

An Evaluation of the Self-Efficacy Theory in Agricultural Education

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Abstract

This research sought to evaluate the use of the self-efficacy theory in agricultural education. A total of 30 studies, published between 1997 and 2013 using self-efficacy as a theoretical foundation were compiled and analyzed. The findings of these studies were compared to expected outcomes identified by the self-efficacy theory, specifically the positive relationship between Bandura's four identified self-efficacy building experiences and increased self-efficacy as well as the relationship between self-efficacy and career persistence. This synthesis highlights important considerations for the use of self-efficacy theory in agricultural education, including a shift from mastery experiences to vicarious experiences in the teacher development process and specific considerations for the establishment of social persuasion between cooperating and student teachers. Finally, based on the comparison of past research in agricultural education and self-efficacy theory, recommendations are made for future research that will continue the articulation of this theory in both research and practice within agricultural education.

Keywords: self-efficacy, teacher development, career commitment.

Introduction

In his book, *Structure of Scientific Revolutions*, Thomas Kuhn (2012) suggested scientific progress stems from the continual re-evaluation of theoretical foundations within an academic discipline. Kuhn posited that through continual reevaluation of theoretical foundations, researchers can identify anomalous results that provide a context to progress a foundational theory closer to reality. In agricultural education, self-efficacy theory (Bandura, 1977b, 1986, 1997) has played a foundational role in research conducted on agriculture teacher development as well as teacher attrition. The purpose of our study is to utilize self-efficacy research conducted in agricultural education to reevaluate the use of self-efficacy theory in the agricultural education discipline.

The self-efficacy theory originated from Bandura's early work developing the social learning theory (1977a). The social learning theory was a rebuttal to learning theorists' focus on learning through behaviorism and the consequent exclusion of social interaction as a determinant of learning (Bandura 1977a). In his social learning theory, Bandura posited human behavior was reciprocally determined by three factors: (a) the environment, (b) previous behavior, and (c) personal characteristics. From his theoretical ideas surrounding behavior, Bandura developed the concept of self-efficacy. Bandura defined self-efficacy as, "peoples judgments of their capabilities to organize and execute courses of action required to attain designated types of performances" (1986, p. 391). Self-efficacy was Bandura's answer to the question of how behavior changes.

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Bandura (1986) thought behavior, or intention to behave a certain way, changed with experience. Specifically, Bandura conceptualized four experiences critical to the development of an individual's self-efficacy, and therefore behavior. The first, and as Bandura identified the most powerful, of these experiences are mastery experiences. Mastery experiences refer to an individual successfully accomplishing a given behavior. Bandura noted that once an individual was successful in accomplishing a behavior, that individual would be more likely to attempt the task again and find success. Vicarious experiences, the second strongest developer of self-efficacy, entail an individual observing another individual successfully accomplish a given behavior. Bandura described many important considerations when evaluating vicarious experiences, for example, the more the observing individual perceives him- or herself as similar to the observed individual, the more powerful the vicarious experiences are. Social persuasion, the third self-efficacy builder identified by Bandura (1986), refers to the impact of others on one's self-efficacy. More specifically, the concept of social persuasion states that if an individual were to receive verbal support from others in their environment (e.g., someone stating "I know you can do this" as the individual considers a task) their self-efficacy would increase. The final self-efficacy builder identified by Bandura, physiological and emotional states, acknowledges the importance of internal states to an individual's self-efficacy. Bandura posited that if an individual experienced, for example, excessive nerves or sweaty palms when considering a task, this individual's self-efficacy could be reduced. The following table, developed from a synthesis of relevant literature (Bandura, 1997, 1986; Tschannen-Moran, Woolfolk Hoy, & Hoy, 1998; Wolf, Foster, & Birkenholz, 2010), describes the application of the four self-efficacy developing experiences and an example of their application in teacher development (see Table 1).

