and all conversations posted to a discussion board. In this situation, student teachers may be

experiencing feedback fatigue, limiting their thoughtfulness in their responses to peers. If the number of blog posts per student teacher does not correlate with their average level of critical thinking, should there be a set requirement as to *how much* student teachers are expected to post blogs over the duration of a semester? Or, perhaps, should the focus remain on the *quality* of blog posts?

Recommendations

The following are recommendations based upon the conclusions and implications of this study. If the goal of teacher preparation programs is to guide student teachers in the process of constructing practical knowledge and reflecting with purpose (Pena & Almaguer, 2012; Perry & Power, 2004), it would be appropriate that University supervisors play a more involved role in guiding learners through the student teaching experience. However, Szabo and Schwartz (2011) and Gilbert and Dabbagh (2005) recognized the importance of students taking responsibility for their own learning through the constructivist approach inherent in learning environments such as a CoP.

It is recommended that a facilitator or University supervisor implement question prompts (MacKnight, 2000; Pena & Almaguer, 2012) and specific discussion topics to encourage students to utilize higher-order thinking skills within asynchronous discussions. These questions may prompt responses based upon the manner in which the questions are asked and what/how they challenge the student teachers to assess, evaluate, create, or debate. If designed to prompt higher-order thinking, question prompts may serve as a guide for student teacher learning (Pena & Almaguer, 2012; Perry & Power, 2004); however, responsibility remains with the student teacher (Szabo & Schwartz, 2004) to respond and collaborate with his/her peers to determine the appropriate analysis

or evaluation of a situation. In addition, if university supervisors utilize prompts, they must find credible and reliable resources that suggest ways to format and ask probing questions that will encourage student teachers to utilize higher-order thinking skills.

In contrast to having university faculty involvement in the CoP, Hoadley (2012) suggests that an important aspect of gaining true insightful conversations in a community of practice is the notion that it is private. As researchers, we must consider the idea of university supervisors remaining completely absent from the community of practice. Would there be different results if the student teachers had complete privacy from university supervisors? Conversation topics, the quantity of posts, and the amount of critical thinking may differ. Student teachers may feel more freedom to talk about their preparation, or lack thereof, in the teacher preparation program. They may also utilize the affective domain more in their reflection and feedback to their peers, including emotions, attitudes, and feelings, knowing that university faculty will not read their discussions.

The layout of the CoP must also be user-friendly, not overwhelming. If an environment develops in which the CoP becomes a free-for-all where student teachers are not encouraged to participate within prepared, organized threads, discussions will fail to have a focus, and student teachers' thoughts and discussions may not reach higher-order levels of thinking. In addition, it might be valuable to assign student teachers to groups of three or four, in which they can focus their feedback and ask for suggestions. This will help reduce the pressure on student teachers to read and reply to all of their peers' reflections and discussions, and allow them to provide more meaningful feedback for a few, rather than less thoughtful feedback for many.

It is recommended that teacher education faculty who utilize Web 2.0 technologies during the student teaching experience establish and then analyze a baseline level of critical thinking expectations, in order to determine a satisfactory level of critical thinking in the student teaching experience, in part to ensure effective student teacher collaboration by means of asynchronous discussion. Can student teachers be expected to display average levels of critical thinking between the Taxonomy levels of and analysis, or analysis and synthesis? Whittington and Newcomb (1993) and Whittington, Stup, Bish, and Allen (1997) recommend that higher education students perform at higher levels of cognition—considering other related factors—but do not provide a specific critical thinking level which students should achieve. We recommend that a goal for student teacher critical thinking is necessary, before analysis or assessment of critical thinking, in order to determine if online technologies can be used to enhance student teachers' critical thinking skills and abilities. However, this was a baseline study, and establishing such a specific level of critical thinking as an expected outcome would not have been supported by literature or previous research.

In relation to the instrumentation of this study, a few recommendations should be considered. Though there are many critical thinking assessments available, it is difficult to find a suitable instrument to analyze critical thinking through discourse in an online CoP. It is impossible to determine nonverbal cues of the student teacher based solely upon one or two paragraphs posted weekly. The FTCB is a valuable tool, but it would be valuable to design an instrument specific to analyzing critical thinking in reflective writings and asynchronous discussions via online environments. Garrison et al. (2001) utilized content analysis when evaluating online discourse, but also recognized the

difficulty in obtaining an accurate account of interaction, as what would be collected in a face-to-face setting. However, if the FTCB remains one of the best tools in measuring critical thinking in online environments, measures need to be taken in order to ensure reliability of the instrument. Whittington (1991) received training in the use of the FTCB before implementation. If critical thinking is to be assessed by supervisors that do not have a background in critical thinking literature and wish not to receive such training, an instrument should be devised that would be user-friendly and easy to adopt.

Finally, it is suggested that in future studies student teachers are encouraged to attend a weekly focus group with the researcher(s) so that truthful and rich data can be ensured. The student teacher can then clarify any misunderstandings and confirm what was actually done in the classroom setting in relation to the context described in their online postings. Ultimately, the insight and opinions of the student teachers may determine the inclusion of the University supervisor in the CoP. A focus group with student teachers will not only add triangulation to the methodology to gain a better understanding of coding text-based messages in Web 2.0 applications, but will also provide insight to how much privacy the student teachers want, and what benefits they see of the probing questions and prompts. Replication of similar studies with other populations or conditions may help to define frameworks of phenomenon presented in this study.

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CHAPTER V. STUDENT TEACHER DIALOGUE IN AN ELECTRONIC COMMUNITY OF PRACTICE: COGNITION RELATED TO THE INTASC STANDARDS

Paper to be submitted to the *Journal of Agricultural Education*

Taylorann K. Clark

Dr. Thomas H. Paulsen

Abstract

Teachers are constantly being evaluated based upon their ability to provide the best education for their students. These evaluations are done at a macro level, where teachers must meet state and national mandates that deem them highly qualified, and at a micro level, where teachers must display proficiency as effective teachers through teacher education standards. Specific to pre-service teachers, the Interstate New Teacher Assessment and Support Consortium (InTASC) aligns standards based upon what pre-service teachers should know and be able to do. The purpose of this study was to determine the frequency in which student teacher blog posts in an electronic community of practice related to the InTASC standards, as well as determine the average level of student teacher critical thinking displayed in the blog posts related to standards. Student teachers most frequently discussed the Professional Learning and Ethical Practices standard as compared to the other nine InTASC standards. It was found that for blog posts that discussed an InTASC standard, a lower average level of critical thinking was displayed in their engagement with that InTASC standard. It is recommended that future studies utilize open coding in order to gain a broader insight of the student teachers' discussions.

Introduction

Teacher preparation programs in colleges and universities throughout the country are being strategically reviewed by state and accreditation agencies to ensure university teacher preparation programs are appropriately aligned to credible performance standards (Darling-Hammond, 1999; Edelfelt & Raths, 1998). "Policy makers and stakeholders are calling for better prepared teachers as a means for raising the academic achievement of students in an increasingly diverse society" (Whittington, 2005, p. 90). Goals and expected outcomes for teacher education have been established at the national level (e.g., highly qualified teachers established by No Child Left Behind) and the state level (e.g., teacher education standards). Established by No Child Left Behind, pre-service, inservice, and experienced teachers are evaluated upon criteria which personify a highly qualified teacher as one who has a bachelor's degree in the subject that they will be teaching, has full state certification or licensure, and can prove that they are knowledgeable in their chosen subject (U.S. Department of Education, 2005).

The state or national standards a teacher is required to meet may differ depending upon the teachers' status in the profession (e.g., pre-service, in service, or experienced) or states' implementation of a specific set of standards. Three of the primary nationally recognized standards that provide guidance for teachers are: the National Council for Accreditation of Teacher Education (NCATE) standards, which serve as teacher education accreditation standards; the Interstate New Teacher Assessment and Support Consortium (InTASC) standards, which serve as the initial licensing standards; and the National Board for Professional Teaching Standards (NBPTS), which serve as advanced certification standards (Darling-Hammond, 1997; Kraft, 2001). These standards list the

professional, technical, and general knowledge competencies that should be a part of baccalaureate agricultural education programs (Stripling & Barrack, 2013), and "prescribe the attitudes, skills, and dispositions required of all new teachers" (Sands & Goodwin, 2005, p. 818). States are required to measure core content teachers' qualifications, devise plans that ensure every teacher is highly qualified, and report the states' progress in meeting these goals (U. S. Department of Education, 2005).

