

PRE-SERVICE AGRICULTURAL EDUCATION TEACHERS'
KNOWLEDGE AND PERCEIVED
SELF-EFFICACY TO TEACH
WELDING

By

BRIAN LEE LEIBY

Bachelor of Science in Agricultural Education

Oklahoma State University

Stillwater, Oklahoma

2008

Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
In partial fulfillment of
the requirements for
the Degree of
MASTERS OF SCIENCE
December, 2010

PRE-SERVICE AGRICULTURAL EDUCATION TEACHERS'
KNOWLEDGE AND PERCEIVED
SELF-EFFICACY TO TEACH
WELDING

Thesis Approved:

Dr. J. Shane Robinson

Thesis Adviser

Dr. James P. Key

Dr. Harry Fields

Dr. James G. Leising

Dr. Mark E. Payton

Dean of the Graduate College

ACKNOWLEDGEMENTS

Thesis building, like any other worthwhile project, is not without its share of struggles, triumphs, disappointments and eventually victories. For all who have helped me on my journey of thesis completion, please allow me this moment to say thank you.

Dr. Leising, it's hard to believe that four years ago I wandered into your office as a lost little undergraduate student. Since then you have assisted me in building class schedules, finding jobs, and helping me start my thesis study. Your time and dedication to my success as a student, future educator and as a person will never be forgotten.

Dr. Key, thank you agreeing to serve on my committee and for being our "go-to-guy" for statistical advice. Your experience and guidance have served me well during data analysis and thesis development.

Dr. Field, I can only hope that your decision to hire me two years ago as your teaching assistant has proven to be as beneficial for you as it has for me. Our time spent together teaching students will remain some of the busiest and best educational experiences I have had yet. Thank you for allowing me to gain valuable experience as a teacher of agricultural mechanics.

Dr. Robinson, your guidance, patience, and assistance for the last year have truly proven to be an invaluable asset in the development of my thesis. Thank you for your time trouble, efforts, suggestions and multiple revisions. Your efforts have truly been appreciated.

To my “Stillwater family,” Jim, Linda, and Rockie Ward. It’s humorous to think that we have worked side by side for four years now and I never gave you an official opportunity to hire me. In the words of the great philosopher Koy Ramsey, “It’s hard to fire someone who shows up for work on time every time.” Ms. Linda, I have never left your table hungry or disappointed. Thank you for the opportunity to be a part of your family.

Chris and Sheyenne, sometimes it a blessing to have someone to share in your problems and struggles. Thank you for having an open ear, an open mind and an open door.

To my sisters Sarah and Bonnie, you leave big shoes to fill. I hope that my endeavors and efforts in the past six years have led me steps closer to following in your footsteps.

To my mother and father thank you for your constant encouragement. Even when we were small children your reinforcement for the value of education has helped guide us on the paths we now follow. Father, rest in peace knowing your children have done well.

Bill and Imogene, thank you for reaffirming my beliefs in the value of labor, effort and persistence. You are truly models of the benefits of hard work and dedication. Our past five, “tours of duty” are and will remain some of the fondest memories of my life.

This process would not have been possible without the support of a true friend. Lacy, realizing that thesis development has a tendency to make me anxious and grumpy, thank you for always supporting me and my efforts.

TABLE OF CONTENTS

Chapter	Page
INTRODUCTION	1
Skills Standards	4
Technological Change	6
Statement of the Problem	6
Purpose of the Study	7
Research Objectives	7
Basic Assumptions	8
Limitations	9
Significance of the Study	10
Need for the Study	10
Definition of Terms	10
Chapter Summary	11
REVIEW OF LITERATURE	13
Introduction	13
Statement of the Problem	13
Purpose of the Study	14
Research Objectives	14
Theoretical Framework	15
Sources of Efficacy Beliefs	15
Teacher Efficacy	17
The Role of Experience	21
Teacher Content Knowledge and Competence	22
Agricultural Mechanics Needs of Agriculture Teachers	25
METHODOLOGY	31
Research Design	31
Research Objectives	32
Subject Selection	33
Instrumentation	33
Instrument Development	34
Validity	35
Reliability	36
Data Collection	40
Data Analyses	40

Pearson Product-Moment Correlation Coefficient.....	42
Chi Square test	43
Independent Samples <i>t</i> -test	44
FINDINGS	45
PURPOSE OF THE STUDY	67
Research Objectives	67
Population	68
Research Design.....	68
Data Collection.....	69
Data Analysis	69
Summary of Findings.....	70
Conclusions	71
Recommendations for Future Research	76
Recommendations for Practice	78
Implications	79
REFERENCES	86
APPENDIX A – SURVEY INSTRUMENT SECTION 1	
WELDING CONFIDENCE & IMPORTANCE	96
APPENDIX B – OKLAHOMA DEPARTMENT OF CAREER AND TECHNOLOGY EDUCATION AGRICULTURAL POWER AND TECHNOLOGY WELDING TECHNICIAN SKILLS STANDARDS	99
APPENDIX C – SCANTRON & SURVEY INSTRUMENT PART II & III.....	102
APPENDIX D – PERCENT DIFFICULTY MEASURES FOR WELDING KNOWLEDGE FROM PILOT TEST #1 DATA.....	109
APPENDIX E – PERCENT DIFFICULTY MEASURES FOR WELDING KNOWLEDGE FROM PILOT TEST #2 DATA.....	111
APPENDIX F – PRE-SURVEY ORAL INSTRUCTIONS.....	115
APPENDIX G – INSTITUTIONAL REVIEW BOARD APPROVAL LETTER.....	119

Pre-Service Agricultural Education Teachers' Knowledge and Perceived Self-Efficacy to Teach Welding

Chapter 1

Introduction

With most teacher preparation institutions hovering below 128 credit hours, finding ways to include technical competency preparation for pre-service teachers is difficult (Burris, Robinson, & Terry, Jr., 2005; Robinson, Krysher, Haynes, & Edwards, in press). Providing secondary students with adequate opportunities to acquire necessary technical competencies in agriculture is challenging, especially when considering the subject of agricultural mechanics (Burris et al., 2005).

Today's pre-service teachers experience difficulty acquiring the skills necessary to be competent in teaching agricultural mechanics, especially due to the small number of available technical course hours. Dillard (1991) stated that it can be difficult to produce prepared teachers of agricultural mechanics with a minimum requirement of seven credit hours. Currently, Oklahoma State University (OSU) requires only five credit hours in agricultural mechanics coursework. As such, a need exists to determine if the current agricultural mechanics coursework at OSU is meeting the needs of its pre-service agricultural education teachers.

Agricultural mechanics is a science-based curriculum that provides teachers with opportunities to integrate concepts of physics, chemistry, and mathematics (Miller, 1991). "Agricultural mechanics traditionally has been a cornerstone in the secondary program" (Burris

et al., 2005, p. 23). Currently, 59 percent of the United States' eleven thousand agricultural education instructors teach agricultural mechanics at their local school system (National FFA Organization, 2010). Therefore, ensuring that instructors are prepared to teach agricultural mechanics is critical.

Teacher preparation programs should ensure its graduates are exposed to a high level of technical skill training in agricultural mechanics and strive to increase students' confidence to teach agricultural mechanics. Kennel (2009) stated, "because teachers are the single most important influence on student achievement, teacher education programs need to provide learning experiences for pre-service educators to impact their confidence to teach pertinent subject matter and their perceptions of its importance" (p. 2). Graduating, producing, and retaining highly qualified teachers is imperative to the success of the United States as a country (Wallis, 2008). Unfortunately, not all new graduates are ready to assume the responsibilities of professional work roles (Levine, 2005).

"For more than a decade, employers have expressed a concern for the lack of graduates sufficiently trained to meet the challenges of a high-performance workplace" (Graham, 2001, p. 89). Today's college graduates are leaving school with the hope of finding employment that compensates them well for their education, training, and skills (Becker, 1964; Purcell & Pitcher, 1996). Unfortunately, not all graduates acquire the skills necessary to be successful in the workplace immediately after completing their degrees (Andelt, Barrett, & Bosshamer, 1997; Evers, Rush, & Berdrow, 1998; Robinson, Garton, & Terry, Jr., 2007; Robinson, Garton, & Vaughn, 2007).

The skills learned by students during their academic career can be placed into two broad skill categories: technical and non-technical. “Technical skills refer to subject-specific or content-specific knowledge and competence relevant to, or within, a particular discipline such as information technology or psychology” (Cassidy, 2006, p. 508). “Technical skills then are those skills necessary for competent functioning within a particular discipline, while non-technical skills are those skills which can be deemed relevant across many different jobs or professions” (Sherer & Eadie, 1987, p. 16, as cited in Cassidy, 2006, p. 508). Non-technical skills, also known as employability skills, consist of problem solving, decision making, teamwork, time management, and oral and written communication to name a few (Candy & Crebert, 1991; Carnevale, Gaine, & Villet, 1990; Evers, Rush, & Berdrow, 1998; Levine, 2005; Peddle, 2000; Robinson, 2006; Robinson & Garton, 2007). Researchers have noted that graduates are often not well prepared to enter the workforce (Brown, Hesketh, & Williams, 2003; Heldrich, 2005; Morley, 2001). Therefore, ensuring graduates are competent at performing their job is imperative.

Agricultural education is designed to be industry-validated in an effort to equip students with the necessary skills, education, and training to be successful in industry and post secondary education (Roberts & Ball, 2009). Therefore, teachers should be competent at teaching all agricultural subject areas (Robinson et al., in press). Good teachers are the single most influential factor in providing students with a quality education (Kennel, 2009; Wallis, 2008). As such, “good” educators should “link the teaching of academic subjects to real-world applications” (Carnevale et al., 1990, p. 237). In an effort to link education to real world application different states take different approaches. Oklahoma implemented skills standards for various subjects to help close the gap between the classroom and the workplace.

Skills Standards

Skills standards provide the foundation for competency-based instruction in Oklahoma's Career Tech system. The skills standards outline the knowledge, skills and abilities needed to perform related jobs within an industry. Skills standards are aligned with national skills standards; therefore, a student trained to the skills standards; possesses technical skills that make him/her employable in both state and national job markets (ODCTE, OD46903, 2006, p. A).

Oklahoma skills standards for welding were developed by the ODCTE. Welding skills standards pertain to the welding industry, specifically and to the national welding industry, generally. Oklahoma welding skills standards are aligned with and endorsed by the American Welding Society (AWS). Skills standards provide a listing of necessary skills in which an individual should be proficient to be deemed competent and employable. To ensure that competencies are met, written assessments are used to evaluate student performance (ODCTE, OD46903, 2006). Skills standards provide educators with a roadmap of essential skills which they should teach. Skills standards also provide students with a list of necessary skills which they should possess or acquire. Students of agricultural education need highly qualified competent teachers.

