Volume 54, Number 4, pp. 121 – 133
DOI: 10.5032/jae.2013.04121

Exploring Science Teaching Efficacy of CASE Curriculum Teachers: A Post-Then-Pre Assessment

Jonathan D. Ulmer
Texas Tech University
Jonathan J. Velez
Misty D. Lambert
Greg W. Thompson
Oregon State University
Scott Burris
Texas Tech University
Phillip A. Witt
Nevada Regional Technical Center

This descriptive-correlational study sought to investigate teachers' levels of Personal Science Teaching Efficacy (PSTE) and Science Teaching Outcome Expectancy (STOE) using the Science Teaching Efficacy Beliefs Instrument (STEBI). The population included all teachers completing a CASE Institute training session during summer 2010. Assessments were made at two points. First, the participants were assessed by using a post-then-pre assessment with a second follow-up assessment after nine months of implementing the new curriculum. Demographic characteristics are presented to provide insight into the participants. The teachers experienced gains during the institute on both their personal science teaching efficacy and their science teaching outcome expectancy. However, after nine months of using the curriculum, their efficacy remained high while their outcome expectancy returned to the same levels held before attending the professional development. It appears the CASE Institute had a lasting impact on the participants' personal efficacy, but not their outcome expectancy beliefs. Recommendations are made for future research.

Keywords: CASE curriculum, teaching efficacy, science teaching efficacy, science teaching outcome expectancy

The National Council for Agricultural Education established the Curriculum for Agricultural Science Education (CASE) in 2007. CASE describes their curriculum as "an instructional system that provides intense teacher professional development and curriculum that is changing the culture of agriculture programs" (CASE, 2011, p. 1). The CASE curriculum was developed in collaboration with Project Lead the Way, a nationally recognized nonprofit organization that prepares students to be leaders in the science, technology, engineering, and mathematics (STEM) areas though the use of problems-based investigation (CASE, 2011). The purpose is to develop and implement a national curriculum for secondary agricultural education that provides a high level of rigor and relevance to the agriculture, food, and natural resources (AFNR) subject matter. CASE is aligned with the National Council for Agricultural Education's Agricultural, Food, and Natural Resources Career Cluster Content Standards (Team AGED, 2007). Additionally, the curriculum is aligned with core academic standards including the National Science Education Standards (National Research Council, 1996), Principles and Standards for School Mathematics (National Council of Teachers of Mathematics, 2000), and Standards for the English Language Arts (National Council of Teachers of English, 1996).

CASE strives to ensure quality teaching by providing extensive professional development for teachers that leads to certification (CASE, 2011). The CASE Institute is a professional development workshop requiring 80 hours of intense training for each course CASE has developed. CASE Institute sessions provide teachers important background related to the pedagogy used in the CASE curricula and practice teaching various lessons to prepare them for classroom instruction. Teachers are required to attend the entire 10-day, 80 hour workshop where upon CASE Institute instructors determine if each teacher is adequately prepared to provide instruction using CASE curricula. This institute is typically hosted by a college or university, and entails full-time, hands-on training in the use of the CASE curriculum. Institute participants have the opportunity to work their way through the experiments and applied components of the curriculum (CASE, 2011). In a small case study, Dixon (1999) found that innovative curriculum can impact a teacher in positive ways. While some changes may be a direct result of the written curriculum, others may be a result of changing philosophy from using the curriculum.

The professional development component of the CASE curriculum is unique among the resources typically used in agricultural education. High quality professional development is a key component to the success of educational programs (Kent, 2004). As agricultural education continues to evolve with new curricular goals in the areas of math and science, the professional development needs of teachers will grow. Providing prolonged and sustained professional development, in conjunction with teacher quality, can be used as an excellent predictor of student success (Sullivan, 1999). In math and science teachers, Garet, Porter, Desimone, Birman, & Yoon (2001) found that professional development focused on content, hands-on learning, and application to the classroom, was most likely to produce an increase in achievement. These characteristics are all hallmarks of the CASE model of professional development.

Professional development in regard to the incorporation of science and math has received much attention in the agricultural education profession. In a meta-analysis of the research on science integration, Wilson and Curry (2011) found that several researchers have called for increased support for teachers in the form of professional development opportunities. According to Wilson and Curry, teachers who participated in these professional development opportunities were more confident to teach science than the control groups. Darling-Hammond (1996) indicated the lack of professional development for beginning and seasoned teachers is a barrier for student learning in the United States.