It is expected that pre-service teachers demonstrate their content knowledge, pedagogical knowledge, and teaching ability (Darling-Hammond, 1997). As faculty and University supervisors assess student teachers on their ability to meet InTASC standards, other researchers have found importance in examining professional identity creation in pre-service candidates (Sutherland, Howard, & Markauskaite, 2010). In the coursework found in teacher preparation programs, pre-service teachers' knowledge of teaching and learning is developed primarily through an introduction to educational theories (Sutherland et al., 2010). During the student teaching experience, the pre-service teachers' knowledge of teaching and learning comes from daily practical application in the classroom (Sutherland et al., 2010). For Iowa State University agricultural education student teachers, this practical daily application in the classroom during the student teaching experience is assessed using the InTASC standards.

A consortium of over 30 states and professional associations, under the patronage of the Council of Chief State School Officers (CCSSO) (CCSSO, 2011; Darling-Hammond, 2000) developed the InTASC standards, which have been adopted by many accreditation agencies and programs (Olson & Wyett, 2000). These standards "are based on knowledge of effective learning and teaching and on the student learning standards

developed by professional associations" (Darling-Hammond, 2000, p. 34). "The InTASC principles were drafted by teachers, teacher educators, and state agency officials, and represent a shared view that reflection is an important skill to be attained by preservice teachers" (Greiman & Covington, 2007, p. 116). The teacher education state standards at Iowa State University are based upon the InTASC standards in which agricultural education pre-service teachers must demonstrate competency and include: 1) learner development, 2) learning differences, 3) learning environments, 4) content knowledge, 5) application of content, 6) assessment, 7) planning for instruction, 8) instructional strategies, 9) professional learning and ethical practice, and 10) leadership and collaboration (CCSSO, 2011).

Edgar, Roberts, and Murphy (2011) recognized the student teaching experience to be an essential component for pre-service teachers in agricultural education. This experience "provides prospective [agricultural education] teachers opportunities to apply pedagogical knowledge and skills of teaching in a real-life setting under the supervision of an experienced teacher" (Torres & Ulmer, 2007, p. 1). By immersing pre-service teachers in field experiences, they will be better prepared through the process of purposeful reflection and construction of practical knowledge (Pena & Almaguer, 2012; Perry & Power, 2004).

During the student teaching experience, student teachers are expected to participate in relevant (Smalley, Retallick, & Paulsen, 2015) teaching experiences. Of the eight student teaching activities proposed by Smalley et al. (2015), student teachers determined planning for classroom instruction to be the most important activity of the student teaching experience. Smalley et al.'s (2015) conclusions are supported by Torres

and Ulmer's (2007) finding that 26% of agricultural education student teachers' time was devoted to instructional planning. Though proven to be an integral component of the student teaching experience, effective instructional planning is only one of many key characteristics of an effective teacher.

Regardless of the discipline, an effective teacher is one who wears many hats and has developed not only content knowledge, but acquired diverse professional skills. An effective teacher is able to implement various pedagogical strategies (Darling-Hammond, 2000), communicate effectively (Garrison, Anderson, & Archer, 2001; Santrock, 2011), understand student development (Council of Chief State School Officers (CCSSO), 2011), employ skills that will keep them up-to-date (Partnership for 21st Century Skills, 2009) in this ever-advancing technological society (Santrock, 2011), is competent in their subject matter (Bransford, Darling-Hammond, & LePage, 2005), is one who reflects (Berggren & Soderlund, 2011; Bonney & Sternberg, 2011; Norris & Ennis, 1989; Pena & Almaguer, 2012; Perry & Power, 2004; Yang, 2009), and is a critical thinker (Bloom, Engelhart, Furst, Hill, Krathwohl, 1956; Norris & Ennis, 1989; Partnerships for 21st Century Skills, 2009; Scriven & Paul, 1987).

Requiring the use of cognitive skills in higher education has become increasingly popular and important as educators prepare pre-service teachers for real-world issues (Flores, Matkin, Burbach, Quinn, & Harding, 2010; Partnership for 21st Century Skills, 2011; Rudd, Baker, & Hoover, 2000; Whittington, 1995; Whittington & Newcomb, 1993). As pre-service teachers utilize critical thinking in developing mini-teaching lessons or presentations for undergraduate courses, it is important that they be able to transfer those higher-level skills to the student teaching experience and further

professional settings (Paul & Elder, 2006; Pena & Almaguer, 2012; Perry & Power, 2004). Though effective teachers that utilize higher-order thinking skills in the classroom have been found to positively impact their students' academic achievement (Wenglinsky, 2000), classroom teachers have begun to give up their creative thinking for less imaginative, more routine practices as a result of No Child Left Behind (Moss & Less, 2010).

Conceptual Framework

Teacher education program reform efforts have proved influential in strengthening the subject matter and pedagogical preparation pre-service teacher education candidates receive, and assist in creating pedagogies and authentic assessments for teacher education that have linked theory and practice, thus changing the ways pre-service teachers are being taught (Darling-Hammond, 2006). Darling-Hammond and Berry (2006) determined highly qualified teachers to be those who have certification and licensure in their subject area, are knowledgeable in their subject area and are competent at teaching it, consistent with the criteria proposed by No Child Left Behind (U.S. Department of Education, 2005). Bransford et al. (2005) developed A Framework for Understanding Teaching and Learning, shown in Figure 5.1, which is based upon the core concepts and skills that should be present in the teacher education curriculum, as recognized by the National Academy of Education Committee on Teacher Education.

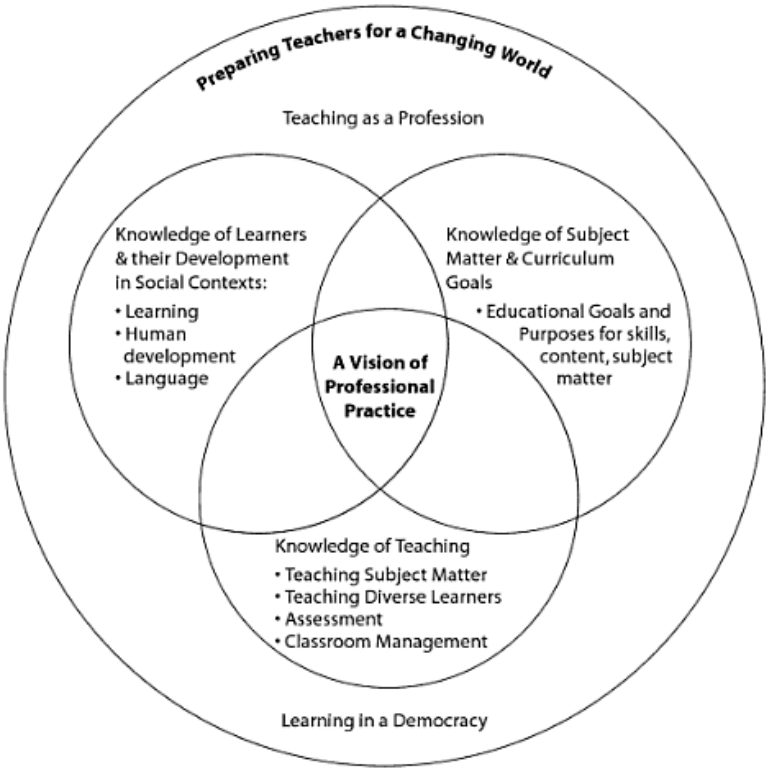

Figure 5.1. A Framework for Understanding Teaching and Learning. From Bransford, Darling-Hammond & LePage, 2005, p. 11. Reprinted with permission.

It is evident that the InTASC teaching standards align with the concepts of the Framework for Understanding Teaching and Learning (Bransford et al., 2005) model. A teacher must know and understand how students learn differently. Without this knowledge, a teacher will "lack the foundation that can help them figure out what to do when a given technique or text is not effective with all students" (Darling-Hammond, 2006, p. 4). It is expected that teachers refine their knowledge in developing appropriate student activities, teaching methods, and assessments. As the knowledge of teaching has become excessively expansive, teachers must rely on their ability to research and collaborate in order to meet the dynamic needs of students through continual adoptions in teaching (Darling-Hammond, 2006).