Competent, qualified teachers are the backbone of high quality instruction at any level. According to the No Child Left Behind Act (2002), "Highly Qualified Teachers" were those who were fully certified, had earned a bachelor's degree, and competent in their subject knowledge and pedagogy (Roberts, Dooley, Harlin, & Murphrey, 2006). "Full certification and having a bachelor's degree are easily determined. Competency in subject matter and pedagogy is more

subjective and thus more difficult to measure" (Roberts, et al., 2006, p. 1). At OSU, agricultural education majors must also meet three minimal requirements to be "qualified" to teach. Students must obtain a bachelor's degree, be granted full certification, and possess proficiency in the subject matter they are expected to teach by passing the Oklahoma Subject Area Test (OSAT) (Student Handbook for Agricultural Education & Student Teaching, 2009-2010).

To pass the OSAT examination, pre-service teachers must possess strong content knowledge in the field of agriculture. Specifically, prospective Oklahoma agricultural education teachers need to possess content knowledge in "(I.) Agricultural Business, Marketing, and Communication, (II.) Animal Science, (III.) Plant and Soil Science, (IV.) Agricultural Power and Technology, (V.) Natural Resources" (Oklahoma Subject Area Tests, Study Guide-Agricultural Education, 2007, p. 2-2). "It is strongly recommended that most course work be completed before sitting for the Agricultural Education OSAT" (OSU Student Handbook for Agricultural Education and Student Teaching, 2009-2010, p. 27).

Confident, competent teachers are a significant contributing factor in determining the level of success to which their students are able to achieve, academically and physically. High quality agricultural educational programs are the result of great teaching, and low quality programs are the result of poor teaching (Crunkilton & Krebs, 1982). Nowhere is this truer than in the realm of mechanized agriculture. Burris et al., (2005) noted that agricultural mechanics instructor competency is still important in secondary agricultural education. With this same thought in mind, Rosencrans and Martin (1997) developed the Curriculum Model for Agriculture Technology Education (CMATE). CMATE was developed to promote students' agricultural mechanics success. Additionally, the model focused on eight elements which are suggested for incorporation into agricultural mechanics instruction. The model serves as a guide for quality

agricultural mechanics instruction. It incorporates elements such as, problem solving and critical thinking, self evaluation, entrepreneurship and experiential learning to promote the growth and advancement of students' in the field of agricultural mechanics.

Technological Change

Agriculture witnessed a rapid growth in mechanization during the middle 1900's (Cochrane, 1979). Agricultural education experienced similar growth and development during the same period of time. Success of agricultural education programs will depend on its ability to stay current with and replicate advancements in the agricultural industry (Crawford, 1987).

“Change has had to take place in agricultural education for its survival and more importantly for its improvement” (Dillard, 1991, p. 6). With changes in agriculture and agricultural technology come new questions of how teachers of secondary agriculture approach teaching and learning. Advancements in the agricultural industry such as global positioning systems (GPS), variable rate application, robotic welding and cutting, and genetically modified crop varieties dictate which information is relevant and which is seemingly outdated. In today's era, the agricultural industry has changed; thus, the classroom must change and adapt to stay current. Therefore, are agricultural education pre-service teachers competent at teaching agricultural mechanics in the 21st century?

Statement of the Problem

“The need exists to structure teacher education programs to more adequately prepare graduates in agricultural mechanics” (Burris et al., 2005, p. 33). The Oklahoma Commission for Teacher Preparation (OCTP) documents professional examination scores in its program assessment report. In the section designated for OSAT scores, agricultural education pre-service teachers averaged the lowest or second to lowest examination scores in agricultural power and

technology from 2002 to 2005 (Leising, Edwards, Ramsey, Weeks, & Morgan, 2005).

Additionally, agricultural education pre-service teachers were most likely to receive failing scores in the area of agricultural power and technology on the OSAT. Below average certification scores combined with the highest rate of failure in the agricultural power and technology OSAT area indicated a need to determine OSU pre-service agricultural education teachers' knowledge in and efficacy to teach welding.

Purpose of the Study

The purpose of this study was twofold: 1) to determine OSU pre-service agricultural education teachers' knowledge of mechanical agricultural skills standards related to welding; 2) to assess OSU pre-service agricultural education teachers' perceived levels of self-efficacy to teach welding skills standards in the Oklahoma secondary agricultural mechanics curriculum.

Research Objectives

1. Describe selected personal characteristics (age, sex, major, prior welding employment experience) of pre-service agricultural education teachers.
2. Compare pre-service agricultural education teachers' perceived level of self-efficacy to teach selected welding skills standards before and after instruction.
3. Compare pre-service agricultural education teachers' perceptions of importance to teach selected welding skills standards before and after instruction.
4. Determine the need for pre-service curriculum enhancement in welding, based on the perceptions (prior to and at the end of instruction) of pre-service agricultural education teachers, using the Borich needs assessment model.
5. Determine the relationship between pre-service agricultural education teachers' perceived level of confidence to teach selected welding skills standards and final course grade.

6. Determine the relationship between pre-service agricultural education teachers' age, sex, and perceived level of self-efficacy to teach selected welding skills standards.
7. Determine the relationship between pre-service agricultural education teachers' final course grade and level of work experience in welding.
8. Compare pre-service agricultural education teachers' level of technical knowledge in welding before and after instruction.

Basic Assumptions

The following assumptions were made in this study:

1. MCAG 3222–Metals and Welding has been taught for 25 years by the same instructor to essentially the same types of students. The intended group in which the course is designed to serve is pre-service agricultural education teachers. Each year, a few students outside of agricultural education enroll in the course because of its practical applicability. Students participating in the current study were no different. Yet, because of its “intended” population (i.e., pre-service teachers), the participants in this study are referred to as “pre-service teachers” even though not each student in the course intends to teach or even major in agricultural education.
2. The pre-service teachers who participated in this study were assumed to be no different than pre-service teachers who completed MCAG 3222–Metal and Welding in previous years. Therefore, the “time and place” sample method (Oliver & Hinkle, 1982) was employed.
3. Pre-service agricultural educators were interested in the subject material (i.e., welding).
4. Pre-service agricultural educators were interested in improving their welding skills.

5. The survey method of gathering data enabled students to assess their self-perceived abilities and weaknesses accurately.
6. Students answered all questions honestly.

Limitations

The following limitations were applied to this study:

1. Participants in the study were referred to as pre-service teachers. In reality, thirteen students participated in this study who had declared majors outside of agricultural education. Therefore, a limitation exists, and caution should be used in generalizing the findings of this study beyond its current population.
2. The population studied was limited to OSU pre-service agricultural educators enrolled in MCAG 3222 –Metals and Welding during the fall 2009 semester. Therefore, generalizations beyond this population are not recommended.
3. The population studied consisted primarily of students from Oklahoma and its surrounding neighboring states. Thus, the conclusions may have limited usability when extrapolated and applied to other pre-service agricultural educators from other areas of the continental United States.
4. Questions comprising MCAG 3222–Metals and Welding were high quality in nature and fitting for usage in this study.

Significance of the Study

By identifying pre-service agricultural education teachers' perceived levels of self-efficacy, it may be possible to enhance the mechanical agriculture curriculum at OSU to meet pre-service teachers' needs in welding better. Additionally, after administration of the questionnaire, and end-of-instruction examination, it will be possible to determine which areas are most in need of increased instruction.

Need for the Study

This study is perceived necessary as the agricultural power and technology course is the third highest demanded secondary agricultural education course offered in Oklahoma (Oklahoma Department of Career and Technology Education, 2008). Also, below average subject area scores in agricultural mechanics suggests that there is a need to improve those skills of OSU pre-service agriculture teachers.

Definition of Terms

Agricultural Education: “The systematic instruction in agriculture and natural resources at the elementary, middle school, secondary, postsecondary, or adult levels for the purpose of (1) preparing people for entry or advancement in agricultural occupations and professions, (2) job creation and entrepreneurship, and (3) agricultural literacy” (Phipps, Osborne, Dyer, & Ball, 2008, p. 527).

Agricultural Educator: “A person teaching agriculture and natural resources and related topics to youth or adults in formal or non-formal settings” (Phipps et al., 2008, p. 527).

Pre-service teacher: “A student who is enrolled in teacher education courses, but has not earned a teaching certificate or license” (Knobloch, 2002, p. 10).

Self-efficacy: “Perceived self-efficacy refers to beliefs in one's capabilities to organize and execute the courses of action required to manage prospective situations. Efficacy beliefs influence how people think, feel, motivate themselves, and act” (Bandura, 1995, p. 2).

Chapter Summary

Competent teachers are a necessity for quality education to occur. Unfortunately, competence is gained through time and experience. Consequently pre-service teachers often rely on coursework to build competence in agricultural mechanics subjects. Agricultural mechanics is a cornerstone of the secondary agricultural education curriculum (Burris et al., 2005). Nearly 60% of the United States’ agricultural education teachers teach agricultural mechanics (National FFA Organization, 2010). Additionally, the results of these programs are dependent highly on the competence of the educator which manages the agricultural mechanics program. Wallis (2008) stated that competent teachers are the single most important factor for student achievement. Unfortunately, not all graduates are well prepared for work after college (Graham, 2001).

Pre-service teachers at OSU are required to pass three professional certification examinations to obtain a teaching license. One of these examinations is the Oklahoma OSAT, which for agricultural educators, includes questions on agricultural mechanics and welding subjects. Between 2002 to 2005, pre-service teachers averaged the lowest or second lowest scores in the section for Agricultural Power and Technology and were most likely to receive failing scores in power and technology (Leising et al., 2005). Dillard (1991) suggested that seven hours of coursework is the minimal amount of time needed to build competence in agricultural mechanics. The Agricultural Education pre-service preparation program at OSU currently requires only five hours of agricultural mechanics coursework for teacher preparation.

Therefore, it is crucial to determine if pre-service teachers are competent in and have received enough knowledge about agricultural mechanics to teach it effectively.

Through survey methodology, it will be possible to better assess the learning needs of the student body enrolled in MCAG 3222–Metals and Welding. Through evaluation and assessment, it may be possible to alter curriculum to custom–fit course objectives and create a more prepared, more confident pre-service agricultural educator.

Chapter II

Review of Literature

Introduction

In the course of this chapter, it is the intention of the researcher to take into account all available and pertinent literature. Chapter II shall be divided into the following sections: introduction, statement of the problem, purpose of the study, research objectives, theoretical framework, sources of efficacy beliefs, the role of experience, teacher efficacy, collective efficacy, teacher content knowledge and competence, determining educational needs of pre-service agricultural education teachers, and summary.

Statement of the Problem

“The need exists to structure teacher education programs to more adequately prepare graduates in agricultural mechanics” (Burris et al., 2005, p. 33). The Oklahoma Commission for Teacher Preparation (OCTP) documents professional examination scores in its program assessment report. In the section designated for OSAT scores, agricultural education pre-service teachers averaged the lowest or second to lowest examination scores in agricultural power and technology from 2002 to 2005 (Leising, Edwards, Ramsey, Weeks, & Morgan, 2005). Additionally, agricultural education pre-service teachers were most likely to receive failing scores in the area of agricultural power and technology on the OSAT. Below average certification scores combined with the highest rate of failure in the agricultural power and

technology OSAT area indicated a need to determine OSU pre-service agricultural education teachers' knowledge in and efficacy to teach welding.