Table 1
Description of Self-Efficacy Building Experiences and Examples in Teacher Development

Experience	Definition	Teacher Development Examples
Mastery	Successfully accomplishing the task.	Student teaching, early field experiences, peer teaching
Vicarious	Observing someone else successfully accomplish the task.	Observing peers teach, observing early career teachers, observing videos of teachers
Social Persuasion	Encouragement or feedback on your ability to accomplish the task.	Communication with cooperating teacher, peer encouragement, feedback from teacher educator
Physiological and Emotional States	Internal state and emotions when considering or completing the task.	Occurs when contemplating or completing any task associated with teaching

In addition to the developmental components of self-efficacy, Bandura postulated the impact of self-efficacy on an individual's persistence in a given task (Bandura, 1977, 1986, 1997). Bandura identified individuals anticipate challenges associated with tasks they are considering attempting. If an individual perceives the challenges associated with a task as being greater than his or her perceived abilities (i.e., self-efficacy), this individual is at a high risk to not attempt the task or discontinue their involvement in future tasks they perceive as similar. Alternatively, if an individual perceives his or her abilities related to a given task as higher than the perceived challenges, this individual is more likely to persist in the task.

Educational research picked up on the value of using the concept of self-efficacy in the development and success of teachers (Tschannen-Moran et al., 1998). In education, the self-efficacy of a teacher, or teacher self-efficacy, is identified as a teacher's belief in his or her abilities to execute the tasks associated with teaching (Tschannen-Moran et al., 1998). Teacher self-efficacy research has identified positive relationships between teachers' self-efficacy and their intention to remain in the teaching profession, persistence when working with difficult students, and overall effectiveness as a teacher (Tschannen-Moran et al., 1998).

Within the field of agricultural education, self-efficacy research originated with a doctoral dissertation completed by Juan Rodriguez (1997) and has spanned to recent publications in the *Journal of Agricultural Education* (Stripling & Roberts, 2013a; 2013b). The research in agricultural education mirrors the dualistic nature of the theory of self-efficacy, addressing both the development of and outcomes associated with agriculture teachers' self-efficacy. With more than 17 years of research in agricultural education contributing to our knowledge of self-efficacy, an evaluation of the current state and future directions of the self-efficacy theory is needed. Furthermore, given self-efficacy research in agricultural education is often limited in scope and generalizability; we feel a synthesis of the research allows for a clarifying look at commonalities and conflicts within findings and gives readers a better understanding of how self-efficacy theory can be applied to both research and practice throughout agricultural education.

Purpose and Objectives

The purpose of this research was to describe the contributions of previous research in agricultural education as they inform our current understanding of self-efficacy theory in the agricultural education discipline. Furthermore, this research sought to provide future directions for self-efficacy research within agricultural education. This research addresses National Research Agenda priority area number five, efficient and effective agricultural education programs (Doerfert, 2011). By evaluating the current state and future directions of self-efficacy theory, we are providing an important synthesis of information related to the development of teachers' confidence in their abilities to teach agriculture effectively and their commitment to the agriculture teaching profession. The following research objectives were developed to guide our work.

Using research conducted in agricultural education related to self-efficacy:

1. Analyze the use of mastery experiences, vicarious experiences, social persuasion, and physiological and emotional states in the development of agriculture teachers;
2. Analyze evidence of the relationship between agriculture teachers' self-efficacy and their persistence in the agriculture teaching profession; and
3. Describe areas of research necessary for the continual development of self-efficacy theory within the agricultural education profession.

Methods

Data Collection

Using the *Journal of Agricultural Education*, *Academic Search Premier*, *Regional and National Agricultural Education Conference Proceedings*, the *Journal of Southern Agricultural Education Research*, and Google Scholar, researchers collected 30 studies conducted in agricultural education, published between 1997 and 2013, that utilized the concept of self-efficacy as a theoretical foundation. The 30 studies were reviewed and categorized by their investigation of the development of self-efficacy or outcomes associated with self-efficacy, specifically the relationship between self-efficacy and agriculture teachers' persistence in the profession.

Data Analysis

For both categories of studies, research addressing the development of self-efficacy and research addressing the outcomes associated with self-efficacy, a content analysis was conducted. A content analysis is defined as "...a careful, detailed, systematic examination and interpretation of a particular body of material in an effort to identify patterns, themes, biases, and meanings" (Berg, 2007, pp. 303-304). We systematically analyzed the findings of each study by comparing them to the theoretical postulations forwarded within self-efficacy theory. Once each study was analyzed in light of the self-efficacy theory, we looked across studies to identify commonalities and conflicts, both of which are highlighted in our findings. Through this process, researchers also identified areas of self-efficacy theory not yet investigated in agricultural education that, if researched, would continue the development of this theory within the field of agricultural education.