The notion of teacher confidence, or teaching efficacy, is another concept that is prevalent in agricultural education research. Roberts, Harlin, and Ricketts (2006) investigated teaching efficacy of student teachers during their internship experience and found teachers became more efficacious from the beginning to the end of their teaching experience. Wolf, Foster, and Birkenholz (2010) also explored teaching efficacy of student teachers. They found certain experiences during the student teaching experience resulted in increased levels of teaching efficacy, while others had no effect. Gill (2009) found pre-service teachers had more confidence in their ability to integrate academic content into their teaching when specifically instructed on integration. This highlights the need to explore professional development opportunities so their effect on teachers can be better understood.

While teaching efficacy has been studied in practicing teachers with mixed results, Hamilton and Swortzel (2007) studied agricultural science teachers' ability to teach science and their science teaching efficacy. They found teachers had a high science teaching efficacy, but it correlated negatively with their ability. These results are consistent with the results of Scales, Terry, and Torres (2009) who found agriculture teachers were confident they could integrate science content, but scored low on a science subject test.

This disconnect between teacher performance and teacher confidence might indicate teachers are not prepared to integrate science into their classroom. Boone, Gartin, Boone, and Hughes (2006) found agricultural science teachers had limited knowledge of science topics. Warnick and Thompson (2007) found teachers believed a lack of funding and equipment were also barriers to integrating science into the agriculture curriculum. These are examples of many barriers to integrating science into the agriculture curriculum that have been reported by researchers. It is important to remember that "agricultural education provides students with transferable academic skills so as to prepare them to achieve in other courses" and higher education (Dailey, Conroy, & Shelley-Tolbert, 2001, p. 18). Often these conclusions result in recommendations of providing professional development programs that are designed to break down these barriers (Wilson & Curry, 2011).

Theoretical Framework

The theoretical framework for this study was based on Bandura's Social Cognitive Theory and the concept of self-efficacy. Social Cognitive Theory (Bandura, 1986) grew out of Bandura's frustration with earlier depictions of human agency captured in the Psychodynamic, Trait, and Behaviorist theories. Earlier theories focused on the locus of agency in humans as either autonomous or mechanical. Bandura proffered that neither is entirely true, rather, the locus of agency is interactive and shares a reciprocal relationship between determinants, action and environmental factors (Bandura, 1986). Bandura described this effect and termed it reciprocal determinism. According to Bandura (1986) "the relative influence exerted by the three sets of interacting factors will vary for different activities, different individuals, and different circumstances" (p. 24). After the development of reciprocal determinism, Bandura began to conceptualize his ideas concerning how people develop beliefs in their ability to succeed; a concept he called self-efficacy.

Bandura defined self-efficacy as "judgments about one's ability to organize and execute specific courses of action" (Bandura, 1997). Bandura identified four primary sources of self-efficacy, listed in order from the perceived greatest contributor, they are: mastery experiences, vicarious experiences, verbal persuasion, and physiological and affective states (Bandura, 1997). Mastery experiences provide the greatest source of self-efficacy information and can be developed through application of the learning broken down into small steps that yield frequent successes. Vicarious experiences are most frequently provided through modeled experiences. Both students and teachers can enhance self-efficacy by direct observation of their peers. The vicarious effect is enhanced when, through observation, the observer feels a sense of social similarity to the model. Mastery experiences and vicarious experiences are two of the most powerful sources of self-efficacy (Bandura, 2006).

Verbal persuasion serves to strengthen belief in an individual's ability to succeed by providing positive, social reinforcement. Bandura (1997) believed verbal persuasion could solidify the beliefs of an individual who was struggling in a given activity. Bandura (1997) stated "verbal persuasion alone may be limited in its power to create enduring increases in perceived efficacy, but it can bolster self-change if the positive appraisal is within realistic bounds" (p. 101). The last self-efficacy source identified by Bandura was physiological and affective states. Simply put, individuals can establish self-efficacy information through anxiety, stress, arousal, fatigue and mood states (Pajares, 1997). Affective mood states allow individuals to gauge their degree of confidence in a particular activity (Pajares, 2002).

Specific to this study, self-efficacy was focused on teacher efficacy. Teacher self-efficacy has been identified as "the extent to which teachers believe they can affect student learning" (Dembo & Gibson, 1985, p. 1). Teacher self-efficacy has been found to be a very powerful construct with connections to student achievement, motivation, and student self-efficacy (Tschannen-Moran & Hoy, 2001). Woolfolk (2007) identified teacher efficacy as one of the few teacher traits directly connected to student academic achievement. Woolfolk-Hoy, and Hoy (2009) suggested teaching efficacy is a powerful construct and "helping teachers develop a strong sense of efficacy beliefs early in their career will pay lasting dividends" (p. 169).

