THE EFFECTS OF PARTICIPATION IN "AGRISCIENCE FOR TEACHERS" ON AGRISCIENCE TEACHING EFFICACY

by

BRENT JACKSON

(Under the Direction of Maria Navarro)

ABSTRACT

Teacher efficacy is the focus of research at a time when teachers are held accountable for their students' performance on state standardized tests, while competing with technology and entertainment. The Science Teaching Efficacy Belief Instrument (STEBI) was developed by Riggs and Enochs (1990) to quantitatively measure elementary teachers' science teaching efficacy. It was modified for utilization with pre-service agriscience teachers participating in an Agriscience for Teachers course at the University of Georgia. Students in two sections of this class were asked to complete the modified STEBI, and some participants were invited to join in an eight-question semi-structured interview of about one hour each. Participants signed consent forms and interviews were recorded. Insight into better preparing individuals for teaching agriscience was desired. Results revealed that many pre-service teachers feared the word science and, due to inexperience, did not see the connection between agriscience and standard science curriculums.

INDEX WORDS: Science Teacher Efficacy, Science Teacher Self-Efficacy, Teacher Beliefs, Teacher Efficacy, Teacher Self-Efficacy, Teacher Outcome Expectancy, Pre-service Teacher Efficacy, Pre-service Teachers

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DEDICATION

I dedicate this thesis to my family, especially to my mother Nancy Jackson, my wife Brenda Darby Jackson, and to the memory of my father Richard Jackson.

ACKNOWLEDGEMENTS

I now recognize those without whom I could not have accomplished this task. I thank you, Dr. Maria Navarro, for having the patience to stand with me and see this project through to completion. I am indebted to the faculty and staff of ALEC for their support and understanding. I pray that all those involved have fruitful and blessed futures.

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CHAPTER 1

INTRODUCTION

Problem Statement

Teacher self-efficacy has been the focus of research for years. During this time teachers have been held responsible for their students' performance on state standardized tests, while having to compete with technology and entertainment. Quantitative research instruments such as the STEBI or Science Teaching Efficacy Belief Instrument (Riggs & Enochs, 1990), Teacher Efficacy Scale (TES), and Teacher Self-Efficacy Scale (TSES) have been designed in order to measure teacher self-efficacy, an important component in teacher effectiveness (Bandura, 1977; Henson, Kogan, & Vacha-Haase, 2001; Riggs & Enochs, 1990; Tschannen-Moran & Hoy, 2001); however, the researcher noticed a gap in the available research and measures of determination for pre-service (middle school and high school) teachers, as well as a lack of research regarding the relationship between quantitative and qualitative measures of determination.

Purpose

The purpose of this research is to investigate the teaching efficacy of potential pre-service agriscience teachers (for middle school and high school) participating in an Agriscience for Teachers course, and the change they experience between the beginning and the end of the course. A secondary purpose of the research is to compare and contrast quantitative and qualitative measures of determination regarding pre-service teacher efficacy belief.

Consequently, this research is expected to fill a gap (in qualitative and quantitative research) in the literature pertaining to agriscience teacher self-efficacy beliefs and outcome expectancy.

In order to gain greater insight into pre-service teacher efficacy, some participants will be asked to participate in a one hour interview with eight questions, and complete the modified STEBI survey (Riggs & Enochs, 1990) (retrospective pre and post). Other participants will only be asked to complete the STEBI survey (retrospective pre and post). The students' responses in the interview will be transcribed, categorized, and analyzed to find similarities and differences among students, and to compare themes with the quantitative measure (STEBI). Determinations will be inferred from the data in order to assess methods of creating a more conducive environment for fostering increased teacher success.

Agriscience

Agriscience would be best defined as the application of scientific techniques and new technologies to agriculture. Careers in agriscience include, but are not limited to, agricultural education, aquaculture, agriculture engineering, animal science technology, crop science, soil science, biotechnology, integrated pest management, organic food, water resource, and environmental science. It is through agriscience that new advances are made in human medicine. It is extremely important that agriscience teachers understand how science applies to their area of focus in order to accurately present the material to their students.

Definitions

Terms that need to be defined and are pertinent to the research conducted are as follows: teacher efficacy belief, personal science teaching efficacy belief (PSTEB), science teaching outcome expectancy (STOE), and pre-service teacher.

- Teacher Efficacy Belief: The confidence a teacher has in his/her ability to facilitate student learning. Efficacy belief "has proven to be an important variable in teacher effectiveness" (Henson, Kogan, & Vacha-Haase, 2001, p. 404).
- Personal Science Teaching Efficacy Belief (PSTEB): Often called self-efficacy belief. One of the dimensions of teacher efficacy belief in Riggs and Enochs (1991) teaching efficacy belief instrument. According to Riggs and Enochs (1990), the PSTEB refers to the personal behaviors and internal components of teaching ability, and the teacher has more control over these factors. Examples are answering students' questions, explaining and monitoring experiments, finding ways to teach science, etc.
- Science Teaching Outcome Expectancy (STOE): STOE is the belief that adequate instruction and information will have the desirable effect. STOE is the second dimension of teacher efficacy belief in Riggs and Enochs (1990) teaching efficacy belief instrument. According to Riggs and Enochs (1990), the STOE refers to external factors of teaching efficacy over which the teachers may feel they have no control. Examples are student background, students with special needs, student motivation, etc.
- Pre-service Teacher: An individual enrolled in an undergraduate or graduate program with intensions of entering the teaching field.

Deliminations

This study was delimited to the students participating in Section 1 (22) and Section 2 (15) of the Agriscience for Teacher's course, offered by the Department of Agricultural Leadership, Education, and Communication of the University of Georgia.

Limitations

The following limitations associated to the research study should be noted:

- Respondents were restricted to students in Section 1 and Section 2 of the UGA Agriscience for teachers course;
- Time and personal constraints limited the researcher in relation to the breadth and depth of inquiry possible;
- Population size (thus sample size) was small;
- Limitations of the qualitative component of the research include researcher bias, interpretation limitations, and respondent concerns. The researcher discusses in chapter 3 (methodology) some procedures followed to maximize truthfulness;
- The researcher used the Science Teaching Efficacy Belief Instrument (STEBI) (Riggs and Enochs, 1990) for his investigations. The STEBI was developed for elementary science teachers, and the researcher used it for pre-service agriscience teachers (middle school and high school). The assumption of transferability could be a possible limitation of the instrument in the environment in which it was used;
- The external validity of the quantitative research component is threatened because of a response rate different from 100%. The response rate to the STEBI instrument was 95% in Section 1 of the course and 53% in Section 2 of the course. Because of the response rate obtained, the findings of this study will not be a reflection of all the participants in the class, let alone of other pre-service teachers, thus limiting the generalizability of the findings;
- Because this was an exploratory and descriptive (one-shot ex-post facto) study, it did not have the rigor and design of an experimental study, and might therefore be limited in terms of internal validity.

Results are limited to the degree of reliability with which students responded to the survey and interviews.

CHAPTER 2

LITERATURE REVIEW

For about 30 years, there has been much research done regarding the concept of teacher efficacy, based mostly on Bandura's (1977) Social Cognitive Theory. Bandura hypothesized that "expectations of personal efficacy determine whether coping behavior will be initiated, how much effort will be expended, and how long it will be sustained in the face of obstacles and aversive experiences" (1977, p. 191). Since then, teacher efficacy belief has been referred to as the extent to which a teacher believes he/she is capable of positively affecting student achievements and thus considered an important component of teacher effectiveness (Bandura, 1977; Henson, Kogan, & Vacha-Haase, 2001; Riggs & Enochs, 1990; Shaughnessy, 2004; Taimalu & Oim, 2005). It has also been used to emphasize "the importance of teachers' beliefs in their own ability to bring about students' learning" (Taimalu & Oim, 2005, p. 178), and justify the need for change in teacher pre-service education (Hoy & Spero, 2005) and in-service programs to promote teacher efficacy to improve student outcomes (Tucker et al., 2005).

In more detail, Bandura (1994) defines self-efficacy "as people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives" (Glossary section, para 1). "Self-efficacy beliefs determine how people feel, think, motivate themselves, and behave" (Bandura, 1994, Glossary section, para. 1). "If people experience only easy successes they come to expect quick results and are easily discouraged by failure", and "a resilient sense of efficacy requires experience in overcoming obstacles through perseverant effort" (Bandura, 1994, Sources of Self-Efficacy section, para. 2).

"Teacher efficacy has been found to be associated with many powerful forces in teaching and learning, including, but not limited to, the following:

- A sense of personal accomplishment (where teachers view their work as important);
- A willingness to try innovative practices;
- Personal responsibility for student learning in that area;
- Strategies for achieving objectives for their students;
- More persistence with students who struggle or have special needs;
- Greater job satisfaction which correlates with greater retention;
- A sense of control in the classroom or a belief that the teacher can influence student learning;
- A sense of common teacher/student goals and democratic decision making" (Shore, 2004, p. 116);
- "Situation or context of teachers' work" (Taimalu & Oim, 2005, p. 179);
- "Social-economic status of students, their age, the size of class, and the achievements of students" (Raudenbush, Rowan, & Cheong, 1992, p. 152).

Based on Bandura's theory, Riggs and Enochs (1990) posit that behavior depends both on personal self-efficacy beliefs (belief that one will be able to perform appropriately) and "a generalized expectancy about action-outcome contingencies based upon life experiences," also called outcome expectancy (p. 626). Concomitantly, these dimensions may explain differences in the varying degree of effectiveness amongst a group of teachers (Denzine, Cooney, & McKenzie, 2005; Riggs & Enochs, 1990). Though it may provide a way to measure teacher effectiveness, teacher efficacy beliefs should never be taken as a literal interpretation of effectiveness (Shaughnessy, 2004). According to Woolfolk-Hoy, "efficacy judgments are specific to a

teacher's individual situation (subject taught, teaching and managerial skills, knowledge, students, class size, etc.) and less affected by school organization level differences (administrative support)" (Shaughnessy, 2004, p. 156).