Findings and Discussion

Our discussion of previous research studies in agricultural education and their relationship to the self-efficacy theory is separated into two major themes: the development of self-efficacy and the relationship between self-efficacy and agriculture teachers' persistence in the teaching profession. We will first focus on the development of self-efficacy. This discussion is broken into four parts, which relate to the four self-efficacy building experiences put forth by Bandura (1977, 1986). Furthermore, to improve the flow of information, we merged the findings and discussion sections of this paper. While we acknowledge this is atypical, we feel it provides readers with evidence of how our discussion directly links to previous research within agricultural education.

Development of Self-Efficacy: Mastery Experiences

Throughout the teacher development process there are a variety of opportunities for mastery experiences related to teaching (Tschannen-Moran et al., 1998). Within agricultural education, the first opportunities for teachers to engage in mastery experiences are early field experiences and peer teaching. In a 2001 study, Knobloch analyzed the impact of an early field experience in which, among other tasks, students "assisted their cooperating teacher with teaching or facilitating responsibilities" and a peer teaching experience in which teams of students taught their peers using a variety of teaching strategies. The study conducted by Knobloch identified early field experiences were not significantly related to preservice teachers' teaching efficacy, but peer teaching was significantly related to increased levels of teaching efficacy for one of the two groups analyzed.

In addition to the Knobloch study, the peer teaching experience was tested as a component of a recent evaluation of the development of agriculture teachers' general and mathematics teaching efficacy (Stripling & Roberts, 2013a, 2013b). In this quasi-experimental study, preservice teachers in the treatment group were required to teach their peers two math-enhanced micro-teaching lessons. The research conducted by Stripling and Roberts found this treatment was ineffective at significantly improving the personal or mathematics teaching efficacy of preservice agriculture teachers.

Researchers in agricultural education have also investigated potential mastery experiences during student teaching. Student teaching is designed to offer students practical, mastery experiences as teachers (Tschannen-Moran et al., 1998; Wolf et al., 2010). Research conducted by Wolf et al. (2010) found teaching additional courses during student teaching was related to lower levels of classroom management efficacy. Furthermore, a study of first through third year teachers conducted by Whittington, McConnell, and Knobloch (2006) found the number of classes taught was negatively correlated with the teaching efficacy of first through third year agriculture teachers.

The research in agricultural education exploring specific mastery experiences and their relationship with agriculture teachers' self-efficacy has highlighted important considerations for the use of the Self-Efficacy Theory in agricultural education. First, it is important to acknowledge that for mastery experiences to have a positive influence on self-efficacy, they must be perceived as positive by the individual (Bandura, 1977, 1986, 1997). This brings about a major concern in teacher preparation; increased self-efficacy leads to success, yet success is required to build self-efficacy. This concern may explain why previous research in agricultural education has found a negative relationship between additional preservice teaching experience and self-efficacy (Whittington et al., 2006; Wolf et al., 2010). In light of these findings, we suggest there is a potential for mastery experience overload among preservice teachers. Preservice teachers may not have had the opportunity to build their self-efficacy through mastery teaching experience; therefore, when they are presented with the potential for additional mastery experiences, in the form of additional courses to teach, they are susceptible to additional challenges and failure resulting in reduced self-efficacy.

Development of Self-Efficacy: Vicarious Experiences

In the absence of mastery experiences, vicarious experiences can be extremely powerful builders of self-efficacy (Bandura, 1977). However, research in agricultural education focused on the development of self-efficacy through vicarious experiences is limited. Two studies, discussed in the previous section, have investigated the impact of peer teaching experiences on preservice agriculture teachers' self-efficacy. The peer teaching experience offers a combination of both mastery and vicarious experiences as students both teach (mastery experience) and observe their peers teach (vicarious experience). Therefore, the findings from these studies will also be considered in this discussion. One additional study has addressed the relationship between specific vicarious experiences and preservice agriculture teachers' self-efficacy (Wolf et al., 2010). This research found the vicarious experiences of observing a first year agriculture teacher, observing another student teacher, observing a non-agriculture teacher, observing their cooperating teacher, and observing an agriculture teacher other than their cooperating teacher were all positively correlated with student teachers' general teaching efficacy. Furthermore, the most powerful of these experiences, observing a first year agriculture teacher, was found to explain 11% of the variance in general teacher efficacy.