Student achievement has been closely linked with teacher efficacy, and personal teaching efficacy has been used to predict teacher behaviors (Ashton, Webb, & Doda, 1983). Teaching efficacy has been further refined into personal science teaching efficacy. Teachers high in personal science teaching efficacy are likely to persist longer in a task, provide more academic focus, and provide more feedback for students than teachers low in science teaching efficacy (Gibson & Dembo, 1984). Teachers who are high in science self-efficacy feel capable to teach science and will likewise persist in their efforts to reach unmotivated students and enlist support from fellow teachers and administrators.

Teaching efficacy is closely related to outcome expectancies. Bandura (1989) linked the two closely by stating "The effects of outcome expectancies on performance motivation are partly governed by self-beliefs of efficacy" (p. 1180). Outcome expectancy seeks to measure the level at which teachers expect certain behaviors to produce desirable outcomes (Riggs & Enochs, 1989). Bandura theorized people high in outcome expectancy and high in efficacy would be motivated to engage in and complete tasks. Whereas, individuals low in outcome expectancy and high in efficacy would try hard, but soon become frustrated and give up. For example, a teacher with high outcome expectancy genuinely believes that as a result of their teaching efforts, the students will make substantial cognitive gains. Whereas a teacher low in outcome expectancy might be viewed as a pessimistic teacher who does not believe students can succeed. The theory and research indicate outcome expectancy and science efficacy work together to allow teachers to be successful in a science-based classroom. The current research sought to examine both personal science teaching efficacy and science teaching outcome expectancies through the use of the Riggs and Enochs (1989) Science Teaching Efficacy Beliefs Instrument (STEBI).

Purpose and Objectives

The purpose of this study was to explore the effect of the CASE Institute and curriculum on the science teaching efficacy belief of teachers. This purpose aligns with the National Research Agenda for Agricultural Education and Communication (Doerfert, 2011). The study supports research priority areas for Efficient and Effective Agricultural Education Programs which include "the effective integration of science, technology, engineering and math" (p.10). The following research objectives were developed for the study:

1. Describe the demographic characteristics of the CASE institute participants.
2. Describe the mean levels of participant efficacy on the pre, post and post-post assessments of Personal Science Teaching Efficacy and Science Teaching Outcome Expectancy.
3. Analyze the mean differences between the pre, post, and post-post.

Methods and Procedures

The design for this study was descriptive-correlational. The population for this study included all teachers enrolled in CASE Institutes across the country during the summer of 2010 (N = 88). The population frame for this study was obtained from the CASE project staff. Dillman's (2000) tailored design method for conducting electronic surveys was followed for the data collection process. The instrument used for data collection was originally created by Enochs and Riggs (1990) to measure the self-efficacy of science teachers, called the Science Teaching Efficacy Belief Instrument (STEBI).

The STEBI consisted of 25 questions scaled from 1 (*strongly disagree*) to 6 (*strongly agree*). Enochs and Riggs (1990) found their instrument measured two separate constructs which align with Bandura's (1997) two dimensions of self-efficacy. The first factor measured the construct of Personal Science Teaching Efficacy (PSTE) using 13 questions. Example questions include "I am not very confident in managing science experiments," and "When teaching science, I usually welcome student questions." Previous research reported reliabilities of .92 (Enochs & Riggs, 1990). Post-hoc reliability estimate of the PSTE for the first phase was .85. For phase two, the reliability estimate for PSTE was calculated at .90.

The second construct of Science Teaching Outcome Expectancy (STOE) consisted of 12 questions similarly scaled from 1 (*strongly disagree*) to 6 (*strongly agree*). Example questions include "The low science achievement of some students cannot generally be blamed on their teachers," and, "Effectiveness in science teaching has little influence on the achievement of students with low motivation." Previous research reported reliabilities of .77 (Enochs & Riggs, 1990). The instrument consisted of 11 demographic questions and the 25-item STEBI with terminology adjusted by the researchers to accommodate for high school teachers. An online form of the instrument was created using Qualtrics, a web-based survey tool. Post-hoc reliability estimate of the STEBI for the first phase was .75. For phase two, the reliability estimate for STEBI was calculated at .76.

Data collection for this study occurred in two phases. The first phase occurred during summer 2010, directly following each CASE Institute. Coordinators of each institute were emailed the instrument URL and instructions for distribution to each of the institute participants. This phase of the study utilized a post-then-pre design (Colosi & Dunifon, 2006). Participants were asked to respond twice to each of the 25 STEBI items to indicate their level of agreement before the CASE Institute and their level of agreement after the CASE Institute.