According to Bandura (1994), "self-efficacy beliefs produce diverse effects through four processes" known "as cognitive, motivational, affective, and selection processes" (Glossary section, para. 1). Cognitive processes involve critical thinking skills that allow people to build scenarios in their mind and come up with solutions to those scenarios; the types of scenarios people build depends on low (scenarios involving failure) and high (scenarios involving success) self-efficacy. Motivational processes consist of the attribution theory (what people attribute success and failure to), expectancy-value theory (production of outcome and the value of outcomes), and goal theory (setting of goals to reach and incentives for reaching those goals). The attribution theory is made up of external attributions (outside factor blamed for occurrence) and internal attribution (internal factor blamed for occurrence), those teachers that accept responsibility demonstrate a higher level of teaching efficacy. Affective processes involve coping skills that directly influence how people approach situations and carry out actions which are directly determined by the individual's sense of self-efficacy. Selection processes refer to those decisions that individuals make which directly influence life paths and are directly linked to an individual's sense of self-efficacy. (Bandura, 1994)

The quality of a teacher may be gauged through an understanding of teacher efficacy which is "a construct that can be observed to measure teacher change" (Shore, 2004, p. 116). It is potentially "influenced more in the early years of learning (first years of teaching)" which may "be critical to the long term development of teacher efficacy" (Shore, 2004, p. 117; Shaughnessy, 2004). Particularly, Hoy and Spero (2005) used teaching efficacy measures to study changes in

teacher efficacy in a longitudinal study, from the early college years to graduation and beyond. They found “significant increases in efficacy during student teaching, but significant declines during the first year of teaching. Changes in efficacy during the first year of teaching were related to the level of support received” (Hoy & Spero, 2005, p. 343). Other authors have also found correlation between treatments during in-service training and changes in teacher efficacy belief (Tucker et al., 2005). “Teacher level of education is positively related to her/his personal efficacy beliefs,” (Hoy & Woolfolk, 1993, 367).

In short, teacher efficacy refers to a psychological state of the teacher which is strongly impacted by self-esteem, confidence, willingness to learn and change, and overall desire to improve. Those teachers demonstrating a high level of self-efficacy spend less time on discipline and more time on instruction (especially in whole groups as opposed to small groups), and recognize struggling students and link with them in a way that allows the teacher to present the material differently to allow an understanding to be developed (Onafowora, 2004).

Another view on teacher efficacy beliefs takes into account different learning approaches associated with students (surface approaches and deep approaches). “Surface approaches are seen as being motivated by the learner’s desire to meet minimum requirements with minimum effort and teach the student study behaviors; deep approaches are characterized by an intention to understand the material being studied and result in active integration of new information with old information” (Gordon & Debus, 2002, p. 484). Students’ adoption of such learning approaches is directly related to teacher efficacy beliefs and outcome expectancy.

However, there are shortcomings in the research as teacher efficacy beliefs and outcome expectancy over “the past 25 years” has predominantly been measured “through quantitative

scales and surveys" (Shaughnessy, 2004, p. 155). The following is a list of problems that exist when trying to measure teacher efficacy:

- "Researchers have questioned the validity and reliability of existing measures;
- Many measures reveal a two-factor structure when subjected to factor analysis which has generated confusion and debate as to their meaning;
- Researchers cannot agree as to whether teacher efficacy is specific to given contexts and to what extent it may be transferable across contexts;
- Levels of specificity in the measure of teacher efficacy is difficult to ascertain. " (Tschannen-Moran & Hoy, 2001, p. 784)

The following is a list of quantitative measures of teacher efficacy beliefs:

- MPRAC (Mastery Instructional Practices) and PPRAC (Performance Instructional Practices) (Deemer, 2004, p. 77),
- MCULT (Mastery School Culture) (refers to mastery-oriented goal structure at the school level) and PCULT (Performance School Culture) (refers to performance goal orientation at the school level) (Deemer, 2004, p. 77),
- Teacher Efficacy Scale (Gibson & Dembo, 1984, as cited by Labone, 2004),
- Bandura's (undated) Teacher Self-Efficacy Scale (TSES) (Tschannen-Moran & Hoy, 2001),
- Ohio Teacher Sense of Efficacy Scale (Tschannen-Moran & Hoy, 2001),
- Science Teacher Efficacy Belief Instrument (STEBI) (Deemer, 2004),
- Teachers' Efficacy Beliefs System-Self (TEBS-Self) (Dellinger, Bobbett, Olivier, & Ellett, 2008).

The STEBI was developed for use in an elementary science classroom. The "Personal Science Teaching Efficacy Belief" scale and the "Science Teaching Outcome Expectancy" scale combine to form the STEBI. The scales were altered to reflect outcome expectancy and self-efficacy independently as opposed to a combination of the two. The instrument was developed based on a summated rating scale and responses range from strongly disagree to strongly agree. (Riggs & Enochs, 1990)

Anita Woolfolk-Hoy was quoted as saying, "I believe that qualitative methods are appropriate for an exploration of factors that mediate efficacy development and cultural influences on the construction of efficacy beliefs" (Shaughnessy, 2004, p. 155). Shaughnessy (2004) notes that Anita Woolfolk-Hoy's beliefs in the importance of qualitative research in this field lead her to base the majority of her research on qualitative methods, and that using qualitative research as a foundation, Woolfolk-Hoy could determine which areas of her research would be complemented through quantitative methods.

Outcome expectations are judgments of the likely consequences that a behavior will produce (Bandura, 1986). "Outcome expectations are related to self-efficacy beliefs precisely because these beliefs in part determine the expectations" (Pajares, 1993, p. 4). It refers to a teacher's belief that his/her students are capable of learning the subject at hand. "Teachers' beliefs in their personal efficacy to motivate and promote learning affect the types of learning environments they create and the level of academic progress their students achieve; efficacious teachers feel self-empowered (personal self-efficacy) to create those learning environments that allow them to motivate and promote student learning" (Onafowora, 2004, p. 35).

Teachers may wish to develop mastery skills which result through trial and error in teaching practices as well as through the observation of seasoned educators. Outcomes are

directly related to teacher effort in terms of mastery goal orientation (Deemer, 2004). Teachers may exhibit low or high levels of success which directly relate to outcome expectancy in the following ways: 1) teachers exhibiting high levels of efficacy will challenge students, seek out new ways of teaching, and display persistence when working with struggling students (this reflects mastery goal orientation); and 2) teachers exhibiting low level of efficacy will commit very little time to resources and lesson plans, display little persistence with struggling students, and seldom seek new ways to present material (Deemer, 2004). Deemer (2004) notes that administrative practices at schools (mastery goal orientation or performance-oriented) directly influence teacher efficacy, as has also been noted by Hoy & Spero (2005), especially for first year teachers. Schools at the mastery level equally provide resources and opportunities to all teachers, where schools on the performance level foster competition between teachers and are selective with resource distribution. The goal of all school systems should be the mastery goal orientation approach as the future minds of all nations should not be compromised by setting teachers against one another in competition.

The noticeable gaps in literature pertaining to teacher efficacy beliefs and outcome expectancy are studies pertaining to middle school and high school teachers, as most of the research has been done with elementary school teachers, and more specifically science related curriculum. When dealing with science, once again, the majority of research has focused on elementary school teachers and their understanding of science, which is directly linked to their background in science. Given that teacher efficacy is content and environment specific, a major problem pertaining to the study of teacher efficacy beliefs and outcome expectancy is the lack of studies that focus specifically on single subject oriented teachers who are more frequently found at the middle school, high school, and college levels. Researchers must explore all attributes

pertaining to this area of research; therefore, more qualitative research must be conducted, especially at the middle school, high school, and college level as subject specific teaching may provide a deeper insight to teacher efficacy beliefs and outcome expectancy.

CHAPTER 3

METHODOLOGY

Subjectivities Statement

I am interested in researching this topic as I am currently enrolled in Agricultural Leadership and will be obtaining my teacher certification in conjunction with my master's degree. I feel very strongly about the education of youth today and the quality of teacher professionals that are involved in their instruction. There has been a low level of interaction between myself and the students participating in this project (classmates in other courses) which is enough to create small personal bias due to that interaction. Also, I have been under the instruction of the professors involved in teaching the Agriscience for Teachers course; however, I limited my participation and presence in the course to reduce bias as much as possible. It is my place to sort through my feelings, keep a reflective journal, and use peer debriefings as a tool to keep my focus on the reactions of the interviewees rather than mine. The sole responsibility for ensuring the relevance of this information and compiling it in a manner that will benefit future educators and researchers is that of me, Dr. Maria Navarro, and participating peer reviewers. All parts of this research were approved by the IRB (Internal Review Board) at UGA.

Participants

The only requirement for participation in this research was enrollment in the Agriscience for Teachers course. Participants pertained to two different sections of the class. Twenty two students participated in Section 1 of the Agriscience for Teachers course. Fifteen students participated in Section 2 of the course.

Research Design: Qualitative research

Lincoln and Guba's (1985) research process for naturalistic inquiry was used as a model to design the qualitative component of this study. The qualitative component of this research involved interviews of course participants. In preparation for the interviews, an interview protocol was prepared with eight questions. These questions were developed by Brent Jackson under the direction of Dr. Maria Navarro, and were designed to assess an individual's teaching efficacy (separating personal self-efficacy beliefs and outcome expectancy) in relation to their experiences (past and present). The model used to design these questions was Riggs and Enochs (1990) Science Teaching Efficacy Belief Instrument (STEBI), and its two constructs, Personal Science Teaching Efficacy Belief (PSTEB) and Science Teaching Outcome Expectancy (STOE).

In order to assess the course, the participants' expectations upon enrolling in the course were also addressed. Once the questions were formatted and approved, an e-mail (Appendix A), with an attached consent form (Appendix B), inviting the participants of the class to participate in the interview portion of the research was posted on the class webpage. Eight students responded with interest in being interviewed; however, one of the volunteers was dropped as they did not follow through with correspondence and appointment inquiries.

