INTRAPERSONAL FACTORS AFFECTING TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE IN OKLAHOMA AGRICULTURAL EDUCATION TEACHERS

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Bachelor of Science in Agricultural Sciences and Natural

Resources in Agricultural Communications

Oklahoma State University

Stillwater, Oklahoma

2007

Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
in partial fulfillment of
the requirements for
the Degree of
MASTER OF SCIENCE
December 2012

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Title of Study: INTRAPERSONAL FACTORS AFFECTING TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE IN OKLAHOMA AGRICULTURAL EDUCATION TEACHERS

Pages in Study: 86		Candidate for the Degree of Master of Science

Major Field: Educational Technology

Scope and Method of Study: The focus of this exploratory study was to examine intrapersonal factors as well as levels of technology integration and Technological Pedagogical Content Knowledge (TPACK) in preservice and inservice agricultural education teachers in Oklahoma. Data were collected using a combination of an online survey and a paper survey and distributed to 426 agricultural education teachers in Oklahoma schools and approximately 130 agricultural education students at Oklahoma State University. Data analysis included the use of descriptive and inferential statistics.

Findings and Conclusions: The findings of this study suggest that the intrapersonal factors of self-efficacy, outcome expectations, and interest, interact with teacher motivation to integrate technology and influence their Technological Pedagogical Content Knowledge. Further, the results suggest that experienced inservice teachers view technology tools as a mechanism to engage students and achieve instructional gains, whereas novice and preservice teachers tend to see technology tools primarily as a mechanism for improving classroom management. Implications include continuing to support and enact a shift in preservice teacher education from direct lecture and modeling-based instruction to more hands-on, constructivist methods of teaching that incorporate a variety of mastery experiences.

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CHAPTER I

INTRODUCTION

The agricultural education classroom today features not only the *traditional* experiential learning situations and skills learned in livestock fitting and showing, FFA, and mechanical agricultural practices, but also 21st-century learning experiences involving interactive white boards, Web 2.0 and mobile applications, and video- and computer-based livestock judging simulation games. New technologies, practices, and products are emerging continually; as a result, an increased demand exists for information and technology processing and analysis.

As educational researchers study effective applications of emerging educational technologies, K-12 teachers are being challenged to employ educational technology products and processes in their practice. At the forefront of this movement is a goal to engage students in learning experiences that make use of technologies in which today's learners are comfortable. At the same time, a *new* generation of educators is beginning to enter the teaching profession. Marc Prensky's digital native dichotomy suggests this generation, known as digital natives, is more effective at using technology than their older counterparts, known as digital immigrants (Prensky, 2001). Further, Prensky (2001) claimed that when digital natives dominate the teaching profession, integrating technology in the classroom will no longer be an issue due to natives' innovation abilities and familiarity with the digital world.

Recent research has examined some of these claims empirically and suggests that the dividing line between digital natives and digital immigrants may not be as distinct as initially thought (Guo, Dobson, & Petrina, 2008). For example, some studies have indicated that no statistically significant differences exist between natives and immigrants in regard to their use of information and communication technologies. Rather, a gap exists, regardless of the generation of the teacher, in understanding how to use technologies for teaching and learning (Chen, Lim, & Tan, 2010). Thus, the need for teachers to be technologically *fit* is imperative (Brown, Baker, Edwards, & Robinson, 2011).

Technology plays an important role in education if the teacher believes he or she is capable of teaching in a technology-enhanced learning environment. Preservice teacher education programs have spent a considerable amount of time focused on preparing future educators to use technology in their classrooms (Anderson & Maninger, 2007) and agricultural education is no exception. Inservice professional development training has also held technology in its spotlight, attempting to diffuse the confusion that surrounds instructional technology tools while also stressing its relevance to state standards. However, by Prensky's theory, instructional technology training and education programs should become increasingly rare as digital natives enter the workforce.

What the Prensky (2001) dichotomy fails to take into account is the complexity of non-generational factors that influence whether a teacher implements technology. Research indicates teacher decision to integrate technology is influenced by intrapersonal constructs such as self-efficacy beliefs, interest, and outcome expectations (Tschannen-Moran, Woolfolk Hoy & Hoy, 1998; Niederhauser & Perkmen, 2008).

Perhaps most dominant in the field of teaching is self-efficacy beliefs, which have been an area of interest since the 1960's. Research has suggested high teacher self-efficacy results in positive student outcomes, a tendency toward innovation, and a motivated classroom environment (Bandura, 1986, 1997; Tschannen-Moran, et al., 1998; Atkinson, 2000; Wedel & Jennings, 2006; Keller, 2010). For example, a recent study of agriculture teachers' self-efficacy, outcome expectation, and interest using Interactive Whiteboards (IWBs) demonstrated that those who used IWBs more frequently had higher levels of self-efficacy and outcome expectations (Bunch, Robinson, & Edwards, 2012).

Further, self-efficacy researchers such as Bandura (1986; 1997) and Parajes (2002) suggest self-efficacy to be a leading determinant of behavior adoption and change, thus the reason it was selected as a factor in this study of technology integration in agricultural education. While technology training may result in stronger efficacy beliefs toward technology, if training is the only factor considered, the assumption must be made teachers will take the leap from understanding how to use a technology after training and integrating it into their instruction and curriculum, which are two separate tasks (Mishra & Koehler, 2006).

However, self-efficacy does not act alone. Niederhauser and Perkmen (2008) suggest interest and outcome expectations also play a role in teacher decisions. These three primary intrapersonal pieces interact with each other on a constant basis, reinforcing some behaviors while weakening others. Although these three constructs provide insight on teacher confidence, interest, and beliefs, they do not necessarily reveal whether teachers have TPACK, or indicate how intrapersonal factors may influence TPACK.

In 2006, Mishra and Koehler introduced the notion of Technological Pedagogical Content Knowledge (TPACK), which provides a useful framework for understanding teacher perceptions and practices of technology integration into curriculum and pedagogy. In order to integrate technology into their pedagogy and curriculum successfully, teachers must develop confidence in their abilities to integrate technology in the classroom. However, at present, the relationships between intrapersonal factors like general teacher self-efficacy, technology integration self-efficacy, and externalization of these factors through TPACK are not fully understood. Therefore, this study focused on assessing preservice and inservice agricultural education teacher TPACK, examining the intrapersonal factors of self-efficacy, interest, and outcome expectations, and determining whether intrapersonal factors predicted levels of TPACK in preservice and inservice agricultural education teachers in Oklahoma.

CHAPTER II

LITERATURE REVIEW

Motivation is critical to human performance and is a construct that is embedded within multiple cognitive and socio-cultural theories of learning. The power of self-efficacy and motivation within a teacher influences teacher performance and, in turn, has a lasting effect on student motivation and performance. Teachers and students with high levels of motivation to learn place a greater emphasis on learning goals and exhibit more cognitive and emotional engagement with the learning content.

Teacher and student motivation are influenced through such variables as gender, self-efficacy beliefs about general ability (Bandura, 1995), interest and goal orientation (Schunk, Pintrich & Meece, 2008), and the nature of the task itself (Schunk, Pintrich & Meece, 2008). The motivated teacher is an enthusiastic teacher, and motivated teachers produce motivated students (Atkinson, 2000; Wedel & Jennings, 2006; Keller, 2010). Empirical evidence suggests that students are intrinsically motivated to learn when an enthusiastic teacher is guiding their instruction (Patrick, Hisley, & Kempler, 2000). Atkinson (2000) argues, "the lynch pin in sustaining, enhancing or decreasing motivation is very often the teacher, and their influence upon pupil demotivation is an important factor that cannot be ignored" (p. 46). Teachers who set self-determined goals (i.e., are intrinsically motivated) report that they are more supportive of their students' autonomy and have a higher sense of well being (Malmberg, 2006).

As presented within this literature review, motivation is a psychological construct as it pertains to educational motivation. Keller (2010) suggests multiple motivational theories exist and are grouped into the categories of human physiology and neurology, behavioral approaches, cognitive theories, and studies of emotion and affect. An unfortunate consequence within motivational research is each area has established paradigms of inquiry and often researchers resist crossing domains (Keller, 2010). A unified, comprehensive theory to support holistic instructional design, clinical diagnoses, and other contexts may be impossible. Thus, the cognitive approach to motivation (Schunk, Pintrich, & Meece, 2008) was selected for this research study for its interactivity with self-efficacy and empirical research on social cognitive theory, which suggests people are both products and producers of their environment (Bandura, 1986).

Individuals who exhibit interest in a task or feel excited about it are said to be "motivated" regarding that task (Linnenbrink & Pintrich, 2003). Motivation research suggests the positive feelings regarding tasks lead to student engagement and learning in classroom settings (Pintrich & Schunk, 1996). Nearly all motivational research relies on the constructs related to students' beliefs regarding their ability to complete a task, also known as self-efficacy.

The constructs used within this study are largely based on Bandura's social cognitive theory first published in 1977, which deviated from the traditional cognitive theories of the time and integrated cognitive development into a social structure of influences. The social cognitive view of motivation suggests a complex interactive system of self-efficacy beliefs, achievement goals, interests, and attributions of success or failure (Schunk, Pintrich, & Meece, 2008). As shown in Figure 1, motivation has multiple interactions between constructs, resulting in increased difficulty in understanding why teachers are motivated to use certain pedagogy, curriculum, and tools, including instructional technology. This complex system of self-efficacy beliefs, achievement goals, interest, and attribution are suggested as the primary underpinnings influencing agricultural education instructional technology integration and technological pedagogical content knowledge perceptions.

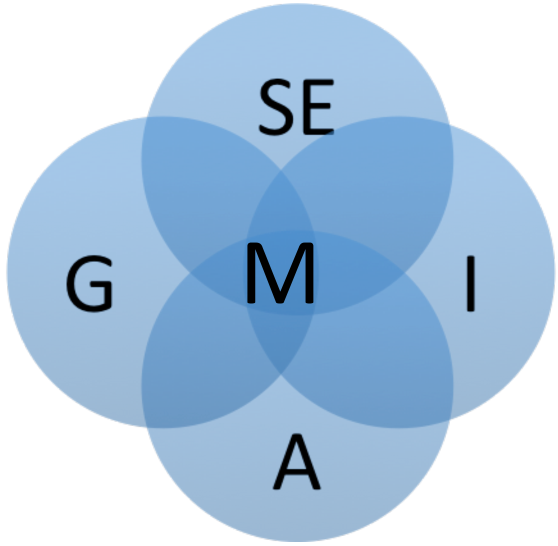

Figure 1. Self-Efficacy (SE), Goal-Setting (G), Interest (I) and Attribution (A) form a complex system influencing motivation and instructional technology integration.

Schunk and colleagues (2008) contend that social cognitive theory "distinguishes learning from performance of previously learned actions" (p. 128). As a result, motivation is a key factor in when an individual will actually demonstrate the skill learned. This separation of learning and action provides an additional challenge in assessing motivation of the teacher to integrate technology into curriculum and pedagogy and the driving force behind integration. Is it because the teacher needs to adjust approach? Has the teacher formulated strong self-efficacy beliefs toward technology integration due to modeling or mastery? Ultimately, self-efficacy beliefs, achievement goals, attribution, and interest become the keys to motivation as it pertains to the instructor.

Self-Efficacy

Self-efficacy (SE) is an individual's perceived confidence level as it relates to completing a task (Bandura, 1986; Tschannen-Moran, Woolfolk Hoy, & Hoy, 1998). SE affects activity choice, degree of persistence, and effort (Schunk, et al., 2008). SE is obtained from actual performance, vicarious experience, persuasion and environment (Schunk, et al., 2008). SE beliefs also factor in to motivated learning, which focuses on acquiring skills and strategies rather than performing tasks (Schunk, et al., 2008). Within motivated learning, SE beliefs are not affected by lack of progress; individuals remain motivated if the individual believes he or she can perform better by adjusting approach. Whether a teacher with strong SE beliefs adjusts his or her instructional technology approach in a classroom where current instructional methods could be improved has yet to be answered. Further, the question still remains as to whether teachers maintain their SE, believing that by changing the instructional method used, the teacher has a learning engagement effect on students.

SE is important not only in motivation and correlations between teacher SE and student achievement level but also in career choice (Bandura, 2001). Knobloch and Harms' study of preservice teacher motivation (2005) found preservice teachers who had plans of pursuing formal education roles were more effacious than those who had plans of pursuing non-formal education roles (pg 113). Further, Bandura (2001) and Lawver (2009) posit that students choose careers and make discipline decisions based on their perceived success and influence on others. Roberts and associates suggest that self- and teacher efficacy have a role in student career choice as well, and students who have a strong belief they can perform the responsibilities of a teacher will be more motivated to pursue a teaching career (Roberts, Greiman, Murphy, Ricketts, Harlin, & Briers; 2009).

Goal-Setting

Goal setting furthers the motivational process by establishing a quantitative or qualitative standard of performance (Schunk, et al., 2008). Individuals who establish a goal and contain efficacy for completing the goal are motivated to engage in activities leading to attainment.

Motivational benefits of goals are dependent upon learner commitment to attain the goal. Goal properties of proximity, specificity, and difficulty influence goal achievement (Schunk, et al., 2008). Proximal goals are stronger in fostering SE and motivation in individuals because progress is easier to track versus that of distal goals. Specificity is an important component as goals incorporating specific standards raise efficacy as compared to general goals (Schunk, et al., 2008). Schunk and colleagues (2008) suggest goal setting and SE are "especially powerful influences on academic attainments" (p. 143), but they are dependent upon difficulty level. Individuals who make progress toward a challenging goal develop stronger SE beliefs. Research in the area of goal setting reveals links between sense of competence and motivation to choose, perform, and persist at tasks (Anderman & Leake, 2005).

Attribution Theory

Although not a traditional part of social cognitive theory, attribution theory is a cognitive theory of motivation (Schunk et al., 2008). Attribution theory makes two assumptions: 1) individuals are motivated by a goal of understanding and mastering the environment and themselves; and 2) people are naïve scientists attempting to understand determinants of their own behaviors (Schunk, et al., 2008). Attribution theory and the attribution process have psychological force to influence expectancies for success, SE beliefs, affects, and actual behavior, and therefore are important in determining why instructors incorporate technology in their classrooms. A teacher who has previously been successful in using new technology tools in the classroom may attribute the new success to aptitude and long-term effort; if the new tool fails, the teacher may consider previous success as chance occurrences. Where the teacher decides to attribute the success or failure has an impact on SE beliefs leading to static or dynamic behavior as it relates to future technology integration.

Interest

Interestingness of the context is a motivational factor when the contextual features make a task or activity "interesting." The interestingness of the context generates situational interest, resulting in motivational learning. Situational interest is interest beyond personal interest; it ignores individual differences (i.e., a general liking for a subject area) and looks at aspects of classroom environment and how those factors generate interest. Bergin (1999) discussed classroom factors that generate interestingness of context. Unlike personal factors, classroom factors are teacher-controlled and can include hands-on activities, novelty, social interaction, modeling, games and puzzles, content, fantasy, narrative, and humor, among others. Instructors who differentiate learning experiences through instructional technologies create interest in classrooms to achieve learning outcomes.

The contextual features that make a task "interesting," such as the text, materials, content, activity, classroom, or context are assumed to develop situational interest (Schunk, et al., 2008). Research has noted situational interest is tied to specific content rather than structural features or environment (Schunk, et al., 2008). Thus, strategies to increase situational interest in the classroom are important because they may lead to development of personal interest. This effect could also explain teacher preference for specific types of technology and lack of technology tool experimentation.

Teacher Self-Efficacy

An integral part of motivation is the power of SE beliefs and it is for that reason teacher SE and SE beliefs toward technology are essential variables when examining instructional technology integration and teachers' Technological Pedagogical Content Knowledge. The interactions between goal setting, attribution, and interestingness create a complex environment where SE becomes the dominant factor in whether a teacher or student decides to complete a task.