These findings support Bandura's position on the positive effect of vicarious experiences in the absence of mastery experience (Bandura, 1977). The limited research in agricultural education supports the idea that vicarious experiences, when considered without the presence of mastery experiences, are positively related to the teaching efficacy of agriculture teachers.

Development of Self-Efficacy: Social Persuasion

Research in agricultural education evaluating the impact of social persuasion on agriculture teachers' self-efficacy is sparse. In a 2007 study conducted by Edgar, Roberts, and Murphy, the type of social persuasion provided by student teachers' cooperating teacher was evaluated. In this quasi-experimental study, a structured communication tool outlining "12 sections of accomplished practices of the student teacher" (p. 22) was given to cooperating teachers. Cooperating teachers were asked to rate students in each of the twelve fields as well as provide feedback for each of the areas. When compared to a control group, the presence of this structured communication tool was detrimental to the teaching efficacy of these student teachers. The research team of Roberts, Harlin, and Briers (2008) also assessed the potential influence of social persuasion, through a peer student teacher, on a student teacher's self-efficacy. Roberts et al. (2008) found that placing two student teachers within the same student teaching experience, at the same time, did not result in increased

self-efficacy gains when compared to a student teacher completing their experience without a peer student teacher.

Research conducted by Wolf et al. (2010) also evaluated the impact of social persuasion on student teachers in agricultural education. This research team found both written and verbal feedback from the cooperating teacher was positively correlated with the teaching efficacy of student teachers. The strongest of these communication types, verbal feedback, explained 10% of the variance in student teachers' general teaching efficacy. Alternatively, being observed by another student teacher, which the researcher categorized as social persuasion, did not have a significant relationship with student teachers' general teaching efficacy.

The research conducted in agricultural education on the relationship between social persuasion and teaching efficacy provides important insight into the role of social persuasion in the development of agriculture teachers. Research conducted by Wolf et al. (2010) supports the inclusion of social persuasion as a self-efficacy builder; however, additional research on social persuasion in agricultural education (Edgar et al., 2007; Roberts et al., 2008; Wolf et al., 2010) provide clarifying structure toward the type of social persuasion that supports the development of self-efficacy among student teachers.

Development of Self-Efficacy: Physiological and Emotional States

Agricultural education research has not yet assessed the role of physiological and emotional states as an influential factor to the development of agricultural education teachers' self-efficacy. Wolf et al. (2010) establish that physiological and emotional states are not assessed "as it is a construct that does not lend itself to measurement on a survey instrument" (p. 42). However, as we continue to develop the use of self-efficacy theory in agricultural education, consideration must be given to methods for measuring physiological and emotional states and their relationship to the development of self-efficacy among preservice and practicing agriculture educators.

The majority of research in agricultural education evaluating the development of teachers' self-efficacy has looked at the relationship between teachers' perception of a broad experience (e.g., student teaching) and their self-efficacy. These studies have identified a positive relationship between teachers' self-efficacy and their perception of student teaching (Knobloch, 2006; Knobloch & Whittington, 2002; Whittington et al., 2006; Wolf, 2008), teacher preparation (Knobloch, 2006), and the first year of teaching agriculture (Wolf, 2008). These studies provide valuable insight into the importance of having positive teacher development experiences; however, they fail to identify specific experiences related to increased levels of self-efficacy. Therefore, as we discussed the development of agriculture teachers' self-efficacy, our focus centered on those studies which have analyzed specific experiences and their relationship with preservice and practicing agriculture teachers' self-efficacy.

Outcomes of Self-Efficacy: Persistence in the Agriculture Teaching Profession

One of the aspects of self-efficacy theory that makes it appealing to researchers in agricultural education is the relationship between self-efficacy and persistence in a given task. For a number of years, agricultural education has suffered a shortage of agriculture teachers (Kantrovich, 2010), a shortage often attributed, in part to teachers' persistence. Researchers in agricultural education have utilized self-efficacy theory as a theoretical foundation for the investigation into why agriculture teachers' are leaving the profession. Knobloch and Whittington (2003a) pioneered this research with an investigation of the relationship between self-efficacy and career commitment. This study found teachers with higher career commitment are more likely to maintain a steady level of self-efficacy, while teachers with a lower career commitment are more likely to experience declines in their self-efficacy.