The interviews were conducted between April 11 and 26, 2007. Dates and times for interviews were arranged for the 7 students who participated in the interview process. Interviewees were given the option to choose the setting for the interview (all chose the Agricultural Leadership, Education, and Communication [ALEC] conference room). At the beginning of every interview the consent form (Appendix B) was reviewed and any questions were answered. It was acknowledged that there was no direct benefit of participation, and permission was obtained for recording interviews (with the understanding that at any time during

the interview the interviewee could request the recorder be stopped and no notes taken). The interview protocol was that of a semi-structured interview, with pre-established questions. A relaxed structure allowed for the researcher and interviewee to vary the degree of depth and discussion devoted to each of the sections of the interview. At the beginning of the interview, participants were given a copy of the questions that were going to be asked throughout the interview. They were allowed to choose to read the questions for themselves each time a new question needed to be asked or choose that the question be read aloud by the researcher (or both). All participants requested that the questions be read orally by the researcher. This made the interview process easier as some questions were lengthy and needed to be broken apart at specific points by the researcher, to allow the participant to answer in small bits of opinions and impressions (Appendix C). The average time spent on each interview was between 45 minutes to one hour. The interviewees' responses were focused and informative enough that member checks were not performed.

Many interviewees expressed concern about whether the professors of the course would know the names corresponding with each interview. Assurance that the interviews were coded and the code key, with names, would not be present during interpretation of interviews was given and maintained. It was explained that the code was the same for the interview, pre-survey, retrospective pre-survey, and post-survey, so each could be linked in order to analyze the results without knowing the name of the participant. Participant confidentiality was of the utmost importance; therefore, the interviewees' key codes were used during response analysis in order to protect their identity.

Upon completion of the interview process, the transcription process was started. If questions had arisen during the transcription process, a copy would have been e-mailed to the

interviewee with attached questions for clarification. However, there were no questions, and member checking was not utilized.

A personal friend that would not be subtle with their views was chosen for peer debriefing. The peer debriefer should be a person who is trustworthy and has no stakes in the research being conducted. The debriefer was a recently graduated professional from the college. The role of the debriefer was to assist with assigning dimensions to the interviewees' responses. The interviews were reviewed twice with dimensions being assigned during the first review. The dimensions were consolidated (due to duplication of key terms or a discrepancy during the first review) during the second review. The peer debriefer served as a second opinion when assigning dimensions and, as a result, reinforced the decision to classify a response to a certain dimension and key term. Once the key terms and dimensions were assigned the most prevalent key terms were determined, and a figure of key terms was created (Figure 2). A table depicting key term prevalence was also created (Table 1).

Consequences: Participants

The first possible consequence that may exist is the individual's identity being compromised. This is safeguarded through coding and ethical behavior on the researcher's part. Never was the code key used to identify an individual's interview results.

A second possible consequence that may exist is the fidelity of data provided by the interviewee. Often, fear can adversely affect the responses of individuals participating in research. In this case the fear that the instructors of the course could recognize or choose to use the code key to identify the responses of individuals could result in the interviewee not being completely truthful in their responses. However, each interviewee volunteered for the interviews

and seemed very calm and comfortable talking about their opinions of the course, as well as their feelings about teaching and their ability to succeed as a teacher.

Consequences: Researcher

There are no direct consequences to the researcher; however, there are potential consequences to researcher bias. A reflective journal was kept in order to bring to light any bias the researcher may have, also such a journal allows the researcher to organize thoughts and strategies in order to develop a more comprehensive view of the information with which he/she is dealing.

Data Analysis Strategies

Qualitative research often requires far grater insight and depth when analyzing the data collected. There are always new paths and patterns emerging, and it is up to the researcher to ensure that as comprehensive an investigation as possible is conducted in order to present, in detail, the findings. All interviews were coded appropriately so data between all surveys and interviews could be properly correlated with individual responses to ensure the validity of data presented. An attempt was made to take comprehensive notes during the interview process. However, taking notes and staying on task with the interview proved to be too complicated a task; therefore, the recordings and the interviewees' perceived nature were relied upon during the review process. Comprehensive notes were taken during the reading process in order to provide an in-depth look at any research previously conducted and the current project conducted by the researcher.

When attempting to construct and compare themes between interviews, line numbers, code keys, and thematic references were used to properly align data between participants. This type of framework is necessary to develop a comprehensive view of the data obtained. Once

patterns were recognized and sorted, properly coded tables were used to allow cross referencing and ease of dissemination. Figure 1 summarizes the process followed for the qualitative part of the study.

Figure 1. Summary of the process followed for the qualitative part of the study.

Time Line			
Activity	**Duration of Activity**	**Description of Activity**	**Participant's Role**
Invitation to Interview	e-mail response	e-mail letter of invitation to students	e-mail acceptance or decline
Schedule Interviews	5-10 minutes	Meet with students in class to arrange date and time	Provide a time and show up for appointment
Perform Interview	30-60 minutes	Question and response session, notes taken, recording made	Provide responses and insight concerning questions
Transcribe Interviews	2-3 hours for every 1 hour of interview	Verbatim typing of recorded interviews	None
Member Checking	30-60 minutes	Interviewees may be asked to clarify points of interest	Editor
Peer Debriefing	No set length	Discuss research, strategies, and data with a peer	Provide recommendations for change/improvement

Research Design: Quantitative Research

The qualitative component of the research was the central focus of the study. To enhance the study, the researcher embraced a mixed-methods approach and included data obtained from a quantitative instrument, which helped complement the data from the interviews.

Instrumentation

For the quantitative part of the study, the researcher used an existing instrument developed by Riggs and Enochs (1990), the Science Teaching Efficacy Belief Instrument (STEBI) (Appendix D). According to Riggs and Enochs (1990), the STEBI "is a valid and reliable tool for studying elementary teachers' beliefs towards science teaching and learning" (p.

633). The researcher used the instrument to survey pre-service agriscience teachers (middle school and high school) and assumed transferability. Also, the researcher had to succinctly modify the instrument to adapt it to his repondents (e.g., changed "science" with agriscience in the instrument wording).

The STEBI has two constructs, the Personal Science Teaching Efficacy Belief (PSTEB) and the Science Teaching Outcome Expectancy (STOE). As presented in Riggs and Enochs (1990), STEBI has 25 items (13 for PSTEB, and 12 for STOE). The instrument uses a summative (Likert-type) 5-point rating scale format (SA = Strongly Agree, A = Agree, UN = Uncertain, D = Disagree, and SD = Strongly Disagree). When scoring, positively phrased items (e.g., I am continually finding better ways to teach science) received 5 points if the response was Strongly Agree, 4 if Agree, 3 if Uncertain, 2 if Disagree, and 1 if Strongly Disagree. Conversely, negative phrased items (e.g., even when I try very hard, I don't teach agriscience as well as I do most subjects) received 5 points if the response was Strongly Disagree, 4 if Disagree, 3 if Uncertain, 2 if Agree, and 1 if Strongly Agree.

Content validity of the instrument was established by Riggs and Enochs (1990) through an involved process:

> All items were edited for clarity by a measurement expert. The fifty resulting items were submitted to a panel of judges who were selected for their knowledge of the construct being measured. Judges were asked to classify each item as a member of the Science Teaching Outcome Expectancy Scale or the Personal Science Teaching Efficacy Belief Scale. Judges were also asked to rate the content validity of the resulting scales. Items inconsistently classified by three out of the five judges were eliminated. (p. 628).

Regarding construct reliability, PSTEB had "an alpha of 0.91" (Riggs and Enochs, 1990, p. 630), and STOE had an alpha of 0.77 (p. 631).

The instrument was also modified to include both a retrospective pre-survey and a post-survey in the same document (also called post then pre) (Attachment D), by asking students to report their agreement or disagreement with the instrument statements as they viewed them at the end of the course (when the survey was distributed), but also to report what they thought their level of agreement would have been before the course. This format allowed for the researchers to not only measure Teacher Efficacy Belief of the students, but also to collect data regarding perceived change because of the course (treatment).

Collection of Quantitative Data

At the end of each section of the course, all students (census) were asked to complete the instrument. The request indicated that completion was optional and voluntary. For Section 1, 21 out of 22 students completed the survey (response rate 95%), while for Section 2, only eight out of 15 completed the survey (response rate 53%).

Analysis of Data

The quantitative data obtained from the survey were analyzed using the Statistical Package for the Social Sciences (SPSS). The procedures used included Descriptive statistics and Compare means. Compare means was used to compare PRE (retrospective pre) and POST construct means (PSTEB and STOE), to determine whether or not there had been change in the value of the self-reported PSTEB and STOE through the course. To compare means, the researcher used paired samples t-tests (by respondent). The probability level of statistical significance was set with a priori alpha of $p < .05$.

CHAPTER 4

RESULTS

After analyzing the results, it was found that 12 key terms were of greatest prevalence for the interview process. Seven out of seven interviewees responded using the following key terms: hands-on, learning styles, practical application, resource material, student/teacher interaction, and teacher background. Six out of seven interviewees had the key term socioeconomics in common. Five out of Seven interviewees had the following key terms in common: ability to simplify, motivation, student/teacher interest, teacher confidence, and teacher preparation. How the terms were used by the interviewees (a demonstration of self-efficacy, outcome expectancy, or a shared response) was the issue that needed to be addressed.

As the questions were designed to test the two dimensions of teacher efficacy (self-efficacy beliefs and outcome expectancy), it was a surprise to discover that the manner in which the key terms were used by many of the interviewees was shared between the two dimensions.

Hands-on (Shared)

Six of the Seven interviewees used the key term hands-on in a way that reflected outcome expectancy. The remaining interviewee's response reflected self-efficacy belief.

The key term hands-on refers to one style of learning utilized by individuals. An individual who prefers hands-on learning tends to lean toward performing labs or other activities where they may observe or actually play a role in the assigned experiment, demonstration, or project. Every interviewee indicated that hands-on learning should be incorporated in all

classroom instruction in order to create a link between the material being covered in class and its practical use.