The framework for teacher SE takes the concept of SE one step further by limiting the definition to specify action and environment. Tschannen-Moran, Woolfolk Hoy, and Hoy (1998) define teacher SE as "the teacher's belief in his or her capability to organize and execute courses of action required to successfully accomplish a specific teaching task in a particular context" (p. 233). Tschannen-Moran and associates (1998) developed this definition based upon the research of Rotter (1966) and Bandura (1997) in an effort to clarify the construct and improve its measurement.

The Rand Corporation, which conducted the first studies of SE, founded its framework on Rotter's social learning theory (1966). The addition of two important questions to an already-extensive Rand questionnaire twenty years ago led to the increased interest in teacher SE. Rand

Item 1, *"When it comes right down to it, a teacher really can't do much because most of a student's motivation and performance depends on his or her home environment,"* provided a measure of teacher's perceptions of the power of external factors on teacher and school ability to influence, which became labeled general teaching efficacy (GTE) (Ashton et al., 1982). Rand Item 2, *"If I really try hard, I can get through to even the most difficult or unmotivated students,"* provided a measure of teacher's perceptions of the power of their own teaching and confidence in their ability as a teacher to influence learning. This was labeled personal teaching efficacy (PTE), which was more individual than a general teacher efficacy belief construct (Tschannen-Moran, et al., 1998). The Rand study (1966) indicated teacher level of agreement with the two statements. The sum of the two statements, called teacher efficacy (TE), suggested a measurement of teacher belief that student motivation and learning could be internally controlled and was teacher-influenced. Rand's use of Rotter's theoretical base aided in the first concept of teacher efficacy, which proposed the construct as the "extent to which teachers believed that they could control the reinforcement of their actions, that is, whether control of reinforcement lay within themselves or in the environment" (Tschannen-Moran, et al., 1998).

The concept of teacher SE became important when Rand studies suggested that higher teacher SE had positive effects on student performance as well as teacher achievement, teacher adaptation to change, and continuity in method and material (Tschannen-Moran, et al., 1998). Efficacy correlates with various factors, and one relevant to the use of educational technology is teacher implementation of innovation (Tschannen-Moran, et al., 1998). Smylie (1988) noted teacher proportion of time spent in interactive instruction after training was significantly related to a concept called personal teaching efficacy (PTE). Additional measures of efficacy in the Rotter tradition exist, including student achievement, teacher stress, less negative affect in teaching, and teachers' willingness to stay in the field, but will not be examined within this literature review (Rose & Medway, 1981; Greenwood, Olejnik, & Parkay, 1990; Guskey, 1981; Ashton, et al., 1982).

A second conceptual framework emerged with Bandura's social cognitive theory and his construct of SE (1986). Bandura (1997) defined SE as "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (p. 3). Bandura's SE construct is perceived as a future-oriented belief about the level of competence a person expects he or she will demonstrate in a specific situation. SE beliefs influence thought patterns that enable action in people's pursuit of goals, persistence in adversarial situations, resilience in challenging situations, and ability to remain in control of events affecting life outcomes (Bandura, 1997).

Within social cognitive theory, outcome expectancy emerges, but it is different from efficacy expectations. *Efficacy expectation* is an individual's idea he or she can demonstrate action to perform a necessary task (such as teaching to achieve a learning outcome) whereas *outcome expectancy* is an individual's estimate of the consequences of performing a task at a certain or expected level of competence (Bandura, 1986). SE is specific to a particular task, unlike other concepts of self, such as self-concept, self-worth, and self-esteem (Tschannen-Moran, et al., 1998). SE pertains to an individual's *perception* of his or her competence versus his or her *actual level* of competence. Tschannen-Moran, Woolfolk Hoy and Hoy (1998) suggest this as an important distinction, as people "regularly overestimate or underestimate their actual abilities, and these estimations may have consequences for the courses of action they choose to pursue or the effort they exert in those pursuits" (p. 7).

Bandura's framework postulates four areas of efficacy expectation:

1) Mastery experiences, the most powerful; the perception of a successful performance raises efficacy beliefs; the teacher expects his or her future performances to be competent. The perception of a failed performance lowers efficacy beliefs; the teacher expects his or her future performances to be incompetent.
2) Physiological and emotional states, such as anxiety or excitement, contribute to the feeling of mastery or incompetence. Attribution is important in this area; internal success

attribution contributes to enhanced SE, whereas external success attribution, such as assistance from others, may not enhance SE (Bandura, 1993; Pintrich & Schunk, 1996).

3) A vicarious experience, such as situations where another person models the skill, contributes to SE through observer identification with the model. High identification with the model contributes to stronger impact on efficacy, although efficacy expectation can be decreased if the model performs poorly on the skill in question.
4) Social persuasion, such as performance feedback, motivational discussion, teacher lounge chat, or the media can persuade an increase in SE, if only temporary. These "boosts" in SE may encourage a person to initiate a task or persuade one to try harder in order to succeed. The strength of social persuasion to affect SE depends upon credibility and expertise of the social persuader (Bandura, 1986).

The importance of teacher SE as a motivational construct suggests efficacy level affects several factors relating to technology integration and instructional experimentation (Allinder, 1994). Enthusiasm and motivation for teaching is also related to teaching SE (Tschannen-Moran, et al., 1998). Rand research (1966) suggests teacher SE is related to student achievement, including student SE (Anderson, Greene & Loewen, 1988). Woolfolk, Rosoff, and Hoy (1990) found that teacher SE also plays a role in student attitude toward school, subject matter, and teacher, suggesting there may be a correlation between teacher SE and student motivation toward pursuing specific career paths.

Teacher Self-Efficacy in Agricultural Education

Current research on agricultural education teacher SE has focused primarily on preservice and novice teacher SE (Knobloch and Whittington, 2003; Stripling, Ricketts, Roberst, Harlin, 2008) and SE in alternative-certified agricultural education teachers, (Rocca & Washburn, 2006) although some research exists in the form of longitudinal studies (Swan, Wolf, & Cano, 2011). Influences on teacher SE include support and feedback, knowledge and education, teaching and student teaching experience, positive interactions with students, preparation, anticipation, and expectations, resources and facilities, personal background, intrinsic motivation, isolation, overwhelmed and helplessness, and other factors such as school procedures, paperwork and workload (Knobloch & Whittington, 2002). Few studies mention adaptation and integration of innovation and technology as an influence on agricultural education teacher SE. Swan, Wolf and Cano's (2011) longitudinal study, which measured teacher SE in the instructional strategies domain, suggested instructional strategy SE was highest at the end of student teaching experience and lowest at the end of their first year of teaching, but it was not noted whether instructional strategy included technology integration. Fluctuations in SE are common; once something new is introduced into the situation, such as having to teach new grades, adopt new curricula, or other challenges, teachers may reevaluate their efficacy (Tschannen-Moran, et al., 1998). This assumption supports the notion that technology integration and perceived efficacy toward technology could affect overall teacher SE.

Self-Efficacy Beliefs Toward Technology

Self-efficacy beliefs toward technology use has been suggested as a factor in determining the extent to which teachers integrate technology into education as well as how well a teacher is able to use technology to improve teaching and learning (Albion, 2001; Enochs, Riggs, & Ellis, 1993; Kellenberger, 1996; Riggs & Enochs, 1993; Wang, Ertmer, & Newby, 2004). Technology anxiety and perception of teaching effectiveness with technology are both barriers to technology integration in classrooms, and the agricultural education classroom is not an exception (Kotrlik, Redmann, & Douglas, 2003). It is noted the placement of technology into classrooms without curriculum consideration and teacher preparation is a major cause of teacher anxiety (Kotrlik, Redmann & Douglas, 2003).

If teachers can proceed beyond technology anxiety, technology can improve instructional effectiveness through various paths: 1) multimedia packages allowing teachers to interact, lead discussions, individualize instruction and direct student attention; 2) telecommunication tools allowing teachers to interact collaboratively with students and other teachers; 3) technology-enhanced scaffolds that help students develop skills; and 4) motivated learning by students through technology use (Lu & Molstad, 1999). A 1998 Delphi study of western region U.S. agricultural educators, state vocational agriculture teacher associations, and state supervisors of agricultural education revealed that those involved in agricultural education considered technology use and integration "very important," and 20 percent of respondents agreed with the statement that agricultural education programs utilized the latest in state-of-the-art technology in their instructional programs (Conners, 1998). Layfield and Dobbins (2002) reported computer integration in instruction and multimedia equipment in teaching as two of the top five competencies in need by experienced agricultural education teachers.

Various arguments have been constructed regarding factors influencing technology integration: socioeconomic characteristics of students, teacher experience, source of training, and learning style (Smerdon, et al., 2000). However, Kotrlik, Harrison, Redmann and Handley's research (2000) determined that those factors do not explain teacher values placed on technology integration. General teacher efficacy theory suggests internal resources, constraints, and self-perception of teaching competence, combined with beliefs about task requirements and external resources and constraints, contribute to teacher efficacy and outcome expectations (Tschannen-Moran, et al., 1998). By this premise, teachers with low self-perception of teaching confidence and internal constraints toward technology, combined with external barriers, will have little to no motivation to integrate technology into the curriculum.

Technology SE research has been aimed toward specific technology devices, such as computers (Niederhauser & Perkmen, 2008) or tools such as interactive white boards; or toward program or instructional management tools (databases and word processors) for teachers (Kotrlik, Redmann & Douglas, 2003; Littrell, Zagumny & Zagumny, 2005). Kotrlik and colleagues explored teacher anxiety toward technology in their 2003 study regarding agriscience teachers integrating technology into their classrooms and reported agriculture teachers did not exhibit differences in computer anxiety as compared to other professionals.

In line with social cognitive theory as it pertains to motivation, Niederhauser and Perkmen (2008) suggest internal factors including personal traits of self-confidence and willingness to change, social cognitive characteristics of SE, outcome expectations, and interest affect teacher attitude toward using technology within instructional practice. Teacher technology integration and efficacy beliefs are intertwined with personal teacher beliefs about instruction style and previous instruction experiences (Niederhauser & Perkmen, 2008).

Because few instruments have been designed to measure internal beliefs and SE relative to technology integration, Niederhauser and Perkmen designed a measure based on Social Cognitive Career Theory (SCCT; Lent, Brown & Hackett, 2002). Primary mechanisms within the SCCT include SE, outcome expectations, and interest. SE is considered a critical factor in the SCCT model because it influences motivation and appears to have a strong influence on interest in conjunction with outcome expectations (Niederhauser & Perkmen, 2008). Internal factors, including SE belief toward technology, play a vital role in whether teachers choose to integrate technology into their instructional practices (Niederhauser & Perkmen, 2008). OE addresses task completion motivation and influences anticipated outcome of an action; formation of internal plans to complete a goal; and drive to sustain behavior (Bandura, 1986; Schunk, 2001; Pajares, 2002). Combined with SE, outcome expectations have an effect on interest, which influences behavior and intention. Niederhauser and Perkmen (2008) conclude that intrapersonal factors are more influential on technology integration than external factors, and "intrapersonal factors like SE, outcome expectations, and interest play a central role in whether teachers choose to integrate technology into their instructional practices" (p. 109). Applying Bandura's theory of SE (1997) to technology integration suggests that despite teacher belief in integrating technology, he or she may be dissuaded from attempting it if belief in personal confidence to implement technology is not strong (Albion & Ertmer, 2001). Lumpe and Chambers (2001) noted teachers' reported SE influenced use of technology-related instructional practices for teaching with computers, as well as context beliefs regarding their teaching effectiveness (Albion & Ertmer, 2001).

Few studies were found regarding secondary agricultural education student perceptions toward instructional technology. Research regarding collegiate-level agricultural education programs suggests college-level students positively perceive technology-based instruction, and it "engages students in more in-depth learning situations, which greatly benefits the overall learning achievement and cognition of students" (Alston & English, 2007). Further, Alston and English (2007) recommended, "agricultural education as a discipline and colleges of agriculture must increasingly adapt to technological change, particularly in daily instruction, in order to more effectively prepare the world's future agricultural leaders" (p. 8).

Bandura (1977) postulates SE beliefs in teachers are more malleable in the early stages of learning; this supports the findings that research often focuses on preservice teachers. SE belief formation is important as research suggests once teachers develop SE beliefs, they are resistant to change (Tschannen-Moran, et al., 1998). Confidence and ease toward using technology in the classroom is critical in the development of students planning to pursue careers in agricultural education to successfully integrate technology into their instruction. It is for this reason this study is measuring SE toward technology use of preservice and inservice agricultural education teachers.

Evaluation of teacher SE suggests that experienced teachers have stable efficacy beliefs, which are difficult to change and sustain (Bandura, 1997). Tschannen-Moran, Woolfolk Hoy and Hoy (1998) encourage developing a strong sense of efficacy in preservice and novice teachers as research indicates experienced teachers are resistant to change. Even when provided with professional development opportunities intended to increase efficacy in a given area, studies suggest efficacy belief in that area is initially higher but may return to previous efficacy level if the teacher does not have prolonged success in completing the given task. A teacher using a new technology in a classroom successfully for the first time may still doubt his or her efficacy belief toward technology integration (Tschannen-Moran, et al., 1998). Teachers with high confidence have a tendency to believe their programs are sufficient and are not in need of innovation or technology (Tschannen-Moran, et al., 1998). The simple response to stronger efficacy beliefs toward technology may be to train teachers how to use technology; however, this premise makes the assumption teachers will take the leap from understanding how to use a technology after training and integrating it into their instruction and curriculum, which are two separate tasks (Mishra & Koehler, 2006). It is within that leap where technological pedagogical content knowledge may offer insight into teacher knowledge of technology integration.

Technological Pedagogical Content Knowledge

Technological Pedagogical Content Knowledge (TPACK) is a recently developed framework founded on "the understanding that teaching is a highly complex activity that draws on many kinds of knowledge" (Mishra & Koehler, 2006, p. 1020). TPACK is based largely on the framework of Pedagogical Content Knowledge (PCK), a knowledge base of teacher education, developed by Shulman (1986). Prior to Shulman's work, the knowledge bases separated the concepts of pedagogy and content, focusing on knowledge of pedagogy or knowledge of content. Shulman took the concepts of pedagogy and content into the next dimension, arguing the concept of PCK exists at the intersection of pedagogy and content (Shulman, 1986). Shulman argued insight into the interaction of pedagogy and content provided an understanding of how certain subject matter is organized and adapted for instruction. Further, Shulman (1986) suggested PCK as the content knowledge that concerns "the ways of representing and formulating the subject that make it comprehensible to others" (p. 9). This viewpoint emphasized the idea that subject matter is "transformed for teaching," which occurs when a teacher interprets information and decides how best to represent it for their learning audience (Mishra & Koehler, 2006). While Shulman's concept of PCK did not include technology knowledge (although it did include categories such as curriculum knowledge and educational context knowledge), Koehler and Mishra suggest that technology was not unimportant at the time (2006, p. 1023). The difference in technologies then and now concerns the idea of transparency; "technology" in previous classrooms had become commonplace (Mishra & Koehler, 2006). Today's usage of technology alludes to "digital computers and computer software artifacts and mechanisms that are new and not yet a part of the mainstream" (Mishra & Koehler, 2006). Today's technologies include hardware and software, Web 2.0 tools, educational games, the Internet, social media, multimedia, and hypermedia that surround the digital world.

Shulman suggested "powerful analogies, illustrations, examples, explanations and demonstrations" were important to PCK, and Mishra and Koehler posit technologies play a critical role in each of those aspects. The difference in technology now as opposed to Shulman's time is the rapidly changing status of technology. Technologies are no longer becoming "transparent" and fixtures of the classroom; rather, teachers are required to stay up to date on technologies in an effort to avoid using obsolete instructional materials or methods (Mishra & Koehler, 2006). This concept of a dynamic technology environment is much different than the relatively stable technology situations of the past; teachers can no longer focus solely on pedagogy and content, and instead must consider technology integration into their instructional methods.

Mishra and Koehler (2006) mention the problems that face technology knowledge as it relates to pedagogy knowledge and content knowledge are some of the same issues Shulman faced in the 1980s with the intersection of PCK. Knowledge of technology is still often considered a separate construct from knowledge of pedagogy and knowledge of content (Mishra & Koehler, 2006).