Additional research in agricultural education has analyzed the relationship between self-efficacy and career commitment (Blackburn & Robinson, 2008; Swan, 2005; Wheeler & Knobloch, 2006). The work completed by Swan (2005) found 17% of the variance in career intent could be attributed to the perceived efficacy of student teachers. Additionally, the research completed by Wheeler and Knobloch (2006) supports the idea of agriculture teachers' self-efficacy being positively related to career commitment. Furthermore, when studying the job satisfaction of Kentucky agriculture teachers, Blackburn and Robinson (2008) identified a positive relationship between self-efficacy and job satisfaction. The research completed in agricultural education supports the theorized relationship between self-efficacy and persistence in a given task.

Our discussion of the research studies conducted in agricultural education focused on studies addressing specific components of the theory of self-efficacy. However, we acknowledge research in agricultural education using self-efficacy as a theoretical foundation includes far more lines of inquiry. Therefore, we have synthesized these studies and provide the population, self-efficacy instrument, and selective findings for the 30 identified studies conducted in agricultural education and provide this information in Table 2.

Table 2
History of Self-Efficacy Research in Agricultural Education

Author(s), Year	Population	Teacher Efficacy Instrument Used	Findings
Rodriguez, 1997	Preservice through second year agriculture teachers in Ohio during the 1996-1997 school year.	Teacher Self Efficacy Scale (short form) (Hoy & Woolfolk, 1993)	Field dependent learning style yielded higher perceived efficacy scores than field independent or field neutral. Learning style was measured using the Group Embedded Figures Test.
Knobloch, 2001	Two groups of preservice agricultural education students enrolled in a foundational agricultural education class.	Teacher Self Efficacy Scale (short form) (Woolfolk & Hoy, 1990)	One group experienced a significant increase in perceived personal teaching efficacy after peer teaching, the other group did not. Neither group experienced an increase in perceived efficacy after their early field experience.
Knobloch & Whittington, 2002	Student teachers through third year agriculture teachers in Ohio during the 2001-2002 school year.	The Ohio State Teacher Sense of Efficacy Scale (TSES) (Tschannen-Moran & Woolfolk Hoy, 2001)	Collective teacher efficacy accounted for 10.8% of the variation in perceived efficacy, teacher support accounted for 1.0% of perceived efficacy, and perception of student teaching accounted for 2.8% of perceived efficacy.
Knobloch & Whittington, 2003a	First through third year agriculture teachers in Ohio during the 2001-2002 school year.	TSES	After ten weeks of teaching, the perceived efficacy of a low career commitment group dropped while the perceived efficacy of a high career commitment group remained the same.
Knobloch & Whittington, 2003b; Knobloch, 2002	Student teachers through third year agriculture teachers in Ohio during the 2001-2002 school year.	Questionnaire developed based on Bandura's concept of self-efficacy and Darling-Hammonds (1999) review of effective teacher qualities.	After the initial ten weeks of school, student teachers were found to have the highest sense of efficacy while first year teachers were found to have the lowest sense of efficacy.
Swan, 2005	Preservice agricultural education students at The Ohio State University in 2004.	TSES	Learning style did not relate to perceived efficacy. This study found 17% of the variance in career intent was associated with self-efficacy.
Whittington, McConnell, & Knobloch, 2006	Ohio agriculture teachers in their first three years of teaching in 2002.	TSES	Perceiving the student teaching experience as excellent was a significant, positive predictor of teacher efficacy. Number of class preparations was a significant, negative predictor of teacher efficacy.