As the Framework for Understanding Teaching and Learning model is analyzed, it can be determined that many of the national and state standards and teacher requirements originate from a "vision of professional practice" (Bransford et al., 2005, p. 11). The importance of highly qualified teachers (U.S. Department of Education, 2005) is recognized by the upper right concept of the Framework for Understanding Teaching and Learning model: knowledge of subject matter and curriculum goals. The knowledge of learners (upper left concept) and the knowledge of teaching (lower concept) are grounded in the InTASC standards (CCSSO, 2011) through which pre-service teachers demonstrate proficiency. As this Venn diagram displays, these three main components of teacher preparation are interconnected. Without one component, the model no longer exists or fails to assist in preparing effective and highly qualified teachers. Leiby, Robinson, and Key (2013) stress that "Competent, qualified teachers are the backbone of high quality instruction at any level" (p. 180). "Scholars concur that specialized knowledge is clearly essential for practice" (Williams, 2001, p. 28).

Based upon the findings of Darling-Hammond (2000, 2012), Darling-Hammond, Holtzman, Gatlin, and Heilig (2005), and Goldhaber and Brewer (2000), knowledge in agricultural content, appropriate preparation in agricultural education departments, and certification in agricultural education are the components that should be an ultimate focus for preparing pre-service teachers in agricultural education. Bransford et al. (2005) noted the importance of placing pre-service teachers in settings where they can apply what they have learned, such as when they "work with other teachers to provide coherent well-grounded curriculum, evaluate and guide student progress using information-rich assessments, and use texts and materials that support thoughtful learning" (p. 4).

It is important to ensure that student teachers are demonstrating growth prescribed within the educational standards in which they will be assessed upon over the duration of their undergraduate experience. More importantly, it is essential to ensure that student teachers are utilizing the student teaching experience for the purposes of practical application (Sutherland et al., 2010) and meaningful reflection (Berggren & Soderlund, 2011; Bonney & Sternberg, 2011; Cakir, 2013; Norris & Ennis, 1989; Pena & Almaguer, 2012; Perry & Power, 2004; Yang, 2009) as two strategies to develop their abilities as effective teachers. If pre-service teachers reflect regularly during the student teaching experience, can those reflections be evaluated to ensure student teachers are engaging higher-order thinking skills as they work towards demonstrating proficiency in educational standards?

Purpose and Objectives

As part of a larger study, the purpose of the present study was to explore the higher-order thinking skills present in student teacher blog post reflections as the blog posts related to InTASC standards. This research aligns with the American Association for Agricultural Education National Research Agenda Priority Area 4: Meaningful, Engaged Learning in All Environments. More specifically, this research aims to "deepen our understanding of effective teaching and learning processes in agricultural education environments…and examine the role of …metacognition, and/or reflection in developing meaningful, engaged learning experiences across all agricultural education contexts" (Doerfert, 2011, p. 9).

The following research objectives guided this study:

1. Determine the frequency in which student teacher blog posts related to the ten InTASC standards.
2. Determine the relationship, if any, between the average level of critical thinking displayed within student teacher blog posts and the frequency with which those blog posts related to the InTASC standards.

Methodology

At Iowa State University, agricultural education pre-service teachers are expected to demonstrate their knowledge of the InTASC standards (Crawford, 2014). The study was employed with all agricultural education student teachers at Iowa State University during the fall of 2013 and spring of 2014 (N = 21). Appropriate IRB approval was obtained through the Office of Responsible Research at Iowa State University to ensure appropriate collection and use of data. The agriculture teacher preparation program at Iowa State University uses technology to enhance the quality of learning (Gilbert & Dabbagh, 2005; Vonderwell, 2002). As a requirement for the student teaching experience, student teachers were expected to post in a weekly discussion forum and write a bi-monthly blog as part of a private online community of practice (CoP) housed by the National Association of Agricultural Educators. This study analyzed student teachers' blog posts.

Blog, a shortened term for the contraction of web log, is a Web 2.0 technology providing an opportunity for users to be involved in asynchronous discussion. Blogs are convenient for producing and sharing student reflections and offer opportunities for students to write within a collaborative learning community (Robertson, 2011). Yang

(2009) stated that blogs are a great tool for pre-service and student teachers to demonstrate growth and change as they build a learning community. The use of blogs is becoming a popular tool that supports student teacher reflection (Walker, 2005; Williams & Jacobs, 2004).

Communities of practice are often used within educational settings and can occur within public or private discussion boards that allow practicing professionals, such as pre-service and inservice teachers, a place to reflect through blog posts and asynchronous communication (Walker, 2005; Williams & Jacobs, 2004; Yang, 2009). CoPs can "solve problems, promote the spread of best practices, [and] develop people's professional skills" (Wenger & Snyder, 2000, p. 140).

Bloom et al.'s (1956) Taxonomy of Educational Objectives is valuable for recognizing specific attributes of the levels in which teachers and learners critically process content. The Taxonomy of Educational Objectives (Bloom et al., 1956) recognizes six levels of cognitive abilities and skills: knowledge, comprehension, application, analysis, synthesis, and evaluation. These levels can be divided into higher- and lower-order thinking levels, where analysis, synthesis, and evaluation behaviors comprise higher-order thinking and knowledge, comprehension, and application comprise lower-order thinking (Duron, Limbach, & Waugh, 2006). The Florida Taxonomy of Cognitive Behavior (FTCB) (Brown, Ober, Soar, & Webb, 1970) is an instrument based upon Bloom et al.'s (1956) Taxonomy. Researchers utilize the FTCB to observe teachers' and students' cognitive behaviors in the classroom. The validity of the FTCB (Brown et al., 1970) comes from its direct development from Bloom et al.'s (1956) Taxonomy (Ball & Garton, 2005; López & Whittington, 2001; Miller, 1989; Whittington, 1991;

Whittington & Newcomb, 1993). Through the instrumentation of the FTCB (Brown et al., 1970) student teachers' blog posts were analyzed for critical thinking.

The blog post reflections and discussions were also analyzed to examine which posts addressed InTASC standards, if any, and which standards were addressed. The InTASC standards descriptions as constructed by the Council of Chief State School Officers (CCSSO, 2011) were utilized to code student teachers' blog posts. The InTASC standards provided definitions of terms and a rich description of standard components. These descriptions were regularly consulted during coding process. The InTASC standard descriptions are not a research instrument.

Intrarater reliability was established as excellent (α=.93) for coding the critical thinking blog posts (N=1, 016). Researchers coded the blog postings three times at four-week intervals (Weir, 2005) utilizing the FTCB. In addition to provisionally coding (Saldaña, 2013) blog posts for critical thinking, each blog post was also coded for the InTASC standards. Provisional coding was used because each level of critical thinking was a predetermined category anticipated from the literature review (Saldaña, 2013), and previous research findings (Bradley, Thom, Hayes, & Hay, 2008; Garrison et al., 2001; Gilbert & Dabbagh, 2005; Walker, 2004).

Simultaneous coding (Miles & Huberman, 1994; Saldaña, 2013) was used to code blog posts for InTASC standards. Simultaneous coding "is the application of two or more different codes to a single qualitative datum, or the overlapped occurrence of two or more codes applied to sequential units of qualitative data" (Saldaña, 2013, p. 80). Saldaña (2013) cautioned researchers that simultaneous coding may attribute to indecisiveness if used excessively, and the researcher should justify the rationale for its use. Simultaneous

coding of InTASC was used in this study used in this study due to the interconnectedness of InTASC standards, which increased the likelihood of multiple standards appearing in a single blog or discussion post by a student teacher. For example, in a discussion of classroom management and student misbehavior, the student teacher may also note that particular students mature and develop at a differing rate than that of their peers. In this situation, two standards are addressed: *Learning Environment* and *Learner Development*. Moreover, the blog posts coded for this study's objectives were assigned the same number as the blog posts coded for critical thinking. This was done so that the researchers could determine any correlational relationship between student teacher blog posts that discussed specific InTASC standards and the level of critical thinking displayed in the blog posts.

Therefore, total blog posts (N = 1,016) were manually coded for identification of InTASC standards. Researchers referenced the CCSSO's *InTASC Model Core Teaching Standard: A Resource for State Dialogue* (2011) throughout the coding process. Because student teachers may have discussed more than one standard in a blog post, the researcher recoded all standards discussed in each post. Several blog posts had more than one standard coded. Some blogs were general statements and did not relate to any of the standards; therefore, they did not receive an InTASC standard code. The total number of InTASC codes (N = 1,632) exceeded that of the actual posts. Posts were coded for InTASC standards three times at four-week intervals. If a standard was recognized as a part of a blog post, but was not coded during the first or second coding trials, the standard code was added to the blog post, and copied into an Excel file.