The TPACK framework focuses on the complexities of technology knowledge, highlighting "connections, interactions, affordances, and constraints between and among content, pedagogy, and technology" (Mishra & Koehler, 2006, p. 1025). Their model does not treat technology knowledge as an individual construct, but rather emphasizes how the three are intertwined. As such, the framework looks at each construct individually as well as in pairs, suggesting Content Knowledge (CK), Pedagogical Knowledge (PK), Pedagogical Content

Knowledge (PCK), Technology Knowledge (TK), Technological Content Knowledge (TCK), and Technological Pedagogical Knowledge (TPK) result in TPACK (Mishra & Koehler, 2006).

Content Knowledge

Content knowledge is actual subject matter knowledge. For example, within agricultural education, knowledge about horticulture is vastly different from knowledge about mechanics and welding. Teachers must understand concepts, theories, and practical skills related to the subject being taught in order to represent the subject clearly and effectively (Koehler & Mishra, 2006; Shulman, 1986).

Pedagogical Knowledge

Pedagogical Knowledge is knowledge about teaching and learning as a process. It looks at educational purpose, value, and aim. Pedagogical Knowledge is ingrained in all areas of student learning, classroom management, lesson plan development and implementation, and evaluating student learning. Pedagogical Knowledge requires knowledge of cognitive, social, and developmental theories of learning.

Pedagogical Content Knowledge

Pedagogical Content Knowledge focuses on the integration of pedagogy and content as it interacts with each other. A teacher who has knowledge in this area understands what teaching methods fit the content being taught as well as how the content can be arranged for better teaching. PCK entails theories of epistemology, knowledge of students' prior knowledge, and understanding of what makes content difficult or easy to learn (Mishra & Koehler, 2006)

Technological Knowledge

Technology Knowledge involves knowledge about technologies, both "transparent," as discussed previously, and more advanced technologies, such as the Internet and digital video. Technology Knowledge requires skills to operate the technologies, including knowledge of operating systems, ability to use standard software, and standard hardware knowledge. Technology workshops and tutorials generally cover acquisition of these skills. Koehler and

Mishra (2006) suggest the nature of Technology Knowledge will need to shift with time as technologies are in a constant state of change (p. 1028).

Technological Content Knowledge

Technological Content Knowledge is the knowledge about how technology and content are related. Mishra and Koehler (2006) posit that "teachers need to know not just the subject matter they teach but also the manner in which the subject matter can be changed by the application of technology" (p. 1024). For example, Iowa State University has implemented virtual welders into their agricultural education programs to prepare students with welding knowledge before practicing in a real application.

Technological Pedagogical Knowledge

Technological pedagogical knowledge is the understanding of how technology can change teaching strategy and process. Those with TPK are aware that a range of tools may exist to teach a particular concept or complete a task; further, one is able to choose a tool based on its fitness and apply strategies to use the technology selected.

Technological Pedagogical Content Knowledge

Mishra and Koehler (2006) suggest technological pedagogical content knowledge is an "emergent form of knowledge that goes beyond all three components (content, pedagogy, and technology)" (p. 1025). Ultimately, TPACK represents knowledge of how technological tools affect content and pedagogy, and how technology can be used to strengthen existing knowledge, develop new epistemologies, or strengthen old ones (Mishra & Koehler, 2006). TPACK makes the realization that no single technology solution applies to every teacher, course, or viewpoint; rather, an understanding of the complex relationships between content, pedagogy and technology provides insight to create context-specific strategies (Mishra & Koehler, 2006).

The designers argue that TPACK is "the basis of good teaching with technology" (2006); however, the framework has been under scrutiny. Weaknesses of the framework include lack of theoretical basis (Graham, 2011); lack of theoretical development (Graham, 2011); lack of specific domains leading to questioning of existence of domains in practice (Archambault & Barnett, 2010); lack of precision and heuristic value (Archambault & Barnett, 2010); and limitation in its ability to assist researchers in predicting outcomes or revealing new knowledge (Archambault & Barnett, 2010). Mishra and Koehler (2006) admit the framework theory is "difficult to tease out in practice," but argue the components of content, pedagogy, and technology exist in a state of "essential tension." They suggest the traditional view of the three components is through a lens in which content drives decision and pedagogy and technology follow. Emerging technologies cause educators to think about pedagogical issues in teaching. This situation is an example of technology driving content and pedagogy, which becomes more prevalent as new technology tools are introduced into education (Mishra & Koehler, 2006).

No known literature exists on TPACK of secondary agricultural education teachers. Some literature exists on TPACK of science teachers, but agricultural education is considered separate from most science programs. Much research exists on teacher belief toward technology, and many studies have been completed on teacher perception of barriers in the classroom, teacher perception of agricultural education programs' use of the latest technology, and professional development needs of agricultural education teachers. This lack of literature on TPACK of secondary agricultural education preservice and inservice teachers provides an opportunity to examine Oklahoma secondary agricultural education teachers and their perceptions of TPACK and whether their SE toward technology is related to perceptions of TPACK.

Purpose of Study

The importance of effective technology integration into instructional practice, content, and pedagogy is becoming widespread as federally mandated initiatives and educational technology standards for students, teachers, and administration are implemented into schools. Upon literature review of general SE, SE toward technology, and technological pedagogical content knowledge, we can more clearly see the complex underpinnings of the three concepts and how they may interact with each other. Further, SE plays a role in career choice of students and motivation.

CHAPTER III

METHODOLOGY

The conceptual frameworks of social cognitive theory (Lent et al., 1994, 2002), intrapersonal factors toward technology use (Niederhauser & Perkmen, 2008), and Technological Pedagogical Content Knowledge (Mishra & Koehler, 2006) informed this study and allow us to hypothesize that agricultural educational teachers who perceive themselves as competent and efficacious in their teaching have higher technology SE and exhibit higher levels of technological pedagogical content knowledge. More specifically, the following research questions guided this study:

1. What are agricultural education preservice and inservice teacher perceptions of Technological Pedagogical Content Knowledge?
2. What intrapersonal factors influence Technological Pedagogical Content Knowledge?
3. Is there a difference between preservice teacher self-efficacy beliefs toward technology and inservice teacher self-efficacy beliefs toward technology?
4. Do relationships exist between self-efficacy beliefs toward technology and general teacher SE beliefs?

Research Design and Variables of Interest

The focus of this exploratory study was to assess teacher levels of technology integration SE and TPACK. This research study also examined the levels of technology integration SE and TPACK between preservice and inservice agricultural education teachers in Oklahoma and investigated intrapersonal predictors of TPACK.

A descriptive research methodology was used in an effort to address the research questions utilizing a quasi-experimental design. The purpose of this study was to examine the relationships between preservice and inservice teacher intrapersonal factors and technology as it relates to TPACK. More specifically, the study attempted to explore the role of self-efficacy on technology integration and TPACK. This investigation sought to uncover intrapersonal relationships or predictors that influence preservice and inservice teachers' technology integration and beliefs toward instructional technology. These factors are intrapersonal technology integration and TPACK and were the variables of interest in this study.

Participants and Sampling Procedures

A web-based survey link was sent via email to 426 secondary agricultural education teachers in Oklahoma as well as distributed both via a web link and as a paper copy to approximately 130 preservice agricultural education students in the Oklahoma State University (OSU) agricultural education program. The web link for preservice teachers was also distributed via an Agricultural Education e-mail list, which is sent to all undergraduate Agricultural Education majors at OSU. A total of 10 inservice teachers had incorrect or otherwise unreliable electronic mail addresses, and were removed from the study. As a result, the original sample of 556 pre- and inservice teachers was adjusted to an accessible sample of 546 teachers. The researcher received a total of 131 responses.

After examining responses for incomplete answers, the resulting sample size used in this research study was ($N = 103$). To address non-response rate error, a method of comparison of early to late respondents was performed. Lindner, Murphy, & Briers (2001) define *late respondent* as "those who respond in the last wave of respondents in successive follow-ups to a questionnaire" (p. 52). The researcher conducted t-tests on early and late respondents on primary variables of interest. No differences were found, either practically or statistically; as such, results may be generalized to the target population (Lindner, Murphy, & Briers, 2001). Non-probability, or nonrandom, sampling was used in this study, which involved nonrandom selection. The preservice and inservice teachers volunteered to participate in this study; as such the selection process was a matter of convenience. As with most research conducted in education, this study relied on a non-random sample and used inferential statistics to explore the data.

Inferential statistical tests were used as an additional level of analysis that was not permitted through descriptive statistics. The reader should interpret the results relative to the characteristics of the study's sample and should not attempt to generalize our findings to larger populations.

Survey Instrument

This exploratory study (Babbie, 1989) employed a combination of three instruments to collect data: the Intrapersonal Technology Integration Scale (ITIS) instrument developed and validated by Niederhauser and Perkmen (2008); the Teachers' Sense of Teacher Efficacy Scale instrument developed and validated by Tschannen-Moran and Woolfolk Hoy (1998); and the Technological Pedagogical Content Knowledge (TPACK) instrument developed and validated by Schmidt and colleagues (Schmidt et al., 2009).

The ITIS provided items to measure teacher levels of intrapersonal factors in technology integration (Niederhauser & Perkmen, 2008). The ITIS scale was developed primarily in an effort to "expand our understanding of intrapersonal cognitive variables that affect teachers' predispositions toward integrating technology into their teaching" (p. 98). All items from the ITIS were used to measure the intrapersonal factors within preservice and inservice teachers in this study.

Tschannen-Moran and Woolfolk Hoy's Teacher Sense of Teacher Efficacy Scale provided items to measure teacher levels of efficacy toward factors in a teacher/classroom setting. This instrument was developed to better understand factors that create difficulties for teachers in their school activities. Long form (24-question) and short form (12-question) exist; in this study, the long form questionnaire was selected by recommendation from Tschannen-Moran and Woolfolk Hoy (2001), who note that with preservice teachers, the long form is suggested due to factor structure being less distinct within the preservice group.

Schmidt and colleagues' (2009) TPACK instrument provided items in the study to measure teacher technological pedagogical content knowledge, or TPACK, and its associated components (Mishra & Koehler, 2008) of technological knowledge, content knowledge, pedagogical knowledge, pedagogical content knowledge, technological content knowledge, and technological pedagogical knowledge. The TPACK scale was developed to examine effective technology integration and knowledge associated with integrating technology effectively into learning environments (Mishra & Koehler, 2008). Validity and reliability of the three scales is presented in the following sections.

Niederhauser and Perkmen (2008) established factorial validity to ensure subscales developed in the ITIS formed distinct constructs. They found factor loadings ranged from 0.73 to 0.85 for the SE subscale, 0.71 to .075 for the Interest subscale, and .071 to 0.93 for the OE subscale (Niederhauser and Perkmen, 2008, p. 106). Further, confirmatory factor analysis fit indices indicated acceptable fit. The measure of Cronbach's alpha coefficient (Cronbach, 1951) was used to establish internal consistency on SE, INT, and OE factors within the ITIS survey. Cronbach's alpha was .90 for the SE subscale, 0.93 for the OE subscale, and 0.89 for the INT subscale (Niederhauser and Perkmen, 2008). Cronbach's alpha for the total scale was 0.96, indicating high internal consistency for each of the subscales and for the total scale. Niederhauser and Perkmen (2008) also note the squared multiple correlations of factor scores ranged between 0 and 1, indicating the observed variables accounted for substantial variance in the factor scores. They suggest these findings "provide good empirical evidence for the internal consistency of the ITIS scale" (p. 108).

Tschannen-Moran and Woolfolk Hoy found an overall Cronbach's alpha of .94 for the overall instrument using the long form; subscale Engagement indicated an alpha of .87; subscale Instruction indicated an alpha of .91; and subscale Management indicated an alpha of .90.

Internal consistency for the TPACK instrument indicated Cronbach's alpha of .78 to .93, and individual Cronbach's alpha are indicated in Table 3.1.

Table 3.1

Internal Consistency of TPACK Domains

TPACK Domain	**Internal Consistency (alpha)**
Technology Knowledge (TK)	.86
Content Knowledge (CK)	
Social Studies	.82
Mathematics	.83
Science	.78
Literacy	.83
Pedagogy Knowledge (PK)	.87
Pedagogical Content Knowledge (PCK)	.87
Technological Pedagogical Knowledge (TPK)	.93
Technological Content Knowledge (TCK)	.86
Technological Pedagogical Content Knowledge (TPACK)	.89

Data Collection Procedures

The ITIS, Teacher Sense of Teacher Efficacy Scale, and TPACK instruments were combined to develop the instrument used in this study. The resulting survey included 82 items using a Likert-type 5-point scale. This survey was administered online to all inservice participants in the study and in both online and paper formats to preservice participants in the study. The total time to complete the survey was estimated at approximately 20-30 minutes.

A link to the survey was emailed to all inservice agricultural education teachers at secondary Oklahoma public schools with the option to request a paper survey. The web link was also emailed to all preservice teachers completing the agricultural education program at Oklahoma State University via an agricultural education list service. A paper copy was distributed in agricultural education courses taught by Drs. Shane Robinson and M. Craig Edwards, OSU Department of Agricultural Education, Communication, and Leadership. All participants who received the link or paper copy were given the option to participate or not participate in the study. Once a determination was made to participate, the participants were asked to proceed by clicking the link to proceed and launch the survey or complete the paper survey.

The data collection period extended from February 4, 2012 to March 10, 2012. An informed consent form was included on the first page of the survey and teachers had the opportunity to consent to participate or not. There was no direct or implied coercion and confidentiality was maintained. An offer to be entered in a drawing to win a two-night package to an Oklahoma resort was presented with the implicit information that responses would not be linked in any way to email addresses entered for the drawing.

Data Analysis Procedures

For the data analysis phase of this research project, the data were downloaded and imported into a Microsoft Excel™ spreadsheet. The data were then imported into SPSS 19™, a statistical analysis software package. The data collected were analyzed using descriptive and inferential statistics. Descriptive statistics were used to summarize and categorize the data. Inferential statistics were used to draw conclusions beyond what the descriptive statistics suggested. As with most research conducted in education, this study relied on a non-random sample and used inferential statistics to explore the data. Inferential statistical tests were used as an additional level of analysis that was not permitted through descriptive statistics. The reader should interpret the results relative to the characteristics of the study's sample and should not attempt to generalize our findings to larger populations.

Data were coded based on gender and teaching status. Further, each survey item was assigned a value with 1 representing strongly disagree to 5 representing strongly agree. Assigning these values provided a means of coding the responses as interval data. The respondents who indicated they were preservice, or completing their degree in agricultural education were coded as group 1 and inservice teachers were coded as group 2.

Descriptive analysis of secondary agricultural education teacher-perceived TPACK was utilized to address Research Question One; results from a regression analysis using TPACK and

SE, OE, and INT as variables of interest was utilized to address Research Question Two; results from an analysis of variance using ITIS SE of preservice and inservice groups was utilized to address Research Question Three; and results from a correlation analysis using ITIS SE and general SE to address Research Question Four. Although non-random sampling is an obvious limitation, survey researchers also note that conclusions derived from survey data tested with inferential statistics are still more likely to be accurate in reflecting the characteristics of the entire sample population than those not tested, even when the sample is not random (Hightower & Scott, 2012).

Limitations

There are several limitations to this study that must be taken into consideration.

This study used a self-reporting method. The data collected is only as reliable as the participants' willingness and ability to provide accurate information. It is assumed respondents were truthful in their self-evaluation and answers to research instruments.

A limitation of sample size should be taken into account. If all preservice and inservice participated fully on all instruments, the overall sample would have been more than 600 subjects. However, due to mortality and missing data, the overall *N* was greatly reduced.

All participants were selected non-randomly, which means non-probability sampling was used. This limits the generalizability of the results to a targeted audience. As a consequence, random sampling as not used in this research study, which impacted the outcome of the study.