Table 2 (continued)
History of Self-Efficacy Research in Agricultural Education

Author(s), Year	Population	Teacher Efficacy Instrument Used	Findings
Knobloch, 2006	Student teachers at The Ohio State University and University of Illinois during the 2001-2002 school year.	TSES	Those student teachers who perceived their teacher prep programs positively had a higher sense of efficacy. The two groups had similar perceived efficacy throughout the student teaching experience.
Roberts, Harlin, & Ricketts, 2006	Student teachers at Texas A&M in the 2004 Fall cohort.	TSES	Perceived efficacy increased during a four week on-campus experience, then dropped halfway through student teaching, but rebounded by the end of the student teaching experience. Perceived student engagement efficacy dropped during student teaching.
Rocca & Washburn, 2006	Agriculture teachers in their first five years of teaching in Florida during the 2003-2004 school year.	TSES	Alternatively certified teachers were, on average, 10 years older than traditionally certified teachers, with an average of 12 more years of agricultural experience. Alternatively and traditionally certified teachers were equally efficacious.
Duncan & Ricketts, 2006	Middle school and/or high school agriculture teachers in a southern state during the 2004-2005 school year.	Researcher developed instrument measuring self-efficacy in four areas specific to agricultural education.	Traditionally certified teachers had higher self-efficacy scores in the following areas: content knowledge, FFA/SAE/Leadership Development, program management. Similar efficacy was observed in teaching and learning.
Wheeler & Knobloch, 2006	Illinois agriculture teachers in the first four years of teaching during the 2002-2003 school year.	TSES	Teaching experience was negatively correlated with perceived efficacy. Contract length, career commitment, student enrollment, and teaching experience explained 11% of the variation in teachers' sense of efficacy.
Harlin, Roberts, Briers, Mowen, & Edgar, 2007	Student teachers at Tarleton State, Texas A&M, Texas Tech, and Oklahoma State in 2005.	TSES	Teachers' sense of efficacy increased through a four week on-campus experience, declined to its lowest level at the mid-point of student teaching, and rebounded to the highest level at the end of student teaching.
Hamilton & Swartzel, 2007	Mississippi agriculture teachers participating in a GIS/GPS workshop in 2006.	Science Teaching Efficacy Belief Instrument (Riggs & Enochs, 1990)	Mississippi agriculture teachers in this study identified a high self-efficacy toward teaching science. A low, negative relationship was found between agriculture teachers' science teaching self-efficacy and capacity to teach science integrated process skills.

Table 2 (continued)
History of Self-Efficacy Research in Agricultural Education

Author(s), Year	Population	Teacher Efficacy Instrument Used	Findings
Edgar, Roberts, & Murphy, 2007	Student teachers at Texas A&M during the 2004, 2005, and 2006 Fall cohorts.	TSES	Structured communication with the cooperating teacher yielded a lower perception of efficacy while the perceived efficacy in the unstructured group increased.
Roberts, Mowen, Edgar, Harlin, & Briers, 2007	Student teachers at Texas A&M during the 2005 Spring and Fall semesters.	TSES	Researchers observed a dip in perceived efficacy at the mid-point of student teaching. Researchers found the personality type “sensing” was negatively correlated with instructional strategies efficacy and the personality type “judging” was positively related to classroom management efficacy.
Wolf, 2008, 2011	Agriculture teachers in Ohio who had been licensed though The Ohio State University teaching four years or less in 2008.	Researcher designed instrument used to collect agriculture teachers’ sense of efficacy in classroom, FFA, and SAE.	Highest level of perceived efficacy found in the classroom domain, lowest sense of efficacy in the SAE domain. Teachers’ perception of their student teaching and first year of teaching were positively correlated with perceived efficacy.
Roberts, Harlin, & Briers, 2008	Texas A&M student teachers from 2004 to 2006.	TSES	Student teachers paired with another student teacher within the same experience had statistically similar self-efficacy development trajectories to those student teachers completing their experience individually.
Blackburn & Robinson, 2008	Agriculture teachers in Kentucky in their first six years of teaching.	TSES	Teachers with three to four years of teaching experience had the lowest self-efficacy and job satisfaction scores. Perceived efficacy was positively correlated with overall job satisfaction.
Stripling, Ricketts, Roberts, & Harlin, 2008	University of Georgia and Texas A&M University students from the Fall of 2004 to the Spring of 2006.	TSES	Preservice students’ perceived teaching efficacy increased at each point of data collection: before teaching methods class, after teaching methods class, and after student teaching.