The post-then-pre method is primarily used to reduce response shift bias among participants. Colosi & Dunifon (2006) describe response shift bias as a change in the way participants respond due to the effect of the treatment. Klatt and Taylor-Powell (as cited in Colosi & Dunifon, 2006) described response shift bias as a "change in the participant's metric for answering questions from the pre test to the post test due to a new understanding of a concept being taught" (p. 2). One advantage to this model is participants are able to respond to pre-test questions using their newly acquired frame of reference.

In addition, the post-then-pre design reduces the requirements and strain on the participants. The CASE Institute is an intensive professional development requiring the teachers to spend 10 days on site with 80 hours of in-service training. The researchers were concerned with asking too much of the participants thereby causing them to drop out of the study. By only asking the participants to respond at one point in time, this strain was reduced. However, there remain threats to validity when using the post-then-pre method. Social desirability bias, effort justification bias, and cognitive dissonance are all threats to validity that should be considered when using the method (Hill & Betz, 2005).

The second phase of the study occurred approximately nine months after participants attended their respective CASE Institute during summer 2010. This allowed participants to implement the curriculum in their classroom for the academic year. All of the participants that responded to the survey during phase one (n = 71) were contacted in April of 2011. Teachers were again sent an email requesting their participation with a link to the online instrument. During phase two, the same modified STEBI was administered through qualtrics to collect data during this phase of the study.

Results

The first objective of this study was to describe the CASE Institute participants from summer 2010. The response rate to the first phase of the study was 80.68%, with 71 teachers responding to the instrument. The mean age for teachers enrolled in the 2010 CASE Institutes was 33.90 (SD = 10.99) with a range from 21-62 years. Teachers averaged 7.25 (SD = 8.09) years of experience, with teachers ranging from 0-35 years in the classroom. The participants with teaching experience reported an average enrollment of 154.45 (SD = 103.28) students in their agriculture education program (see Table 1).

Table 1

Demographic characteristics of CASE institute participants (n = 71)

Characteristic	*M*	*SD*	Range
Age (in years)	33.90	10.99	21-62
Years of Teaching Experience	7.25	8.08	0-35
Students Enrolled in Ag Ed (2009-2010)	154.45	103.28	15-460

Teachers were also asked to describe their involvement with the CASE Institute (see Table 2). At the time, there were three courses developed by CASE in which teachers could become certified. Participants in this study were asked which course they were certified in. The Principles of Agricultural Science – Animal course had the largest enrollment with 39.44% (*f* = 28) of teachers. This was followed by the Introduction to Agriculture, Food, and Natural Resource (AFNR) course with 30.99% (*f* = 22) and the Principles of Agricultural Science – Plant course with 29.58% (*f* = 21). Teachers indicated who made the decision for them to attend the CASE Institute as well. The majority of teachers (*f* = 45) reported it was their decision to attend the institute, while 26.76% (*n* = 19) reported their administrator made the decision. Two teachers chose not to respond to this question. Five teachers reported they and their administrator made a mutual decision to have the teacher attend the CASE Institute. The majority of CASE Institute participants (*f* = 36, 50.7 %) reported they had earned a master's degree, with the remaining 49.3% (*f* = 35) earning a bachelor's degree. When asked about their certification areas, only 25.35% (*f* = 18) of institute participants were certified to teach science.

Table 2

Demographic Characteristics of Institute Participants (n = 71)

Characteristic	*f*	%
Institute Attended		
Animal	28	39.44
AFNR	22	30.99
Plant	21	29.58
Why did you attend CASE		
I wanted to	45	63.38
Administration's decision	19	26.76
Mutual decision	5	7.04
Highest Level of Education		
Master's	36	50.70
Bachelor's	35	49.30
Certified to teach science		
Yes	18	25.35
No	53	74.65

Objective two sought to determine the level of science teaching efficacy of the CASE participants at three different points throughout the study (see Table 3). During the first phase of the study teachers reported before the institute they had a mean personal science teaching efficacy (PSTE) score of 4.01 (*SD* = 1.02) and a science teaching outcome expectancy (STOE) of 4.14 (*SD* = 0.51). After the institute teachers reported an increase in both areas with a mean PSTE of 4.81 (*SD* = 0.69) and a STOE of 4.58 (*SD* = 0.58). The second phase of the study, conducted after a year of teaching, had a response rate of 42.05% with 37 teachers completing the instrument. When participants were asked about their science teaching efficacy after a year of teaching they reported little change. Teachers PSTE mean score was 4.84 (*SD* = 0.67) and their STOE mean score was 4.17 (*SD* = 0.53).