Komogorov-Smirnov (K-S) tests were performed to explore assumptions for normality of data in regard to Research Question Two. The K-S test determined the scores on TPACK score for preservice, $D(42) = .211$, $p < .001$ and TPACK score for inservice, $D(61) = .216$, $p < .001$, were both significantly non-normal. A K-S test performed on ITIS SE score revealed $D(61) = .134$, $p = .008$ for the inservice group, also indicating responses were significantly non-normal. A K-S test revealed $D(61) = .118$, $p = .035$ for variable instructional strategy efficacy ("EFIS") within the inservice group. However, Q-Q plots on variables TPACK score, ITIS SE score, and EFIS indicated normality could be assumed for the data presented.

CHAPTER IV

FINDINGS

The purpose of this study was to examine Oklahoma agricultural education preservice and inservice teacher perceptions of their technological pedagogical content knowledge (TPACK) and interactions between TPACK and perceived self-efficacy (SE). More specifically, the study was designed to explore whether general teacher self-efficacy influenced TPACK and whether the factors of self-efficacy toward technology integration, perceived outcome expectations, and interest (relative to technology integration) affect TPACK. This chapter summarizes results of collected data and statistical analyses conducted in regard to each of the research questions.

Four research questions guided the study:

1. What are preservice and inservice agricultural education teacher's self-reported Technological Pedagogical Content Knowledge?
2. What intrapersonal factors influence Technological Pedagogical Content Knowledge?
3. Is there a difference between preservice teacher self-efficacy belief toward technology and inservice teacher self-efficacy belief toward technology?
4. Are there relationships between self-efficacy toward technology and general teacher self-efficacy?

The following sections provide (1) a profile of the respondents including age, educational attainment, alternative certification, years of teaching experience, and school classification; (2) results from a descriptive analysis of secondary agricultural education teacher perceived TPACK addressing Research Question One; (3) results from a regression analysis addressing Research Question Two; (4) results from an analysis of variance addressing Research

Question Three; (5) results from a correlation analysis address Research Question Four; and (6) qualitative responses received.

Demographic Characteristics

Preservice agricultural education teachers composed 40.8% of the sample (*N* = 42), while inservice agricultural education teachers composed 59.2% of the sample (*N* = 61). Preservice teachers averaged less than a year of teaching experience and a mean age of 20.4. Within the inservice teacher group, respondents' mean age was 37.53 (*N* = 60) and had an average of 12.4 years of teaching experience (*N* = 61; *SD* = 10.93). Inservice teachers were predominantly male, whereas preservice teacher gender exhibited a more even ratio of males to females. Of the 61 inservice teachers, 82% taught in rural schools, 16.4% taught in suburban schools, and 1.6% taught in urban or mixed-classification schools. Table 4.1 describes general characteristics of the sample.

Table 4.1

Descriptive Profile of Participants

	Preservice *(n = 42)*	Inservice *(n = 61)*
Mean Age	20.4	37.5
Gender		
Male	57.1%	86.9%
Female	42.9%	13.1%
Education Level		
Bachelor's Degree	-	73.8%
Master's Degree	-	26.2%
Teaching Experience	< 1 year	12.4 years
% degree obtained from OSU	100%	85.2%

Self-Reported Technological Pedagogical Content Knowledge

The first research question in this study focused on determining the level of preservice and inservice agricultural education teachers' technological pedagogical content knowledge.

To answer research question one, descriptive statistical analysis was performed using total TPACK score of each group. Specific individual TPACK items were also examined. The results indicated 71% of preservice agricultural education teachers (n = 42) perceived themselves as knowledgeable in teaching lessons that combined technologies and teaching approaches in social studies, science, mathematics, and literacy in agricultural education. Of the inservice agricultural education teachers 63.9% (n = 61) agreed they could teach lessons that appropriately combined instructional technologies and teaching approaches in mathematics, science, social studies, and literacy, as it related to agricultural education. Preservice teacher respondents also reported higher levels of TPACK in the areas of mathematics, literacy, and social studies as compared to inservice teacher respondents. Table 4.2 provides responses received from preservice and inservice groups regarding their self-reported technological pedagogical content knowledge as it relates to teaching lessons that appropriately combine content area with technologies and teaching approaches in agricultural education.

Table 4.2

Self-Reported Technological Pedagogical Content Knowledge

	Preservice *(n = 42)*	Inservice *(n = 61)*
Mathematics		
Strongly Agree	23.8%	13.1%
Agree	57.1%	72.1%
Neither Agree nor Disagree	14.3%	9.8%
Disagree	4.8%	4.9%
Strongly Disagree	0.0%	0.0%
Literacy		
Strongly Agree	26.2%	14.8%
Agree	47.6%	57.4%
Neither Agree nor Disagree	21.4%	23.0%
Disagree	4.8%	4.9%
Strongly Disagree	0.0%	0.0%
Science		
Strongly Agree	23.8%	24.6%
Agree	57.1%	65.6%
Neither Agree nor Disagree	14.3%	8.2%
Disagree	4.8%	1.6%
Strongly Disagree	0.0%	0.0%
Social Studies		
Strongly Agree	26.2%	13.1%
Agree	57.1%	57.4%
Neither Agree nor Disagree	14.3%	24.6%
Disagree	2.4%	4.9%
Strongly Disagree	0.0%	0.0%

Technological Knowledge

Another variable of interest within TPACK was Technological Knowledge (TK). Mishra and Koehler (2008) suggested TK is in a continual state of flux, especially as compared to pedagogy and content. Further, their view on TK is that it requires a deeper understanding of information processing, communication, and problem solving than the traditional definition of computer literacy (Mishra & Koehler, 2008). The inservice group had a greater percentage of respondents indicating they strongly agreed with the TK-related statements as compared to the preservice group. Further, inservice teachers indicated stronger agreement in the areas of technology troubleshooting, ability to learn technology, knowledge about different technologies, and technical skill ability. Although the majority of preservice teachers indicated they could learn technology easily and had the technical skills necessary to use technology, less than half agreed they knew about different technologies. Table 4.3 indicates TK responses for preservice and inservice groups.

Table 4.3

Technology Knowledge Responses

	Preservice *(n = 42)*	Inservice *(n = 61)*
I know how to solve my own technical problems.		
Strongly Agree	4.8%	11.5%
Agree	50.0%	47.5%
Neither Agree nor Disagree	28.6%	27.9%
Disagree	11.9%	13.1%
Strongly Disagree	4.8%	0.0%
I can learn technology easily.		
Strongly Agree	9.5%	19.7%
Agree	69.0%	57.4%
Neither Agree nor Disagree	16.7%	19.7%
Disagree	4.8%	3.3%
Strongly Disagree	0.0%	0.0%
I keep up with important new technologies.		
Strongly Agree	4.8%	13.1%
Agree	64.3%	44.3%
Neither Agree nor Disagree	23.8%	31.1%
Disagree	7.1%	11.5%
Strongly Disagree	0.0%	0.0%
I frequently play around with technology.		
Strongly Agree	7.1%	21.3%
Agree	54.8%	55.7%
Neither Agree nor Disagree	21.4%	19.7%
Disagree	16.7%	3.3%
Strongly Disagree	0.0%	0.0%
I know about a lot of different technologies.		
Strongly Agree	7.1%	13.1%
Agree	40.5%	42.6%
Neither Agree Nor Disagree	33.3%	34.4%
Disagree	14.3%	9.8%
Strongly Disagree	4.8%	0.0%

	Preserve *(n = 42)*	Inservice *(n = 61)*
I have the technical skills I need to use technology.		
Strongly Agree	9.5%	11.5%
Agree	64.3%	59.0%
Neither Agree nor Disagree	23.8%	19.7%
Disagree	2.4%	9.8%
Strongly Disagree	0.0%	0.0%

Predictors of Technological Pedagogical Content Knowledge

Research question two focused on determining whether technology integration self-efficacy beliefs and general teacher self-efficacy beliefs influenced technological pedagogical content knowledge in each teacher group. This question was addressed by analyzing what predictors within technology self-efficacy and general self-efficacy affect technological pedagogical content knowledge.

In an effort to answer Research Question Two, Intrapersonal Technology Integration Scale (ITIS) self-efficacy subscale scores were totaled to create variable ITIS SE (total technology integration self-efficacy), and TPACK items 79, 80, 81, and 82 were totaled to create variable TPACK (total technological pedagogical content knowledge score). The possible range of the ITIS self-efficacy total score was 14-30 for the preservice group and 18-30 for the inservice group, where higher scores indicated higher levels of self-efficacy beliefs toward technology use. The possible range of the TPACK score was 8-20 for both preservice and inservice groups, where higher scores indicated higher levels of technological pedagogical content knowledge as it related to mathematics, literacy, science, and social studies.

In order to determine which subscale scores within the Teacher Self-Efficacy and ITIS instrument were predictors of TPACK score, stepwise multiple regression was performed using total TPACK score as the dependent variable and the independent variables of efficacy in student engagement (“EFSE”), efficacy in instructional strategies (“EFIS”), efficacy in classroom management ("EFCM") from the Teachers' Sense of Efficacy Scale (Tschannen-Moran & Woolfolk Hoy, 1998), as well as self-efficacy ("ITISSE"), performance outcome expectations ("ITISPOE"), self-evaluative outcome expectations ("ITISSEOE"), social outcome expectations ("ITISSOE") and interest ("ITISINT") from the Intrapersonal Technology Integration Scale (Niederhauser & Perkmen, 2008).

Multiple regression models for preservice teachers revealed a best-fit model of Adjusted R^2 = .094, $F_{(1, 40)}$ = 5.234, p = .028, d = .629, using the stepwise method and a significant variable of Social Outcome Expectations (B = .377, p = .028). Cohen's effect size value (d = .629) suggested a moderate to high practical significance.

Multiple regression models for inservice teachers revealed a best-fit model of Adjusted R^2 = .374; $F_{(2, 58)}$ = 18.937, p = .000, d = 1.53, using the stepwise method. Significant variables included Self-Efficacy in Instructional Strategy (B = .233, p = .000) and Self-Efficacy Toward Technology (B = .244, p = .014). Cohen's effect size value (d = 1.53) suggested high practical significance.

These results demonstrate that the variables of self-efficacy toward technology and self-efficacy in instructional strategy predict self-perceived TPACK in Oklahoma secondary agricultural education inservice teachers, while the variable of social outcome expectations is a significant predictor of TPACK in preservice teachers.

Self-Efficacy Beliefs Toward Technology Use

Research question three focused on whether self-efficacy beliefs toward technology differed between preservice agricultural education teachers and inservice agricultural education teachers. A one-way analysis of variance of variable ITIS SE, or self-efficacy belief toward technology use, yielded no significant differences between preservice (N = 42) and inservice (N = 61) groups in regard to perceived efficacy ($F_{(1,101)}$ =1.030; *ns*).

Individual ITIS variables were further examined using ANOVAs due to variations in means between the two groups. However, the ANOVA revealed no significant differences between preservice and inservice groups. The means and standard deviations of the technology integration self-efficacy scores are indicated in Table 4.4.

Table 4.4

Preservice and Inservice Technology Integration Scale Mean Scores

	Preservice[a]	***SD***	**Inservice**[b]	***SD***
I feel confident that I have the necessary skills to use instructional technology for instruction.	4.05	.73	4.21	.64
Using instructional technology in the classroom will make it easier for me to teach.	4.12	.77	4.02	.83
I have an interest in reading articles or books about instructional technology.	3.02	.90	3.21	1.00
Using instructional technology in the classroom will increase my effectiveness as a teacher.	3.86	.81	3.97	.77
I am interested in working with instructional technology tools.	4.00	.73	4.20	.68
Using instructional technology in the classroom will make my teaching more exciting.	4.19	.77	4.20	.75
I feel confident that I can effectively use instructional technology in my teaching.	4.02	.60	4.20	.65
Effectively using instructional technology in the classroom will increase my sense of accomplishment.	3.62	.91	3.59	.97
Using instructional technology in the classroom will make my teaching more satisfying.	3.71	.89	3.59	.92
I feel confident that I can regularly incorporate appropriate instructional technologies into my lessons to enhance student learning.	4.00	.66	4.13	.59
Effectively using instructional technology in the classroom will increase my colleagues' respect of my teaching ability	3.52	1.04	3.36	.90
My colleagues will see me as competent if I effectively use instructional technology in the classroom.	3.55	.83	3.43	.81
I feel confident that I can select appropriate instructional technology for instruction-based or curriculum standards-based pedagogy.	3.90	.62	3.82	.72
I have an interest in working on a project involving instructional technology concepts.	3.62	.62	3.57	.94
Using instructional technology in the classroom will increase my productivity.	3.74	.77	3.89	.82
I feel confident that I can teach relevant subject matter with appropriate use of instructional technology.	3.93	.60	4.03	.60
I am interested in learning about new educational software.	4.00	.66	4.03	.71
I feel confident that I can help students when they have difficulty with instructional technology.	3.81	.74	3.92	.61
I have an interest in listening to a famous instructional technologist speaking about effective use of instructional technology in the classroom.	3.21	.81	3.15	.98
Effectively using instructional technology in the classroom will increase my status among my colleagues.	3.31	.90	3.13	.92
I have an interest in attending instructional technology workshops during my teaching career.	3.50	.74	3.75	.83

Note: [a] *n = 42;* [b] *n = 61*
1 = strongly disagree; 2 = disagree; 3 = neither agree nor disagree; 4 = agree; 5 = strongly agree

Relationship Between General Teacher Self-Efficacy and Self-Efficacy Belief Toward Technology

A two-tailed Pearson correlation was computed to assess the relationship between technology integration self-efficacy and general teacher self-efficacy. Variables of total self-efficacy score and technology integration self-efficacy score were used to complete the correlation. A positive correlation existed between the variables ITIS SE and general teacher SE within the preservice teacher group, $r = 0.499$, $n = 42$, $p = 0.001$. The inservice teacher group also indicated a positive correlation of $r = 0.499$, $n = 61$, $p = 0.001$ between variables ITIS SE and general teacher SE. Both r values of 0.499 indicate moderate correlation between the two variables in each teacher group, suggesting general self-efficacy beliefs may move positively or negatively depending on self-efficacy belief toward technology and vice versa. The Pearson r value (.499) indicates moderate to high practical significance (Cohen, 1988).

Additional Results

Participants were asked to describe specific episodes in which they observed effective demonstrations or modeling of combined content, technologies and teaching approaches in a classroom lesson. A total of 37 participants responded to the open-ended question, indicating use of interactive whiteboards and PowerPoint as the dominant instructional technology used in agricultural mechanics, livestock judging and selection, state quiz bowl preparation, the FFA record book system, and math as it relates to agriscience. One participant explained,

> "I like to use SMART technology, the Internet, and my personal history to demonstrate and explain concepts. Examples include teaching how to balance feed rations, how to develop presentations, welding positions and methods, even artificial insemination and how to use a Pundit square."

Additional responses included the use of Excel to teach livestock food ration and the FFA record book system. One preservice respondent indicated her agricultural education classroom used student response systems (e.g., Jones, Antonenko, & Greenwood, 2012). Other educational technology tools used included movie production software such as Movie Maker™ or iMovie™ and agricultural-specific programs to simulate state quiz bowl or livestock judging environments. One inservice participant explained,

> “We build movies and projects on breeds of animals along with the history of where the animals originated. Students do this in Movie Maker, iMovie, and PowerPoint.”

Participants also were asked to describe a specific episode where a colleague was observed effectively demonstrating combined content, technologies and teaching approaches in a classroom lesson. A total of 31 participants responded to the open-ended question; 8 indicated they had not observed other teachers. One inservice participant noted,

> “I do not observe other teachers. Agriculture education has a crammed schedule as it is and there is no time to be out of the classroom to observe other teachers. That time is much better utilized in the classroom since classroom time in agriculture education is much lower than other subjects.”