Interviewee 28: "The hands-on experiences were the best in helping me understand science, watching how science works in the lab. The hands-on experiences brought things together for me personally." This describes hands-on learning in a way that implies outcome expectancy, because the student recognizes the need to perform hands-on activities in order to comprehend how science should be utilized. Students that favor hand-on experiences in order to comprehend material would likely perform at a lower level if placed in a discussion or lecture based environment. It is necessary to accommodate all learning styles.

Interviewee 76: "My biology teacher in high school did a really great job of keeping people engaged. When learning taxonomy, we did a tree scavenger hunt and got to go outside. We had to identify the trees by their scientific name, and my partner and I won the contest (partly to my background, because I had already done tree identification). Just the actual fact of going outside and tying the fact that it is important to know the scientific names of the plants, then actually having it be a competition where we got to search for the plants and being rewarded with a dropped quiz grade was very effective." At first glance this interviewee seems to be talking about outcome expectancy in terms of the student; however, it became apparent that the instructor demonstrated a high level of self-efficacy in their choice of activities which resulted in a high level of self-efficacy in the students (in part due to previous experiences). As a result of this instructor's high level of efficacy, the students were engaged and motivated to perform. The fact that the activity was engaging and instilled confidence in the students' abilities to do the work without seeing it as work, rather an enjoyable exercise for which there would be rewards simply in discovering the importance of science, created the dimension of self-efficacy.

Learning Styles (Shared)

Six of the seven interviewees used the key term learning style in a way that reflected outcome expectancy. The remaining interviewee's response reflected self-efficacy belief.

Interviewee 27: "A lot of school systems portray agriculture and agriscience as vocational so you have the reliance between the administration, counselors, and teachers. You try to find those students that are willing to be in there, and once they are in there you are trying to find out how they best learn and what information is most going to appeal to them. You have the struggle with guidance counselors being so overwhelmed and having so much on their plate that sometimes they simply put students in your Ag classes because they don't feel they can do the regular course work." The end of this quote shows some evidence of self-efficacy, but when you look at the entire quote it refers to outcome expectancy. This quote addresses the issue that if students are willing participants in a course they are more likely to do well. Many students do get placed in courses in which they are not necessarily interested in due to their performance in other courses at the high school level. This is a real issue that needs to be addressed. Georgia has recently removed the general education diploma as an option for high school graduates; however, the vocational seal is still an optional addition. This forces every student to graduate at a college preparatory level. It must be pointed out that limiting students to a college preparatory diploma may hinder those students who desire to receive a general diploma with a vocational seal as they do not wish to attend college.

Interviewee 15: "I would choose greenhouse management for that is my background. See, I like anything that is hands-on for I am a hands-on learner. If I can't do it, I don't learn it, and I feel that a lot of students are that way." This interviewee references learning styles and associates it with outcome expectancy. He/she directly refers to hands-on learning and expresses

the belief that, in order to link course subject matter with practical application, hands-on activities are necessary.

Practical Application (Shared)

Seven of the seven interviewees used the key term practical application in a way that reflected outcome expectancy. However, two of the interviewees' responses to one question reflected self-efficacy. The remaining interviewee used the key term in a manner that reflected outcome expectancy on every question but one which resulted in a view reflecting self-efficacy belief.

Interviewee 1: "As a student in high school you really didn't receive anything, but open your textbook and hears the material. You had to learn it and know it for the test. There wasn't anything outside of class that you could compare what you learned in class to. Same way with science, if I know what to look for outside of class (nature or in plants) that would be better for me to know how to apply it. In college they give you applications to use it outside of class." Outcome expectancy is reflected in this interviewee's use of the key term practical application. If techniques are not utilized, by the teacher, to link subject matter content with practical application, low outcome expectancy would be anticipated. This is directly related to the teacher's potential lack of self-efficacy which may be the imminent result of poor self-esteem.

Interviewee 15: "I feel that we would get more out of the field trips if we could actually watch the teacher in action as opposed to here is the program and here are all the wonderful things I have, here is all my animals and everything. It's great to see all that, but it is not teaching us how to be a teacher and how to teach agriscience. The most I've learned from the whole class was the very last assignment we had to do, the lesson plan. I would have done that in the beginning, the very first day of class. I would have gotten my hands on a syllabus or

curriculum from the high school setting and said this is what I have to teach and this is the amount of time I have to teach it. You, as students, sitting in this agriscience for teachers' class are going to teach a topic to each of these students in our class, getting experience. Then we are going to bounce back off each other and critique each other on what we did well, not so well, and, as experts, have the teachers critique us." This interviewee's response clearly shows a correlation with self-efficacy. Being able to see how other teachers perform tasks and handle behavior is extremely important for one to prepare to become a teacher and build the self-esteem necessary to accurately relay information in a classroom setting. As a pre-service teacher, this interviewee feels that practical application is necessary.

Resource Material (Outcome Expectancy)

Seven out of seven interviewees' referenced the key term resource material. Their response reflected outcome expectancy in their use of the key term.

Interviewee 14: "Sometimes textbooks change and new material is presented. I had a chemistry class where the textbooks were outdated, and the periodic tables that belonged to the science department were way outdated, and some newer elements weren't even on them. I feel that students should be receiving updated information rather than what was around when the teacher was in high school." Outcome expectancy is at the root of this interviewee's response. He/she hits on a very good point. If teachers want their students to excel in their class, as well as in the future, they must provide up-to-date information and techniques. Teachers must continue with professional development, as well as personal development, in order to stay in touch with the changes that are constantly taking place.

Interviewee 27: "I don't know if the funding just wasn't there, but my biology class in high school was in a mobile, and that is not good for science at all. We had to trade with another

biology teacher to have access to a lab when we needed to do labs. This wasn't the biggest hindrance, but it really gave you a different mindset." This response reflects low outcome expectancy. When working with students it is important to have access to the proper materials and facilities. Inferior facilities and funding limits have the potential impair student performance. This may affect your current students and their future course selections.

Student/Teacher Interaction (Shared)

Three out of seven interviewees responded in a manner that reflected a correlation between student/teacher interaction and outcome expectancy. Three out of seven interviewees used student/teacher interaction in a way that showed an interaction between the two dimensions. One out of seven interviewees response demonstrated self-efficacy beliefs when referring to student/teacher interaction.

Interviewee 28: "I would definitely emphasize interaction with the students as far as having success in an agricultural classroom. I feel that it stands out above all the rest. When you understand your students, you can understand how to teach to them. You learn their needs and interests, and that is what will help you have success the most." Meeting the needs of the students is one of the most important things a teacher can achieve. In order to meet their needs, an instructor must earn their trust and respect so they can identify with the students. This response clearly demonstrates outcome expectancy; however, self-efficacy is also applicable for not all teachers believe that developing close interaction with the students is appropriate.

Interviewee 15: "Interaction with the students is always important, being on their level. Everybody has bad days; everyone has personal problems and outside activities. So, if you can put yourself on the level of the students and know where they're coming from, it's going to put things in a comfort zone. Yes, you are still the teacher, and you are the authority in the class, but

you don't have to stand up there like an authoritarian figure. A lot of teachers start out going (first day of class) around trying to get to know the students and things like that (especially on the middle school and high school level), because a lot of students are very involved in outside activities. Attend some games. Attend their fairs. Try to put yourself on more of a personal level, and you'll be able to gain their respect, if you are showing support for them in other areas of their life, other than just the subject you are teaching." This response demonstrates self-efficacy, because not all teachers believe that one should have close relationships or interactions with the students, especially outside of the classroom. However, building these ties of trust will increase the students' self-efficacy as well as their outcome expectancy for this and future courses.

Teacher Background (Shared)

Three out of seven interviewees responded in a manner that reflected teacher background more as outcome expectancy. However, interviewee 27's response to two out of six questions demonstrated self-efficacy belief. Interviewee 1's response to one out of four questions demonstrated self-efficacy belief and their response to one out of four questions showed that the two dimensions were shared. Four out of seven interviewees used teacher background in a manner that reflected self-efficacy belief.

Interviewee 81: "My background, I've taken biology and chemistry in high school and got good grades. In college I've taken two biologies and a chemistry. I feel that, if I were to teach a biology class, I wouldn't be as prepared. However, if I were to teach agriscience, it wouldn't be as hard simply because with biology it's a lot of DNA and things which requires a lot of details. I feel that agriscience just scratches the surface which would be a lot easier. I'm just judging by the agriscience class that I'm taking now because they're just going over the

lesson plans and certain labs and explaining why. I guess it's because I feel that I've done that before and understand what they're talking about." This interviewee is clearly portraying self-efficacy in their response to the question. He/she is not certain in his/her ability to go into depth on scientific concepts which demonstrates that more preparation and professional development would be necessary to prepare for classroom instruction.

Interviewee 27: "I've taken regular science courses all the way through school. I took two extra courses in high school, and I was a biology major starting out my college education. Since I wasn't involved in agriculture or FFA, I participated in 4-H as a Cloverleaf; I was in the geology category and did a demonstration on that. I have always been kind of into the science side of things and always wanting to take the weekend to go to the aquarium, Fernbank, or something science related." This interviewee demonstrates self-efficacy through passion for science which shows a strong belief in the importance of knowing about science and how it is applied. If this interviewee were to teach in an agriscience related field, he/she would be expected to succeed.

Socioeconomics (Shared)

Of the six interviewees that used socioeconomics, four out of six interviewees used the term in a manner that reflected outcome expectancy. One out of the six interviewees' use of the term reflected self-efficacy belief. Another one out of six used the term in a manner that demonstrated the two dimensions as being shared.

Interviewee 15: "The pressures of fitting in, the bi-cultural pressures, and the socioeconomic pressures are of concern. I was not a rich girl going to a private school, so the economic pressures were hard to handle. I was a lower middle class girl going to a private school, so I had those pressures too, but we wore uniforms, so it was not as bad as it is in the

public schools." As the interviewee points out, it is very important to recognize the socioeconomic and cultural pressures that may exist in an area. This falls into self-efficacy because many may struggle with how to help the students or even feel they have no way to help. Also, this is outcome expectancy for these pressures force one to the realization that students will not perform as well as they would if the pressures were removed or reduced.