Purpose of the Study

The purpose of this study was twofold: 1) to determine OSU pre-service agricultural education teachers' knowledge of mechanical agricultural skills standards related to welding; 2) to assess OSU pre-service agricultural education teachers' perceived levels of self-efficacy to teach welding skills standards in the Oklahoma secondary agricultural mechanics curriculum.

Research Objectives

1. Describe selected personal characteristics (age, sex, major, prior welding employment experience) of pre-service agricultural education teachers.
2. Compare pre-service agricultural education teachers' perceived level of self-efficacy to teach selected welding skills standards before and after instruction.
3. Compare pre-service agricultural education teachers' perceptions of importance to teach selected welding skills standards before and after instruction.
4. Determine the need for pre-service curriculum enhancement in welding, based on the perceptions (prior to and at the end of instruction) of pre-service agricultural education teachers, using the Borich needs assessment model.
5. Determine the relationship between pre-service agricultural education teachers' perceived level of confidence to teach selected welding skills standards and final course grade.
6. Determine the relationship between pre-service agricultural education teachers' age, sex, and perceived level of self-efficacy to teach selected welding skills standards.
7. Determine the relationship between pre-service agricultural education teachers' final course grade and level of work experience in welding.

8. Compare pre-service agricultural education teachers' level of technical knowledge in welding before and after instruction.

Theoretical Framework

The theoretical framework utilized for this study was Bandura's (1997) self-efficacy theory. Self-efficacy refers to an individual's beliefs in his or her abilities to accomplish tasks (Bandura, 1997). Thoughts of self-efficacy regulate numerous functions of people's lives, including feelings, motivations, and courses of action (Bandura, 1995). "If people believe they have no power to produce results, they will not attempt to make things happen" (Bandura, 1997, p. 3). Inversely, individuals are more apt to achieve success when they believe they possess the appropriate skills and support needed. Positive achievement assists individuals in building strong feelings of self-efficacy (Bandura, 1995). "After people become convinced they have what it takes to succeed, they persevere in the face of adversity and quickly rebound from its setbacks. By sticking it out through tough times, they emerge stronger from adversity" (Bandura, 1995, p. 3).

Sources of Efficacy Beliefs

An individual's motivation plays a large role in that person's level of self-efficacy (Wood & Bandura, 1989). When people are highly motivated and expect to perform at a high level, their efficacy increases (Hoy & Miskel, 2005). Likewise, when highly motivated people fail, they "attribute their failures to low ability" (Bandura, 1994, p. 5).

Bandura (1995) noted four sources which play important roles for the development of self-efficacy. These four sources consist of mastery experiences, vicarious experiences, social persuasion, physiological and emotional states (Bandura, 1995).

Mastery experiences are the most effective way of creating a strong sense of efficacy (Bandura, 1995). Mastery experiences improve an individual's self-efficacy beliefs. Inversely, individuals who fail to achieve often experience slow or halted efficacy growth (Bandura, 1995). Bandura stated,

If people experience only easy successes they come to expect quick results and are easily discouraged by failure. A resilient sense of efficacy requires experience in overcoming obstacles through perseverant effort. Some difficulties and setbacks in human pursuits serve a useful purpose in teaching that success usually requires sustained effort. (p. 3)

Vicarious experiences are noted as the second source of efficacy. Vicarious experiences allow individuals to gain confidence by observing others perform a given task. By observing models successfully complete a task, individuals are able to increase their own self-efficacy. Bandura (1977) stated, "Vicarious experience, relying as it does on inferences from social comparison, is a less dependable source of information about one's capabilities than is direct evidence of personal accomplishments" (p. 197).

Social persuasion is the third source of influence to affect efficacy beliefs (Bandura, 1995). Individuals who possess doubts concerning personal abilities are more likely to persist if they are verbally reinforced (Schunk, 1989). Likewise, if individuals are verbally reinforced by their peers, then their own level of self-efficacy escalates (Bandura, 1994).

Physiological and emotional state is the fourth source of influence related to efficacy beliefs (Bandura, 1995). Physiological and emotional state takes into account influential efficacy factors such as mood, fatigue, stress, or the lack of stress, and how these factors play a role in influencing an individual's efficacy (Bandura, 1995).

Teacher Efficacy

“Teacher efficacy is the teacher’s belief in his or her capability to organize and execute courses of action required to successfully accomplish a specific teaching task in a particular context” (Tschannen-Moran, Woolfolk Hoy & Hoy, 1998, p. 233). Bandura (1977) identified teacher efficacy as a form of self-efficacy by which teachers construct internal beliefs of their ability to perform teaching tasks at a proficient level. These internal beliefs have the potential to influence teachers' level of expended effort related to persistence in difficult situations, resiliency in the face of failures, and stress or depression (Bandura, 1997).

In a microanalytic observational study, Gibson and Dembo (1984), concluded that teachers with high teacher efficacy were more likely to utilize greater portions of instructional time for academic activities. Additionally, highly efficacious teachers were more likely to assist students with difficulties and praise student academic accomplishments. Further, the authors noted that teachers with lower perceived efficacy spent more time on non-academic activities, readily dismissed students who experienced slower learning curves, and were more likely to criticize students for their failures.

Knobloch and Whittington (2003) assessed the relationship between teacher self-efficacy and their career commitment. They concluded that the more self-efficacy teachers have, the more committed they are to their career. The opposite is also true. The less self-efficacy teachers have, the less committed they are to their career. This finding supports Bandura’s (1997) notion that teachers who have a low sense of self-efficacy often have reduced motivation related to their teaching profession.

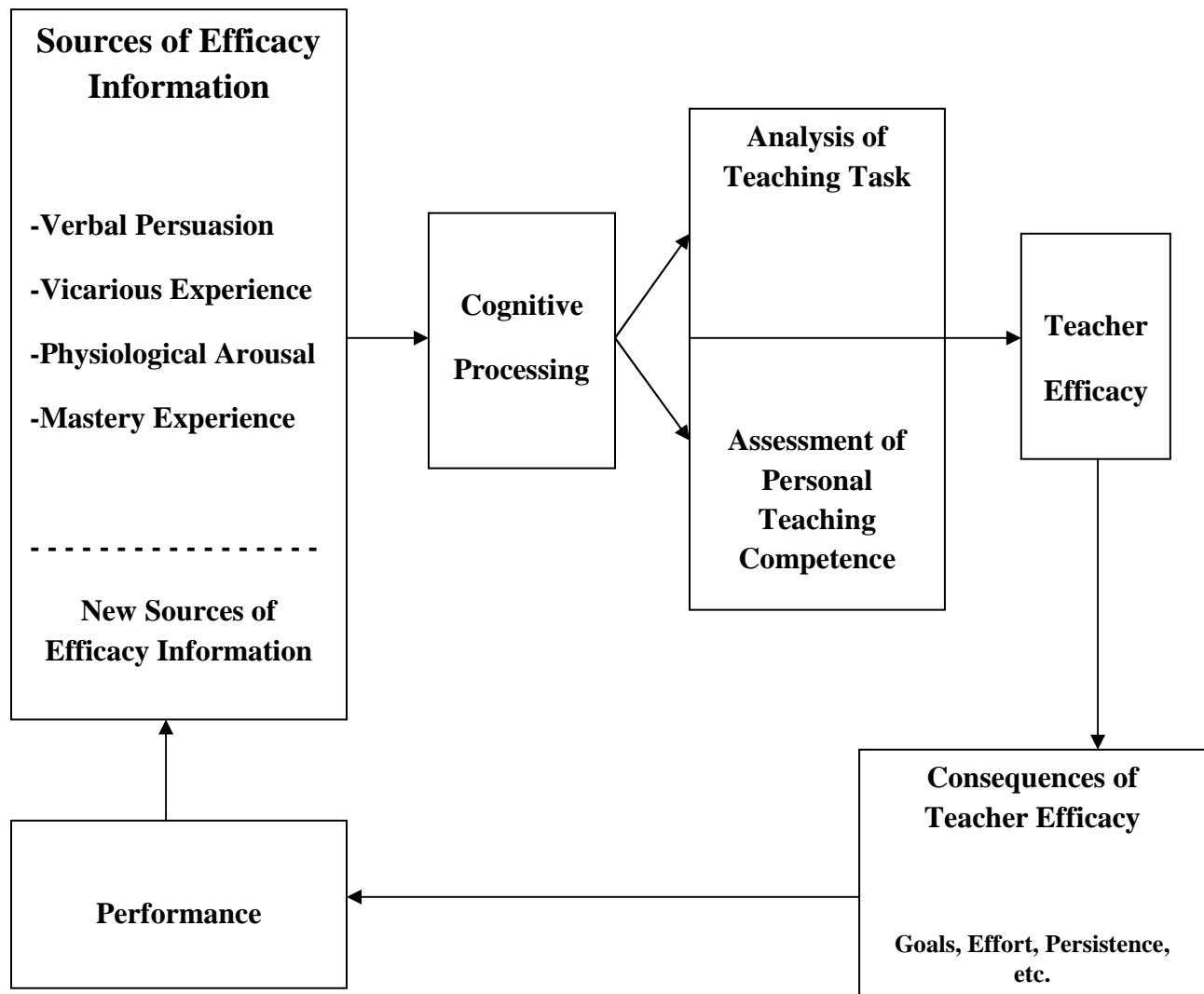


Figure 1. The cyclical nature of teacher efficacy. Note. From “Teacher efficacy: Its meaning and measure,” by M. Tschannen-Moran, A. Woolfolk Hoy, & W. K. Hoy, 1998, *Review of Educational Research*, 68(2), p. 228.

Tschannen-Moran and Woolfolk Hoy (1998) developed a conceptual model of teacher efficacy (Figure 1). The model is cyclical in nature and begins with the four sources of efficacy as outlined by Bandura (1986, 1997). “These four sources contribute to both the analysis of the

teaching task and to self-perceptions of teaching competence, but in different ways” (Tschannen-Moran & Woolfolk Hoy, 1998, p. 228). Providing verbal persuasion to an educator can provide that person encouragement in the face of obstacles (Tschannen-Moran & Woolfolk Hoy, 1998). Verbal persuasion can also assist an educator in maintaining self-efficacy by helping to counter occasional negative situations, which could lessen an educator’s persistence and resilience for completing a task (Shunk, 1989).

Vicarious experiences involve individuals living and gaining experience through other people (Bandura, 1994). Pre-service agricultural education teachers may obtain experiences vicariously by watching a “model” teacher perform a task (i.e., lesson closure, disbudding plants, welding instruction). However, in the case of teacher efficacy, educators observe “model” teachers perform tasks with great skill and success, which in turn aids them in building internal beliefs of teaching competence (Tschannen-Moran & Woolfolk Hoy, 1998).