Of the 23 who had observed other models, respondents indicated they had attended inservice or professional development events, or witnessed a colleague or professional. Topics included the use of YouTube™ videos to increase student attention in reading; computer use and in-field experience to increase student interest in identifying grasses; use of Landscape Pro™ software to teach students about landscape design; use of an Elmo™ and student participation to demonstrate teaching concepts as the instructor teaches; the use of Study Island™; use of interactive whiteboards to diagram soil types; use of search engines to accomplish tasks; and one noted they had implemented an Interactive Television (ITV) system with other schools around the country.

Participants were asked to describe a specific episode where they had effectively demonstrated combined content, technologies and teaching approaches in a classroom lesson. A total of 27 responded, indicating their experience was primarily in using interactive whiteboards and computer software. One teacher explained,

> "I taught a lesson about cellular structures that combined Internet research on wireless laptops, my star board for reference, group participation in building cell models out of craft items, and student-led review."

Another teacher noted he used text, video and live animal evaluation to teach livestock evaluation to his students. He explained he and his class first read and discussed livestock evaluation fundamentals before moving to instructional DVDs and then moving outside to evaluate live animals.

Lastly, a teacher told of a challenge she faced in her rural school classroom:

> "Sometimes we think students already know all there is to know when it comes to technology. However, I have had to come back to the basics of demonstrating how to attach a file to an e-mail. Most of my students must e-mail me their assignments."

Overall, responses indicated agricultural education teachers are incorporating instructional technology into various aspects of their curriculum, and basic administrative computer tasks (attaching a file to an email, using Excel for recordkeeping) are common. It is notable that movie and presentation development software also plays a role in learning in the agricultural education classroom, allowing teacher and students to maximize learning via simulations and then transferring the knowledge to hands-on learning environments.

CHAPTER V

DISCUSSION

The results of this study are discussed relative to the research questions in the following sections: (1) Perceptions of Technological Pedagogical Content Knowledge (TPACK); (2) Predictors of TPACK; (3) Self-Efficacy Beliefs Toward Technology Use in Pre- and Inservice Groups; and (4) Relationship Between General Teacher SE and SE Belief Toward Technology. Implications for practice are then discussed, and suggestions for future research in agricultural education and educational technology are presented.

Self-Reported Technological Pedagogical Content Knowledge

Preservice and inservice groups' self-reported TPACK suggests that both groups perceive themselves as knowledgeable in combining curriculum areas with technologies and teaching approaches. However, in the areas of mathematics, literacy, and social studies, a greater percentage of preservice teachers indicated that they strongly agreed they were capable of teaching lessons that appropriately combined content with teaching approaches and technologies. This could be explained by student preparation programs that expose students to better integration of content areas within agricultural education. This is consistent with research suggesting agricultural programs are becoming more interdisciplinary, combining both academic and vocational curriculum using a variety of models (Roberson, Flowers, & Moore, 2000).

The effect of combining academic and vocational curriculum may also be the cause of inservice teacher responses indicating they are more knowledgeable regarding TPACK in the area of science. An emphasis on science curriculum integration across disciplines, especially in the area of agriculture and agricultural education (Balschwied & Thompson, 2002) has been prominent for several decades. Recommendations urging agricultural education to shift from a vocational-based curriculum to one integrating scientific thinking were released in 1988, causing some programs to move from the traditional term “agricultural education” to “agriscience” (Layfield, Minor, & Waldvogel, 2001). National implementation of the Common Core State Standards, which encourages the infusion of literacy, mathematics and science across all curricula, may affect future TPACK in agricultural education teachers depending on how widely CCSS is adopted.

Another explanation of preservice teacher TPACK score regards teacher modeling as it relates to technology and the classroom. That is, preservice TPACK score may be influenced by high SE beliefs resulting from mastery experiences and vicarious experiences (Bandura, 1986). Qualitative responses indicated preservice teachers may have experienced more modeling experiences from peers and professionals, which could explain their increased confidence in teaching, content, and technology.

High TPACK in preservice teachers and perceived high self-confidence may also be attributed to a generational shift that ultimately could have an effect on SE beliefs. A recent study has noted learners have higher self-confidence than learners 30 years ago (Twenge & Campbell, 2008). However, Twenge and Campbell posit higher self-confidence is not accompanied by higher self-competence. This could influence SE levels later, as estimations have consequences for courses of action pursued, and SE pertains to an individual’s perception of his or her competence (Tschannen-Moran, et al., 1998). Higher TPACK total score could also be attributed to preservice teacher reliance on analysis of the task and on vicarious experiences to gauge their own knowledge; they have witnessed teachers and professionals using technology in the classroom and feel confident they are capable of performing at the same level of competence in the given situation (Tschannen-Moran, et al., 1998).

Conversely, inservice teacher mastery experiences, which may affect overall teacher SE, could explain higher TPACK scores. Further, although qualitative responses indicated a variety of instructional technology tool use witnessed and integrated into classrooms, TPACK score may be artificially inflated if teachers feel they have seen all instructional tools available, and overall, results indicated interest in listening to instructional technologists or attending instructional technology workshops was low.

Another finding within TPACK in preservice and inservice groups concerns Technology Knowledge (TK). Large differences were noted in TK subscale responses in preservice and inservice teachers related to each group's technology habits, which may begin to be explained through the complex relationships of SE and interest pertaining to TK. Interest is developed in areas where individuals consider themselves efficacious and for which they visualize positive outcomes (Niederhauser & Perkmen, 2008). Bandura's (1986, 1997) threshold effect suggests strong SE beliefs result in lower levels of interest, yet moderate SE level is necessary to generate interest. Both preservice and inservice groups reported themselves as effacious toward technology and capable of integrating technology effectively, with inservice teachers indicating slightly higher levels of SE as it related to technology and teacher SE. Bandura also posited increases in SE do not yield linear increments in interest. However, agricultural education preservice and inservice results did not support Bandura's threshold effect; inservice teachers indicated slightly higher SE than preservice teachers while also indicating slightly higher interest in experimenting with technology.

The push for implementing technology in the K-12 classroom may also be a driving force behind inservice teacher interest and experimentation with instructional technology. Research in agricultural education notes preservice teachers tend to be unaware of the perceived importance of educational technology on student learning outcomes, resulting in disinterest in instructional technology. Conversely, inservice teachers receive a constant message that they must implement instructional technology to improve learning outcomes and thus have more interest in finding tools they can use to meet requirements and expectations. (Must find a reference to support this)

Another theory to explain preservice TK results is Bruce and Hogan's (1998) transparency of technology perception. As technology becomes embedded into social practice the conception of the technology moves from novelty to commonplace (Bruce & Hogan, 1998). This effect could explain teacher indifference to exploring technology. Ubiquity of computers and interactive whiteboards in classroom environments may lead to teacher disinterest in commonplace technologies as new instructional tools are introduced. However, Bandura (1997) contends preservice teacher efficacy beliefs are more difficult to change or sustain, providing a challenge for professional development in new teachers if they maintain moderate to high SE levels regarding their technology knowledge and use, yet do not have an actual level of competence as noted by Twenge (2008).

The lack of instructional technology exploration interest in teacher responses coupled with their efficacy beliefs suggests teachers are generally comfortable with current technologies in the classroom as well as their TK. However, these findings do not take into account the constraints and affordances of TK. Mishra and Koehler (2008) suggest TK "enables a person to accomplish a variety of different tasks using information technology and to develop different ways of accomplishing a given task" (p. 15). However, they also argue digital technologies are functionally opaque, which causes computer use to seem arbitrary (p. 8), leading to instructional technology use as a random tool to use as needed rather than integrated into the curriculum. To further complicate technology integration, humans have a tendency to rely on functional fixedness and are unable to apply tools created for business and "work" to classroom contexts. These two concepts may drive teachers to continue utilizing instructional technology they have witnessed or previously used without considering alternative instructional technology tools that may accomplish more effective learning outcomes.

Predictors of Technological Pedagogical Content Knowledge

Beyond assessing Technological Pedagogical Content Knowledge, a large part of this study sought to examine what intrapersonal and efficacy factors influenced, or predicted, Technological Pedagogical Content Knowledge (TPACK) in pre- and inservice agricultural education teachers in Oklahoma. Mishra and Koehler (2008) suggest lack of one construct within the TPACK matrix results in diminished understanding of how to integrate technology into teaching practices. However, internal and external factors also influence whether teachers integrate technology into their instructional practices. Niederhauser and Perkmen (2008) suggest intrapersonal factors, such as self-efficacy (SE), perceived outcome expectations (OE), and interest, also influence instructional technology integration.

Analysis suggested a relationship exists between preservice and inservice technology integration intrapersonal factors and technology integration knowledge (TPACK), and predictor variables vary for each group. Although TPACK total scores were similar in both preservice and inservice groups, different constructs predicted TPACK in each group. Whereas preservice TPACK total score was predicted by social OE, inservice TPACK total score was predicted by instructional strategy SE and technology integration SE. Several areas of social cognitive theory are drawn from to explain the results, including SE and OE.

Preservice teacher TPACK was most predicted by social OE (about 10 percent of the total variance), which is constituted by feedback from others and perceived competence as viewed by colleagues (Niederhauser & Perkmen, 2008). OE assists in forming cognitive maps, influences human motivation, and drives individuals to sustain behaviors (Niederhauser & Perkmen, 2008). The combination of a teacher high in SE ("I can accomplish this task") and outcome expectation ("If I do this, x will happen") results in a powerful duo influencing motivation and choice.

Preservice teachers perceived themselves generally effacious; they also perceived acceptance and respect from colleagues as a result of effective use of instructional technology. Bandura suggested SE determines OE when the quality of performance guarantees the outcome. However, when SE is loosely tied to the quality of performance, OE serves as an independent contributor to motivation (Bandura, 1989). Further, SE has a unidirectional relationship with OE; although SE may influence OE, independent changes in OE do not necessarily affect SE beliefs.

Preservice teacher responses indicated moderate to high SE; combined with their perceived value of OE, this suggests that preservice teachers will assume positive and valued outcomes accrue from using technology in their classrooms and perceive themselves effacious to follow-through with the intended actions. Lent and colleagues (1994, 2004) suggest that even in a situation where the outcome attainment is uncertain, if SE levels are high, the motivation to sustain efforts generally remains high as well. In the case of preservice teachers, general SE beliefs establish teacher perception of ability to perform a task, whereas positive social OE assists in sustaining the motivation to continue performing the task – in this case, having the knowledge to integrate technology into pedagogy and content.

Social OE as a dominant predictor variable in preservice teacher TPACK could result from a variety of causes. Preservice teachers who experienced high intrinsic motivation as a result of an enthusiastic instructor may have higher levels of SE that correspond to strong positive OE beliefs. Vicarious experiences (Bandura, 1986) could explain preservice teacher social OE beliefs; preservice teachers witnessed models who received positive feedback and acknowledgement upon successful technology integration.

Bandura posits self-evaluative OE is the most influential of the OE constructs as it relates to interest. Preservice teachers indicated agreement with self-evaluative OE questions, which suggest preservice teachers anticipate pride, satisfaction and excitement with using instructional technology in the classroom (Niederhauser & Perkmen, 2008). This measure is important as it is intertwined in SE not only of the teacher, but also how it transfers to classroom and student SE. Motivation to teach and excitement with one's work leads to learner motivation and more active cognitive engagement in students; in this situation, preservice teachers can be expected to be motivated toward using instructional technology to increase active learning and engagement. Although self-evaluative OE was a factor in preservice teachers, the construct of SE in student engagement was not, causing concern regarding preservice teacher beliefs toward their student engagement interests.

Attribution theory could play a role in a preservice teacher's future technology integration (Schunk, et al., 2008) based on how the preservice teacher is seen by others. Preservice teachers who attribute successes or failures based on social OE and acknowledgement of others may persist in a static frame of mind toward new instructional technologies, resulting in no progression of TPACK as the teacher gains experience in the classroom.

SE, particularly in the case of teacher efficacy, tends to be context-specific (Tschannen-Moran, et al., 1998). This is evident with inservice results suggesting SE in instructional strategy and SE in student engagement influence TPACK. However, teachers feel more effacious teaching specific subjects or with specific tools, and those who are highly effacious as it relates to instructional strategy may therefore be more comfortable with technology integration in the classroom. High instructional strategy SE is indicative of ability and willingness to innovate teaching strategy and experiment with instruction. Further, high student engagement SE is indicative of teacher enthusiasm and motivation for teaching, which may influence teacher openness to technology integration in the classroom and experimentation with instructional technology tools to further active learning.

Tschannen-Moran and colleagues (1998) suggest making an efficacy judgment requires consideration of the teaching task and its context. The four sources of SE information contribute to the analysis of the teaching task and to self-perceptions of teaching competence, but in different ways. Vicarious experiences provide contributions to self-perceptions of teaching competence, whereas mastery experiences contribute to knowledge about the complexity of the task and individual capabilities. The indication of SE factors as TPACK indicators within the inservice teacher group versus the preservice group indicator of OE may be explained by the differentiation of inservice and preservice teachers' analysis of teaching task. Preservice teacher's analysis results in more contributions to their self-perception of teaching competence, resulting in

OE as an influence of TPACK, whereas inservice teachers analysis results in actual knowledge of individual capabilities and the complexity of the task.

Ultimately, the evidence provided in this study suggests that the factors within the Intrapersonal Technology Integration Scale and TPACK are correlated and they both can serve as predictor variables in determining technology integration of both preservice and inservice teachers.

Self-Efficacy Beliefs Toward Technology in Pre and Inservice Teachers

Research question three asked whether SE beliefs toward technology differed between preservice agricultural education teachers and inservice agricultural education teachers. It was expected a difference may exist due to younger generations' immersion into technology-rich environments (cf., "digital natives", Prensky, 2001); however, preservice and inservice groups shared similar SE beliefs toward technology according to the Intrapersonal Technology Integration Scale responses.

Although preservice responses were not surprising, it was not expected that the inservice group would reach a slightly higher level of total SE (preservice $M = 3.95$ versus inservice $M = 4.05$). However, this could be explained by inservice teacher mastery experience as it pertains to technology use and integration, and these mastery experiences are posited to be the most powerful influences on SE beliefs. Further, mastery experiences are suggested as the most direct influence on self-perception of teaching competence (Tschannen-Moran, 1998). Thus, inservice teacher technology SE is posited to be a result of actual teaching experience and the strengths and weaknesses each teacher experienced as they managed and instructed a group of students. Based on responses, this particular inservice teacher group has experienced not only increased technology SE beliefs, but also increased instructional strategy SE beliefs as a result of actual teaching situations and mastery of the teaching task.

Conversely, preservice teachers may develop technology integration SE as a result of vicarious experiences leading to efficacy belief. Tschannen-Moran and colleagues (1998) propose that vicarious experience – watching others teach – provides information and impressions regarding the teaching task. These vicarious experiences, whether experienced during teacher education, from professional literature, or from gossip, influence preservice and novice teacher decisions regarding learning ability, responsibility, and teacher influence. Beginning teachers tend to base their SE and competence beliefs on those they observe; thus, observation of successful teachers using technology is critical in developing future agricultural education teachers who are comfortable and competent in using technology in the classroom (Bandura, 1997; Tschannen-Moran, 1998). Although it may be assumed that observing teacher failure regarding technology integration may provide a learning opportunity for preservice or beginning teachers, Tschannen-Moran and colleagues (1998) posit that observing failure, combined with perceived strong effort of the observed teacher, will reduce efficacy belief, as the conclusion is made that the task is unmanageable.

It is important to again consider preservice teacher perceived confidence is not necessarily reflective of competence. Although preservice teachers may base their efficacy beliefs on vicarious experiences and indicate strong SE beliefs, levels of SE may change as preservice teachers begin their teaching experiences and progress to novice teachers. Swan, Wolf and Cano (2011) noted that instructional SE was highest at the end of student teaching experiences and lowest after the first year of teaching; this effect could play an integral role in SE belief toward technology as well.