In order to determine correlational relationships between critical thinking and InTASC standards, only the posts in which critical thinking levels were agreed upon after the three, four-week interval coding periods were used (n = 942). All blog posts that were removed from the critical thinking data set were removed from the InTASC data set. Usable codes for InTASC standards were determined (n =1,474). Table 5.1 displays the total number of blog posts coded, the total number of codes assigned to the blog posts for critical thinking and standards, and the usable codes after the three, four-week coding periods.

Table 5.1

Note. Usable codes are those that remained after eliminating blog posts in which critical thinking levels were not agreed upon after three four-week coding periods. Usable codes were used for Spearman's rho correlation.

Summary of Blog Posts Coded for Critical Thinking and InTASC Standards

Component being coded	Total Posts	Total Codes	Usable Codes
For Critical Thinking	1016	1016	942
For Standards	1016	1632	1474

Spearman's rho was calculated using IBM SPSS Version 22.0 to determine if a correlational relationship existed between the number of blog posts in which student teachers discussed the InTASC standards, and the average level of student teacher critical thinking displayed within those blog posts. The average level of critical thinking per InTASC standard was calculated. Because the data was ordinal (Urdan, 2010) with critical thinking being coded among six hierarchical levels, each level was given a multiplier (1: knowledge, 2: comprehension, 3: application, 4: analysis, 5: synthesis, 6: evaluation). Preliminary analyses were performed to ensure normality of the data

(Pallant, 2013). Data demonstrated true linearity suggesting a relationship between the two variables (Pallant, 2013).

Results

Student teachers posted blogs that reflected all ten InTASC teaching standards. Table 5.2 provides an example of student teacher discussions coded for each standard.

Table 5.2

Note. Several of these examples were coded at more than one InTASC standard. These examples may be components of larger blog posts; therefore the level of critical thinking was determined based upon the highest level analyzed in the whole blog post.

Example Blog Posts of Student Teachers Discussions Pertaining to InTASC Standards, and the Level of Critical Thinking Assigned to that Blog Post

InTASC Standard	Example Blog Post	Level of Critical Thinking
Learner Development	*Has anyone else had the issue or noticed that high school student* [sic]*cannot spell correctly? I am in utter shock by this! I just watched a class of 7 use small white boards for an activity, and over half of the answers to the questions were spelling* [sic] *wrong. I'm just in awe that spelling has gotten horrible!*	Application
Learning Differences	*I am excited about being able to teach in the classroom, be able to make connections with the students, and to help them learn. I am a little nervous about having to wear the microphone device for a student who has hearing issues, but it will be awesome to be able to have that experience.*	Comprehension
Learning Environments	*8th graders need a new seating arrangement every week. I thought I had made a classroom management breakthrough when [cooperating teacher] assigned students to tables, without their friends. Wrong…today it seemed that the students had new found friends and no longer understood what classroom rules were.*	Application
Content Knowledge	*While I may be fairly knowledgeable in soils, conveying that information can sometimes be more difficult that* [sic] *anticipated.*	Evaluation

Table 5.2 Continued

Application of Content	*I think if you know the material, you've won half the battle. I think the best soil anticipatory set would be some sort of visual metaphor to help things make sense. Like comparing sand, silt, and clay particle size to that of a basketball, baseball and golf ball…*	Synthesis
Assessment	*I review…the day before an exam…especially if it is an exam I expect 80% or better like the Ag Mech exam I am giving on Thursday! If they cannot successfully pass this assessment, then myself and [cooperating teacher] feel they need to re-take it to be able to work on their wood project alone and be in the shop.*	Comprehension
Planning for Instruction	*I am a little worried making lesson plans and figuring out what to do with the other 3 courses right now. The Ag Mechanics course will be mainly project-based, with…individual to small group projects out in the shop…Ag Business is also more of a project-based class with… individual sales projects or interviewing people who are in different agricultural businesses in the area.*	Comprehension
Instructional Strategies	*I try not to go over their heads with the information, but other times I try to explain a concept and they already know what it means before I start telling them. It's difficult to figure out what they already know, and…they have some idea what [the concept] is but they're unsure. So to help with this struggle we have "Bell-Ringer" questions to start each class. I have 2 questions on the white board or Smart Board…*	Synthesis
Professional Learning and Ethical Practice	*It stinks I couldn't bring any students. I had one senior girl that was able and willing to tag along, but the liability of taking them that far in my own vehicle, and the fact that it would have been smarter to find another student to join us…was too much of a hassle,… If you have thoughts on that (or other rules that most teachers should follow…) I would love to hear about them.*	Application
Leadership and Collaboration	*I also had about 5 after-school meetings this week, including an advisory meeting for the [school] department, a school board meeting, and the [district] Ag Teacher's meeting.*	Knowledge

Professional Learning and Ethical Practices was the standard most evident in student teacher blogs (n=474, 29.04%) while Planning for Instruction appeared in 19% of

student teachers' blogs (*n*=310). The standard identified least often in student teacher blog posts was Content Knowledge (*n*=46, 2.82%). Table 5.3 displays the number of blog posts in which student teachers' discussions related to the InTASC standards.

Table 5.3

Frequency of Blog Posts in which Student Teacher Discussion Reflected the InTASC Standards (N=1,632)

InTASC Standard	*f*	*%*
Professional Learning and Ethical Practices	474	29.04
Planning for Instruction	310	19.00
Learner Development	196	12.01
Instructional Strategies	178	10.91
Leadership and Collaboration	132	8.09
Learning Environment	128	7.84
Application of Content	62	3.80
Learning Differences	58	3.55
Assessment	48	2.94
Content Knowledge	46	2.82

Table 5.4 demonstrates the number of blog posts in which the student teachers discussed the InTASC standards, and the average level of student teacher critical thinking displayed within those blog posts. Student teachers' blog post discussions relating to Professional Learning and Ethical Practices (n=188), Planning for Instruction (n=118), Leadership and Collaboration (n=48), Application of Content (n=22), and Assessment (n=11) were most often at the knowledge level. Student teachers' blog post discussions relating to Learner Development (n=69), Instructional Strategies (n=45), Learning Environment (n=45), Learning Differences (n=17), and Content Knowledge (n=12) were most often at the comprehension level.

The second objective of the study was to determine the relationship, if any, between the InTASC standards discussed in student teacher blog posts and the average level of critical thinking displayed within the blog posts. Spearman's rho was the non-

parametric test of choice due to the small sample of student teachers and because the parametric test assumes a random sample (Pallant, 2013). Preliminary analyses were performed to ensure no violations of linearity (Pallant, 2013).

Table 5.4

Note. Average level of critical thinking is organized from highest to lowest average critical thinking level. Avg. CT Level = the average level of critical thinking level where 1 = Knowledge, 2 = Comprehension, 3 = Application, 4 = Analysis, 5 = Synthesis, and 6 = Evaluation.

Frequency of Blog Posts at each Level of Critical Thinking per InTASC Standard, and Overall Average Level of Critical Thinking per InTASC Standard (n=1,474)

Standard	K	C	AP	AN	S	E	Total	Avg. CT Level
Professional Learning and Ethical Practices	188	181	28	26	6	8	437	1.87
Planning for Instruction	118	98	20	21	17	12	286	2.15
Learner Development	46	69	29	10	13	4	171	2.34
Instructional Strategies	43	45	21	16	22	8	155	2.70
Leadership and Collaboration	48	46	12	10	4	6	126	2.16
Learning Environment	27	45	16	11	5	6	110	2.46
Application of Content	22	13	4	6	9	4	58	2.64
Learning Differences	9	17	8	7	0	4	45	2.64
Assessment	11	10	7	8	4	4	44	2.91
Content Knowledge	12	14	5	3	5	3	42	2.62
Total	524	538	150	118	85	59	1474	

A statistically significant, large, negative correlation (Cohen, 1988) was found between the two variables (r_s = -.709, n = 10, p < .022) with higher numbers of blog posts per each of the ten InTASC standards associated with lower levels of critical thinking displayed within the blog posts related to those InTASC standards.

Conclusion and Discussion

The first objective of the study was to determine the frequency in which student teacher blog post discussions related to InTASC standards. It can be concluded that

student teachers discuss issues related to Professional Learning and Ethical Practices most often in a CoP because of the ongoing professional development and personal evaluation (CCSSO, 2011) that is expected to take place during the student teaching experience. Professional development is a comprehensive and ongoing process in which "the teacher actively seeks professional, community, and technological resources" (CCSSO, 2011, p. 18). However, the quality of personal evaluation is not what was expected as this standard demonstrated the lowest average level of critical thinking.