Interviewee 76: "Home problems, social pressures, boyfriend/girlfriend problems, and funding are areas that can't be controlled by the teacher." Again, this interviewee points out that social and economic pressures directly influence students. Self-efficacy is the focus of this response as the interviewee dictates that the teacher has no control over such circumstances.

Ability to Simplify (Shared)

Four out of five interviewees used the key term ability to simplify in a way that reflected outcome expectancy. One out of five interviewees response used the term in a manner that demonstrated self-efficacy belief in responses to all questions but one. Interviewee 14's response to question 5,1 reflected outcome expectancy.

Interviewee 14: "I think it is the fear of science. Some students fear science and just shut their brains off. The way science just scares some people because they had bad experiences elsewhere. I feel that, if you can hide the science, student success will be a lot higher." This interviewee points out that some people may have had bad experiences in other science courses and, therefore, may shy away from the subject or perform at a lower level. The interviewee actually points out that some students fear science and that, in order to increase interest and ease of learning, one should figure out how to present scientific material in a simplified way. This is clearly outcome expectancy because of the students' lack of motivation or interest due to

previous bad experiences. It doesn't reflect that the students feel they are incapable of doing the work.

Interviewee 28: "I have had teachers teaching material that was too far over my head and not simplifying it enough to explain it to us as students." This response is directly linked to outcome expectancy. If teachers do not recognize that the students do not comprehend the material they are presenting, the students' performance will be lower than desired.

Motivation (Outcome Expectancy)

Five out of five interviewees referenced the key term motivation. Their use of this key term demonstrated outcome expectancy.

Interviewee 76: "You are going to have students who are taking agriscience for they feel it is easier than chemistry. Other students will be in the class because it may fit in with the tech-prep and they are only in there to graduate high school (only goal in life). Other students are going to think that this is far easier than their chemistry class, and they are not going to really want to be there and will cut up and feel they are too good for the class." When students are in a class but have no real interest in the class itself, they are not as likely to perform as well. This clearly represents outcome expectancy. However, a teacher with a high level of self-efficacy may be able to motivate the majority of such students to become active participants.

Interviewee 27: "You should want to continue to be in their minds and let that knowledge take root and grow. Maybe they are the challenge to you as a teacher, and maybe they're the reason you need to look to make yourself better, to find that innovative technique, to go where no one has ever gone before, to be different. I think for the instructor's sake that he/she should see it as their problem, their next challenge, and their next hurdle to go over. I think this can only make you better in your profession and your objectives because it is what you

are getting up for in the morning. Those kids are there to inspire you when they don't just get it the first time or don't exactly go with the way you have planned it. I don't feel that the instructor is going to always be effective with every student, but that is an essential part of being an educator." This interviewee is clearly responding in a way that reflects outcome expectancy. It is the teacher's place to figure out how to best present material to their students and challenge the students to perform well. A good instructor should think outside the box and look at the circumstances surrounding those students who aren't grasping the information quickly, in order to come up with an innovative way to relate the information to those students' learning styles.

Student/Teacher Interest (Shared)

Four out of five interviewees used the key term student/teacher interest in a way that reflected outcome expectancy. One out of five interviewees referred to the key term in a manner that demonstrated self-efficacy belief.

Interviewee 14: "I know that some lecture is necessary, but I feel that, especially in high school, too much lecture allows you to lose attention. It's very hard to hold attention; I have a long attention span, but most students you would lose. I really like being able to do the experiments and see the lesson plans better than I did lecture. I really liked when Dr. Navarro did the learning styles, and I think that is something that should be touched on in every education class." If students are losing focus on the subject matter because it is not presented in a manner that interests them, the students will perform at a lower level. This directly affects outcome expectancy. Lessons must be engaging and cover multiple learning styles by utilizing hands-on activities, discussion, movies, and even music (if only as a break from the ordinary). In order to reach the highest level of performance, one must be as innovative as possible in order to reach the majority of the students.

Interviewee 1: "I had a lecture course in college that the teacher did a great job on keeping us in tune. There were pictures and motions on the screen that kept our attention (it wasn't just a monotonous list of words). I think that a teacher needs to know how to engage each student. If they have a student that doesn't grasp it [comprehend the information], the student can be pulled out (not during class) and worked with after school." It is clear that the interviewee recognizes the need to reach out to every student, and in order to be affective, he/she must utilize various tools for student engagement. In order to reach all the students, the teacher must get to know their students needs and interests. Once student interests are known, the instructor can tailor their lessons to meet their needs. When multiple learning styles are utilized optimum outcome expectancy will result.

Teacher Confidence (Self-Efficacy Belief)

Five out of five interviewees referenced the key term teacher confidence. The interviewees' response demonstrated self-efficacy belief.

Interviewee 15: "I feel that I could be successful. However, you recognize that you have a low self-esteem. Others see your success in something, but you don't really see it yourself. When you do a job you do it well in your bosses' eyes, but you don't see that you do it well. It can be a hindrance, but, overall, you feel that it is a strength for you have that drive to always improve and make it better." This interviewee finds it hard to see when they do a good job due to low self-esteem. This lack of assurance in one's ability to do good or excellent work demonstrates self-efficacy. Through professional development and mastery skills training, this individual's self-efficacy may be positively influenced.

Interviewee 76: "How comfortable am I teaching agriscience techniques, not at all. If I were to be a teacher, I would probably be spending 90% of my time at home studying. I'd

probably be studying more than the students in order to be able to teach it. So, I'm not comfortable at all." The interviewee is not comfortable in his/her ability to accurately relay information to students without having to spend a lot of personal time learning the material. Not believing in one's own ability can lead to nervousness, second guessing, and low self-efficacy which affects the students as well as the teacher.

Teacher Preparation (Shared)

Five out of five interviewees referred to the key term teacher preparation. However, interviewee 1 responded to four out of five questions in a manner that demonstrated outcome expectancy and to one out of five questions in a manner that demonstrated the two dimensions were shared. Interviewee 14 responded to four out of six questions in a manner that demonstrated self-efficacy, to one out of six questions in a manner that demonstrated outcome expectancy, and to one out of six questions in a manner that demonstrated the two dimensions were shared. The remaining three interviewees referred to teacher preparation in a manner that demonstrates self-efficacy.

Interviewee 14: "I think that the background is very important, and you must be prepared for class because students aren't going to sit and be quiet while you prepare for the experiment. You've got to know what is coming and be able to have everything ready for them (you can't go to make copies in the middle of the class). You've got to have everything ready the day before or the morning before class starts." A lack of preparation can lead to disorder which reduces outcome expectancy for the class as a whole. Teachers must always strive to be prepared in order to ensure that material is always available. Thorough preparation is essential to ensure that student engagement is not lost.

Interviewee 81: "If I'm teaching a high school class, they'll have more questions because they don't have the background I do. I feel that I would really have to know what I was doing. If I'm doing a lesson plan for tomorrow, I'll have to really prepare and make sure that I know what they may ask, so I can answer all their questions and not look like an idiot. I feel that being prepared for a certain day is very important for you can't just come to class and say okay kids just read this chapter. You really need to be ready for the kids, always be prepared, and always have something for them to do." This interviewee is unsure of his/her ability to accurately answer questions that may be asked by the students which is clearly representative of self-efficacy. It is true that one will not always have all the answers; however, if a teacher has prepared for the lesson and has a background in the subject matter, he/she should be capable of providing sufficient information to answer any question presented by a student. It is important to remember that one can never be over prepared for class, but it is also important to realize that the teacher is the authority on the subject and that, if the answer is not known, one should admit it and provide accurate information at a later date.

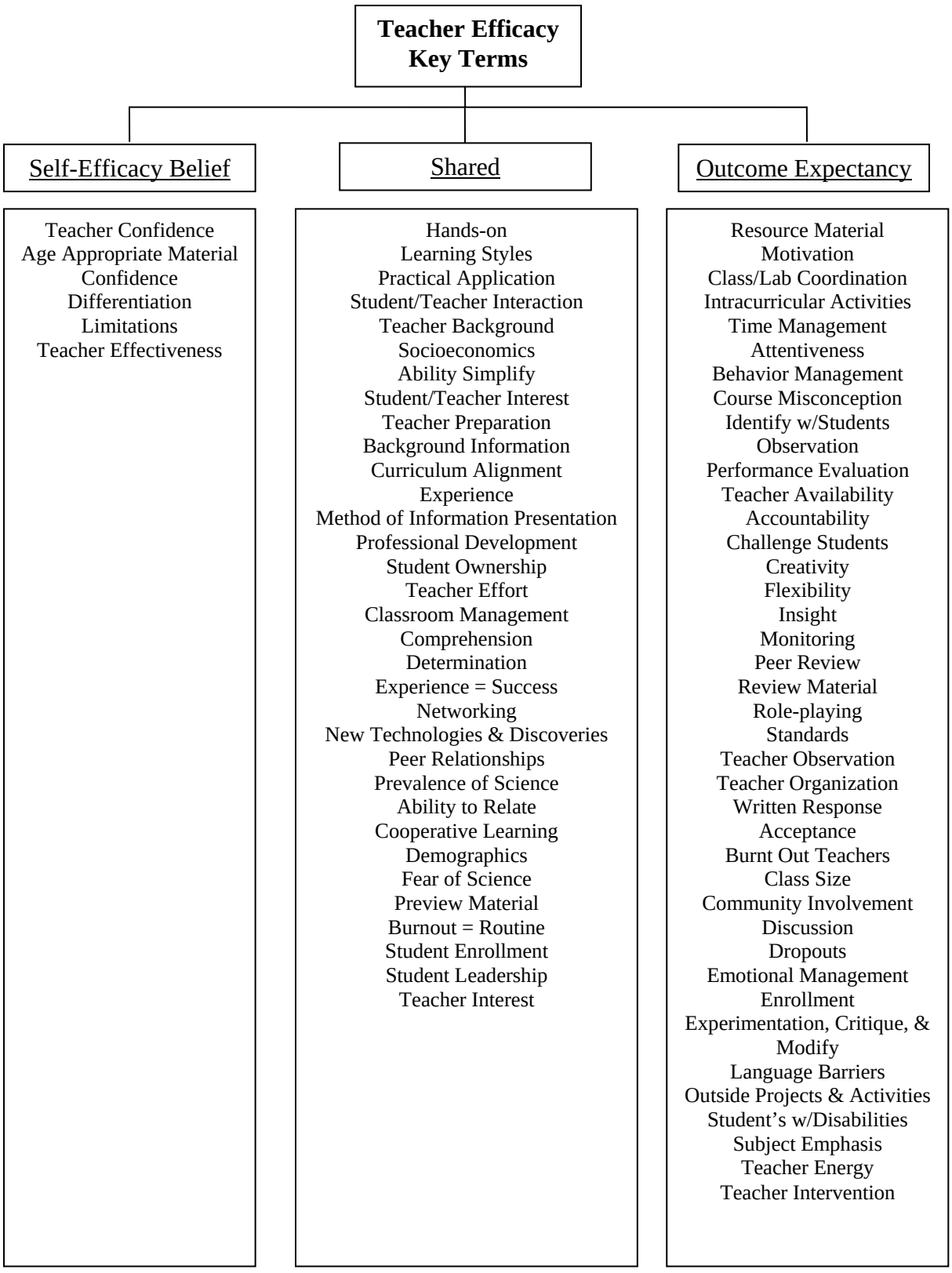

Figure 2. Teacher efficacy key terms.