Table 3

Mean PSTE and STOE values for CASE Institute participants

	Pre (n = 71)		Post (n = 71)		Post-Post (n = 37)	
STEBI measure	*M*	*SD*	*M*	*SD*	*M*	*SD*
PSTE	4.01	1.02	4.81	0.69	4.84	0.68
STOE	4.14	0.51	4.58	0.58	4.17	0.53

The third research objective was to analyze the mean differences between the pre, post, and post-post teaching efficacy scores. For this objective, a one-way repeated measures analysis of variance (ANOVA) was conducted for both PSTE and STOE, with the factor being the point at which the STEBI was administered and the dependent variables the measure of teacher efficacy. When examining the means of PSTE, researchers found Mauchly's test indicated the assumption of sphericity was not violated, $X^2(2) = 0.82$, $p < 0.05$. The results show the PSTE was significantly affected by the point at which the STEBI was administered, $F_{(2, 72)} = 33.08$, $p < 0.05$ (see Table 4).

Table 4

ANOVA Personal Science Teaching Efficacy

	SS	*df*	*MS*	*F*	*p*
PSTE	18.67	2	9.34	33.08	0.01*
Error	20.32	72	0.28		

* p < .05

Post-hoc tests using the Bonferroni correction revealed PSTE increased significantly between the pre test and the post test, $p < .05$ (see Table 5). However, there was no change in PSTE between the post-test and the post-post after one year of implementing CASE, $p = 0.44$.

Table 5

Post-Hoc Bonferroni for Personal Science Teaching Efficacy

	Mean Difference	*p* - value
Pre test / Post test	-0.82	0.01*
Pre test / Post-Post test	-0.91	0.01*
Post test / Post-Post test	-0.09	0.44

* p < .05

Teachers' science teaching outcome expectancy was analyzed in the same way. Mauchly's test indicated the assumption of sphericity was not violated for STOE, $X^2(2) = 3.59$, $p < 0.05$. The repeated measures ANOVA indicated STOE was also significantly affected by the point at which the STEBI was administered, $F(2, 72) = 15.69$, $p < .05$ (see Table 6).

Table 6

ANOVA Science Teaching Outcome Expectancy

	SS	*df*	*MS*	*F*	*p*
STOE	4.46	2	2.23	15.69	.01*
Error	10.24	72	0.14		

* p < .05

Post-hoc tests using the Bonferroni correction revealed Science Teaching Outcome Expectancy increased significantly between the pre test and the post test, $p < .05$. The test also indicated teachers' STOE decreased signi-ficantly between the post test after the institute and the post-post after a year of teaching, $p > 0.05$ (see Table 7).

Table 7

Post-Hoc Bonferroni for STOE

	Mean Difference	*p* - value
Pre-test / Post test	-0.43	0.01*
Pre-test / Post-Post test	0.01	0.99
Post test / Post-Post test	0.42	0.01*

* p < .05

Conclusions, Implications, and Recommendations

The purpose of this study was to explore the impact of the CASE Institute and curriculum on the science teaching efficacy and expectancy beliefs of teachers. Seventy-one teachers participated in the study, ranging in ages from 21 to 62, with 0 to 35 years of teaching experience. The participating teachers reported agriculture education enrollment at their schools from 15-460, averaging around 150 students. Age and years of teaching experience of the 2010 CASE participants was similar to demographics of teachers involved in the 2007 National Agriscience Teacher Ambassador Academy (Myers, Thoron, & Thompson, 2009).

Participants were asked why they attended the CASE Institute. Of the 69 respondents, more than 60% indicated it was their decision to attend the CASE Institute and one quarter (26.76%) of the participants indicated they attended the institute because of an administrator decision to send them. Although a majority of the participants attended CASE as a personal/professional choice, the fact that one fourth of the participants indicated it was an administrator's decision to send them is interesting.

The implication of this finding is that many administrators see the value of enhancing the agriculture curriculum through science integration. Educating administrators about CASE is an important component to enrolling teachers in CASE. Research has shown the important leadership role principals play in implementing new programs or curriculum (Hipp & Huffman, 2000; Nanus, 1992; Nwanne, 1987; Rogers, 2007). In fact, Nanus (1992) argued that principals directly control the factors that "determine what shall and shall not be done by the organization" (p.142). With this in mind, it is important to be cognizant of the pivotal agency that principals have with regard to new programs such as CASE. The CASE Institute Lead Teachers should be aware that not all teachers in the CASE Institute may be attending on their own accord. It may be important to continue marketing the CASE model and the advantages of CASE to teachers who are present at the workshop and to design learning activities that emphasize the benefits of CASE, as they may be reluctant participants.