Table 2 (continued)
History of Self-Efficacy Research in Agricultural Education

Author(s), Year	Population	Teacher Efficacy Instrument Used	Findings
Wolf, Foster, & Birkenholz, 2010	Student teachers at The Ohio State University during the 2007 Fall term.	TSES	Vicarious experiences accounted for the strongest relationship with perceived efficacy. Specifically, observing a first year teacher accounted for 11% of perceived efficacy and 14% of the perceived instructional strategies efficacy. Cooperating teacher feedback was positively correlated with perceived efficacy. The number of courses taught was negatively correlated with classroom management efficacy.
Aschebrener, Garton, & Ross, 2010	Early career agriculture teachers in Missouri during the 2006-2007 school year.	Modified version of working with diverse students scale (Brownell & Pajares, 1999).	Perceived efficacy accounted for 14% of the variance in teachers' self-perceived success working with students with special needs.
Burris, McLaughlin, McCulloch, Brashears, & Fraze, 2010	First and fifth year agriculture teachers in Texas during the 2006-2007 school year.	General and personal teacher self-efficacy through the Teacher Self Efficacy Scale (Woolfolk & Hoy, 1990).	Fifth year agriculture teachers were more efficacious in: personal teaching, general teaching and in five areas of specific agriculture content knowledge. The differences in self-efficacy between the two groups were considered "small."
Hartfield, 2011	Agriculture teachers in Arizona during the 2010-2011 school year.	Agriculture Teacher Self-Efficacy Scale (Wolf, 2008)	Experienced teachers were more efficacious in the classroom, FFA and SAE domains when compared to Arizona teachers with five years, or less, experience.
Swan, Wolf, & Cano, 2011	Longitudinal study of The Ohio State University's 2004 Fall agriculture student teaching cohort.	TSES	The lowest point of self-efficacy was after the first year of teaching, the highest point of self-efficacy was after the student teaching experience. Student engagement was the lowest self-efficacy domain throughout the study.
Stripling & Roberts, 2012	Florida preservice agriculture teachers during the Fall 2010 semester.	Mathematics Enhancement Teaching Efficacy Instrument (Jansen, 2007) and Mathematics Ability Test (Stripling & Roberts, 2012)	Although preservice teachers perceived their personal mathematics efficacy, mathematics teaching efficacy, and personal teaching efficacy as moderate to high they did not have strong mathematics ability.

Table 2 (continued)
History of Self-Efficacy Research in Agricultural Education

Author(s), Year	Population	Teacher Efficacy Instrument Used	Findings
McKim & Saucier, 2013	Missouri agriculture teachers responsible for mechanics shop management in 1989 and 2008.	Researchers modified Johnson's (1989) agricultural mechanics competency instrument	Agriculture teachers in 2008 were more competent in their ability to maintain computer based school academic records, develop a written statement of agricultural mechanics lab policies/procedures, and develop a procedure to ensure proper agricultural mechanics clean up.
Stripling & Roberts, 2013a	Florida preservice agriculture teachers during the Fall 2010 and Spring 2011 semesters.	Mathematics Enhancement Teaching Efficacy Instrument (Jansen, 2007) and Mathematics Ability Test (Stripling & Roberts, 2012)	Researchers analyzed the effect of a math-enhanced agricultural teaching methods course on preservice agriculture teachers. The math-enhanced course significantly increased preservice teachers' mathematics ability. Additionally, a statistically insignificant decrease in preservice teachers' personal mathematics efficacy and a statistically insignificant increase was found in mathematics and personal teaching efficacy.
Stripling & Roberts, 2013b	Florida preservice agriculture teachers during the Fall 2011 semester.	Mathematics Enhancement Teaching Efficacy Instrument (Jansen, 2007)	Researchers compared a preservice agriculture teacher group engaged in a math-heavy teaching methods course using mathematics teaching and integration strategies and a group taught in a teaching methods course without a math focus. No statistically significant differences were found in the change in personal mathematics efficacy, mathematics teaching efficacy, or personal teaching efficacy between the two groups over the 15 week teaching methods course.
Stripling & Roberts, 2013c	Florida preservice agriculture teachers during the 2010-2011 and 2011-2012 academic years.	Mathematics Enhancement Teaching Efficacy Instrument (Jansen, 2007) and Mathematics Ability Test (Stripling & Roberts, 2012)	Mathematics teaching efficacy had a moderate, positive relationship with personal mathematics efficacy, grade point average, and date of last mathematics course. Personal teaching efficacy had a moderate, positive relationship with preservice teachers' enrollment in an intermediate high school mathematics course.

Conclusions and Recommendations

The agricultural education profession has utilized the concept self-efficacy as a theoretical underpinning for research since 1997. Our study sought to utilize this expansive research to evaluate self-efficacy theory and its utility in the agricultural education discipline. Our focus was on two areas of self-efficacy research in agricultural education. First, we synthesized research in the four developmental experiences related to self-efficacy: mastery experiences, vicarious experiences, social persuasion, and physiological and emotional states. Then we synthesized research investigating the relationship between agriculture teachers' self-efficacy and their commitment to persist as an agriculture teacher.