Planning for Instruction was the second most highly discussed standard, which would suggest that student teachers regularly conversed about lesson planning and other aspects of instructional planning. However, it was assumed that Planning for Instruction and Instructional Strategies would be the standards most often discussed based upon Moir's (2011) premise as well as the findings by Tweeten et al. (2014), Smalley et al. (2015), and Torres and Ulmer (2007) that curriculum development and lesson planning require the majority of student teachers' focus and time commitment during their student teaching experience.

It was expected that Content Knowledge would not be one of the standards in which student teacher blog posts related to most, as Moir (2011) and Tweeten et al.'s (2014) findings suggested that student teachers were not confident in their content knowledge, and they did not feel safe discussing their content knowledge or lack thereof with their peers in CoPs (Robertson, 2011). This finding may have been due to a couple of underlying factors. The cooperating teacher may have had an influence on the student teachers' application of the InTASC standards, placing more emphasis on professional development and lesson plan development and less on content knowledge during the

student teaching experience. Student teachers may also have been timid to discuss their content knowledge with their experienced cooperating teacher or discuss this matter on the CoP with the fear of appearing incompetent, thus eliminating the majority of content knowledge discussion in general.

The second objective of the study was to determine the relationship, if any, between the number of blog posts which related to the InTASC standards, and the average level of student teacher critical thinking displayed within those blog posts. The more often student teachers posted blog discussions related to Professional Learning and Ethical Practices, the less often those discussions demonstrated critical thinking. Students told of their professional activities or ethical practices, but minimally evaluated (Brown et al., 1970) "the needs of the learners, school, and system" (CCSSO, 2011, p. 18) or demonstrated an effort to "build and implement a plan for professional growth directly aligned with his/her needs as a growing professional using feedback from teacher evaluations and observations, data on learner performance, and school- and system-wide priorities" (CCSSO, 2011, p. 18).

In retrospect, when student teachers infrequently discussed Assessment*,* they did so at a critical thinking level higher than that of the other standards. In Smalley et al.'s (2015) findings, student teachers found evaluation of student performance and the methods of student evaluation to be very relevant to the student teaching experience. Therefore, it could be concluded that student teachers did not create or evaluate their own assessments because they often utilized the cooperating teachers' instead, knowing that student achievement was at stake. It is common in agricultural education that students be assessed with more project-based, student-centered evaluations. If the student teachers

did not recognize these as student evaluations and expected more traditional paper-based quizzes that are utilized less often, it stands to reason why discussion was minimal with regards to this standard.

Implications and Recommendations

As researchers, we must ask ourselves what these findings mean for the agricultural education student teachers at Iowa State University. University supervisors should be pleased with the consistency in which student teachers blog posts related to the educational standards for teaching assessment. Though not all standards were equally represented, there is something to be said that such a high percentage of the total blog posts were able to be related to the InTASC standards. Aligned with this finding, it is recommended that similar studies include a tool or tools to analyze blog posts that discuss FFA and Supervised Agricultural Experiences. Phipps, Osborne, Dyer, and Ball (2008) noticed the pride agricultural education has taken in providing pertinent learning experiences grounded in the three-circle school-based agricultural education model. In assessing agricultural education student teachers' reflections as they related to InTASC standards, SAE and FFA discussions were often difficult to code, as there is no one standard that specifically addresses the advisory role a student teacher will assume for the FFA chapter and the experiential learning concepts of SAE. Discussions of FFA and SAE were assigned to an InTASC standard at the best ability of the researcher.

Smalley et al. (2015) included FFA and SAE components in their student teaching experience activity relevance study. The constructs—which were determined from a compilation of student teaching handbooks in the North Central AAAE Region—recognized in the Smalley et al. (2015) study would serve as beneficial predetermined

topic categories in a CoP to enhance higher-order thinking. Predetermined topic categories posted by a CoP facilitator or University supervisor would help maintain organized discussion threads for student teachers, and allow for more focused discussions.

The student teaching experience—and all that it entails—can be challenging and provide obstacles (Knobloch & Whittington, 2002) as the student teacher works through the daily tasks of student teaching and compiles appropriate lessons and artifacts that supports proficiency in each of the InTASC standards. It is recommended that further studies utilize open coding (Saldaña, 2013) of blog posts to determine underlying meaning. What in particular were student teachers discussing with regards to the standards? Does a student teacher's blog post address a concern to keep up with the demands of lesson planning or was it a success story of a behavior management practice? The affective domain (i.e. moods, feelings, attitudes) was not coded as a part of this study and may offer insight into student teacher reflections in online communities of practice in future studies.

Similar to Moir's (2011) phases, it would be useful to determine which standards were discussed during which week (how far into) the student teaching experience, and whether or not these somehow aligned with Tweeten et al.'s (2014) phases of student teaching that mimic those of a first year teacher (Moir, 2011). Perhaps professional development is a topic discussed all semester, but learner development is discussed most often at the beginning of the student teacher experience, when student teachers are initially experiencing the diversity of the students they teach. This could identify the most appropriate times for facilitators or University supervisors to prompt their students with

probing questions to aid increased higher-order thinking in online environments (MacKnight, 2000; Garrison et al., 2001) pertaining to the standards in which they must demonstrate proficiency.

Scholars have offered that reflection and self-critique are critical to teachers' competence (Harris, 1993; Schön, 1995). The use of blogging in a CoP allows agricultural education student teachers to reflect not only on their own growth, but provide suggestions to their peers as well. The CoP also allows for quick and easy facilitation for University supervisors at a distance from the student teachers. It is recommended that further studies be done to support the findings of this paper.

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CHAPTER VI. MAJOR FINDINGS, GENERAL CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

The purpose of this thesis was to explore the critical thinking demonstrated within student teacher blog posts as they discussed and reflected during their student teaching experience in an online community of practice, and to determine the critical thinking demonstrated within these student teaching blog posts as they related to InTASC standards. This chapter reviews the major findings of the study, and summarizes the general conclusions, implications and recommendations from Chapters Four and Five.

Major Findings

Objective One

The first objective of this study was to determine the frequency and average level of critical thinking exhibited by Iowa State University agricultural education student teachers' reflections through blog posts in an electronic Community of Practice (CoP). It was found that student teacher blog posts (*n*=942) demonstrated each of the six levels of critical thinking. The lowest level of critical thinking, Knowledge, was demonstrated most often in student teachers' blog posts (*n*=441, 46.82%), while the Evaluation critical thinking level demonstrated least often (*n*=17, 1.80%).

Objective Two

The second objective of the study was to determine the relationship, if any, between the number of blogs posted by each student teacher and the average level of critical thinking displayed by student teachers within their respective blog posts. The highest number of blog posts posted over the duration of a semester was 97 and the

lowest was 8. The highest average level of critical thinking demonstrated in blog posts was 2.73 and the lowest was 1.38 on a 6-point scale, with all student teachers demonstrating average critical thinking between Bloom, Engelhart, Furst, Hill, and Krathwohl's (1956) Application and Knowledge levels. There was no significant relationship between the number of blogs posted by student teachers and the average level of critical thinking. Consistent with prior research, an increase in the number of posts did not display a significant correlation with an increase in critical thinking (Vonderwell, 2002).

Objective Three

The third objective of the study was to determine the frequency in which student teacher blog posts related to the ten InTASC standards. The InTASC standard most often discussed was Professional Learning and Ethical Practices (n=474, 29.04%), and the standard discussed least was Content Knowledge (n=46, 2.82%).

Objective Four

The fourth objective of the study was to determine the relationship, if any, between the number of blog posts which related to InTASC standards, and the average level of student teacher critical thinking displayed within those blog posts. The more often student teachers posted blog discussions related to a specific InTASC standard, the less often those discussions demonstrated critical thinking. Professional Learning and Ethical Practices was determined to display the lowest average level of critical thinking (M=1.87). Blogs post discussions that related to Assessment were determined to have the highest average level of critical thinking, M = 2.91. Spearman's rho correlation determined that there was a statistically significant, large, negative correlation (r_s = -.709,

$n = 21$, $p < .022$). A higher frequency of posts per standard related to a lower average level of critical thinking.

General Conclusions

Critical thinking

There are several reasons why student teachers may have utilized lower-order thinking skills when reflecting through blog posts in a CoP. The first is that student teachers were given no specific discussion topics or question prompts, which may enhance critical thinking in asynchronous discussions (MacKnight, 2000; Pena & Almaguer, 2012). Second is the idea of facilitator involvement in the CoP, which was minimal in this study. Facilitator involvement may explain the lack of higher-order thinking because there was not an experienced agricultural educator to provide feedback and suggestions to the student teachers, by, for example, sharing similar encounters. Having an expert or someone with whom the students could relate and seek out for meaningful feedback is a critical component of the CoP (Hoadley, 2012).