Science teacher efficacy increased from pre and posttest through the post-post (approximately one year after the Institute) scores. CASE teachers began the CASE Institute with a moderate level of science teaching efficacy, with the average STEBI item rating at *slightly agree* (M = 4.01). After the CASE institute, science teaching efficacy increased to an average item rating of *agree* (M = 4.81). Only a slight increase in science teaching efficacy was detected approximately one year later (M = 4.84). Comparisons of the pre and posttest mean scores produced a statistically significant difference. Comparisons of the posttest and post-post test scores showed a slight increase. Implications of this finding indicate the CASE Institute significantly impacts science teaching efficacy. The measurements used in this research validate the impact of the CASE Institute on teachers' sense of science efficacy. To further increase science efficacy change after the CASE Institute, teachers should be encouraged to engage in communities of practice following their attendance at a CASE Institute.

The researchers recommend CASE consider providing additional support after the conclusion of the institute. Specifically, the self-efficacy of teachers can be maintained and increased through their exposure to both mastery and vicarious experiences (Bandura, 1997). Bandura (1997) believed mastery experiences provide the greatest and most influential source of self-efficacy information by, "organizing mastery experiences in ways that are especially conducive to the acquisition of generative skills" (p. 80). CASE project staff can enable this process by engaging with institute participants after the institute and continuing to breakdown complex curriculum or skills into more easily mastered sub-skills that allow teachers to experience small frequent successes (Bandura, 1997). CASE can provide vicarious experiences for institute participants by webinars, videos, and other multimedia opportunities that allow successful CASE teachers to model their experiences. The self-efficacy of the teachers will increase if they are allowed to observe the successful experiences of their peers (Bandura, 1986). This effect may partially account for the significant increase in self-efficacy during the actual institute. Participants were able to gain mastery through application and observe the success of their peers, thereby enhancing their vicarious experiences.

Science teacher outcome expectancy also changed during the CASE Institute. CASE teachers began the CASE Institute slightly agreeing about student outcome expectancy (M = 4.14) and then increased more toward agreeing (M = 4.58) about their outcome expectancy after the institute. Teachers then decreased back to slightly agreeing in science outcome expectancy approximately one year after their involvement in the CASE Institute (M = 4.17). The pre and post-test mean scores showed a statistically significant difference from slightly agree toward agree, while the post-post test scores decreased to slightly above pre-institute levels.

The implications of this finding indicate the CASE Institute appears to significantly impact science outcomes expectancy. However, this effect is short lived. Long term educational interventions have historically evidenced a decrease. Likewise, the constructs in this research decrease accordingly. Posnanski (2010) found professional development on the nature of science may have been short lived; indicating efficacy prior to workshops and professional development tends to decrease over time following the training. Neuman and Cunningham (2008) found similar results in a study on literacy instructional practices. There is an intuitive reason for this dip. Following an intervention (training, inservice, etc.) participants tend to feel empowered and ready to take on a new task. However, as time passes the participants assume a more realistic or practical viewpoint. As teachers exit the CASE institute, they feel confident about science teaching and the new curriculum. However, as the year progresses, they possibly encounter realities such as increased class sizes, end of the year procedural requirements, and shrinking budgets. As a result, teachers may evidence a decrease in outcome expectancy. The good news is, despite the decrease, they do not decrease below the pretest level and, thus, the results still reveal net gains. The results of this research provide evidence that the CASE institute is impacting the science efficacy and outcome expectancy of the participants.

Recommendations for Future Research

CASE has provided one answer to the National Research Agenda's call to provide uniquely qualified and motivated teachers in agricultural education. Additional research to determine the effect of the CASE curriculum on student achievement in agriculture as well as math and science content areas should also be conducted. Future research should consider the actual cognitive gains in science during a CASE institute as measured through a content-specific pre and post-test. Perception studies should be conducted to understand what teacher and administrators know and perceive about science integration and curriculum. Understanding the support of integration can support the more widespread adoption of programs such as CASE.

Further research relating to teachers' concerns and challenges related to science efficacy following a CASE Institute may help to determine how teachers can be better supported upon completion of the CASE institute. While this study did show an impact from the institute, further investigation and longitudinal studies may determine why and at what point during the year teachers experience the decline in their science outcomes efficacy. It would also benefit the researchers to know more about the level of implementation these teachers have been able to achieve with CASE and what kind of financial and fiscal support they are receiving. The level at which the teachers are able to implement CASE could be greatly influencing the impact on their efficacy with teaching science.

References

Ashton, P., Webb, R., & Doda, C. (1983). *A study of teachers' sense of efficacy* (Final Report, Executive Summary). Gainesville: University of Florida.

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

Bandura, A. (1989). Human agency in social cognitive theory. *American Psychologist*, *44*, 1175-1184.