Utilizing research conducted in agricultural education on specific self-efficacy developing experiences, we found evidence that mastery experiences may not be the optimal method for initially increasing preservice teachers' self-efficacy. This leads to important considerations for agriculture teacher development programs; specifically, programs should consider shifting their initial focus from providing potential mastery experiences to initially providing vicarious experiences. Based on research conducted on the positive relationship between vicarious experiences and agriculture teacher self-efficacy (Wolf et al., 2010), we recommend consideration toward teacher observations, specifically observing first year agriculture teachers, as a method for improving the self-efficacy of preservice teachers.

The increased self-efficacy brought about by vicarious experiences should lay a foundation for mastery experience opportunities, like student teaching. The student teaching experience is an important opportunity for agricultural education students to continue their teacher efficacy development (Knobloch, 2006; Knobloch & Whittington, 2002; Whittington et al., 2006; Wolf, 2008). Research conducted on the self-efficacy building opportunities that occur during student teaching has identified two important considerations for agriculture teacher development programs. First, unstructured verbal communication between cooperating and student teacher should be encouraged throughout the student teaching experience. Second, consideration should be made for the number of courses a student teacher can successfully facilitate during their student teaching experience. Some student teachers may have the increased self-efficacy required to manage a larger course load; however, other students may benefit from first observing their cooperating teacher, or other teachers, and then progressing to larger course loads later in their student teaching.

Research focused on the developmental experiences related to agriculture teachers' self-efficacy has primarily focused on preservice and early career teachers, and has been limited to teacher education courses and student teaching. Future research should consider the exploration of self-efficacy developing experiences that occur during professional development opportunities throughout the broader career spectrum of agriculture teachers. Additionally, research in agricultural education should consider methods for measuring preservice and practicing agriculture teachers' physiological and emotional states. One potential method for measuring these important variables is through the use of qualitative interviewing. Exploring the relationship between physiological and emotional states and teacher efficacy may provide researchers and practitioners with important information for the continued utilization of self-efficacy theory in agricultural education.

The research conducted in agricultural education on the relationship between self-efficacy and career persistence has provided strong evidence of a positive relationship between these two variables. Yet, the types of self-efficacy research have been limited. Agricultural education teachers are challenged with a diverse set of expectations, and therefore need high levels of self-efficacy in a myriad of skills. Research in agricultural education analyzing the relationship between self-efficacy and career persistence has not mirrored the diverse challenges faced by agriculture teachers. Most of the research conducted on this relationship has utilized the Teacher Sense of Efficacy Scale (TSES; Tschannen-Moran & Woolfolk Hoy, 2001). The TSES measures three sub-scales of self-efficacy: classroom management, instructional strategies, and student engagement.

While these are essential skills for the success of agriculture teachers, future research should consider the use of agricultural education specific self-efficacy instruments, like the instrument developed by Wolf in 2008, which measures teaching efficacy in classroom instruction, FFA, and SAE. Furthermore, consideration should be given for additional areas of self-efficacy such as: STEM education, program management, leadership development, and laboratory facilitation.

Through this analysis, we identified the majority of research exploring the outcomes of self-efficacy focused on the relationship between an agriculture teacher's self-efficacy and career commitment. However, the literature in agricultural education remains silent on additional outcomes of teacher self-efficacy (e.g., instructional success, student learning, professional innovation). While we feel continued research on the relationship between self-efficacy and career commitment is warranted, we also feel expanding the research to explore agriculture teachers' self-efficacy and additional outcomes would further our understanding of the importance of teacher self-efficacy in the agricultural education discipline.

Research in agricultural education using self-efficacy theory has yielded important insight into the development of self-efficacy and the relationship between self-efficacy and career persistence. Our comprehensive synthesis of this literature identified a number of important considerations to the implementation of this theory in agricultural education research and teacher development. Additionally, areas for future exploration were identified that would continue the refinement of this theory in the agricultural education discipline. Our final recommendation is for the continued investigation of the theoretical foundations for agricultural education research and practice. We must acknowledge as a discipline that the teachers and learners involved in agricultural education today are different than those involved when these theories were first established. Therefore, continued evaluations of these theories will help to redefine our theoretical roots to meet the challenges and opportunities faced by current agriculture students and teachers.

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