InTASC

Student teachers discussed Professional Learning and Ethical Practices most often because of the ongoing professional development and personal evaluation that is expected to take place during the student teaching experience (Council of Chief State School Officers, 2011). However, the quality of evaluation was not what was expected, as this standard demonstrated the lowest average level of critical thinking. It was expected that content knowledge would be discussed less often based upon Moir (2011) and Tweeten, Paulsen, & Anderson's (2014) findings that student teachers were not

confident in content knowledge or didn't feel safe discussing content knowledge or lack thereof with peers in a community of practice (Robertson, 2011).

Student teachers discussed Professional Learning and Ethical Practice, but minimally evaluated (Brown, Ober, Soar, & Webb, 1970) those situations or experiences. Student teachers least often discussed assessment, because they frequently utilized their cooperating teachers' assessments and did not create their own because of reasons that should be researched further.

General Implications and Recommendations

Critical thinking

The conclusions of this study have several possible implications for higher education faculty. Student teachers may feel overwhelmed providing feedback to all of their peers. It is recommended that student teachers from small groups of three or four so that students are only required to provide feedback for a select few of their peers. This will prevent feedback fatigue and increase the chances that student teachers provide meaningful feedback for a few, rather than less thoughtful feedback for many. Future studies should establish a baseline level of critical thinking at which student teachers should be expected to perform in order to determine how Web 2.0 technologies impact critical thinking skills demonstrated through online environments. Facilitator involvement is also critical, and it is suggested that question prompts or a rubric be utilized to guide student teachers in utilizing critical thinking as they reflect on their student teaching experience.

To increase instrument reliability, it is suggested that future research in this area utilize multiple coders and a weighted kappa. Weighted kappa is used with categorical

data in an ordinal manner (Cohen, 1968) such as the hierarchical manner of Bloom et al.'s (1956) Taxonomy. This would add reliability to the instrument used in coding student teacher blog posts. Thus, if researchers have a coding discrepancy between one level of critical thinking (e.g., one coder designates a blog to be at the Application level and one coder at the Analysis level), the interrater reliability would be penalized less than it would be if the coders' designations differed by several levels on the Taxonomy (e.g., between Application and Evaluation).

InTASC

Though not all standards were discussed equally, it should be noted that so many student teacher blog posts related to the standards in which proficiency is required. However, as Smalley, Retallick, & Paulsen (2015) discovered, student teachers noted FFA and Supervised Agricultural Experiences to be relevant components of the student teaching experience. The InTASC standards do not explicitly provide knowledge measures or critical dispositions in which student teachers can prove competency in the FFA and Supervised Agricultural Experiences components of the student teaching experience. For future studies, it is suggested that these two components be coded separately. It is also suggested that future studies utilize open coding (Saldaña, 2013). By openly coding student teacher blog posts, the researcher can explore the affective domain (e.g., mood, feelings, attitude) to determine underlying messages in student teacher discussions.

Overall, it is critical that University supervisors continue to facilitate student teachers' reflection processes throughout the student teaching. It is also important to gain the student teachers' point of views when coding to ensure that the researcher is coding

consistently with student teachers' blog posts discussions in a community of practice. A weekly focus group with the student teachers and university faculty would help ensure truthful, rich data.

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APPENDIX A. INSTITUTIONAL REVIEW BOARD APPROVAL LETTER

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Institutional Review Board
Office for Responsible Research
Vice President for Research
1138 Pearson Hall
Ames, Iowa 50011-2207
515 294-4566
FAX 515 294-4267

Date: 10/20/2014

To: Dr. Thomas H Paulsen
217 Curtiss Hall

From: Office for Responsible Research

Title: A Longitudinal Study of the Perceptions and Experiences of Student Teachers in an Electronic Community of Practice

IRB ID: 14-084

Study Review Date: 10/20/2014

The project referenced above has been declared exempt from the requirements of the human subject protections regulations as described in 45 CFR 46.101(b) because it meets the following federal requirements for exemption:

- (1) Research conducted in established or commonly accepted education settings involving normal education practices, such as:
  - Research on regular and special education instructional strategies; or
  - Research on the effectiveness of, or the comparison among, instructional techniques, curricula, or classroom management methods.

- (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey or interview procedures with adults or observation of public behavior where
  - Information obtained is recorded in such a manner that human subjects cannot be identified directly or through identifiers linked to the subjects; or
  - Any disclosure of the human subjects' responses outside the research could not reasonably place the subject at risk of criminal or civil liability or be damaging to their financial standing, employability, or reputation.

The determination of exemption means that:

- **You do not need to submit an application for annual continuing review.**

- **You must carry out the research as described in the IRB application.** Review by IRB staff is required prior to implementing modifications that may change the exempt status of the research. In general, review is required for any modifications to the research procedures (e.g., method of data collection, nature or scope of information to be collected, changes in confidentiality measures, etc.), modifications that result in the inclusion of participants from vulnerable populations, and/or any change that may increase the risk or discomfort to participants. Changes to key personnel must also be approved. The purpose of review is to determine if the project still meets the federal criteria for exemption.

  Non-exempt research is subject to many regulatory requirements that must be addressed prior to implementation of the study. Conducting non-exempt research without IRB review and approval may constitute non-compliance with federal regulations and/or academic misconduct according to ISU policy.

  Detailed information about requirements for submission of modifications can be found on the Exempt Study Modification Form. A Personnel Change Form may be submitted when the only modification involves changes in study staff. If it is determined that exemption is no longer warranted, then an Application for Approval of Research Involving Humans Form will need to be submitted and approved before proceeding with data collection.

Please note that you must submit all research involving human participants for review. **Only the IRB or designees may make the determination of exemption**, even if you conduct a study in the future that is exactly like this study.

Modification Information

Please provide answers to all questions, except as specified. The fields will expand as you type. Incomplete forms will be returned without review.

☒Yes ☐ No	**Was your project initially determined to be eligible for exempt review?** *This information can be found in the approval letter you received when the study was last reviewed.*
	If *No*, **STOP!** This is not the correct form! Please submit a Modification Form for Non-Exempt Research form instead. If *Yes*, please complete Parts A and B below.

Part A: Changes in Personnel

☐Yes	☒ No	1. Does the modification involve a change in Principal Investigator? If *Yes*, **STOP!** The new principal investigator must submit a completed new Exempt Study Review Form.
☒Yes	☐ No	2. Are you adding or removing members of the key personnel? If *Yes*, complete Table A.1 below.

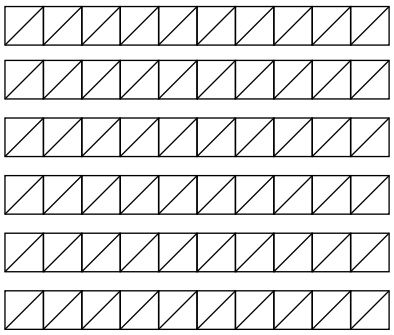
Table A.1

1. **List any individuals that are no longer part of the key personnel: NA**
2. **Complete the following table to list any new key personnel:**

NAME	Interpersonal contact or communication with subjects, or access to private identifiable data?	Involved in the consent process?	Contact with human blood, specimens, or other biohazardous materials?	Other Roles in Research	Qualifications (i.e., special training, degrees, certifications, coursework, etc.)	Human Subjects Training Date
Taylorann K. Smith	☒	☐	☐	Data Analysis	Licensed Teacher	1/15/2014
	☐	☐	☐			
	☐	☐	☐			
	☐	☐	☐			
	☐	☐	☐			
	☐	☐	☐			
	☐	☐	☐			

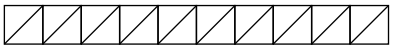
APPENDIX B. FLORIDA TAXONOMY OF COGNITIVE BEHAVIOR
BROWN, OBER, SOAR, AND WEBB (1970)

1 2 3 4 5 6 7 8 9 10

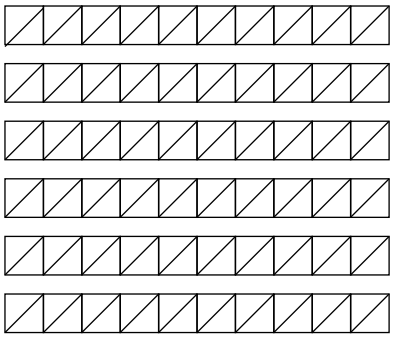


1. Reads
2. Spells
3. Identifies something by name
4. Defines meaning of term
5. Gives a specific fact
6. Tells about an event