Physiological arousal in regard to stressful teaching situations has the ability to induce feelings of anxiety and can cause potential decreases in teacher efficacy (Bandura, 1997). However, moderate levels of arousal can improve teacher efficacy and professional performance by channeling and focusing teaching efforts and activities. Physiological arousal that produces feelings of comfort while teaching can lead to improved teacher confidence (Bandura, 1996).

Mastery experiences are the most powerful experiences of Bandura’s four sources of efficacy (Tschannen-Moran & Woolfolk Hoy, 1998). “Enactive mastery experiences are the most influential source of efficacy information because they provide the most authentic evidence of whether one can muster whatever it takes to succeed” (Bandura, 1997, p. 80). “The perception that a performance has been successful raises efficacy beliefs, which contributes to

the expectation of proficient performance in the future” (Tschannen-Moran & Woolfolk Hoy, 1998, p. 229).

The sources of efficacy information affect cognitive processing.

Cognitive processing determines how the sources of information will be weighed and how they will influence the analysis of the teaching task and the assessment of personal teaching competence. The interaction of task analysis and competence, in turn shapes efficacy. (Tschannen-Moran, & Woolfolk Hoy, 1998, p. 230)

If the interaction of task analysis and competence affect efficacy positively, then the consequences of improved efficacy are goal setting, increased teacher effort, and persistence in less than ideal circumstances (Tschannen-Moran, & Woolfolk Hoy, 1998).

One of the things that makes teacher efficacy so powerful is its cyclical nature. . . the proficiency of a performance creates a new mastery experience, which provides new information that will be processed to shape future efficacy beliefs. Greater efficacy leads to greater effort and persistence, which leads to better performance, which in turn leads to greater efficacy. (p. 234)

The inverse is also true. Poorer perceptions of self-efficacy lead to minimized efforts, early submission to failure, and ultimately poor educational outcomes, which leads to a decrease in teaching efficacy (Tschannen-Moran, & Woolfolk Hoy, 1998). An educator’s teaching efficacy is directly related to that individual’s perceived level of success in teaching experiences. Educators with higher efficacy remain in the profession longer (Burley, Hall, Villeme & Brockmeier, 1991) because they are more committed (Knobloch & Whittington, 2003).

The Role of Experience

Experience assists teachers in improving their overall level of self-efficacy (Knobloch & Whittington, 2002). Bandura (1997) noted that mastering a skill through experience, such as an activity in teaching, is one of the most powerful influencers of efficacy. Knobloch and Whittington (2002) sought to determine which experiences contributed to the greatest amount of variance in teacher efficacy. Their study concluded that 17 percent of efficacy among teachers studied could be contributed to perceived support, teacher preparation quality, and student teaching experiences. They also noted that new teachers who possessed technical training and pedagogical preparation through teacher education courses had higher levels of teacher confidence.

Talbert, Camp, and Heath-Camp (1994) noted that the entry-year of teaching can be extremely difficult. A lack of overall teaching experience has been related to new teachers leaving the profession (Whittington, McConnell, & Knobloch, 2006; Marso & Pigge, 1997; Walker, 2002; Wilkinson, 1994). Those who leave the profession are typically less efficacious than those who stay (Glickman & Tamashiro, 1982). As such, first-year teachers need to be somewhat sheltered from difficult course preparations, challenging students, and demanding obligations unrelated to teaching (National Commission on Teaching and American's Future, 1996).

Blackburn and Robinson (2008) assessed secondary agricultural education teachers in Kentucky on their levels of teacher self-efficacy. The authors assessed three groups of teachers (Group 1 – first and second year teachers; Group 2 – third and fourth year teachers; Group 3 – fifth and sixth year teachers). It was found that Group 3 teachers had the highest levels of teacher self-efficacy, as assessed on the Tschannen-Moran and Woolfolk Hoy Teachers' Sense

of Efficacy Scale (TSES). As such, it was concluded that the most experienced teachers had the highest levels of efficacy related to teaching because “these teachers have had enough experience to firmly establish their own personal teaching style” (p. 8).

Although numerous studies have indicated that experience is related to efficacy, Whittington, McConnell, and Knoblach (2006) concluded that factors other than professional teaching experience can impact a teachers’ level of self-efficacy. Specifically, the authors found that the quantity of course preparations was related to teacher self-efficacy. Also, it was concluded that the teachers’ perceived quality of experience regarding their student teaching internship impacted their efficacy as classroom instructors.

Teacher Content Knowledge and Competence

Being efficacious as a teacher is important because confidence typically leads to expectation fulfillment (Bandura, 1982a). “Competence in one’s professional work role is important in the overall learning process” (Findlay & Drake, 1989, p. 46). Teacher competence starts with deep understanding of the subject in which an educator is expected to teach. Ingersoll (1996) stated, “One of the most important characteristics of a qualified high school teacher is college training in the subject in which he or she teaches” (p. 2). Ingersoll also reported that both private and public schools suffered from faculty teaching outside of their trained field.

Wingenbach, White, Degenhart, Pannkuk, and Kujawski (2007) stated that,

Highly qualified teachers are defined in the No Child Left Behind Act of 2001 (NCLB) as those who not only possess state certification, but who also have content knowledge of the subjects they teach. In Career and Technical Education (CTE), teachers need to be competent in technical, employability, and academic skills. Additionally, high-quality

CTE [Career Technical/Workforce Education] teachers are essential in helping the United States develop a 21st-century workforce that will be competitive in the world marketplace. (p. 114-115)

In an effort to develop competent teachers, Oklahoma Agricultural Education instructors at OSU are mandated to be proficient in five different agricultural content areas (Leising et al., 2005). These areas consist of agricultural business, marketing, and communications; animal science; plant and soil science; agricultural mechanics; and natural resources. Agricultural education instructors need to be competent at teaching agricultural subject matter because they are responsible in assisting students acquire the skills needed for college entrance and employment in industry (Roberts & Ball, 2009). Slusher (2009) stated that,

it is important for high school students to begin to consider and understand which paths they may decide to follow as it relates to future careers, because this will determine in part the courses they undertake in secondary education and beyond. (p. 22)

To assist in this regard, the Oklahoma Department of Career and Technology Education (ODCTE) outlines subjects which are necessary for teacher competence and student achievement by way of career clusters and pathways. Career clusters and pathways are tools which assist educators in knowing what to teach, as they strive to produce prepared and technically proficient future employees. “Pathways provide, knowledge and skills for their respective career cluster” (Slusher, 2009, p. 6). Specifically, seven career pathways have been identified by the ODCTE in an effort to assist students in becoming “program completers” who are more employable in various sectors of the agricultural industry (Ruffing, 2006). The seven identified pathways consist of Agribusiness, Agricultural Communication, Animal Science, Plant and Soil Science,

Natural Resources and Environmental Science, Food Production and Processing, and Agricultural Power and Technology (ODCTE Agricultural Education Courses and Standards website, ¶ 2).

Agricultural education comprises one of 16 career clusters (Ruffing, 2006). Career clusters are “groupings of occupations/career specialties” (States’ Career Clusters initiative, 2009). “Career clusters organize related occupations by the types of products and services they provide. . . Career pathways provide guidance as to the knowledge and skills, both academic and technical, that must be acquired to prepare for occupations at varying levels within these clusters” (Lewis, 2008, p. 169). Career clusters and pathways are tools which assist educators in knowing what to teach to produce prepared and technically proficient future employees.

Educational Needs of Pre-Service Agricultural Education Teachers

In an effort to improve competence, agricultural educators persistently desire and seek in-service education, especially when it pertains to technical content material (Barrick, Ladewig, & Hedges, 1983). Teachers are especially interested in participating in professional development when they are expected to introduce “new subject matter or subject matter in which they have had little previous training” (Newman & Johnson, 1994, p.54). Because teachers seek professional development, it is important to identify the educational needs of these instructors, especially as it relates to agricultural mechanics.

Tyler (1997) defined an educational “need” as the difference between a present condition and an acceptable standard. As such, a need could be expressed as a deficiency. To that end “one method utilized to determine discrepancies is the Borich needs assessment model” (Borich, 1980, p. 42). One of the purposes of using the Borich needs assessment model is to “determine

the congruence between what should be and what is, i.e., between what the teacher should be able to do and what the teacher can do” (p. 42). The Borich model takes into consideration the assessment of two constructs, (i.e., importance and competence) simultaneously, which provides the researcher information as to the areas needed for curricular enhancement (Robinson, 2006) or professional development.

Numerous studies have been conducted in agricultural education using the Borich needs assessment model. Newman and Johnson (1994) utilized the model to identify the in-service training needs of 29 Mississippi agricultural educators teaching pilot agri-science courses. The authors concluded that, “the three most pressing needs for in-service education were in the areas of biotechnology, computers, and mechanical/physical technology” (p. 57).

Garton and Chung (1996) sought to capture the perceptions of beginning agricultural education teachers in Missouri, as well as various teacher educators and state supervisors. Those queried were asked to provide their perceptions of importance and personal competence in regard to 50 professional competencies relevant to agricultural education programs. The researchers noted great variability of responses between the early career agricultural educators when compared to the responses provided by the teacher educators and state supervisors. The authors concluded that beginning teachers in Missouri would benefit most from in-service training in the areas of instruction, program development and evaluation, and program administration.

Agricultural Mechanics Needs of Agriculture Teachers

Johnson, Schumacher, and Stewart (1990) used the Borich needs assessment model to determine specific agricultural mechanics laboratory management in-service needs of practicing

Missouri agricultural educators. The authors determined that Missouri agricultural educators had specific in-service needs related to agricultural mechanics laboratory management. All five competencies receiving the highest MWDS were related to safety (Johnson et al., 1990). These five competencies consisted of “(a) administering first aid, (b) storing, handling and disposing of hazardous materials, (c) providing and documenting safety instruction, (d) conducting safety inspections and correcting hazardous conditions, and (e) selecting, storing and maintaining student protective equipment” (p. 37).