The attributional process has psychological force to influence expectancies for success and SE beliefs. Within SE toward technology, it could be expected inservice teachers would attribute previous successes and failures with technology as indicative of their SE, whereas preservice teachers would attribute their perceived successes – outcomes – based on educational experiences in which they have participated. Because most preservice teachers begin with little or no mastery experience to draw upon to support or influence their SE beliefs, they must rely on situations they have witnessed. For the preservice teacher who does not already have moderate to high SE belief, vicarious experience may hinder SE development if the preservice teacher does not believe he or she has the competence to achieve the witnessed outcome, or attributes the outcome to chance (Tschannen-Moran, et al., 1998; Schunk, et al., 2008).

Relationship Between General Teacher Self-Efficacy and Self-Efficacy Belief Toward Technology

SE is an internal factor influencing technology integration (Niederhauser & Perkmen, 2008; Tschannen-Moran, et al., 1998), which is why the relationship between general teacher SE and SE belief toward technology is important. Initial correlation analysis indicated a moderately significant positive correlation between general teacher SE and SE toward technology. Both preservice teachers and inservice teacher responses indicated the same relationship between the two SE levels. Further analysis revealed differences exist in preservice SE and inservice SE as it relates to technology integration SE.

Preservice teacher classroom management and instructional strategy SE were noted as having the most direct relationship with technology integration SE. These results are in line with research (Tschannen-Moran, et al., 1998) suggesting efficacy beliefs of preservice teachers are linked to attitudes toward children and control. Classroom management SE therefore may have an effect on technology integration SE; as the preservice or novice teacher gains classroom management experience and is satisfied with his or her classroom management competence, perceived ability to change instructional strategies becomes higher and it is perceived that technology integration can happen with positive social outcome expectation results. The preservice or novice teacher who is not effacious in classroom management will tend to focus on gaining control of the classroom before considering alternative instructional tools and strategies. It should be noted that student engagement SE has been reported to be the lowest of the three SE domains in various studies of preservice and beginning agricultural education teachers (Roberts, Harlin & Briers, 2009; Stripling, Ricketts, Roberts, & Harlin, 2008; Wolf et al., 2008). However, low correlation of student engagement SE to technology integration SE may indicate preservice teachers do not consider instructional technology tools to contribute to student engagement in the classroom.

Conversely, inservice teacher technology SE has a stronger relationship with student engagement SE. As inservice teachers increase their beliefs they can engage students, their technology SE may also increase, and teachers may be more apt to integrate technology into their classrooms to promote active learning. Likewise, teachers who attribute student engagement to implementation of instructional technology will increase both areas of SE through their mastery experiences, and further development of SE will continue in both areas.

Two other SE domains that exhibit a relationship with technology integration SE in inservice teachers are instructional strategy SE and classroom management SE. Though not as strong as student engagement SE, these two efficacy domains provide insight into factors that may influence inservice teacher technology integration SE.

Implications for Practice

As Littrel, Zagumny and Zagumny suggest (2005), addressing “faulty philosophical foundations” of instructional technology use is a challenge that continues to exist in the classroom. Technology is presented as an end-goal, rather than as a tool to improve the emotional, (meta)cognitive, and behavioral engagement in students (Fredricks, Blumenfeld, & Paris, 2004). As a result, instructional technology is not “infused” into the curricula, as Littrel and colleagues recommend (2005). SE plays a strong role in technology integration in the classroom, and this study’s findings suggest that TPACK and technology integration may be stronger within those who perceive high instructional strategy efficacy and student engagement efficacy. This implies that professional development in technology use in the classroom may need to incorporate more of an emphasis on technology integration through those two channels of SE, building on the competency beliefs of inservice teachers and providing additional modeling and vicarious experience situations to continue efficacy development and foster technology integration.

Due to the high SE development attributes of mastery experience, preservice teacher education may need to shift from a focus of direct, lecture and modeling based instruction to more hands-on, constructivist teaching that incorporates a variety of mastery experiences. While vicarious experiences are important in the development of SE belief, Bandura suggested mastery experiences were the most influential on perceived self-confidence; further, increased mastery experiences with instructional technology would allow preservice teachers to not only perceive themselves as self-confident, but also as self-competent, resulting in successful integration into the professional classroom. Littrel and colleagues (2005) note that a common mistake made by education faculty is in determining a set list of IT competencies and expecting them to transfer through instruction; education faculty should *facilitate* the interaction rather than *direct* it (2005, p. 45). Encouraging students to experiment with different instructional technology strategies within the undergraduate setting would allow for additional mastery experience and further vicarious experience among peers in addition to complementing attributional and outcome expectation views.

Additional findings within this study suggest novice/preservice and experienced/inservice teacher viewpoints differ as to why technology should be used, and this may be a consideration in creation of educational curricula and professional development training. The research presented here suggests experienced inservice teachers view technology tools as a mechanism to engage students and achieve instructional gains, whereas novice and preservice teachers may see technology tools as a mechanism for improving classroom management. Viewing technology only as a classroom management tool, and as one that distracts and provides temporary student pacification within the learning environment will not result in instructional technology infusion into content and curriculum as noted by Littrell (2005), Mishra & Koehler, and other researchers. Rather, technology tools will be seen as novelties to satiate an uninterested classroom or perhaps as a calming or enlivening agent when the instructor notices students having attention issues.

Understanding the importance of social outcome expectations to preservice teacher development and education is an additional factor to consider. Differences in perceived importance of social OE to inservice versus preservice teachers may cause challenges in communication and classroom experiences that hinders, rather than encourages, SE beliefs, competence, and confidence levels in preservice teachers.

Recommendations for Future Research

While this study suggests preservice and inservice teacher technology knowledge and efficacy beliefs are similar, additional studies with larger sample sizes are needed to validate and potentially expand on the research findings presented here. Further, current research could benefit from an in-depth, qualitative examination of the preservice group and the inservice group to explore the characteristics of vicarious and mastery experiences on targeted groups and technology integration SE. Stability of technology SE perceptions and TPACK in both groups may also reveal important indicators to assist in answering questions related to technology integration and infusion.

The differences that exist in TPACK predictors between preservice and inservice teacher groups suggest further examination of age groups is detrimental in understanding when in the teacher's career the SE factor becomes more influential to TPACK than OE, and what factors make a contribution to that transition.

Further study on the number of perceived mastery experiences and TPACK score may also be beneficial in understanding the role of SE belief in technology integration. Mastery experiences are purported as the most significant experiences influencing SE beliefs (Bandura, 1989), which in turn affect motivation not only of the teacher but also the students in addition to influencing engagement and technology integration.

Lastly, a longitudinal study of preservice and inservice teacher levels of technology integration SE and TPACK could be beneficial in isolating occurrences and experiences that both hinder and encourage technology integration into the agricultural education classroom.

Conclusion

The results of this study contribute to the growing area of research indicating that a complex system of interrelated intrapersonal variables contributes to technology integration and Technological Pedagogical Content Knowledge. While external factors such as funding, lack of IT support, and lack of technology skills training continue to be external barriers to technology integration in agricultural education classrooms, this study suggests intrapersonal factors such as self-efficacy, outcome expectations, and interest not only have a relationship with technology integration self-efficacy, but may also serve as predictors of Technological Pedagogical Content Knowledge.

Instructional technology will continue to be a useful way to further student engagement, learning, and effectiveness. However, barriers, both external and internal, also continue to be a factor influencing technology integration and decisions made regarding instructional technology use. In an effort to maximize student engagement and learning, it is critical to understand the intrapersonal factors influencing teacher technology integration and incorporate this knowledge in the design of curricula. Further, teacher knowledge of integrating technology with pedagogy and content is crucial in effective student learning with technology while also influencing student belief toward technology. Vicarious experiences witnessed by students influence their own beliefs about learning and using technology to learn; therefore, teacher use of technology is vital to continuing appropriate instructional technology modeling.

The importance of teacher beliefs and values cannot be ignored in the research of instructional technology decision-making. Further study regarding the formation and dynamics of teacher beliefs toward technology integration and motivation to integrate is crucial in determining best practices for education and professional development programs for preservice and inservice teachers. Differences in predictors for TPACK in the preservice and inservice groups suggest approaches to education regarding technology use must be differentiated to be effective and engage teachers to implement technology.

REFERENCES

Albion, P. R. (2001). Some factors in the development of self-efficacy beliefs for computer use among teacher education students. *Journal of Technology and Teacher Education*, 9(3), 231-347.

Albion, P. R., & Ertmer, P. A. (2001). Beyond the foundations: The role of vision and belief in teachers' preparation for integration of technology. *TechTrends*, 46(5), 34-38.

Allinder, R. M. (1994). The relationship between efficacy and the instructional practices of special education teachers and consultants. *Teacher Education and Special Education*, 17, 86-95.

Alson, A. J., & English, C. W. (2007). Technology enhanced agricultural education learning environments: An assessment of student perceptions, 48(4), 1-10.

Anderson, R., Greene, M., & Loewen, P. (1988). Relationships among teachers' and students' thinking skills, sense of efficacy, and student achievement. *Alberta Journal of Educational Research*, 34 (2), 148-165.

Archambault, L. M., & Barnett, J. H. (2010). Revisiting technological pedagogical content knowledge: Exploring the TPACK framework. *Computers & Education*, 55, 1656-1662.

Arrington, L. R. (1985). Relationship of student attitudes about vocational agriculture to selected student, school, and program variables. *The Journal of the American Association of Teacher Educators in Agriculture*, 26(1), 48-56.

Ashton, P. T., Olejnik, S., Crocker, L. & McAuliffe, M. (1982). Measurement problems in the study of teachers' sense of efficacy. Paper presented at the annual meeting of the American Educational Research Association, New York.

Atkinson, E. S. (2000). An investigation into the relationship between teacher motivation and pupil motivation. *Educational Psychology*, 20(1), 45-57.

Babbie, E. (1989). *The practice of social research.* Belmont CA: Wadsworth.

Bandura, A., (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, 84, 191-215.

Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychologist*, 37, 122-147.

Bandura, A., (1986). Social foundations of thought and action: A social cognitive theory. Englewood Cliffs, NJ: Prentice-Hall.

Bandura, A. (1993). Perceived self-efficacy in cognitive development and functioning. *Educational Psychologist*, 28(2), 117-148.

Bandura, A. (1996). Self-efficacy in changing societies. New York: Cambridge University Press.

Bandura, A. (1997). Self-efficacy: The exercise of control. New York: W. H. Freeman and Company.

Bergin, D. A. (1999). Influences on classroom interest. *Educational Psychologist*, *34*(2), 87.

Brown, N. R., Baker, M. A., Edwards, M. C., & Robinson, J. S. (2011). Becoming technologically FIT: Enabling pre-service teachers to become fluent with informational technology as part of the teacher preparation experience. *Proceedings of the American Association for Agricultural Education (AAAE) Research Conference.* Coeur d'Alene, ID. Retrieved from http://aaaeonline.org/uploads/allconferences/5-10-2011_132_AAAE_2011_Poster_Session_Proceedings.pdf

Bunch, J. C., Robinson, J. S., & Edwards, M. C. (2012). Measuring the relationship between agriculture teachers' self-efficacy, outcome expectation, interest, and their use of interactive whiteboards. *Journal of Agricultural Education, 53*(1), 67-80.

Cohen, J. (1988). Statistical power analysis for the behavioral sciences. New York: Academic Press.

Conners, J. J. (1998). A regional Delphi study of the perceptions of NVATA, NASAE, and AAAE members on critical issues facing secondary agricultural education programs. *Journal of Agricultural Education*, 39(1), 37-47.

Edwards, M. C., & Briers, G. E. (2001). Selected variables related to expected longevity in teaching of entry-phase agriculture teachers. *Journal of Career and Technical Education*, 16(1), 7-18.

Enochs, L. G., Riggs, I. M., & Ellis, J. D. (1993). The development and partial validation of microcomputer utilization in teaching efficacy beliefs instrument in a science setting. *School Science and Mathematics, 93*(5).

Ertmer, P. A. (1999). Addressing first- and second-order barriers to change: Strategies for technology integration. *Educational Technology Research & Development*, 47(4), 47-61.

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research, 74*, 59 – 109.

Graham, C. R. (2011). Theoretical considerations for understanding technological pedagogical content knowledge (TPACK). *Computers & Education*, 57, 1953-1960.

Greenwood, G. E., Olejnik, S. F., & Parkay, F. W. (1990). Relationships between four teacher efficacy belief patterns and selected teacher characteristics. *Journal of Research and Development in Education*, 23(2), 102-106.

Guskey, T. R. (1981). Measurement of responsibility teachers assume for academic successes and failures in the classroom. *Journal of Teacher Education*, 32, 44-51.

Harms, B. M, Knobloch, N. A. (2005). Preservice teachers' motivation and leadership behaviors related to career choice. *Career and Technical Education Research*, 30(2), 101-124.

Hightower, C., & Scott, K. (2012). Infer more, describe less: More powerful survey conclusions through easy inferential tests. *Issues in Science and Technology Librarianship, 69*. doi: 10.5062/F45H7D64

Hillison, J., Camp, W. G., & Burke, S. R. (1986). Why undergraduates choose agricultural education as a major: 1980 vs. 1985*. Journal of Agricultural Education*, 28(2), 2-7, 32.

Kellenberger, D. W. (1996). Preservice teachers' perceived computer self-efficacy. *Journal of Research on Computing in Education*, 29(2), 124.

Keller, J. M. (2010). Motivational design for learning and performance: The ARCS Model Approach. New York, Dordrecht, Heidelberg, London; Springer.

Kotrlik, J. W., & Harrison, B. C. (1987). Factors related to the career decisions of seniors who have taken vocational agriculture. *The Journal of the American Association of Teacher Educators in Agriculture*, 25(3), 13-21.

Kotrlik, J. W., Harrison, B. C., Redmann, D. H., & Handley, C. H. (2000). Information technology related professional development needs of Louisiana agriscience teachers. *Journal of Agricultural Education*, 41(1), 18-29.

Kotrlik, J. W., Redmann, D. H., Douglas, B. B. (2003) Technology integration by agriscience teachers in the teaching/learning process. *Journal of Agricultural Education*, 44(3), 78-90.

Kotrlik, J. W., & Redmann, D. H. (2009). A trend study: Technology adoption in the teaching-learning process by secondary agriscience teachers-2002 and 2007. *Journal of Agricultural Education*, 50(2), 62-74.

Knobloch, N. A., & Whittington, M. S. (2002). Novice teachers' perceptions of support, teacher preparation quality, and student teaching experience related to teacher efficacy. *Journal of Vocational Education Research,* 27(3), 331–341.

Kyriacou, C., & Coulthard, M. (2000). Undergraduate views of teaching as a career choice. *Journal of Education for Teaching*, 26(2), 117-126.

Lawver, R. G. (2009). Factors influencing agricultural education students' choice to teach. Doctoral Dissertation, University of Missouri, 2009. Retrieved from the University of Missouri electronic theses and dissertations of The Department of Agricultural Education, http://mospace.umsystem.edu/xmlui/handle/10355/6168.

Layfield, K. D., & Dobbins, T. R. (2002). Inservice needs and perceived competencies of South Carolina agricultural educators. *Journal of Agricultural Education*, 43(4), 46-55.

Lent, R., Brown, S., & Hackett, G. (1994). Toward a unifying social cognitive theory of career and academic interest, choice, and performance. *Journal of Vocational Behavior*, 45, 79-121.

Lent, R. W., Brown, S. D., & Hackett, G. (2002). Social cognitive career theory. In D. Brown (Ed.), *Career choice and development* (pp 255-311). San Francisco: Jossey-Bass.

Lindner, J.R., Murphy, T. H., & Briers, G. E. (2001). Handling nonresponse in social science research. *Journal of Agricultural Education* 42(4), 43-53. doi: 10.5032/jae.2001.04043.

Linnenbrink, E. L. & Pintrich, P. R. (2003). The role of self-efficacy beliefs in student engagement and learning in the classroom. *Reading & Writing Quarterly*, 19(2), 119-137

Littrell, A. B., Zagumny, M. J., & Zagumny, L. L. (2005). Contextual and psychological predictors of instructional technology use in rural classrooms. *Educational Research Quarterly*, 29(2), 37-47.