1.2 Knowledge of ways and means of dealing with specifics

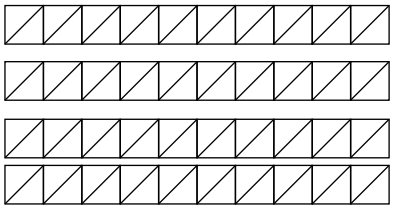


7. Recognizes symbol



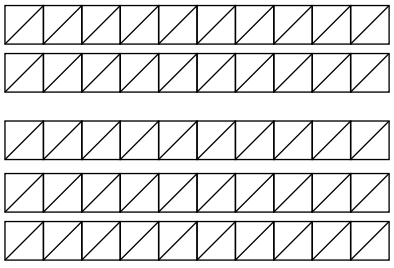
8. Cites a rule
9. Gives chronological sequence
10. Gives steps of process, describes method
11. Cites trend
12. Names classification system or standard
13. Names what fits given system or standard

1.3 Knowledge of universals and abstracts

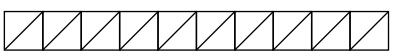


14. States generalized concept or idea
15. States a principle, law, theory
16. Tells about organization or structure
17. Recalls name of principle, law, theory

2.0 Translation

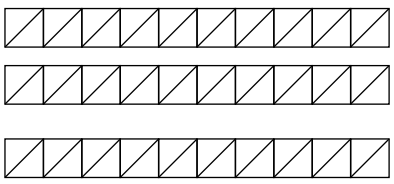


18. Restate in own words or briefer terms
19. Gives concrete examples of an abstract idea
20. Verbalizes from a graphic representation
21. Translates verbalization into graphic form
22. Translates figurative statements into literal statements or vice versa

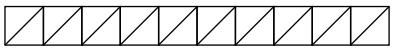


23. Translates foreign language to English or vice versa

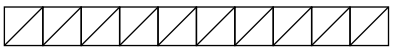
3.0 Interpretation



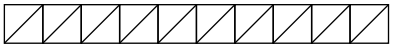
24. Gives reason (tells why)
25. Shows similarities, differences
26. Summarizes or concludes from observation of evidence



27. Shows cause and effect relationship

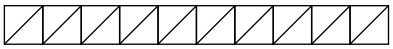


28. Gives analogy, simile, metaphor

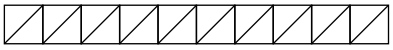


29. Performs a directed task or process

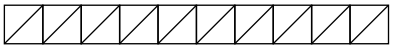
4.0 Application



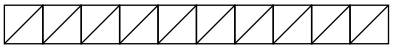
30. Applies previous learning to new situations



31. Applies principle to new situation

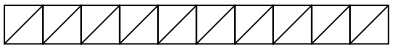


32. Applies abstract knowledge in a practical situation

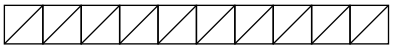


33. Identifies, selects and carries out process

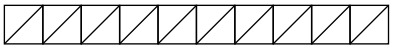
5.0 Analysis



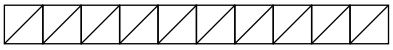
34. Distinguishes fact from opinion



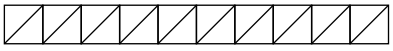
35. Distinguishes fact from hypothesis



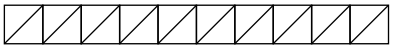
36. Distinguishes conclusion from statements which support it



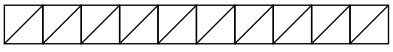
37. Points out unstated assumption



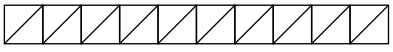
38. Shows interaction or relation of elements



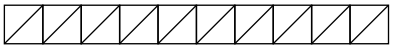
39. Points out particulars to justify conclusions



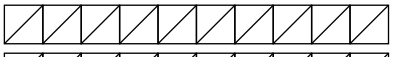
40. Checks hypotheses with given information



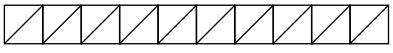
41. Distinguishes relevant from irrelevant statements



42. Detects error in thinking

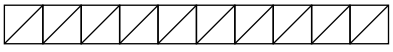


43. Infers purpose, point of view, thoughts, feelings

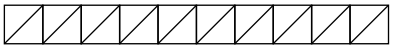


44. Recognizes bias or propaganda

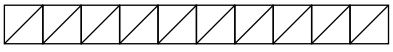
6.0 Synthesis (Creativity)



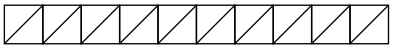
45. Reorganizes ideas, materials, processes



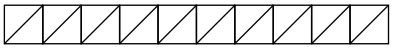
46. Produces unique communication, divergent idea



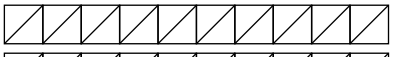
47. Produces a plan, proposed set of operations



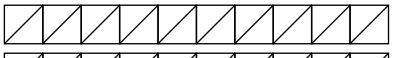
48. Designs an apparatus



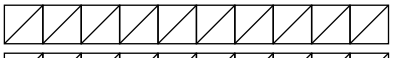
49. Designs a structure



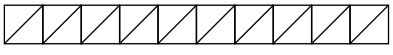
50. Devises a scheme for classifying information



51. Formulates hypotheses, intelligent guesses

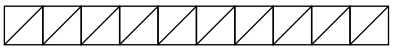


52. Makes deductions from abstract symbols, propositions

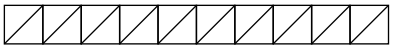


53. Draws inductive generalization from specifics

7.0 Evaluation



54. Evaluates something from evidence



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Publication: American Journal of Distance Education

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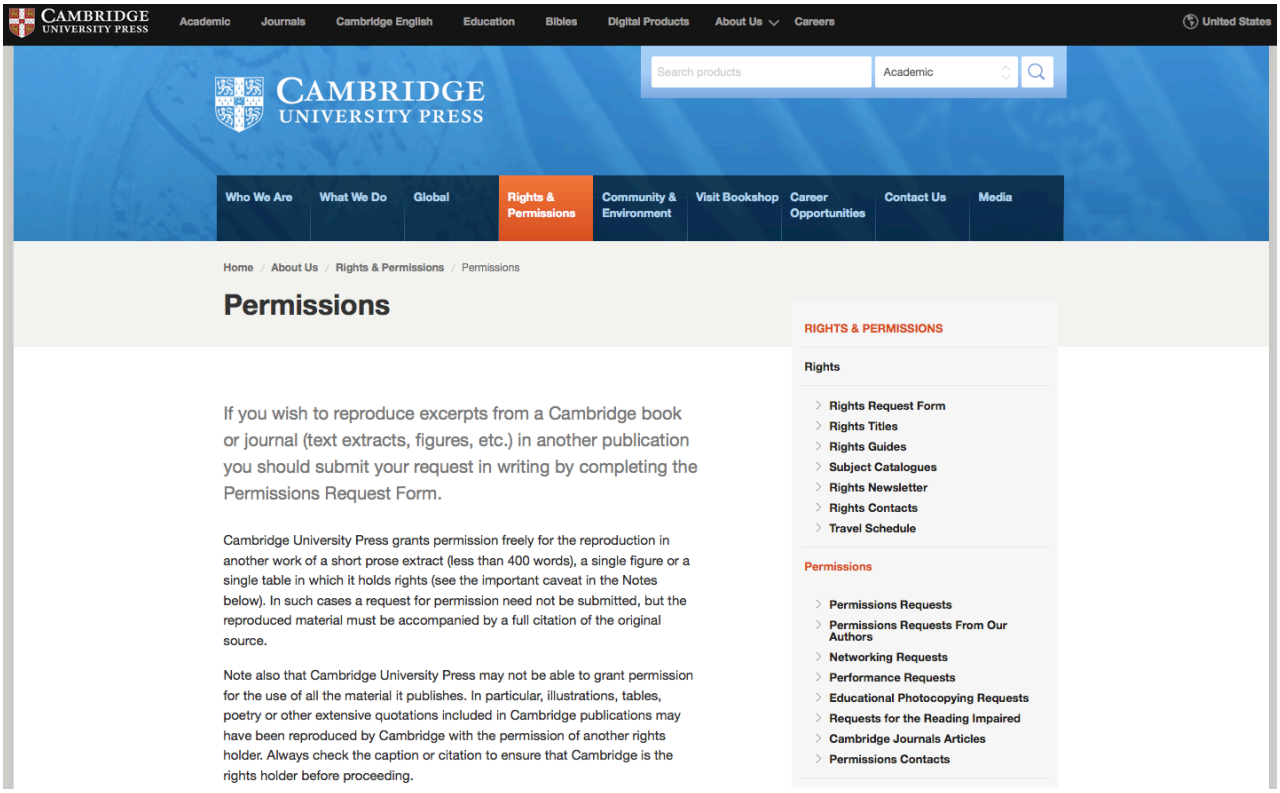

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Editors: Linda Darling-Hammond, John Bransford
Published by: Jossey-Bass
Year: 2005

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APPENDIX F. INTASC STANDARDS AND CROSSWALKING THE CURRENT AND PROPOSED TEACHER EDUCATION STANDARDS, CRAWFORD (2015)

InTASC Standards

The Learner and Learning
Standard #1: Learner Development. The teacher understands how learners grow and develop, recognizing that patterns of learning and development vary individually within and across the cognitive, linguistic, social, emotional, and physical areas, and designs and implements developmentally appropriate and challenging learning experiences.