Burris, Robinson, & Terry Jr. (2005) sought to determine the perceptions of university faculty in teacher preparation programs across the country regarding the agricultural mechanics skills needed by pre-service students. The authors found that university faculty rated their students as “prepared” in the selection and use of hand tools, “somewhat prepared” in the areas of agricultural power, metal fabrication, electricity, building/construction, project planning and material selection, concrete, and plumbing, and “poorly prepared” in handling machinery and equipment. Burris et al. (2005) concluded that limited and finite undergraduate course hours and limited technical content hours pose potential problems in preparing competent teachers. Burris et al. (2005) also stated,

If agricultural mechanics is to remain a vital part of secondary programs, certainly the delivery systems in which these courses are applied is critical. However, regardless of the approach taken by agricultural teachers, the success of those courses depends upon the instructors’ ability to first master those competencies in agricultural mechanics. (p. 25)

Saucier, McKim, Murphy, and Terry Jr. (2010) sought to determine the agricultural mechanics laboratory management needs of 98 agricultural education student teachers in Texas. Using the Borich (1980) needs assessment model, the researchers assessed student teachers' perceptions on the importance of teaching 70 agricultural mechanics laboratory management competencies. Additionally, the students' perceptions of their perceived abilities were assessed. These researchers concluded that Texas student teachers needed further instruction in the areas of "lab equipment diagnosis and repair, first aid, and safe disposal of hazardous materials" (p.1). The authors recommended that individuals responsible for producing highly qualified educators, i.e., teacher educators, must continue to provide ongoing and appropriate opportunities for teacher improvement in agricultural laboratory management competencies through workshops, conferences, and structured coursework. Saucier et al. (2010) further stated that,

Future research within the realm of agricultural mechanics education should be explored by researchers. In fact, little research has been conducted in this area of instruction over the past 20 years. Agricultural mechanics courses still remain a popular option for many secondary students and thus, require highly qualified agricultural educators who are technically and pedagogically competent. (p. 13)

Saucier, Terry, Jr., Schumacher (2009) noted that Missouri agricultural mechanics instructors possessed areas of their practice which could benefit from in-service training. Four hundred twenty-four agricultural managers in the state of Missouri were surveyed to determine their perceptions of importance related to managing an agricultural mechanics laboratory. Participants were also asked to provide their perceptions of the needs related to selected competencies regarding agricultural mechanics laboratory management, as well as in-service training needs. Responses were gathered on an instrument developed by Johnson and

Schumacher (1988) and modified by Saucier et al. (2009). The Borich needs assessment model was employed to predict competencies most in need of in-service training. Saucier et al., (2009) noted that,

Secondary agricultural teachers in Missouri who manage agricultural mechanics laboratories have the greatest need for in-service education in areas of: laboratory and student safety, dealing with hazardous materials, and equipment repair. Specific areas of greatest need for improvement are: maintaining and repairing agricultural mechanics laboratory tools and equipment, maintaining a safe agricultural mechanics laboratory, and storing, handling and disposing of hazardous materials. (p. 14)

McKim, Saucier, and Reynolds (2010) sought to determine the laboratory management in-service training needs of 47 secondary agricultural education laboratory managers in Wyoming. Participants were asked to provide their perceptions of importance and confidence regarding 70 agricultural mechanics lab competencies. McKim et al. (2010) concluded that laboratory managers of secondary agricultural mechanics programs in Wyoming had the greatest in-service training need in “first aid, correcting hazardous laboratory conditions, and general laboratory safety” (p. 129). McKim et al. (2010) concluded,

In-service education is necessary to address discrepancies that exist between the teachers’ perceived importance of agricultural mechanics laboratory management competencies and their ability to perform the competencies. In-service education cannot address all discrepancies at once; therefore, pertinent and continuous in-service education should be facilitated each year and focus on one agricultural mechanics management competency at a time beginning with the highest priority construct. (p. 140)

Variables Effecting Teaching Efficacy: Experience and Gender

Lafferty (2004) utilized the Borich needs assessment model to determine the perceptions of beginning (1 to 3 years) agricultural science teachers in Texas. Specifically, Lafferty was interested in capturing teachers' perceptions of their "knowledge, abilities to perform tasks, and ability to teach basic agricultural mechanics skills" (p. 2). Lafferty utilized a mail survey to gather the perceptions of 74 new teachers. "Significant differences were found between inexperienced teachers and experienced teachers on three competencies: "the ability to identify basic principles of electrical wiring and terminology," "the ability to perform basic electric wiring skills," "and the ability to plan and construct fences" (p. 43). "Significant differences were found between males and females of twelve competencies" (Lafferty, 2004, p. i). These significant differences were noted in the areas of,

the ability to maintain electric motors, plan cost effective construction, ability to cut, file, shape, and drill metal, ability to select and operate oxy-fuel welding and cutting equipment, the ability to describe the principles of operation of internal combustion engines and related systems, the ability to disassemble and reassemble small air-cooled engines, the ability to identify and service monitoring, sensing, and metering devices, the ability to maintain intake and exhaust systems, the ability to select lubricants and maintain lubricant systems, the ability to maintain fuel systems, power trains, and hydraulic systems, the ability to maintain steering and braking systems, and the ability to calculate insulation values and heating/cooling loads. (p. 43)

Female respondents who noted large variations in discrepancy scores, felt a given competency was important, but felt inadequately trained to instruct in the context of the

competency (Lafferty, 2004). These findings indicated that there were differences in knowledge and confidence between teachers' with more experience versus less experiences. Also, noticeable differences were seen on numerous competencies regarding, teachers' sex. The study concluded that there was a need for better preparation of female teachers in numerous agricultural mechanics competency areas.

CHAPTER III
METHODOLOGY
Research Design

The research design employed for this study was descriptive-correlational. Descriptive statistics (i.e. modes of central tendency, and variability- means, standard deviations, frequencies and percentages) are helpful for summarizing trends, they assist researchers to better understand degrees of variation in data, and help to define relationships among data sets (Cresswell, 2008); whereas, “In correlational research designs, investigators use the correlation statistic test to describe and measure the degree of association (or relationship) between two or more variables or sets of scores” (Creswell, 2008, p. 356).

Using teachers' responses, the welding education need for pre-service agricultural education teachers was determined. The population for this study was all ($N = 58$) pre-service agricultural education teachers' enrolled in MCAG 3222–Metals and Welding at OSU in the fall 2009. Because this course has been taught for the past 25 years by the same instructor to essentially the same types of students, it was assumed that these pre-service teachers were no different than other pre-service teachers in previous years. So, it was determined that this study was a “time and place” sample, as defined by Oliver and Hinkle (1982), and inferential statistics (i.e., *t*-tests) were applied.

Research Objectives

1. Describe selected personal characteristics (age, gender, major, prior welding employment experience) of pre-service agricultural education teachers.
2. Compare pre-service agricultural education teachers' perceived level of self-efficacy to teach selected welding skills standards before and after instruction.
3. Compare pre-service agricultural education teachers' perceptions of importance to teach selected welding skills standards before and after instruction.
4. Determine the need for pre-service curriculum enhancement in welding, based on the perceptions (prior to and at the end of instruction) of pre-service agricultural education teachers, using the Borich needs assessment model.
5. Determine the relationship between pre-service agricultural education teachers' perceived level of confidence to teach selected welding skills standards and final course grade.
6. Determine the relationship between pre-service agricultural education teachers' age, sex, and perceived level of self-efficacy to teach selected welding skills standards.
7. Determine the relationship between pre-service agricultural education teachers' final course grade and level of work experience in welding.
8. Compare pre-service agricultural education teachers' level of technical knowledge in welding before and after instruction.

Hypothesis Statements

A Pearson Product-Moment Correlation was run for objectives 5, 6, and 7. For objective five, the null hypothesis stated that in the population studied, there was no relationship between teachers' perceived level of confidence to teach selected welding skills standards and final course grade ($H_0: P = 0$). Objective six stated that in the

population studied, there was no relationship between teachers' age, gender, and perceived level of self-efficacy to teach selected welding skills ($H_0: P = 0$). Objective seven stated that in the population studied, there was no relationship between teachers' final course grade and level of prior work experience in welding ($H_0: P = 0$).

An independent t -test was run for objective eight. For objective eight, the null hypothesis stated that the population studied, no statistically significant ($p < .05$) difference existed between teachers' level of technical knowledge of welding before and after instruction ($H_0: \mu_1 = \mu_2$).

Subject Selection

The *population* for this study was derived from the pre-service agricultural education teachers enrolled in MCAG 3222–Metals and Welding at OSU in fall 2009. Evaluation of the study population was accomplished via survey research administered at the beginning and end of the semester, with the intention to identify growth and deficiencies in welding throughout the duration of this 16-week course.

Instrumentation

Finding no suitable instrument to measure the desired research variables, the researcher opted to design a custom-made instrument capable of acquiring accurate and appropriate data needed to answer questions posed by the research objectives. The instrument employed in this study was divided into three sections. The first section of the instrument sought to assess pre-service agricultural education teachers' perceptions on the importance they placed on teaching selected welding skills standards in the Oklahoma secondary agricultural education curriculum. Additionally, pre-service teachers were asked to provide their perceived levels of self-confidence (i.e., efficacy) related to teaching the welding skills standards in the Oklahoma secondary agricultural education curriculum (Appendix A). All prompts used for instrument section one

were developed from course questions taken from the MCAG 3222–Metals and Welding course question bank. Additionally, all (26) prompts were hand selected for their alignment to a skills standard listed in the Oklahoma Department of Career and Technology Education (ODCTE) – Agricultural Power and Technology Welding Technician Skills Standards document. This document outlines the minimal skills which should be possessed by an agricultural welding technician to be deemed competent in their field of employment (Appendix B).

The second section of the instrument consisted of twenty-five question multiple-choice questions which assessed pre-service agriculture education teachers’ knowledge of welding (Appendix C). The knowledge section was based on questions taken from the MCAG 3222–Metals and Welding course question bank. Additionally, every question in section two was selected due to its alignment with a skills standard listed within the Oklahoma Department of Career and Technology Education (ODCTE) - Agricultural Power and Technology Welding Technician Skills Standards.

The third section of the instrument consisted of the personal characteristics of the participants. Specifically, data were collected pertaining to participants’ age, sex, current grade point average, current college classification, college major, prior high school welding course completion, number of completed welding courses, level of potential certification, level of work experience in welding, and participants’ level of participation in welding related career development events.

Instrument Development

The instrument was comprised of selected questions from the MCAG–3222 Metals and Welding course question bank. The course question bank has been established and utilized in its

current form by the lead instructor for the last four years (2006 to present). The lead instructor who teaches the course and developed the course question bank has been teaching metals, welding, and related subjects for 24 years at OSU. Additionally, he has taught pre-service agricultural education teachers at the University of Nebraska. Further, he has previous secondary agricultural education teaching experience in the state of Kansas. Due to the qualifications of the course instructor, it was assumed the question bank was high quality in nature and fitting for the knowledge section of this study.

After securing questions from the course instructor, the researcher hand-selected questions which were not only relevant to course content, but also aligned directly with skills standard identified within the ODCTE Agricultural Power and Technology Welding Technician Skills Standards document (OD46903) Oklahoma Department of Career and Technology Education, 2006).

Validity

A research study is considered valid if “researchers can draw meaningful and justifiable inferences from scores about a sample or population” (Creswell, 2008, p. 649). In this study, validity and reliability were assessed from three avenues. Initially, the instrument developed by the researcher was reviewed by a panel of experts, which consisted of six experienced educators at OSU who had previously taught welding in a secondary agricultural education program and were currently involved with agricultural education teacher preparation. Four of the experts hold doctorate degrees; two of the experts are doctoral candidates. Additionally, the instrument was submitted for revision to a technical content expert who has prepared teacher educators in the field of agricultural mechanics for the last 24 years.