Lu, J., & Molstad, L. (1999). Instructional effectiveness of computer technology in non-computer-oriented courses as perceived by South Dakota high school business teachers, *The Delta Pi Epsilon Journal*, 39(3), 159-176.

Lumpe, A. T., & Chambers, E. (2001). Assessing teacher's context beliefs about technology use. *Journal of Research on Technology in Education, 34*(1), 93-107.

Malmberg, L. (2006). Goal-orientation and teacher motivation among teacher applicants and student teachers. *Teaching and Teacher Education*, 22, 58-76.

Niederhauser, D. S., & Perkmen, S. (2008). Validation of the intrapersonal technology integration scale: Assessing the influence of intrapersonal factors that influence technology integration. *Computers in the Schools*, 25(1), 98-111.

Pajares, F. (2002). Overview of social cognitive theory and of self-efficacy. Retrieved December 22, 2011from http://www.emory.edu/education/mfp.eff.html.

Patrick, B. C., Hisley, J., & Kempler, T. (2000). "What's everybody so excited about?": The effects of teacher enthusiasm on student intrinsic motivation and vitality. *The Journal of Experimental Education*, 68(3), 217-236.

Pintrich, P. R., & Schunk, D. H. (1996). Motivation in Education: Theory, research, and applications. Englewood Cliffs, NJ: Merrill/Prentice-Hall.

Prensky, M. (2001). Digital natives, digital immigrants. *On the Horizon*, *9*(5), 1-6.

Riggs, I. M., & Enochs, L. G. (1993). A Microcomputer Beliefs Inventory for Middle School Students: Scale Development and Validation. *25*(3), 383-391.

Roberts, T. G., Harlin, J. F., & Ricketts, J. C. (2006). A longitudinal examination of teaching efficacy of agricultural science student teachers. *Journal of Agricultural Education, 47*(2), 81–92.

Roberts, T. G., Greiman, B. C., Murphy, T.H., Ricketts, J.C., Harlin, J.F., & Briers, G.E. (2009). Changes in student teachers' intention to teach during student teaching. *Journal of Agricultural Education*, 50(4), 134-145.

Rocca, S. J., & Washburn, S. G. (2006). Comparison of teacher efficacy among traditionally and alternatively certified agricultural teachers. *Journal of Agricultural Education, 47*(3), 58–69.

Rose, J. S., & Medway, F. J., (1981). Measurement of teachers' beliefs in their control over student outcome. *Journal of Educational Research*, 74, 185-190.

Rotter, J. B. (1966). Generalized expectancies for internal versus external control of reinforcement. *Psychological Monographs*, 80*,* 1-28.

Schmidt, D. A., Baran, E., Thompson, A. D., Mishra, P., Koehler, M. J., & Shin, T. S. (2009). Technological pedagogical content knowledge (TPACK): The development and validation of an assessment instrument for preservice teachers. *Journal of Research on Technology in Education*, 42(2), 123-149.

Schunk, D.H. (2001). Learning theories: An educational perspective (3rd ed.). Upper Saddle River, NJ: Prentice-Hall/Merrill.

Schunk, D. H., Pintrich, P.R. and Meece, J. L. (2008). Motivation in Education: Theory, Research and Applications (3rd ed.). Upper Saddle River, NJ: Merrill–Prentice Hall

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, 15(2), 4–14.

Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review*, 57(1), 1–22.

Smerdon, B., Cronen, S., Lanahan, L., Anderson, J., Iannotti, N., & Angeles, J. (2000). Teachers' tools for the 21st century: A report on teachers' use of technology. Washington, D.C.: National Center for Education Statistics, U.S. Department of Education.

Smylie, M. A., (1988). The enhancement function of staff development: organizational and psychological antecedents to individual teacher change. *American Educational Research Journal*, 25, 1-30.

Swan, B. G., Wolf, K. J., & Cano, J. (2011). Changes in teacher self-efficacy from the student teaching experience through the third year of teaching. *Journal of Agricultural Education*, 52(2), 128-139.

Tschannen-Moran, M., Woolfolk Hoy, A. & Hoy, W. K. (1998). Teacher efficacy: Its meaning and measure. *Review of Educational Research*, 68, 202 - 248.

Wang, L., Ertmer, P. A., & Newby, T. J. (2004). Increasing preservice teachers' self-efficacy beliefs for technology integration. *Journal of Research on Technology in Education, 36*(3), 231.

Watson, G. (2006). Technology professional development: Long-term effects on teacher self-efficacy. *Journal of Technology and Teacher Education*, 14(1), 151-165.

Wedel, C. & Jennings, V. (2006). Motivating students begins with a motivated teacher. *The Agricultural Education Magazine*. 78(4); 6.

Woolfolk, A. E., Rosoff, B., & Hoy, W. K. (1990). Teachers' sense of efficacy and their beliefs about managing students. *Teaching and Teacher Education*, 6, 137-148.

APPENDIX A

IRB Approval and Final Versions of Recruitment, Consent and Assent Documents

Oklahoma State University Institutional Review Board

Date:	Friday, January 27, 2012
IRB Application No	ED1210
Proposal Title:	Self-efficacy and Technological Pedagogical Content Knowledge in Pre-service and in-service Agricultural Education
Reviewed and Processed as:	Exempt

Status Recommended by Reviewer(s): Approved Protocol Expires: 1/26/2013

Principal Investigator(s):

Jessica Stewart
139 Ag Hall
Stillwater, OK 74078

Pasha Antonenko
209 Willard
Stillwater, OK 74078

The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

☒ The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval.
2. Submit a request for continuation if the study extends beyond the approval period of one calendar year. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of this research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact Beth McTernan in 219 Cordell North (phone: 405-744-5700, beth.mcternan@okstate.edu).

Sincerely,

Shelia M. Kennison

Shelia Kennison, Chair
Institutional Review Board

Appendix A: Recruitment Script (e-mail)

I am an Oklahoma State University Educational Technology masters student conducting research on the use of technology by agricultural educators in the state of Oklahoma. I invite you to participate in a 20-minute survey that will ask you to provide responses regarding your experiences and preparedness to use digital tools in the agricultural education classroom.

At the end of the survey, you will have the option to provide your e-mail address, if you would like it to be entered in a drawing for a getaway package for two in Oklahoma (e-mail addresses are collected separately from responses).

If you would like to participate, please find the link to the anonymous online survey below. The link will take you to an information page providing more details about the research that will allow you to make an informed decision to participate.

http://www.XXXXXXXXXXX.XXXXX

If you would prefer to complete a paper copy of the survey, please e-mail your mailing address to jessica.stewart@okstate.edu and a paper copy of the survey will be mailed to you. A separate form will be used to collect your e-mail address if you would like to be entered in the drawing. This form will be immediately separated from your response to maintain the anonymity of data collection.

Thank you for considering participating in this study!

Jessica Stewart
Educational Technology Master's student
Oklahoma State University
139 Agricultural Hall, Stillwater, OK 74078
405-744-6638
jessica.stewart@okstate.edu

Advisor: Dr. Pasha Antonenko, 405-744-8003, pasha.antonenko@okstate.edu

Agricultural Education cooperating faculty:
Dr. Shane Robinson, 405-744-3094, shane.robinson@okstate.edu
Dr. M. Craig Edwards, 405-744-8141, craig.edwards@okstate.edu

Participant Information

Title: Self-efficacy and Technological Pedagogical Content Knowledge in Pre-service and In-service Agricultural Education

Principal Investigator: Jessica Stewart, jessica.stewart@okstate.edu
Advisor: Dr. Pasha Antonenko, pasha.antonenko@okstate.edu

We are inviting you to participate in a research study that is conducted with the support of OSU's Agricultural Education faculty (Drs. Shane Robinson and Craig Edwards). This study is aimed at exploring the use of technology by agricultural educators in the state of Oklahoma. Specifically, our survey will ask you to provide responses regarding your experiences and preparedness to use digital tools in the agricultural education classroom.

The primary benefits from this work are for the advancement of our understanding of the meaningful applications of digital technologies in agricultural education and teachers' preparedness to use these tools in the classroom. If you are interested in the outcomes of this research, arrangements can be made with the Principal Investigator, Jessica Stewart, to acquire copies of the publications, as they become available.

Note that if you are completing the online version of the survey, your response will be collected anonymously, but you will have the option to provide your e-mail address, if you would like it to be entered in a drawing for a getaway package for two in Oklahoma. Thus, e-mail addresses will be collected separately from responses. If you are to completing a paper copy of the survey, a separate form is included for your email address to enter the drawing. This form will be immediately separated from your response to maintain your anonymity

All information about you will be kept confidential and will not be released. The survey data will be collected using LimeSurvey, which is a secure, password-protected survey management tool or via paper copies mailed directly to the Principal Investigator. All research records will be stored securely in Excel files on the PI's office computer and only the PI and individuals responsible for research oversight will have access to the records. This information will be kept as long as it is scientifically useful; typically, such information is kept for three years after publication of the results. Results from this study may be presented at professional meetings or in publications. You will not be identified individually; results will be reported for the group as a whole.

There are no risks associated with this project, including stress, psychological, social, physical, or legal risk which are greater, considering probability and magnitude, than those ordinarily encountered in daily life. If, however, you begin to experience discomfort or stress in this project, you may end your participation at any time.

You may contact any of the researchers at the following addresses and phone numbers, should you desire to discuss your participation in the study and/or request information about the results of the study: Jessica Stewart, MS in Educational Technology student, 139 Agricultural Hall, Oklahoma State University, Stillwater, OK 74078, 405-744-6638, jessica.stewart@okstate.edu or Dr. Pasha Antonenko, 405-744-8003, pasha.antonenko@okstate.edu. If you have questions about your rights as a research volunteer, you may contact Dr. Shelia Kennison, IRB Chair, 219 Cordell North, Stillwater, OK 74078, 405-744-3377 or irb@okstate.edu.

Your participation in this research is voluntary. There is no penalty for refusal to participate, and you are free to withdraw your consent and participation in this project at any time, without penalty.

By completing the survey, you are giving your consent to participate.

Thank you for considering participating in this study!

2

Okla. State Univ.
IRB
Approved 1/27/12
Expires 1/26/13
IRB # ED-12-10

APPENDIX B

Teachers' Sense of Efficacy Scale – Long and Short Forms (Tschannen Moran and Woolfolk Hoy, 1998, 2001, 2002)

Teachers' Sense of Efficacy Scale[1] (long form)

Teacher Beliefs	How much can you do?								
Directions: This questionnaire is designed to help us gain a better understanding of the kinds of things that create difficulties for teachers in their school activities. Please indicate your opinion about each of the statements below. Your answers are confidential.	Nothing		Very Little		Some Influence		Quite A Bit		A Great Deal
1. How much can you do to get through to the most difficult students?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
2. How much can you do to help your students think critically?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
3. How much can you do to control disruptive behavior in the classroom?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
4. How much can you do to motivate students who show low interest in school work?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
5. To what extent can you make your expectations clear about student behavior?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
6. How much can you do to get students to believe they can do well in school work?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
7. How well can you respond to difficult questions from your students ?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
8. How well can you establish routines to keep activities running smoothly?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
9. How much can you do to help your students value learning?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
10. How much can you gauge student comprehension of what you have taught?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
11. To what extent can you craft good questions for your students?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
12. How much can you do to foster student creativity?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
13. How much can you do to get children to follow classroom rules?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
14. How much can you do to improve the understanding of a student who is failing?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
15. How much can you do to calm a student who is disruptive or noisy?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
16. How well can you establish a classroom management system with each group of students?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
17. How much can you do to adjust your lessons to the proper level for individual students?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
18. How much can you use a variety of assessment strategies?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
19. How well can you keep a few problem students form ruining an entire lesson?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
20. To what extent can you provide an alternative explanation or example when students are confused?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
21. How well can you respond to defiant students?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
22. How much can you assist families in helping their children do well in school?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
23. How well can you implement alternative strategies in your classroom?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
24. How well can you provide appropriate challenges for very capable students?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

Teachers' Sense of Efficacy Scale[1] (short form)

	Teacher Beliefs	How much can you do?								
	Directions: This questionnaire is designed to help us gain a better understanding of the kinds of things that create difficulties for teachers in their school activities. Please indicate your opinion about each of the statements below. Your answers are confidential.	Nothing		Very Little		Some Influence		Quite A Bit		A Great Deal
1.	How much can you do to control disruptive behavior in the classroom?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
2.	How much can you do to motivate students who show low interest in school work?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
3.	How much can you do to get students to believe they can do well in school work?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
4.	How much can you do to help your students value learning?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
5.	To what extent can you craft good questions for your students?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
6.	How much can you do to get children to follow classroom rules?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
7.	How much can you do to calm a student who is disruptive or noisy?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
8.	How well can you establish a classroom management system with each group of students?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
9.	How much can you use a variety of assessment strategies?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
10.	To what extent can you provide an alternative explanation or example when students are confused?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
11.	How much can you assist families in helping their children do well in school?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
12.	How well can you implement alternative strategies in your classroom?	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

APPENDIX C

Directions for Scoring Teachers' Sense of Efficacy Scale and Reliabilities (Tschannen-Moran and Woolfolk Hoy, 1998, 2001, 2002)

Directions for Scoring the Teachers' Sense of Efficacy Scale[1]

Developers: Megan Tschannen-Moran, College of William and Mary
Anita Woolfolk Hoy, the Ohio State University.

Construct Validity

For information the construct validity of the Teachers' Sense of Teacher efficacy Scale, see:

Tschannen-Moran, M., & Woolfolk Hoy, A. (2001). Teacher efficacy: Capturing and elusive construct. *Teaching and Teacher Education, 17,* 783-805.

Factor Analysis

It is important to conduct a factor analysis to determine how your participants respond to the questions. We have consistently found three moderately correlated factors: *Efficacy in Student Engagement, Efficacy in Instructional Practices*, and *Efficacy in Classroom Management*, but at times the make up of the scales varies slightly. With preservice teachers we recommend that the full 24-item scale (or 12-item short form) be used, because the factor structure often is less distinct for these respondents.

Subscale Scores

To determine the *Efficacy in Student Engagement, Efficacy in Instructional Practices*, and *Efficacy in Classroom Management* subscale scores, we compute unweighted means of the items that load on each factor. Generally these groupings are:

Long Form

Efficacy in Student Engagement:	Items 1, 2, 4, 6, 9, 12, 14, 22
Efficacy in Instructional Strategies:	Items 7, 10, 11, 17, 18, 20, 23, 24
Efficacy in Classroom Management:	Items 3, 5, 8, 13, 15, 16, 19, 21

Short Form

Efficacy in Student Engagement:	Items 2, 3, 4, 11
Efficacy in Instructional Strategies:	Items 5, 9, 10, 12
Efficacy in Classroom Management:	Items 1, 6, 7, 8

Reliabilities

In Tschannen-Moran, M., & Woolfolk Hoy, A. (2001). Teacher efficacy: Capturing and elusive construct. *Teaching and Teacher Education, 17,* 783-805, the following were found**:**

	Long Form			Short Form		
	Mean	SD	alpha	Mean	SD	alpha
OSTES	7.1	.94	.94	7.1	.98	.90
Engagement	7.3	1.1	.87	7.2	1.2	.81
Instruction	7.3	1.1	.91	7.3	1.2	.86
Management	6.7	1.1	.90	6.7	1.2	.86

[1] Because this instrument was developed at the Ohio State University, it is sometimes referred to as the *Ohio State Teacher Efficacy Scale*. We prefer the name, *Teachers' Sense of Efficacy Scale*.