Standard #2: Learning Differences. The teacher uses understanding of individual differences and diverse cultures and communities to ensure inclusive learning environments that enable each learner to meet high standards.

Standard #3: Learning Environments. The teacher works with others to create environments that support individual and collaborative learning, and that encourage positive social interaction, active engagement in learning, and self-motivation.

Content
Standard #4: Content Knowledge. The teacher understands the central concepts, tools of inquiry, and structures of the discipline(s) he or she teaches and creates learning experiences that make the discipline accessible and meaningful for learners to assure mastery of the content.

Standard #5: Application of Content. The teacher understands how to connect concepts and use differing perspectives to engage learners in critical thinking, creativity, and collaborative problem solving related to authentic local and global issues.

Instructional Practices
Standard #6: Assessment. The teacher understands and uses multiple methods of assessment to engage learners in their own growth, to monitor learner progress, and to guide the teacher and learner's decision making.

Standard #7: Planning for Instruction. The teacher plans instruction that supports every student in meeting rigorous learning goals by drawing upon knowledge of content areas, curriculum, cross-disciplinary skills, and pedagogy, as well as knowledge of learners and the community context.

Standard #8: Instructional Strategies. The teacher understands and uses a variety of instructional strategies to encourage learners to develop deep understanding of content areas and their connections, and to build skills to apply knowledge in meaningful ways.

Standard #8A: Technology. The teacher integrates current and emerging technology in instruction to encourage student creativity, problem solving, collaboration, and digital literacy. Teachers practice and advocate safe, legal, and responsible use of information and technology.

Professional Responsibility
Standard #9: Professional Learning and Ethical Practice. The teacher engages in ongoing professional learning and uses evidence to continually evaluate his/her practice, particularly the effects of his/her choices and actions on others (learners, families, other professionals, and the community), and adapts practice to meet the needs of each learner.

Standard #10: Leadership and Collaboration. The teacher seeks appropriate leadership roles and opportunities to take responsibility for student learning, to collaborate with learners, families, colleagues, other school professionals, and community members to ensure learner growth, and to advance the profession.

Crosswalking the Current and Proposed Teacher Education Standards

Current ISU Teacher Education Standard	InTASC Standard
Content/subject matter specialization. The candidate demonstrates an understanding of the central concepts, tools of inquiry, and structure of the discipline(s) the candidate teaches, and creates learning experiences that make these aspects of the subject matter meaningful for students. This is evidenced by a completion of a 30-semester-hour teaching major which must minimally include the requirements for at least one of the basic endorsement areas, special education teaching endorsements, or secondary level occupational endorsements. Each elementary candidate must also complete a field of specialization in a single discipline or a formal interdisciplinary program of at least twelve semester hours.	**Standard #4:** Content Knowledge. The teacher understands the central concepts, tools of inquiry, and structures of the discipline(s) he or she teaches and creates learning experiences that make the discipline accessible and meaningful for learners to assure mastery of the content. **Standard #5:** Application of Content. The teacher understands how to connect concepts and use differing perspectives to engage learners in critical thinking, creativity, and collaborative problem solving related to authentic local and global issues.
Student learning. The candidate demonstrates an understanding of human growth and development and of how students learn and participates in learning opportunities that support intellectual, career, social and personal development.	**Standard #1:** Learner Development. The teacher understands how learners grow and develop, recognizing that patterns of learning and development vary individually within and across the cognitive, linguistic, social, emotional, and physical areas, and designs and implements developmentally appropriate and challenging learning experiences.
Diverse learners. The candidate demonstrates an understanding of how students differ in their approaches to learning and creates instructional opportunities that are equitable and adaptable to diverse learners.	**Standard #2:** Learning Differences. The teacher uses understanding of individual differences and diverse cultures and communities to ensure inclusive learning environments that enable each learner to meet high standards.
Instructional planning. The candidate plans instruction based upon knowledge of subject matter, students, the community, curriculum goals, and state curriculum models.	**Standard #7:** Planning for Instruction. The teacher plans instruction that supports every student in meeting rigorous learning goals by drawing upon knowledge of content areas, curriculum, cross-disciplinary skills, and pedagogy, as well as knowledge of learners and the community context.
Instructional strategies. The candidate demonstrates an understanding and use of a variety of instructional strategies to encourage student development of critical and creative thinking, problem-solving, and performance skills.	**Standard #8:** Instructional Strategies. The teacher understands and uses a variety of instructional strategies to encourage learners to develop deep understanding of content areas and their connections, and to build skills to apply knowledge in meaningful ways.
Learning environment/classroom management. The candidate uses an understanding of individual and group motivation and behavior; creates a learning environment that encourages positive social interaction, active engagement in learning, and self-motivation; maintains effective classroom management; and is prepared to address behaviors related to substance abuse and other high-risk behaviors.	**Standard #3:** Learning Environments. The teacher works with others to create environments that support individual and collaborative learning, and that encourage positive social interaction, active engagement in learning, and self-motivation.

Current ISU Teacher Education Standard	InTASC Standard
Communication. The candidate uses knowledge of effective verbal, nonverbal, and media communication techniques, and other forms of symbolic representation, to foster active inquiry, collaboration, and support interaction in the classroom.	N/A
Assessment. The candidate understands and uses formal and informal assessment strategies to evaluate the continuous intellectual, social, and physical development of the student, and effectively uses both formative and summative assessment of students, including student achievement data, to determine appropriate instruction.	**Standard #6:** Assessment. The teacher understands and uses multiple methods of assessment to engage learners in their own growth, to monitor learner progress, and to guide the teacher's and learner's decision making.
Foundations, reflective practice and professional development. The candidate develops knowledge of the social, historical, and philosophical foundations of education. The candidate continually evaluates the effects of the candidate's choices and actions on students, parents, and other professionals in the learning community; actively seeks out opportunities to grow professionally; and demonstrates an understanding of teachers as consumers of research and as researchers in the classroom.	**Standard #9:** Professional Learning and Ethical Practice. The teacher engages in ongoing professional learning and uses evidence to continually evaluate his/her practice, particularly the effects of his/her choices and actions on others (learners, families, other professionals, and the community), and adapts practice to meet the needs of each learner.
Collaboration, ethics and relationships. The candidate fosters relationships with parents, school colleagues, and organizations in the larger community to support student learning and development; demonstrates an understanding of educational law and policy, ethics, and the profession of teaching, including the role of boards of education and education agencies; and demonstrates knowledge and dispositions for cooperation with other educators, especially in collaborative/co-teaching as well as in other educational team situations.	**Standard #9:** Professional Learning and Ethical Practice. The teacher engages in ongoing professional learning and uses evidence to continually evaluate his/her practice, particularly the effects of his/her choices and actions on others (learners, families, other professionals, and the community), and adapts practice to meet the needs of each learner. **Standard #10:** Leadership and Collaboration. The teacher seeks appropriate leadership roles and opportunities to take responsibility for student learning, to collaborate with learners, families, colleagues, other school professionals, and community members to ensure learner growth, and to advance the profession.
Technology. The candidate effectively integrates technology into instruction to support student learning.	**Standard #8A:** Technology. The teacher integrates current and emerging technology in instruction to encourage student creativity, problem solving, collaboration, and digital literacy. Teachers practice and advocate safe, legal, and responsible use of information and technology.
Methods of teaching. Methods of teaching have an emphasis on the subject and grade level endorsement desired.	N/A