Bandura, A. (1997). *Self-efficacy: The exercise of control.* New York: Freeman.

Bandura, A. (2006). Adolescent development from an agentic perspective. In F. Pajares & T. Urdan (Eds.). *Self-efficacy beliefs of adolescents*, (Vol. 5., pp. 1-43). Greenwich, CT: Information Age Publishing.

Boone, H. N., Gartin, S. A., Boone, D. A., & Hughes, J. E. (2006). Modernizing the agricultural education curriculum: An analysis of agricultural education teachers' attitudes, knowledge, and understanding of biotechnology. Journal of Agricultural Education, 47(1), 36-45. doi:10.5032/jae.2006.01078

Colosi, L., & Dunifon, R. (2006). *What's the difference? "Post then pre" & "pre then post".* Cornell Cooperative Extension.

Curriculum for Agricultural Science Education. (2011). *CASE Program Description*. Retrieved from http://www.case4learning.org/about-case/promotional-tools.html.

Dailey, A. L., Conroy, C. A., & Shelley-Tolbert, C. A. (2001). Using agricultural education as the context to teach life skills. *Journal of Agricultural Education 42*(1), 11-20. doi: 10.5032/jae.2001.01011

Darling-Hammond, L. (1996). What matters most: A competent teacher for every child. *Phi Delta Kappan, 78*(3), 193-202.

Dembo, M. H., & Gibson, S. (1985). Teachers' sense of efficacy: An important factor in school improvement. *The Elementary School Journal 86*(2), 173-184.

Dixon, P. J. (1999). *A case study of teachers using innovative curriculum materials* (Doctoral dissertation). Retrieved from ProQuest. (Document Number: 730206321)

Dillman, D. A. (2000). *Mail and internet surveys: The tailored design method*. New York: Wiley.

Doerfert, D. L. (Ed.) (2011). *National research agenda: American Association for Agricultural Education's research priority areas for 2011-2015*. Lubbock, TX: Texas Tech University, Department of Agricultural Education and Communications.

Enochs, L. G., & Riggs, I. M. (1990). Further development of an elementary science teaching efficacy belief instrument: A preservice elementary scale. *School Science and Mathematics, 90*(8), 694-706. doi: 10.1111/j.1949-8594.1990.tb12048.x

Garet, M. S., Porter, A. C., Desimone, L., Birman, B. F., & Yoon, K. S. (2001). What makes professional development effective? Results from a national sample of teachers. *American Educational Research Journal, 38*(4), 915-945. doi:10.3102/00028312038004915

Gibson, S., & Dembo, M. H. (1984). Teacher efficacy: A construct validation. *Journal of Educational Psychology, 76*(4), 569-582. doi:10.1037/0022-0663.76.4.569

Gill, B. E. (2009). *Incorporating science, technology, engineering and mathematics (S.T.E.M.) into the preservice teachers' teaching agricultural mechanics curriculum.* Poster presented at the Annual American Association of Agricultural Education Conference, Louisville, KY. Abstract retrieved from http://www.aaaeonline.org/uploads/allconferences/AAAE_conf_2009/Posters/Incorporating%20Science.pdf

Hamilton, R. L., & Swortzel, K. A. (2007). Assessing Mississippi AEST teachers' capacity for teaching science integrated process skills. *Journal of Southern Agricultural Education Research 57*(1).

Hill, L., & Betz, D. (2005). Revisiting the Retrospective Pretest. *American Journal of Evaluation, 26*(4), 501-517.

Hipp, K. A., & Huffman, J. B. (2000). *How leadership is shared and visions emerge in the creation of learning communities.* Paper presented at the 81st Annual meeting of the American Educational Research Association, New Orleans, LA.

Kent, A. M. (2004). Improving teacher quality through professional development. *Education, 124*(3), 427-435.

Myers, B. E., Thoron, A. C., & Thompson, G. W. (2009). Perceptions of the national agriscience teacher ambassador academy toward integrating science into school-based agricultural education curriculum. *Journal of Agricultural Education, 50(4), 120-133.* doi: 10.5032/jae.2009.04120

Nanus, B. (1992). *Visionary leadership: Creating a compelling sense of directions for your organization.* San Francisco: Jossey-Bass

National Council of Teachers of English. (1996). *Standards for the English language arts*. Newark, DL: International Reading Association.

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Reston, VA: Author.

National Research Council. (1996). *National science education standards*. Washington, DC: National Academy Press.