“Two different types of validity are face and content validity” (Robinson, 2006, p. 58). The panel of experts reviewed the instrument for face, and content validity (Ary, Jacobs, & Razavieh, 2002) and made additions, subtractions, corrections or clarifications where necessary. Face validity indicates that a document is pleasant to look at and “appears valid for its intended purpose” (Ary et al., 2002, p. 409). Content validity is, “the test’s content and its relationship to the construct it is intended to measure” (p. 243). To that end, the panel of experts ensured that face and content validity for the research instrument used for this study.

Reliability

A study is considered reliable if responses from an individual are consistent over time on the same instrument (Cresswell, 2008; Wiersma & Jurs, 1990). Reliability for this study was assessed through two pilot tests. The initial test was used to gather data on how the instrument performed. A small group of five pre-service agricultural education teachers was used to assess the reliability of the instrument. These individuals made foot notes on the instrument in order to mark the sections which were unclear, ambiguous, or confusing. Modifications to the instrument were made based upon these teachers’ initial suggestions.

A second pilot test occurred in the summer section of MCAG 3222–Metals and Welding (Summer 2009). The second administration of the pilot test was larger in nature with a population of 23 pilot participants. The second pilot test was deemed necessary to increase instrumental reliability due to the relatively limited sample size which occurred for the initial pilot test. Difficulty measurements were calculated by the researcher with the assistance of the University testing center (Appendix D & E). The researcher calculated the reliability estimates, for all seven welding constructs as a result of the data collected for the second pilot test (Table 1).

Table 1

Reliability Estimates of the Seven Welding Constructs

Constructs	Confidence	Importance
Welding Safety	.79	.54
Welding Process & Procedure	.87	.73
Welding Knowledge	.94	.86
Oxy-Fuel	.89	.79
Brazing	.89	.88
Manual Arc Welding	.95	.91
Manual Cutting	.94	.84

All constructs met Nunally's (1980) requirement of .70 or higher with the exception of welding safety importance, which was calculated at .54. As such, section one of the instrument was deemed reliable and suitable for use for formal data collection.

The welding knowledge test was administered per section two of this study as a criterion-referenced test. Reliability coefficients such as a Crombach's alpha are not necessary for establishing reliability of criterion-referenced tests. Wiersma and Jurs (1990) listed eight factors which researchers should address in order to improve measurement reliability when working with criterion-referenced tests.

Homogeneous items: When criterion-referenced test items emanate from a specific item form or objective, the items should be similar in content and format.

Discriminating items: Items that have undergone item analysis and have been found to be positively discriminating will increase the test's reliability.

Enough Items: The reliability is directly affected by the test length. Longer tests are more reliable.

High-quality copying format: Make sure that the items are legible and not too crowded on the page. A test that looks sharp will promote an appropriate reaction from the students.

Clear directions to the student: The student needs to know how to respond to the questions. Any ambiguity may introduce inconsistencies.

A controlled setting: The teacher should ensure an optimal test setting that eliminates confounding factors as much as possible.

Motivating introduction: The students will respond more consistently and be more involved in the task when she or he knows that the teacher considers the test to be important and knows how the test scores will be used.

Clear directions to the scorer: Any inconsistency in the scoring of the student's responses will lower the test's reliability. Attention to the above factors will help promote reliable test scores. (p. 264)

The following accommodations were made to address the suggestions of Wiersma and Jurs (1990):

Homogeneous items: The questions utilized in the design of the instrument were taken directly from course content (section I) or from an established course question bank (section II). All material used for instrument development were cross-referenced with Oklahoma Agricultural Power and Technology and Welding Skills Standards.

Discriminating items: Survey instrument questions were analyzed utilizing question difficulty and discrimination scores provided and computed by the OSU Testing Center .

Enough items: The instrument completed by survey respondents consisted of 26 questions concerning teacher self-efficacy, 26 questions on teacher importance perceptions, 25 questions on pre-service teachers' knowledge of welding, and 10 questions on selected personal characteristics. In its entirety, the instrument contained 87 questions and was administered twice during the semester (prior to instruction and at the end of instruction). Therefore, the instrument was deemed acceptable in length.

High quality copying and format: Section one of the instrument was professionally custom printed by the OSU Testing Center. Sections two and three were printed using laser jet ink mass copying systems. All laser jet ink copies were reviewed, sorted, culled, and reprinted when necessary to provide clean, sharp, and readable copies. All responses were provided on commercially available orange scantron forms.

Clear directions for the students: Oral instructions were developed by the researcher and read aloud to participants before all survey administrations. With the assistance of white-board illustrations, the researcher attempted to explain the process and purpose of taking the survey. The instructions were provided with the intention of minimizing the rate of student errors and any potential sources of confusion (Appendix F).

Motivating instructions: In addition to receiving the oral instructions, pre-service teachers were provided with the intentions of the assessment and the importance of answering questions accurately and honestly.

Clear directions to the scorer: All scantron forms completed by study participants were scored and tabulated by the OSU Testing Center.

Data Collection

Data were collected via administration of the same instrument prior to and at the end of instruction (i.e., 16 week semester). The first survey was administered in class on Monday, August 17, 2009 at the first class session of MCAG 3222–Metals and Welding. The second administration of the survey occurred on Monday, November 23, 2009, two weeks (one class meeting) prior to the final examination. To increase the efficiency of the data handling and analysis, the researcher designed an instrument to utilize scantrons, to minimize human data handling.

Subject non-response was addressed by the researcher making no less than four but no more than ten attempts to contact non respondents. Data collected prior to instruction, resulted in 62 completed surveys. Data collected at the end of instruction resulted in 58 completed surveys, as two study mortalities were noted. Thus the total population for the study was 58.

Data Analyses

After completion of the data collection process, the researcher commissioned the assistance of the OSU Testing Center to process the scantrons utilized for data collection. Then, the researcher analyzed the data using SPSS 17.0 and Microsoft Office Excel 2007. Numerous

statistical tests were performed to appropriately and completely answer all questions. For analysis of data, the researcher utilized descriptive statistics, the Borich Needs Assessment Model (MWDS), Pearson Product-Moment Correlation Coefficients, Chi-Square, and *t*-tests.

Descriptive statistics are “a set of concepts and methods used in organizing, summarizing, tabulating, depicting, and describing collections of data” (Shavelson, 1996, p. 8). As such, means, standard deviations, percentages, sums, and ranges were used to describe data pertaining to the pre-service agricultural education teachers enrolled in the MCAG 3222–Metals and Welding course in the fall semester 2009. Specifically, descriptive statistics were used for objectives one, two and three.

Additionally, the researcher utilized the Borich Needs Assessment Model in order to examine the discrepancies that existed between teachers’ confidence and importance to teach the skills standard prior to and at the end of instruction. The Borich Needs Assessment Model is useful in determining the in-service needs of practicing teachers (Garton & Chong, 1996; Johnson, Schumacher, & Stewart, 1990; Newman & Johnson, 1994; Saucier, Terry Jr., & Schumacher, 2009) and was used by the researcher to establish the welding training needs of pre-service agricultural education teachers (Borich, 1980).

The Borich Needs Assessment Model relies heavily on the comparison of Mean Weighted Discrepancy Scores (MWDS) (Borich, 1980). MWDS are first calculated by computing a discrepancy score (DS). Discrepancy scores are determined by subtracting the difference between a teachers’ surveyed response for their perceived importance to teach a given skills standard from their self-perceived confidence to teach the same skills standard. After a series of discrepancy scores has been determined for every teacher on each skills standard, the

DS is multiplied by the mean importance rating for each skills standard, resulting in a Weighted Discrepancy Score (WDS). WDSs are then summated and divided by the total number of participants in the study to create a Mean Weighted Discrepancy Score (MWDS). For evaluation purposes, the mean weighted discrepancy scores are listed in numerical order from highest to lowest and are accompanied by their respective skills standard when shown in the Borich Needs Assessment Model. Skills standards which are accompanied with larger mean weighted discrepancy scores are in greater need of in-service/continued training by the pre-service teacher (Kennel, 2009). For this study, per objective four, the researcher was interested in assessing how perceptions changed from the beginning of the semester to the end. Consequently, the Borich Needs Assessment process was conducted twice for objective four (Table 4).

Pearson Product-Moment Correlation Coefficient

Pearson Product-Moment Correlation Coefficient tests were used by the researcher to explain relationships among study variables per objectives five, six, and seven. “Correlation studies are used when we ask questions about the relationship between two variables” (Shavelson, 1996, p. 739). Pearson’s Correlation Coefficients are also useful to determine and define the magnitude of a relationship (Shavelson, 1996). As such, Pearson Product Moment Correlations were used to determine if statistically significant relationships existed between pre-service teachers’ level of self-efficacy to teach selected welding skills standards and their final course grade. Also of interest to the researcher was the potential for a relationship between a teacher’s final course grade and their level of prior work experience in welding.

Davis (1971) noted that correlations between .10 and .29 are negligible, positive associations; correlations between .30 and .49 are low, positive associations; and correlations between .50 and .69 are moderate, positive associations. Correlations between .70 and .89 are strong, positive associations; and correlations between .90 and 1.00 are very strong, positive associations.

substantial, positive associations; correlations between .70 and .99 are very strong, positive associations, and a correlation of 1.00 is a perfect, positive correlations.

For objective five, the null hypothesis stated that in the population studied, there was no relationship between teachers' perceived level of confidence to teach selected welding skills standards and final course grade ($H_0: P = 0$). Objective six stated that in the population studied, there was no relationship between teachers' age, sex, and perceived level of self-efficacy to teach selected welding skills ($H_0: P = 0$). Objective seven stated that in the population studied, there was no relationship between teachers' final course grade and level of prior work experience in welding ($H_0: P = 0$).

Chi Square test

Shavelson (1996) stated that, "Chi-square tests are frequently used because behavioral researchers often are interested in counting the number of subjects falling into particular categories" (p. 550). Chi-square tests assist researchers to determine if two variables influence one another (Ary, Jacobs, & Razavieh, 2002). Because objective six compared male and female teachers' self-efficacy, the Chi-square test was employed in addition to Pearson Product Moment correlation.

There are three assumptions of a Chi-square test: 1) Observations must be independent—that is, the subjects in each sample must be randomly and independently selected; 2) The categories must be mutually exclusive: Each observation can appear in one and only one of the categories in the table; 3) The observations are measured as frequencies (Ary et al., 2002, p. 207).