Table 1. Classification of Key Terms by Interviewee and Dimension

			Interviewees						
Key Terms	**n**	**D**	**28**	**15**	**81**	**76**	**27**	**14**	**1**
Hands-on	7	O	1,1	2,2	1,1; 2,1; 5,1; 7,2		1,2; 3,1	1,2; 3,1; 5,2; 5,3	7,1; 7,2
		E				1,1; 2,1; 3,1; 7,3; 8,1; 8,2			
		OE							
Learning Styles	7	O	3,1; 5,1; 5,2; 5,3	2,2; 5,1	3,1; 5,3; 6,1		5,1	1,2; 5,1	5,1; 5,3; 6,1
		E				1,1; 5,1; 5,2; 5,3; 6,1			
		OE							
Practical Application	7	O	1,1; 2,1; 3,1	3,1; 7,1; 7,2	2,1	1,1; 3,1; 8,2	1,2; 3,1; 7,2	8,1; 8,2	1,1; 3,1; 7,1; 8,1; 8,2
		E		1,2					4,1
		OE							
Resource Material	7	O	1,1; 7,2	1,2	1,2; 3,1; 8,1; 8,2	8,2	1,2; 7,2	1,2; 4,1; 8,1; 8,2	1,2; 4,1; 7,1
		E							
		OE							
Student/Teacher Interaction	7	O					1,1; 5,3; 6,1; 8,2	1,1; 1,2; 3,1; 5,2;	3,1; 5,2
		E		5,2; 6,1					
		OE	5,2		5,1	3,1; 5,1; 5,2; 6,1			
Teacher Background	7	O	4,1				1,1; 1,2; 7,1; 7,2		5,3; 7,1
		E		2,1; 2,2; 7,1; 7,2	2,2; 7,1	1,1; 4,1; 5,2; 7,1; 7,2	2,1; 4,1	2,1; 5,2; 7,1	2,2
		OE							2,1
Socioeconomics	6	O	6,1		6,1		6,1		5,3
		E				6,1			
		OE		6,1					
Ability to Simplify	5	O	5,1	1,2		3,1		5,1	8,2
		E						2,1; 5,2; 7,1	
		OE							

Table 1 cont'd.

Key Terms	n	D	Interviewees						
			28	**15**	**81**	**76**	**27**	**14**	**1**
Motivation	5	O		5,2		5,3	5,1; 5,3	2,1; 5,2; 5,3	1,2; 2,1
		E							
		OE							
Student/Teacher Interest	5	O				1,1; 5,3; 7,1; 7,3	1,1; 1,2; 2,1; 3,1; 5,3	1,1; 1,2; 5,3; 8,2	1,1; 5,1; 5,3; 6,1; 7,1
		E			2,1				
		OE							
Teacher Confidence	5	O							
		E	4,1	4,1		7,1	4,1; 7,1; 8,1		7,1
		OE							
Teacher Preparation	5	O						5,2	1,2; 6,1; 7,2; 8,1
		E			4,1; 7,1; 7,2; 8,2	2,1; 5,2; 6,2; 7,2; 7,3	4,1	4,1; 7,1; 7,2; 7,3	
		OE						1,2	7,3
Background Information	4	O							
		E	1,2; 1,2, 5,1; 7,3	7,2; 8,1		1,2			5,2; 7,2
		OE							
Class/Lab Coordination	4	O		1,1	1,1	1,1	8,2		
		E							
		OE							
Curriculum Alignment	4	O	2,1; 2,2				1,2; 2,1; 3,1	2,1	2,1
		E			2,1				
		OE							
Experience	4	O		1,2	4,1				
		E							
		OE				4,1		4,1; 8,1	
Intracurricular Activities	4	O			8,2		1,2	5,3; 8,2	1,2
		E							
		OE							
Method of Information Presentation	4	O					8,2	1,2; 2,1	8,2
		E				6,1			
		OE				7,3			
Professional Development	4	O				4,1; 7,1		4,1; 5,2	
		E		4,1; 7,2				7,2	
		OE	7,2				4,1		

Table 1 cont'd.

Key Terms	n	D	Interviewees						
			28	**15**	**81**	**76**	**27**	**14**	**1**
Student Ownership	4	O				7,1			1,2
		E							
		OE	5,2	5,3; 6,1					
Teacher Effort	4	O			5,1			1,2; 5,3	
		E					5,3		
		OE				4,1			
Time Management	4	O				2,1; 8,1; 8,2	1,1; 8,2	1,1; 8,2	6,1; 8,2
		E							
		OE							
Attentiveness	3	O					8,2	5,3	6,1
		E							
		OE							
Behavior Management	3	O					5,2; 6,1	5,3; 6,1	6,1
		E							
		OE							
Classroom Management	3	O					8,2		
		E	6,1						
		OE				6,1			
Comprehension	3	O						3,1; 5,1	
		E		1,2				4,1	
		OE						2,1	
Course Misconception	3	O		1,2; 8,1			8,1	2,1; 8,1; 8,2	
		E							
		OE							
Determination	3	O					1,1	5,3	
		E		4,1					
		OE							
Experience = Success	3	O	4,1						
		E							
		OE		7,2					4,1
Identify w/students	3	O					5,2;		1,2; 5,1; 5,2
		E							
		OE							
Networking	3	O					3,1; 4,1; 7,2		4,1
		E				3,1; 8,2			
		OE							

Table 1 cont'd.

			Interviewees						
Key Terms	**n**	**D**	**28**	**15**	**81**	**76**	**27**	**14**	**1**
New Technologies & Discoveries	3	O		4,1			4,1		
		E							
		OE				4,1			
Observation	3	O		1,2; 8,2					
		E							
		OE							
Peer Relationships	3	O					6,1		5,3
		E				6,1			
		OE							
Performance Evaluation	3	O			8,2		1,1; 4,1	1,2	
		E							
		OE							
Prevalence of Science	3	O							3,1; 7,1
		E	2,1; 2,2; 3,1		3,1				
		OE							
Teacher Availability	3	O			1,2		1,1	1,2	
		E							
		OE							
Ability to Relate	2	O					5,3		
		E		6,1					
		OE							
Accountability	2	O		6,1			6,1		
		E							
		OE							
Challenge	2	O				1,1		1,1	
		E							
		OE							
Cooperative Learning	2	O					6,1; 7,2		
		E							
		OE		5,2					
Creativity	2	O			5,2		1,2		
		E							
		OE							
Demographics	2	O							2,1
		E				2,1			
		OE							
Fear of what is not understood	2	O						2,1; 5,1	
		E							
		OE	5,1						

Table 1 cont'd.

Key Terms	n	D	Interviewees						
			28	15	81	76	27	14	1
Flexibility	2	O		5,2				5,1; 5,3	
		E							
		OE							
Insight	2	O	4,1						7,2; 8,1
		E							
		OE							
Monitoring	2	O			1,1			5,1	
		E							
		OE							
Peer Review	2	O							8,2
		E							
		OE							
Preview Material	2	O	1,1; 1,2						
		E						1,1	
		OE							
Review Material	2	O			1,2; 3,1; 5,3			5,1	
		E							
		OE							
Role-playing	2	O		1,2; 8,2			3,1		
		E							
		OE							
Standards	2	O					1,1	1,2	
		E							
		OE							
Teacher Observation	2	O			5,3; 6,1	5,2			
		E							
		OE							
Teacher Organization	2	O				7,3; 8,1		8,2	
		E							
		OE							
Written Response	2	O			5,3		1,1		
		E							
		OE							
Acceptance	1	O							3,1; 6,1
		E							
		OE							
Age Appropriate Material	1	O							
		E			1,2				
		OE							

Table 1 cont'd.

Key Terms	n	D	Interviewees						
			28	15	81	76	27	14	1
Burnout = Routine	1	O							
		E							
		OE	4,1						
Burnt Out Teachers	1	O	5,1						
		E							
		OE							
Class Size	1	O				1,1			
		E							
		OE							
Community Involvement	1	O							2,1; 5,2
		E							
		OE							
Confidence	1	O							
		E							7,3
		OE							
Differentiation	1	O							
		E				2,1			
		OE							
Discussion	1	O			5,3				
		E							
		OE							
Dropouts	1	O						5,3	
		E							
		OE							
Emotional Management	1	O					5,1		
		E							
		OE							
Enrollment	1	O					5,1		
		E							
		OE							
Experimentation, Critique, and Modify	1	O		1,2					
		E							
		OE							
Language Barriers	1	O		1,2					
		E							
		OE							
Limitations	1	O							
		E				5,2			
		OE							
Outside Projects and Activities	1	O	5,3						
		E							
		OE							

Table 1 cont'd.