Neuman, S. B., & Cunningham, L. (2008). The impact of professional development and coaching on early language and literacy instructional practices. *American Educational Research Journal, 46*(2), 532-566. doi: 10.3102/0002831208328088

Nwanne, A. I. (1987). The perceptions of public school principals in the state of Texas toward selected United States Supreme Court decisions concerning desegregation issues. (ERIC Document Reproduction Service: ED301921)

Pajares, F. (1997). Current directions in self-efficacy research. In M. Maehr & P. R. Pintrich (Eds.). *Advances in motivation and achievement*. Volume 10, (pp. 1-49). Greenwich, CT: JAI Press.

Pajares, F. (2002). *Self-efficacy beliefs in academic contexts: An outline*. Retrieved from: http://des.emory.edu/mfp/efftalk.html

Posnanski, T. J. (2010). Developing understanding of the nature of science within a professional development program for inservice elementary teachers: Project nature of elementary science teaching. *Journal of Science Teacher Education, 21*(5), 589-621. doi: 10.1007/s10972-009-9145-8

Riggs, I., & Enochs, L. (1989, March). *Toward the development of an elementary teacher's science teaching efficacy belief instrument*. Paper presented at the annual meeting of the National Association for Research in Science Teaching, San Francisco. (ERIC Document Reproduction Service No. ED 308 068)

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. doi:10.5032/jae.2009.04120

Rogers, G. E. (2007). The perceptions of Indiana high school principals related to project lead the way. *Journal of Industrial Teacher Education, 44*(1), 49-65.

Scales, J., Terry, R., & Torres, R. M. (2009). Are teachers ready to integrate science concepts into secondary agriculture programs? *Journal of Agricultural Education, 50*(2), 100-111. doi:10.5032/jae.2009.02100

Sullivan, B. (1999, August). *Professional development: The linchpin of teacher quality.* ASCD Infobrief. Retrieved from http://www.ascd.org/readingroom/infobrief/9908.html

Team AGED (2007). *Unmistakable potential: 2005-2006 Annual report on agricultural education*. Retrieved from http://aaaeonline.org/files/07.annualreportaged.pdf

Tschannen-Moran, M., & Hoy, A. W. (2001). Teacher efficacy: Capturing an elusive construct. *Teaching and Teacher Education, 17*(7), 783-805. doi:10.1016/S0742-051X(01)00036-1

Warnick, B. K., & Thompson, G. W. (2007). Barriers, support, and collaboration: A comparison of science and agriculture teachers' perceptions regarding integration of science into the agricultural education curriculum. *Journal of Agricultural Education, 48*(1), 75-85. doi:10.5032/jae.2007.01075

Wilson, E. B., & Curry, K. W. (2011). Outcomes of integrated agriscience processes: A synthesis of research. *Journal of Agricultural Education, 52*(3), 136-147. doi: 10.5032/jae.2011.03136

Wolf, K. J., Foster, D. D., & Birkenholz, R. J. (2010). The relationship between teacher self-efficacy and the professional development experiences of agricultural education teacher candidates. *Journal of Agricultural Education, 51*(4), 38-48. doi: 10.5032/jae.2010.04038

Woolfolk, A. (2007). *Educational psychology: Instructor's copy*. Boston, MA: Allyn and Bacon.

Woolfolk-Hoy, A. E., & Hoy, W. K. (2009). *Instructional leadership: A research-based guide to learning in schools.* Boston, MA: Allyn and Bacon.

JONATHAN D. ULMER is an Assistant Professor of Agricultural Education in the Department of Agricultural Education and Communications at Texas Tech University, Box 42131, Lubbock, TX 79409, jon.ulmer@ttu.edu.

JONATHAN J. VELEZ is an Assistant Professor of Agricultural Education in the Department of Agricultural Education and Agricultural Sciences at Oregon State University, 112 Strand Agricultural Hall, Corvallis, OR 97331, jonathanvelez@oregonstate.edu.

MISTY D. LAMBERT is an Assistant Professor of Agricultural Education in the Department of Agricultural Education and Agricultural Sciences at Oregon State University, 112 Strand Agricultural Hall, Corvallis, OR 97331, misty.lambert@oregonstate.edu.

GREG W. THOMPSON is an Assistant Professor of Agricultural Education in the Department of Agricultural Education and Agricultural Sciences at Oregon State University, 112 Strand Agricultural Hall, Corvallis, OR 97331, greg.thompson@oregonstate.edu.

SCOTT BURRIS is an Associate Professor of Agricultural Education in the Department of Agricultural Education and Communications at Texas Tech University, Box 42131, Lubbock, TX 79409, scott.burris@ttu.edu.

PHILLIP A. WITT is a director at Nevada Regional Technical Center, 900 W Ashland, Nevada, MO, 64772, pwitt@nevada.k12.mo.us.