Independent Samples *t*-test

“The index used to find the significance of the difference between the means of two samples . . . is called the *t*-test for independent samples” (Ary et al., 2002, p. 185). Specifically, a *t*-test was utilized on objective eight to compare pre-service teachers’ level of technical knowledge in welding before and after instruction. This *t*-test was independent because it was “drawn independently from a population without any pairing or other relationship between the two groups” (p. 185). The null hypothesis stated that the population studied, no statistically significant ($p < .05$) difference existed between teachers’ level of technical knowledge of welding before and after instruction ($H_0: \mu_1 = \mu_2$).

Chapter IV

Findings

Objective one sought to describe selected personal characteristics (age, sex, major, prior welding employment experience) of the pre-service agricultural education teachers. It was found that nearly half (46.55%) of pre-service agricultural education teachers were twenty-two years of age or older (Table 1). Twenty pre-service teachers (34.48%) were 21 years of age, and 11 (18.96%) were 20 years old. Forty-three (74.14%) of these teachers were male. Although the MCAG 3222–Metals and Welding course is designed specifically to assist pre-service agricultural education teachers, students representing other disciplines also enroll in the course for various reasons. As such, this course consisted of 39 (67.34%) pre-service agricultural education teachers, three (5.17%) animal science/agricultural education double majors, three (5.17%) animal science majors, and 13 (22.41%) “other” majors. Over one half (58.62%) of the pre-service teachers had no former welding employment experience. Twelve (20.68%) pre-service teachers had up to two years of welding employment experience, two had between two and three years of experience, and 10 (17.24%) had over three years of welding employment experience.

Table 1

Personal Characteristics of Pre-Service Agricultural Education Teachers Age (N = 58)

Characteristic	<i>f</i>	%
Age by Categories		
20 Years of Age	11	18.96
21 Years of Age	20	34.48
22+ Years of Age	27	46.55
Sex		
Male	43	74.14
Female	15	25.86
Academic Major		
Agricultural Education	39	67.34
Animal Science/Agricultural Education Double Major	3	5.17
Animal Science	3	5.17
Other	13	22.41
Employment Experience		
No Experience	34	58.62
Less Than 1 Year	6	10.34
1 to 2 Years	6	10.34
2 to 3 Years	2	3.57
3+ Years	10	17.24

Objective two sought to compare pre-service agricultural education teachers' perceived level of self-efficacy to teach selected welding skills standards before and after instruction. Twenty-six skills standards encompassing seven constructs were assessed. Pre-service teachers experienced a positive perceived increase of teacher self-efficacy at performing all skills standards from the beginning of the semester to the end (Table 2). Specifically, it was found that the skills standard in which pre-service teachers experienced the greatest amount of perceived growth from prior to instruction to the end of instruction was "proper surface preparation for brazing" (+2.12). Skills standards in which teachers gained between 1.50 and 1.73 points of growth contained "advantages and disadvantages of brazing" (+1.73), "the purpose of using flux in brazing" (+1.71), "safety rules for handling oxy-acetylene welding gasses, and equipment" (+1.60), "square groove butt joint welding, using shield metal arc welding in the flat position" (+1.57), "lighting, flame adjustment and shut-down procedures of oxy-fuel welding equipment" (+1.50), "cutting mild steel plate at a 90 degree angle, using an oxy-fuel torch" (+1.50), and lighting flame adjustment and shut-down procedures of oxy-fuel welding equipment (+1.50).

There were 14 skills standards in which pre-service teachers increased between 1.00 and 1.49 points of efficacy throughout the semester-long course. An improvement of one point on a five point scale would be the equivalent of survey participants moving from "no confidence" to "below average confidence" or from "above average confidence" to "high confidence." These 14 skills standards consisted of "electrode identification and selection" (+1.49), "manual operation of a plasma cutter" (+1.45), "T-joint fillet welding, using shield metal arc welding in the flat and vertical up position" (+1.39), "cutting shapes in mild steel plate, using a plasma cutter" (+1.38), "orange peel cutting of mild steel pipe, using a plasma cutter or oxy-fuel torch" (+1.35), "joint preparation for welding" (+1.31), "identification of major parts of gas metal arc

welding (MIG) equipment” (+1.31), “shielding gas selection and usage” (+1.31), “proper setup of equipment for oxy-acetylene cutting” (+1.21), “identification of welding errors, such as improper travel speed and excessive arc length” (+1.19), “cutting a hole in mild steel plate, using an oxy-fuel torch” (+1.09), “advantages of the gas metal arc welding (MIG) method” (+1.07), “slag chipping (weld cleaning)” (+1.06), and “weld testing for strength and defects” (+1.00).

Additionally, there were five skills standards in which pre-service teachers showed less than a 1.00 point increase in efficacy. These standards comprised a positive growth in teacher self-efficacy and consisted of “welding equipment settings, such as wire speed, temperature, and polarity, (+0.94), “selection of personal protective equipment (PPE) for welding” (+0.79), “appropriate eyewear selection for welding” (+0.70), “organization and maintenance of a clean and safe work area” (+0.62), and “selection and use of fire extinguishers” (+0.57).

Pre-service teachers experienced perceived gains in self-efficacy on all 26 skills standards of +0.57 or greater. Further, these teachers also experienced perceived gains on all seven constructs. The greatest amounts of perceived gains were documented for Brazing (+1.86), Manual Arc Welding (+1.48), and Oxy-fuel (+1.44), respectively. The construct receiving the least amount of overall perceived gain in teacher self-efficacy was Welding Safety (+0.67).

Table 2

Comparison of Teacher Efficacy to Teach Selected Welding Skills Standard Prior to and End-of-Instruction

Construct	PI ^a		EI ^b		Mean
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	Differences
Welding Safety					
Selection and use of fire extinguishers	3.59	1.17	4.16	0.99	+0.57
Selection of personal protective equipment (PPE) for welding	3.76	1.11	4.55	0.68	+0.79
Appropriate eyewear selection for welding	4.09	1.08	4.79	0.41	+0.70
Organization and maintenance of a clean and safe work area	3.98	1.08	4.60	0.65	+0.62
Welding safety composite mean	3.86	1.11	4.53	.68	+0.67
Welding process and procedure					
Joint preparation for welding	2.88	1.33	4.19	0.80	+1.31
Weld testing for strength and defects	2.84	1.23	3.84	0.99	+1.00
Slag chipping (weld cleaning)	3.41	1.41	4.47	0.73	+1.06
Welding equipment settings, such	2.78	1.26	3.72	0.95	+0.94

as wire speed, temperature and polarity					
Welding process and procedure composite mean	2.98	1.31	4.05	0.87	+1.07
Welding knowledge					
Electrode identification and selection	2.49	1.26	3.98	0.76	+1.49
Identification of major parts of gas metal arc welding (MIG) equipment	2.67	1.22	3.98	0.87	+1.31
Shielding gas selection and usage	2.41	1.17	3.72	0.98	+1.31
Identification of welding errors, such as improper travel speed and excessive arc length	2.67	1.29	3.86	0.98	+1.19
Advantages of the gas metal arc welding (MIG) method	2.91	1.38	3.98	0.94	+1.07
Welding knowledge composite mean	2.63	1.26	3.90	.91	+1.27
Oxy-Fuel					
Safety rules for handling oxy- acetylene welding gasses, and equipment	2.78	1.39	4.38	0.81	+1.60
Proper setup of equipment for oxy-	2.88	1.39	4.09	0.88	+1.21

acetylene cutting					
Lighting flame adjustment and	2.86	1.38	4.36	0.89	+1.50
shut-down procedures of oxy-					
fuel welding equipment					
Oxy-fuel composite mean	2.84	1.39	4.28	0.86	+1.44
Brazing					
Proper surface preparation for	2.21	1.11	4.33	0.91	+2.12
brazing					
Advantages and Disadvantages of	2.24	1.22	3.97	0.97	+1.73
brazing					
The purpose of using flux in	2.34	1.18	4.05	0.89	+1.71
brazing					
Brazing composite mean	2.26	1.17	4.12	0.92	+1.86
Manual arc welding skills					
T-joint fillet welding, using shield	2.59	1.28	3.98	0.89	+1.39
metal arc welding in the flat					
and vertical up position					
Square groove butt joint welding,	2.50	1.29	4.07	0.93	+1.57
using shield metal arc					
welding in the flat position					
Manual arc welding composite	2.55	1.29	4.03	0.91	+1.48
mean					
Manual Cutting					

Orange peel cutting of mild steel pipe, using a plasma cutter or oxy-fuel torch	2.24	1.19	3.59	1.04	+1.35
Cutting mild steel plate at a 90 degree angle, using an oxy- fuel torch	2.59	1.43	4.09	0.92	+1.50
Cutting a hole in mild steel plate, using an oxy-fuel torch	2.86	1.39	3.95	1.07	+1.09
Cutting shapes in mild steel plate, using a plasma cutter	2.59	1.35	3.97	0.95	+1.38
Manual operation of a plasma cutter	2.74	1.38	4.19	0.80	+1.45
Manual cutting composite mean	2.60	1.35	3.96	0.96	+1.36
Overall composite mean	2.82	1.26	4.12	0.87	+1.30

Note. ^aPI = Pre-Instruction; ^bEnd of Instruction; Scale: 1 = No Confidence, 2 = Below Average Confidence, 3 = Average Confidence, 4 = Above Average Confidence, 5 = High Confidence

Objective three sought to compare pre-service agricultural education teachers' perceptions of the importance to teach selected welding skills standards prior to and at the end of instruction. Twenty-six skills standards covering seven constructs were assessed. Pre-service teachers experienced positive perceived increases on 19 skills standards, a perceived loss on five skills standards, and negligible growth on three skills standards (Table 3). Specifically, it was found that the skills standards in which pre-service teachers experienced the greatest amount of

perceived increase from pre-instruction to the end of instruction was “slag chipping (weld cleaning)” (+0.43), followed by “proper surface preparation for brazing” (+0.38). Pre-service teachers also experienced positive increases on the following skills standards: “square groove butt joint welding, using shield metal arc welding in the flat position” (+0.25), “organization and maintenance of a clean and safe work area” (+0.22), “safety rules for handling oxy-acetylene” (+0.22), “joint preparation for welding” (+0.22), “identification of welding errors, such as improper travel speed and excessive arc length” (+0.21), “electrode identification and selection” (+0.15), “selection of personal protective equipment (PPE) for welding” (+0.14), “manual operation of a plasma cutter” (+0.14), “T-joint fillet welding, using shield metal arc welding in the flat and vertical up position” (+0.12), “advantages of the gas metal arc welding (MIG) method” (+0.11), “identification of major parts of gas metal arc welding (MIG) equipment” (+0.09), “orange peel cutting of mild steel pipe, using a plasma cutter or oxy-fuel torch” (+0.09), “cutting shapes in mild steel plate, using a plasma cutter” (+0.09), “cutting mild steel plate at a 90 degree angle, using an oxy-fuel torch” (+0.07), “welding equipment settings, such as wire speed, temperature and polarity” (+0.05), and “proper setup of equipment for oxy-acetylene cutting” (+0.03).