Key Terms	n	D	Interviewees						
			28	15	81	76	27	14	1
Student Enrollment	1	O							
		E							
		OE				6,1			
Student Leadership	1	O							
		E							
		OE		6,1					
Students w/Disabilities	1	O				5,3; 6,1			
		E							
		OE							
Subject Emphasis	1	O	2,2						
		E							
		OE							
Teacher Effectiveness	1	O							
		E				5,3			
		OE							
Teacher Energy	1	O			5,2				
		E							
		OE							
Teacher Interest	1	O			5,1				
		E			1,2; 5,2				
		OE							
Teacher Intervention	1	O					6,1		
		E							
		OE							

n= the number of interviewees associated with a key term.
D= dimension
O= outcome expectancy
E= self-efficacy beliefs
OE= sharing of the two dimensions (outcome expectancy & self-efficacy beliefs)

This study also included a quantitative instrument, the Science Teaching Efficacy Belief Instrument, used to complement the data from the interviews. Table 2 shows the results of the student responses to the Retrospective Pre and Post survey with the Science Teaching Efficacy Belief Instrument (Personal Science Teaching Efficacy Belief Scale [PSTEB] and Science Teaching Outcome Expectancy Scale [STOE]), for Section 1 and Section 2 of the Agriscience for Teachers course. It is important to note that the average values for both groups, in both pre

and post survey, are lower than the values reported by Riggs and Enochs (1990) in their sample (n=327) (reported PSTEB *M*>55, and reported STOE *M*>49). The main differences among this study's sample and the one reported in Riggs and Enochs (1990) are in teaching experience and level of science teaching (high school as opposed to elementary school). In fact, in this study's case, the respondents were pre-service agriscience teachers (college students with the intention to teach middle school/high school agriscience in the future), while Riggs and Enochs (1990) sample included only practicing *elementary science* teachers, ranging from 1-5 years of teaching experience (17%) to more than 20 years of teaching experience (29%).

Table 2. Results of the responses to the Retrospective Pre and Post student survey of the Science Teaching Efficacy Belief Instrument (Personal Science Teaching Efficacy Belief Scale [PSTEB] and Science Teaching Outcome Expectancy Scale [STOE])

Respondent	PSTEB Pre	PSTEB Post	STOE Pre	STOE Post
Agriscience for Teachers Section 1				
a	34	39	41	41
b	52	52	35	35
c	42	51	40	41
d	48	48	37	37
e	51	54	.	.
f	51	53	38	40
g	43	51	42	46
h	43	51	38	38
i	43	49	41	41
j	35	43	.	.
k	28	48	34	39
l	43	49	46	48
m	36	50	42	47
n	49	49	43	43
o	23	52	40	45
p	47	60	39	46
q	41	57	39	39
r	42	42	42	42
s	48	58	41	50
t	53	55	47	47
u	42	51	38	44
Mean Section 1	42.57	50.57	40.16	42.58
Agriscience for Teachers Section 2				
1	33	43	34	35
15	37	38	41	45
85	.	.	44	45
62	38	47	40	42
14	37	43	.	.
27	39	49	38	45
40	48	40	37	37
88	.	.	43	44
Mean Section 2	38.67	43.33	39.57	41.86

Several teaching efficacy scholars have used changes in teaching efficacy through interventions to justify the need for changes in teacher pre-service education or to promote

teacher efficacy "training" in in-service programs to improve student outcomes (Hoy & Spero, 2005; Tucker et al., 2005). This study also analyzed the change experienced throughout the course in teaching efficacy belief by asking respondents (pre-service teachers) to respond to the STEBI "before" (retrospective pre) and "after" the course (post). Table 3 shows the results of paired samples (by student) *t*-tests comparing the "pre" and "post" STEBI (PSTEB and STOE) results for course Section 1. The paired samples *t*-test show a significant difference in both comparisons (PSTEB pre compared with PSTEB post, and STOE pre compared with STOE post), meaning that students perceived that they had improved their Personal Science Teaching Efficacy Belief and their Science Teaching Outcome Expectancy (thus their Teaching Efficacy) throughout the course.

Table 3. Results of Paired Samples *t*-tests Comparing the "pre" and "post" STEBI (PSTEB and STOE) results for respondents in Course Section 1

	Paired Differences							
				95% Conf. Int. of the Diff.				
Comparison	Mean	Std.Dev.	Std. Error Mean	Lower	Upper	t	df	Sig (2-tail)
Pair 1 PSTEB Pre-Post	-8.00	7.37	1.61	-11.35	-4.65	-4.98	20	.000**
Pair 2 STOE Pre-Post	-2.42	2.93	0.67	-3.83	-1.01	-3.60	18	.002**

*p<.05 **p<.01

CHAPTER 5

CONCLUSION

Teacher efficacy is at the root of teacher success and failure. It is divided into two dimensions (self-efficacy beliefs and outcome expectancy). Bandura (1994) originally addressed the topic of teacher efficacy and defined it as people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives and determine how they feel, think, motivate themselves, and behave. Interviewee responses demonstrate that teachers with a strong sense of self-efficacy will challenge their students, seek out new ways of teaching, and display persistence when working with struggling students (Deemer, 2004); these teachers do not stop perfecting their methods when the workday ends for they strive to always improve their ability to produce results in the classroom environment. Anyone who considers education for their profession just because they want a job that is going to give them summers off and workdays that are over by three or four o'clock, should not teach for they may find themselves overwhelmed.

Interviewees' responses indicated that teacher background was of great importance to teacher efficacy. The relationship between teacher background and teacher efficacy is supported by Hoy and Woolfolk, "teacher level of education is positively related to her/his personal efficacy beliefs" (1993, p. 367). A strong background, in the teacher's area of focus, is needed to promote a high level of teaching efficacy. Professional development opportunities should be afforded teachers who may lack the background to reach a high level of efficacy.

The interviewees' responses indicated a need for pre-service teachers to have the opportunity to observe seasoned instructors (this is mastery skill development). According to Deemer (2004) mastery skill development is necessary to achieve higher levels of teaching efficacy. Based on what has been stated by interviewees and researchers, mastery skill development is needed by teachers. In order for teachers to receive mastery skill development it would be in the school administrator's best interest to develop a summer workshop headed by mastery teachers (seasoned professionals with a high success rate). Many administrators assign new teachers mentors; however, the mentors are usually in place for program support and are not used for mastery skill development.

Mastery skill development is further supported by the interviewees in their belief that successful teachers are ones that believe in the subject they teach and their ability to successfully provide adequate instruction. Schools are riddled with teachers that perform at varying degrees of efficacy. Shore (2004, p. 116) notes that teacher efficacy is related to "powerful forces [such as] a sense of personal accomplishment (where the teachers view their work as important), a willingness to try innovative practices, and personal responsibility for student learning in that area. It is apparent that belief in one's ability and area of focus is necessary to be successful in the classroom. The school administration and community can help set the example for teachers by providing adequate support, resources, and funding, for if they do not support the program then fewer teachers will succeed due to lack of motivation. This is further supported by Deemer (2004) and Hoy and Spero (2005), all of whom note that administrative practices at schools (mastery goal orientation or performance-oriented) directly influence teacher efficacy, especially for first year teachers. Schools at the mastery level equally provide resources and opportunities to all teachers, and this should be the goal of all school systems. Also, Hoy and Spero (2005, p.

343) note that, “changes in efficacy during the first year of teaching is related to the level of support received.”

Outcome expectancy is related to self-efficacy as it results directly from the decisions teachers make and the results those decisions produce (Bandura, 1986; Pajares, 1993). Outcome expectancy refers to a teacher’s belief that he/she can produce outcomes (whether positive or negative) and that their students are capable of learning the subject at hand. A teacher’s belief in his/her students’ abilities, or lack thereof, will determine whether or not he/she engages certain students participating in their class and will directly effect the students’ performance (positively or negatively) in the class. Also, outcome expectancy will directly affect the method of preparation and information presentation the teacher will utilize for their class.

Researchers hope to utilize teacher efficacy in a way that will promote the development of an instrument that may be implemented to measure teacher quality (Shaughnessy, 2004; Shore, 2004). However, if such an instrument was successfully developed and implemented, how would it be utilized? Such an instrument could be viewed as a gift, yet further hinder the quality of the education afforded students, as it potentially could be utilized for screening purposes. It is necessary to always be aware of the positive and negative influences research may impose on teacher efficacy.

The results of this study show that the two dimensions of teacher efficacy are intertwined. A successful teacher is one that should believe in the subject he/she is teaching, his/her ability to successfully provide adequate instruction, and the students with whom he/she works. He/she should continuously strive to seek new and innovative ways to instruct and motivate students in order to achieve the highest outcomes possible. A successful teacher should always be adequately prepared for current and future lessons in the event of unforeseen circumstances. It is

very important that he/she identify with students and be observant of their actions and reactions in order to best meet their needs. A teacher working with students participating in school athletics, or other extracurricular activities, should try to attend a few of the events so the students will learn to identify with him/her and see him/her as being approachable.

The interviewees demonstrated positive efficacy in their response to all of the questions as they recognized the information that was beneficial as well as the information they determined to be of little interest. They demonstrated genuine concern for their potential future students, a desire for continued personal and professional development, and a need to observe seasoned teachers (master goal oriented) working in the classroom environment. Overall, the interviewees show an increase in teacher efficacy as a result of participating in the Agriscience for Teachers course.

There was an unexpected development amongst a few of the interviewees' responses. When asked if they would choose a science or non-science based agricultural education course, they seemed to be unsure as to which courses were science related. An example is one interviewee's statement that he/she would choose the non-science based course, yet he/she used horticulture as the non-science based example. Another interviewee stated that he/she didn't consider palpation and animal reproduction to be a part of agriscience. This inability to link science based content as being an essential part of agriscience is of concern, and appropriate planning should be implemented to ensure a comprehensive understanding of agriscience and its uses. These individuals and others like them need to improve their background and strive for mastery skill development.