APPENDIX D

Intrapersonal Technology Integration Scale (Niederhauser and Perkmen, 2008)

Technology Integration Scale

	Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
1. I feel confident that I have the necessary skills to use instructional technology for instruction.					
2. Using instructional technology in the classroom will make it easier for me to teach.					
3. I have an interest in reading articles or books about instructional technology.					
4. Using instructional technology in the classroom will increase my effectiveness as a teacher.					
5. I am interested in working with instructional technology tools.					
6. Using instructional technology in the classroom will make my teaching more exciting.					
7. I feel confident that I can effectively use instructional technology in my teaching.					
8. Effectively using instructional technology in the classroom will increase my sense of accomplishment.					
9. Using instructional technology in the classroom will make my teaching more satisfying.					
10. I feel confident that I can regularly incorporate appropriate instructional technologies into my lessons to enhance student learning.					
11. Effectively using instructional technology in the classroom will increase my colleagues' respect of my teaching ability.					

1

	Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
12. My colleagues will see me as competent if I effectively use instructional technology in the classroom.					
13. I feel confident that I can select appropriate instructional technology for instruction based on curriculum standards–based pedagogy.					
14. I have an interest in working on a project involving instructional technology concepts.					
15. Using instructional technology in the classroom will increase my productivity.					
16. I feel confident that I can teach relevant subject matter with appropriate use of instructional technology.					
17. I am interested in learning about new educational software.					
18. I feel confident that I can help students when they have difficulty with instructional technology.					
19. I have an interest in listening to a famous instructional technologist speaking about effective use of instructional technology in the classroom.					
20. Effectively using instructional technology in the classroom will increase my status among my colleagues.					
21. I have an interest in attending instructional technology workshops during my teaching career.					

APPENDIX E

Technological Pedagogical Content Knowledge Instrument (Schmidt, Baran, Thompson, Koehler, Mishra, and Shin, 2009-10)

Survey of Preservice Teachers' Knowledge of Teaching and Technology

Denise A. Schmidt, Evrim Baran, and Ann D. Thompson
Center for Technology in Learning and Teaching
Iowa State University

Matthew J. Koehler, Punya Mishra, and Tae Shin
Michigan State University

Usage Terms: Researchers are free to use the TPACK survey, provided they contact Dr. Denise Schmidt (dschmidt@iastate.edu) with a description of their intended usage (research questions, population, etc.), and the site locations for their research. The goal is to maintain a database of how the survey is being used, and keep track of any translations of the survey that exist.

Version 1.1: (updated September 1, 2009). This survey was revised to reflect research results obtained from its administration during the 2008-2009 and 2009-2010 academic years. This document provides the latest version of the survey and reports the reliability scores for each TPACK domain. (This document will be updated as the survey is further developed).

The following papers and presentations highlight the development process of this survey:

Schmidt, D. A., Baran, E., Thompson A. D., Koehler, M. J., Mishra, P. & Shin, T. (2009-10). Technological Pedagogical Content Knowledge (TPACK): The Development and Validation of an Assessment Instrument for Preservice Teachers. *Journal of Research on Technology in Education, 42*(2), 123-149.

Schmidt, D. A., Baran, E., Thompson A. D., Koehler, M. J., Mishra, P. & Shin, T. (2009). The Continuing Development, Validation and Implementation of a TPACK Assessment Instrument for Preservice Teachers. Paper submitted to the 2010 Annual Meeting of the American Educational Research Association. April 30-May 4, Denver, CO.

Schmidt, D., Baran, E., Thompson, A., Koehler, M.J., Shin, T, & Mishra, P. (2009, April). *Technological Pedagogical Content Knowledge (TPACK): The Development and Validation of an Assessment Instrument for Preservice Teachers.* Paper presented at the 2009 Annual Meeting of the American Educational Research Association. April 13-17,San Diego, CA.

Schmidt, D., Baran, E., Thompson, A., Koehler, M.J., Mishra, P., & Shin, T. (2009, March). *Examining preservice teachers' development of technological pedagogical content knowledge in an introductory instructional technology course.* Paper presented at the 2009 International Conference of the Society for the Information and Technology & Teacher Education. March 2-6, Charleston, SC.

Shin, T., Koehler, M.J., Mishra, P. Schmidt, D., Baran, E., & Thompson, A.,(2009, March). Changing technological pedagogical content knowledge (TPACK) through course experiences. Paper presented at the 2009 International Conference of the Society for the Information and Technology & Teacher Education. March 2-6, Charleston, SC.

How do I use the survey? The questions you want are most likely questions 1-46 starting under the header "TK (Technology Knowledge)". In the papers cited above, these categories were removed so that participants were not oriented to the constructs when answering the survey questions. The items were presented in order from 1 through 46, however. The other items are more particular to individual study and teacher education context to better understand results found on questions 1-46. You are free to use them, or modify them. However, they are not the core items used to measure the components of TPACK.

How do score the survey. Each item response is scored with a value of 1 assigned to strongly disagree, all the way to 5 for strongly agree. For each construct the participant's responses are averaged. For example, the 6 questions under TK (Technology Knowledge) are averaged to produce one TK (Technology Knowledge) Score.

Reliability of the Scores (from Schmidt et al, 2009).

TPACK Doman	Internal Consistency (alpha)
Technology Knowledge (TK)	.86
Content Knowledge (CK)	
Social Studies	.82
Mathematics	.83
Science	.78
Literacy	.83
Pedagogy Knowledge (PK)	.87
Pedagogical Content Knowledge (PCK)	.87
Technological Pedagogical Knowledge (TPK)	.93
Technological Content Knowledge (TCK)	.86
Technological Pedagogical Content Knowledge (TPACK)	.89

Thank you for taking time to complete this questionnaire. Please answer each question to the best of your knowledge. Your thoughtfulness and candid responses will be greatly appreciated. Your individual name or identification number will not at any time be associated with your responses. Your responses will be kept completely *<u>confidential</u>* *and will not influence your course grade.*

DEMOGRAPHIC INFORMATION

1. Your ISU e-mail address

2. Gender
   a. Female
   b. Male

3. Age range
   a. 18-22
   b. 23-26
   c. 27-32
   d. 32+

4. Major
   a. Early Childhood Education (ECE)
   b. Elementary Education (ELED)
   c. Other

5. Area of Specialization
   a. Art
   b. Early Childhood Education Unified with Special Education
   c. English and Language Arts
   d. Foreign Language
   e. Health
   f. History
   g. Instructional Strategist: Mild/Moderate (K8) Endorsement
   h. Mathematics
   i. Music
   j. Science-Basic
   k. Social Studies
   l. Speech/Theater
   m. Other

6. Year in College
   a. Freshman
   b. Sophomore
   c. Junior
   d. Senior

7. Are you completing an educational computing minor?
   a. Yes
   b. No

8. Are you currently enrolled or have you completed a practicum experience in a PreK-6 classroom?
   a. Yes
   b. No

9. What semester and year (e.g. Spring 2008) do you plan to take the following? If you are currently enrolled in or have already taken one of these literacy blocks please list semester and year completed

Literacy Block-I (C I 377, 448, 468A, 468C)	
Literacy Block-II (C I 378, 449, 468B, 468D)	
Student teaching	

Technology is a broad concept that can mean a lot of different things. For the purpose of this questionnaire, technology is referring to digital technology/technologies. That is, the digital tools we use such as computers, laptops, iPods, handhelds, interactive whiteboards, software programs, etc. Please answer all of the questions and if you are uncertain of or neutral about your response you may always select "Neither Agree or Disagree"

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
TK (Technology Knowledge)					
1. I know how to solve my own technical problems.					
2. I can learn technology easily.					
3. I keep up with important new technologies.					
4. I frequently play around the technology.					
5. I know about a lot of different technologies.					
6. I have the technical skills I need to use technology.					
CK (Content Knowledge)					
Mathematics					
7. I have sufficient knowledge about mathematics.					
8. I can use a mathematical way of thinking.					
9. I have various ways and strategies of developing my understanding of mathematics.					
Social Studies					
10. I have sufficient knowledge about social studies.					
11. I can use a historical way of thinking.					
12. I have various ways and strategies of developing my understanding of social studies.					
Science					
13. I have sufficient knowledge about science.					
14. I can use a scientific way of thinking.					
15. I have various ways and strategies of developing my understanding of science.					
Literacy					
16. I have sufficient knowledge about literacy.					
17. I can use a literary way of thinking.					
18. I have various ways and strategies of developing my understanding of literacy.					

PK (Pedagogical Knowledge)					
19. I know how to assess student performance in a classroom.					
20. I can adapt my teaching based-upon what students currently understand or do not understand.					
21. I can adapt my teaching style to different learners.					
22. I can assess student learning in multiple ways.					
23. I can use a wide range of teaching approaches in a classroom setting.					
24. I am familiar with common student understandings and misconceptions.					
25. I know how to organize and maintain classroom management.					

PCK (Pedagogical Content Knowledge)					
26. I can select effective teaching approaches to guide student thinking and learning in mathematics.					
27. I can select effective teaching approaches to guide student thinking and learning in literacy.					
28. I can select effective teaching approaches to guide student thinking and learning in science.					
29. I can select effective teaching approaches to guide student thinking and learning in social studies.					
TCK (Technological Content Knowledge)					
30. I know about technologies that I can use for understanding and doing mathematics.					
31. I know about technologies that I can use for understanding and doing literacy.					
32. I know about technologies that I can use for understanding and doing science.					
33. I know about technologies that I can use for understanding and doing social studies.					

TPK (Technological Pedagogical Knowledge)					
34. I can choose technologies that enhance the teaching approaches for a lesson.					
35. I can choose technologies that enhance students' learning for a lesson.					
36. My teacher education program has caused me to think more deeply about how technology could influence the teaching approaches I use in my classroom.					
37. I am thinking critically about how to use technology in my classroom.					
38. I can adapt the use of the technologies that I am learning about to different teaching activities.					
39. I can select technologies to use in my classroom that enhance what I teach, how I teach and what students learn.					
40. I can use strategies that combine content, technologies and teaching approaches that I learned about in my coursework in my classroom.					
41. I can provide leadership in helping others to coordinate the use of content, technologies and teaching approaches at my school and/or district.					
42. I can choose technologies that enhance the content for a lesson.					

TPACK (Technology Pedagogy and Content Knowledge)					
43. I can teach lessons that appropriately combine mathematics, technologies and teaching approaches.					
44. I can teach lessons that appropriately combine literacy, technologies and teaching approaches.					
45. I can teach lessons that appropriately combine science, technologies and teaching approaches.					
46. I can teach lessons that appropriately combine social studies, technologies and teaching approaches.					

Models of TPACK (Faculty, PreK-6 teachers)					
47. My mathematics education professors appropriately model combining content, technologies and teaching approaches in their teaching.					
48. My literacy education professors appropriately model combining content, technologies and teaching approaches in their teaching.					
49. My science education professors appropriately model combining content, technologies and teaching approaches in their teaching.					
50. My social studies education professors appropriately model combining content, technologies and teaching approaches in their teaching.					
51. My instructional technology professors appropriately model combining content, technologies and teaching approaches in their teaching.					
52. My educational foundation professors appropriately model combining content, technologies and teaching approaches in their teaching.					
53. My professors outside of education appropriately model combining content, technologies and teaching approaches in their teaching.					
54. My PreK-6 cooperating teachers appropriately model combining content, technologies and teaching approaches in their teaching.					

	25% or less	*26% - 50%*	*51% - 75%*	*76%-100%*
Models of TPCK				
55. In general, approximately what percentage of your teacher education professors have provided an effective model of combining content, technologies and teaching approaches in their teaching?				
56. In general, approximately what percentage of your professors outside of teacher education have provided an effective model of combining content, technologies and teaching approaches in their teaching?				
57. In general, approximately what percentage of the PreK-6 cooperating teachers have provided an effective model of combining content, technologies and teaching approaches in their teaching?				

Please complete this section by writing your responses in the boxes.

73. Describe a specific episode where an ISU professor or instructor effectively demonstrated or modeled combining content, technologies and teaching approaches in a classroom lesson. Please include in your description what content was being taught, what technology was used, and what teaching approach(es) was implemented.

74. Describe a specific episode where one of your PreK-6 cooperating teachers effectively demonstrated or modeled combining content, technologies and teaching approaches in a classroom lesson. Please include in your description what content was being taught, what technology was used, and what teaching approach(es) was implemented. If you have not observed a teacher modeling this, please indicate that you have not.

75. Describe a specific episode where you effectively demonstrated or modeled combining content, technologies and teaching approaches in a classroom lesson. Please include in your description what content you taught, what technology you used, and what teaching approach(es) you implemented. If you have not had the opportunity to teach a lesson, please indicate that you have not.

APPENDIX F

Email Sent to Professors and Undergraduate List Serv.

From: Stewart, Jessica
Sent: Friday, February 03, 2012 2:54 PM
To: Robinson, Shane
Cc: Edwards, Craig
Subject: Use of Technology by Agricultural Educators in Oklahoma survey

Please forward the information below to the undergraduate agricultural education student listserv. Thank you kindly.

Jessica

Dear Agricultural Education Students:

I am an Oklahoma State University Educational Technology Master's student conducting research on the use of technology by agricultural educators in the state of Oklahoma. I invite you to participate in a 20-minute survey that will ask you to provide responses regarding your experiences and preparedness to use digital tools in the agricultural education classroom. At the end of the survey, you will have the option to provide your e-mail address, if you would like it to be entered in a drawing for a getaway package for two in Oklahoma (e-mail addresses are collected separately from responses).

If you would like to participate, please find the link to the anonymous online survey below. The link will take you to an information page providing more details about the research that will allow you to make an informed decision to participate.

http://tinyurl.com/osu-ag-survey

If you would prefer to complete a paper copy of the survey, please e-mail your mailing address to jessica.stewart@okstate.edu and a paper copy of the survey will be mailed to you. A separate form will be used to collect your e-mail address if you would like to be entered in the drawing. This form will be immediately separated from your response to maintain the anonymity of data collection.

Thank you for considering participating in this study!

Jessica Stewart
Educational Technology Master's student
Oklahoma State University
139 Agricultural Hall, Stillwater, OK 74078
405-744-6638
jessica.stewart@okstate.edu

Advisor: Dr. Pasha Antonenko, 405-744-8003, pasha.antonenko@okstate.edu

Agricultural Education cooperating faculty:
Dr. Shane Robinson, 405-744-3094, shane.robinson@okstate.edu
Dr. M. Craig Edwards, 405-744-8141, craig.edwards@okstate.edu

APPENDIX G

Second email sent to participants

Dear Participant:

This is just a reminder if you have not yet filled out this survey regarding technology use in agricultural education. I appreciate your response, and I want to say thank you (very much!) to those who have already responded to the survey.

I am an Oklahoma State University Educational Technology Master's student conducting research on the use of technology by agricultural educators in the state of Oklahoma. I invite you to participate in a 20-minute survey that will ask you to provide responses regarding your experiences and preparedness to use digital tools in the agricultural education classroom. At the end of the survey, you will have the option to provide your e-mail address, if you would like it to be entered in a drawing for a getaway package for two in Oklahoma (e-mail addresses are collected separately from responses).

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Agricultural Education cooperating faculty:
Dr. Shane Robinson, 405-744-3094, shane.robinson@okstate.edu
Dr. M. Craig Edwards, 405-744-8141, craig.edwards@okstate.edu

VITA

Jessica Lea Stewart

Candidate for the Degree of

Master of Science

Thesis: INTRAPERSONAL FACTORS AFFECTING TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE IN OKLAHOMA AGRICULTURAL EDUCATION TEACHERS

Major Field: Educational Technology

Biographical:

Education:

Completed the requirements for the Master of Science in Educational Technology at Oklahoma State University, Stillwater, Oklahoma in December 2012.

Completed the requirements for the Bachelor of Science in Agricultural Communications at Oklahoma State University, Stillwater, Oklahoma, in 2007.

Experience:

May 2012-Present, Grant Coordinator, New Product Development Center and Inventor's Assistance Services, Oklahoma State University, Stillwater, Oklahoma.

October 2011-May 2012, Graduate Coordinator, Master of International Agriculture Program, Oklahoma State University, Stillwater, Oklahoma.

February 2008-October 2011, Marketing Coordinator, Oklahoma 4-H Youth Development Programs, Oklahoma State University, Stillwater, Oklahoma.

Professional Memberships: Phi Kappa Phi, The Golden Key Honor Society