In order to further this research, it would be important to repeat the interviews of pre-service agriscience teachers participating in an "Agriscience for Teachers" course and follow

them into their first three to five years of teaching at a middle or high school. The interviews could be conducted during their first, third, and fifth year of instruction. This is an area of teacher efficacy that has not yet been focused upon and would fill a current gap in research. During the initial pre-service interviews it would be necessary to determine how well the interviewees understand agriscience and its application in agriculture related courses. This could be evaluated through a pretest, retrospective pre-test and post-test format.

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Appendix A

Dear Students,

I (Brent Jackson) am contacting you in order to thank you for participating in the research linked with the Agriscience for Teachers course. You have already participated in a pre-survey, and your participation was greatly appreciated.

We need additional feedback in order to develop a better understanding of the needs of present students, future students, and future teachers, so we can focus on those needs to offer the best curriculum. My portion of this research is to conduct an interview with as many of you as are willing to participate in the interview process. There is no direct gain for you (monetarily or otherwise); however, you will indirectly be helping to ensure a better educational/learning experience for future students.

Dr. Navarro has expressed interest in interviewing 2 or 3 of you herself. If you are interested in allowing her to interview you, please let me know via e-mail and I will follow up with her.

Your participation in the interview is voluntary, and it will not reflect (in any way) on your involvement in the course. The interview question/answer sheets will be coded using the same key used to code your pre and post surveys. Your name will not be used to identify who the participant is while analyzing the results, but for tracking purposes only (e.g., linking the interview with the survey responses).

Again, I would like to thank you for your participation and your help. Please feel free to talk with me about any concerns you may have. Also, please find enclosed, for your information, a copy of the consent form for the interview.

Sincerely,

Brent Jackson

Appendix B

The Effects of Participation in Agriscience for Teachers on Agriscience Teaching Efficacy Belief

I, _____, agree to participate in a research study titled "The Effects of Participation in Agriscience for Teachers on Agriscience Teaching Efficacy Belief" conducted by Brent Jackson from the Department of Agricultural Leadership, Education, and Communication at the University of Georgia (phone: 706-583-0863) under the direction of Dr. Maria Navarro, Department of Agricultural Leadership, Education, and Communication, at the University of Georgia (phone 706-583-0225). I understand that my participation is voluntary. I can refuse to participate or stop taking part without giving any reason, and without penalty. I can ask to have all of the information about me returned to me, removed from the research records, or destroyed.

The reason for this study is to test the effectiveness of an Agriscience for Teachers course designed to better prepare agricultural educators to teach agriscience, and to better understand the factors affecting the "agriscience teaching efficacy belief" of students. If I volunteer to take part in this study, I will be asked to participate in one or two interviews of not more than one hour each, and maybe answer some questions from the researcher outside of the interviews, as "member checks" (when analyzing my interviews, the researcher may ask me if what he interpreted in our interview was appropriate or not). The interview will address questions regarding my personal agriscience teaching efficacy belief, my science teaching outcome expectancy, and my expectations and experience regarding the "Agricultural Science for Teachers" course.

I understand that my information will be kept on file and my identity will be protected (my name will not appear in the notes from the interviews). I understand that I will be asked if the interview can be taped. If I agree to have the interview taped, I understand that at any time I can request the tape recorder be turned off and anything said at that time will be off the record.

The researcher hopes to learn more about the preparedness of students entering the field of agricultural education, and more specifically, their preparedness to teach agriscience, and the effectiveness of the agriscience for teachers course. I understand that I do not have any direct benefit from participating in this interview. An indirect benefit may be to help improve how the agricultural science for teacher course is taught, and to better understand how I can improve my own effectiveness as a teacher.

Participation in this study is completely voluntary and there is no direct benefit to the participants. Audio tapes created of interviews will be accessible by Brent Jackson only and once the tapes have been transcribed they will be completely erased. No risk or discomfort is anticipated for participants in the interview process.

No individually-identifiable information about me, or provided by me during the research, will be shared with others without my written permission. I will be assigned an identifying number and this number will be used instead of my name in tapes (if applicable) and notes taken by the researcher.

The investigator will answer any further questions about the research, now, or during the course of the project.

I understand that I am agreeing by my signature on this form to take part in this research project and understand that I will receive a signed copy of this consent form for my records.

_____	_____	_____
Name of Researcher	**Signature**	**Date**

Telephone: _____

Email: _____

_____	_____	_____
Name of Participant	Signature	Date

Please sign both copies, keep one and return one to the researcher.
Additional questions or problems regarding your rights as a research participant should be addressed to The chairperson, Institutional Review Board, University of Georgia, 612 Boyd Graduate Studies Research Center, Athens, Georgia 30602-7411; Telephone (706) 542-3199; E-Mail Address IRB@uga.edu

Appendix C

Interview Questions

Self-Efficacy Belief and Outcome Expectancy

1. Reflecting on your experience as a student, what could your teachers have done differently to help you better understand science? What did they do well (give specific examples of strategies or lessons you participated in)? What would you have suggested in order to make their strategies more effective for you? What about your experience in the Agriscience for Teacher class?

2. What could you do as a teacher to better communicate agriscience/science to your students? Do you feel that it is important for your students to know about science and understand the processes involved? Why or why not?

3. If you had the choice of teaching agriscience or another "agricultural education" course which would you choose and why? Why would you or would you not choose the agriscience course? Why would you or would you not choose the non-science based course?

4. If you had to start tomorrow, do you think you could be a successful agriscience teacher? Why or why not? How about after 5/10 years of teaching it?

5. What do you feel are the most important factors affecting student success in agriscience? Do you feel teacher motivation, preparedness, background, and interaction with the students is important? Why or why not? What other factors are important? Do you feel a successful agriscience teacher is always effective with all students? Why or Why not? What can a teacher do to help all his/her students?

6. When thinking about the teacher and their position in the classroom, what factors are within the teacher's control and what factors are not? Please discuss

7. What is your background in science/agriscience? Given your current level of knowledge are you comfortable communicating scientific techniques and processes to students? What would be required to help you become a more effective science/agriscience instructor? Do you feel the Agriscience for Teachers course is improving your ability to better communicate scientific information? Why or why not? Do you better understand the actual scientific processes behind the science after participating in the course?

8. What were your expectations upon enrolling in Agriscience for Teachers and do you feel those expectations are being met? How are they being met (or not)? What would you continue doing, what would you stop doing, and what would you start doing? Why? (discuss content, strategies, process, etc.)

Appendix D

Science/Agriscience Teaching Efficacy Belief Instrument*

Please indicate the degree to which you agree or disagree with each statement below by circling the appropriate letters in each of the two columns to the right of each statement. The column "before the class" corresponds with "where" you where you were before you took this class. The second column corresponds to "where" you are today

SA = Strongly Agree
A = Agree
UN = Uncertain
D = Disagree
SD = Strongly Disagree

		Before the class	At the end of the class
1.	When a student does better than usual in science/agriscience, it is often because the teacher exerted a little extra effort.	SA A UN D SD	SA A UN D SD
2.	I am continually finding better ways to teach science/agriscience.	SA A UN D SD	SA A UN D SD
3.	Even when I try very hard, I don't teach science/agriscience as well as I do other subjects (for example, other Ag Ed subjects).	SA A UN D SD	SA A UN D SD
4.	When the science/agriscience grades of students improve, it is most often due to their teacher having found a more effective teaching approach.	SA A UN D SD	SA A UN D SD
5.	I know the steps necessary to teach science/agriscience concepts effectively.	SA A UN D SD	SA A UN D SD
6.	I am not very effective in monitoring science/agriscience experiments.	SA A UN D SD	SA A UN D SD
7.	If students are underachieving in science/agriscience, it is most likely due to ineffective teaching.	SA A UN D SD	SA A UN D SD
8.	I generally teach science/agriscience ineffectively.	SA A UN D SD	SA A UN D SD
9.	The inadequacy of a student's science/agriscience background can be overcome by good teaching.	SA A UN D SD	SA A UN D SD
10.	The low science/agriscience achievement of some students cannot generally be blamed on their teachers.	SA A UN D SD	SA A UN D SD
11.	When a low achieving child progresses in science/agriscience, it is usually due to extra attention given by the teacher.	SA A UN D SD	SA A UN D SD
12.	I understand science concepts well enough to be effective in teaching science/agriscience.	SA A UN D SD	SA A UN D SD
13.	Increased effort in science/agriscinece teaching produces little change in some students' science/agriscience achievement.	SA A UN D SD	SA A UN D SD
14.	The teacher is generally responsible for the achievement of students in science/agriscience.	SA A UN D SD	SA A UN D SD
15.	Students' achievement in science/agriscience is directly related to their teacher's effectiveness in science/agriscience teaching.	SA A UN D SD	SA A UN D SD
16.	If parents comment that their child is showing more interest in science at school, it is probably due to the performance of the child's teacher.	SA A UN D SD	SA A UN D SD
17.	I find it difficult to explain to students why science/agriscience experiments work.	SA A UN D SD	SA A UN D SD
18.	I am typically able to answer students' science/agriscience questions.	SA A UN D SD	SA A UN D SD
19.	I wonder if I have the necessary skills to teach science/agriscience.	SA A UN D SD	SA A UN D SD
20.	Effectiveness in science/agriscience teaching has little influence on the achievement of students with low motivation.	SA A UN D SD	SA A UN D SD
21.	Given a choice, I would not invite the principal to evaluate my science/agriscience teaching.	SA A UN D SD	SA A UN D SD
22.	When a student has difficulty understanding a science/agriscience concept, I am usually at a loss as to how to help the student understand it better.	SA A UN D SD	SA A UN D SD
23.	When teaching science/agriscience, I usually welcome student questions.	SA A UN D SD	SA A UN D SD
24.	I don't know what to do to turn students on to science/agriscience.	SA A UN D SD	SA A UN D SD
25.	Even teachers with good science/agriscience teaching abilities cannot help some kids learn science/agriscience.	SA A UN D SD	SA A UN D SD

*Modified from Riggs, I., & Enochs, L. (1990). Towards the development of an elementary teacher's science teaching efficacy belief instrument. *Science Education, 74*, 625-637.