Pre-service teachers experienced a decline in perceived importance on five skills standards. These skills standards consisted of “weld testing for strength and defects” (4.43) (-0.07), “the purpose of using flux in brazing” (4.26) (-0.05), “cutting a hole in mild steel plate using an oxy-fuel torch” (4.30) (-0.05), “lighting, flame adjustment and shut-down procedures of oxy-fuel welding equipment” (4.62) (-0.04), and “appropriate eyewear selection for welding” (4.83) (-0.03).

Pre-service teachers were negligible in their importance perception change on three skills standards. These skills standards consisted of “selection and use of fire extinguishers,” “shielding gas selection and usage,” and “advantages and disadvantages of brazing.”

Additionally, pre-service teachers experienced positive importance perception increases on all seven constructs. The greatest amount of perceived gain was observed in “Manual Arc Welding” (+0.18) followed by “Welding Process and Procedure” (+0.15) and “Welding Knowledge and Brazing” (+0.11), respectively.

Table 3

*Comparison of Teacher's Perceptions of Importance to Teach Selected Welding Skills Standard,
Prior to & End-of-Instruction*

Construct	PI ^a		EI ^b		Mean
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	Differences
Welding safety					
Selection and use of fire extinguishers	4.76	0.57	4.76	0.51	0.00
Selection of personal protective equipment (PPE) for welding	4.67	0.71	4.81	0.40	+0.14
Appropriate eyewear selection for welding	4.86	0.40	4.83	0.38	-0.03
Organization and maintenance of a clean and safe work area	4.45	0.75	4.67	0.54	+0.22
Welding safety composite mean	4.69	0.61	4.77	0.46	+0.08
Welding process and procedure					
Joint preparation for welding	4.33	0.66	4.55	0.65	+0.22
Weld testing for strength and	4.50	0.71	4.43	0.73	-0.07

defects					
Slag chipping (weld cleaning)	4.12	0.92	4.55	0.63	+0.43
Welding equipment settings, such as wire speed, temperature and polarity	4.55	0.57	4.60	0.70	+0.05
Welding process and procedure composite mean	4.38	0.72	4.53	0.68	+0.15
Welding knowledge					
Electrode identification and selection	4.33	0.76	4.48	0.60	+0.15
Identification of major parts of gas metal arc welding (MIG) equipment	4.38	0.75	4.47	0.68	+0.09
Shielding gas selection and usage	4.51	0.63	4.51	0.60	0.00
Identification of welding errors, such as improper travel speed and excessive arc length	4.34	0.74	4.55	0.71	+0.21
Advantages of the gas metal arc welding (MIG)	4.28	0.77	4.39	0.77	+0.11

method					
Welding knowledge	4.37	0.73	4.48	0.67	+0.11
composite mean					
Oxy-Fuel					
Safety rules for handling oxy-acetylene welding gasses, and equipment	4.57	0.65	4.79	0.45	+0.22
Proper setup of equipment for oxy-acetylene cutting	4.64	0.67	4.67	0.58	+0.03
Lighting, flame adjustment and shut-down procedures of oxy-fuel welding equipment	4.66	0.58	4.62	0.59	-0.04
Oxy-fuel composite mean	4.62	0.63	4.69	0.54	+0.07
Brazing					
Proper surface preparation for brazing	4.16	0.89	4.54	0.66	+0.38
Advantages and disadvantages of brazing	4.17	0.88	4.17	0.88	0.00
The purpose of using flux in brazing	4.31	0.88	4.26	0.74	-0.05
Brazing composite mean	4.21	0.88	4.32	0.76	+0.11
Manual arc welding skills					

T-joint fillet welding, using shield metal arc welding in the flat and vertical up position	4.22	0.86	4.34	0.76	+0.12
Square groove butt joint welding, using shield metal arc welding in the flat position	4.19	0.93	4.44	0.63	+0.25
Manual arc welding composite mean	4.21	0.89	4.39	0.69	+0.18
Manual Cutting					
Orange peel cutting of mild steel pipe, using a plasma cutter or oxy- fuel torch	4.17	0.98	4.28	0.74	+0.09
Cutting mild steel plate at a 90 degree angle, using an oxy-fuel torch	4.29	0.86	4.36	0.67	+0.07
Cutting a hole in mild steel plate, using an oxy-fuel torch	4.35	0.79	4.30	0.73	-0.05
Cutting shapes in mild steel plate, using a plasma	4.26	0.85	4.35	0.72	+0.09

cutter					
Manual operation of a plasma	4.29	0.92	4.43	0.68	+0.14
cutter					
Manual cutting composite	4.27	0.88	4.34	0.71	+0.07
mean					
Overall composite mean	4.39	0.76	4.50	0.64	+0.11

Note. ^aPI = Prior to Instruction; ^bEnd of Instruction; Scale: 1 = No Importance, 2 = Below Average Importance, 3 = Average Importance, 4 = Above Average Importance, 5 = High Importance

Objective four sought to determine the need of pre-service curriculum enhancement in welding based on perceptions (prior to and at the end of instruction) of pre-service agricultural education teachers, using the Borich needs assessment model. Mean Weighted Discrepancy Scores (MWDS) were assessed across all 26 skills standards. Specifically, MWDS were calculated to determine where discrepancies existed prior to and at the end of instruction. These scores indicate areas needed for professional development; the higher the MWDS, the higher the professional development need. The MWDS for all 26 skills standards were higher prior to instruction than they were at the end of instruction. The range of MWDS prior to instruction (8.74 to 2.23) was larger than the end of instruction (3.77 to 0.16).

The top five highest MWDS skills standards prior to instruction were “shielding gas selection and usage” (MWDS = 8.74), “the purpose of using flux in brazing” (MWDS = 8.32), “proper setup of equipment for oxy-acetylene cutting” (MWDS = 8.31), “lighting, flame

adjustment and shut-down procedures of oxy-fuel welding equipment” (MWDS = 8.27), and “safety rules for handling oxy-acetylene welding gasses and equipment” (MWDS = 8.11).

The top five highest MWDS skills standards at the end of instruction were “welding equipment settings, such as wire speed, temperature and polarity” (MWDS = 3.77), “shielding gas selection and usage” (MWDS = 3.25), “identification of welding errors, such as improper travel speed and excessive arc length” (MWDS = 2.99), “selection and use of fire extinguishers” (MWDS = 2.84), “orange peel cutting of mild steel pipe, using a plasma cutter or oxy-fuel torch” (MWDS = 2.67).

Lastly, six skills standards were consistently in the top ten in terms of MWDS prior to and at the end of instruction. These six standards consisted of “shielded gas selection and usage” (Rank = 1_{prior to instruction}; Rank = 2_{end of instruction}), “proper setup of equipment for oxy-acetylene cutting” (Rank = 3_{prior to instruction}; Rank = 7_{end of instruction}), “safety rules for handling oxy-acetylene welding gasses, and equipment” (Rank = 5_{prior to instruction}; Rank = 10_{end of instruction}), “orange peel cutting of mild steel pipe, using a plasma cutter or oxy-fuel torch” (Rank = 6_{prior to instruction}; Rank = 5_{end of instruction}), “welding equipment settings, such as wire speed, temperature and polarity” (Rank = 9_{prior to instruction}; Rank = 1_{end of instruction}), and “electrode identification and selection” (Rank = 10_{prior to instruction}; Rank = 8_{end of instruction}). Skills standards that were in the top ten prior to instruction and remained within the top ten at the end of instruction indicate areas needed for curriculum revision.

Table 4

Borich Needs Assessment Model

Prior to Instruction		Skills Standard	End of Instruction	
Rank	MWDS ^a		Rank	MWDS ^a
1	8.74	Shielding gas selection and usage	2	3.25
2	8.32	The purpose of using flux in brazing	21	0.82
3	8.31	Proper setup of equipment for oxy-acetylene cutting	7	2.18
4	8.27	Lighting, flame adjustment, and shut-down procedures of oxy-fuel welding equipment	16	1.12
5	8.11	Safety rules for handling oxy-acetylene welding gasses and equipment	10	1.86
6	7.99	Orange peel cutting of mild steel pipe, using a plasma cutter or oxy-fuel torch	5	2.67
7	7.98	Proper surface preparation for brazing	23	0.58
8	7.76	Advantages and disadvantages of brazing	22	0.80
9	7.65	Welding equipment settings, such as wire speed, temperature and polarity	1	3.77
10	7.59	Electrode identification and selection	8	2.10
11	7.46	Weld testing for strength and defects	6	2.46
12	7.36	Identification of major parts of gas metal arc welding (MIG) equipment	9	2.01
13	7.25	Cutting mild steel plate at a 90 degree angle, using an oxy-fuel torch	18	1.05
14	7.08	Cutting shapes in mild steel plate, using a plasma cutter	17	1.12
15	6.98	Square groove butt joint welding, using shield metal arc welding in the flat	15	1.14

		position		
16	6.95	Identification of welding errors, such as improper travel speed and excessive arc length	3	2.99
17	6.79	T-joint fillet welding, using shield metal arc welding in the flat and vertical up position	13	1.46
18	6.67	Manual operation of a plasma cutter	20	0.92
19	6.26	Joint preparation for welding	12	1.62
20	6.20	Cutting a hole in mild steel plate, using an oxy-fuel torch	19	1.04
21	5.59	Selection and use of fire extinguishers	4	2.84
22	5.59	Advantages of the gas metal arc welding (MIG) method	11	1.66
23	4.07	Selection of personal protective equipment (PPE) for welding	14	1.24
24	3.53	Appropriate eyewear selection for welding	26	0.16
25	2.95	Slag chipping (weld cleaning)	24	0.37
26	2.23	Organization and maintenance of a clean and safe work area	25	0.30

Note. ^aMean Weighted Discrepancy Score (MWDS)

Objective five sought to determine the relationship between pre-service agricultural education teachers' perceived level of confidence to teach selected welding skills standards and final course grade. All teachers' end of instruction efficacy responses were averaged in order to create an individual mean efficacy measurement for each teacher in the study. Individual self-

efficacy means were then averaged to create a teacher self-efficacy mean of means score (4.11) for pre-service teachers in the study (Table 5).

Also pre-service teachers' end-of-instruction class scores were recorded, transposed, and averaged in order to create a final course grade mean score (78.07) (Table 5). When correlating teacher self-efficacy and final course grade, the r -value was .29 indicating a positive, low relationship (Davis, 1971). However, the p -value was .03, indicating that there was a statistically significant relationship ($p = .03$) between the self-efficacy measurement and end-of semester-mean course grade of pre-service teachers. Therefore, the null hypothesis was rejected.

Table 5

The Relationship between Teacher Self-efficacy to Teach Welding and Final Course Grade

($N = 58$)

Teacher Self-efficacy Grand Mean Score	Final Course Grade Mean Score	r	p -value
4.11	78.07	.29	.03*

*Note. $p = < .05$; $df = 56$, Scale: 1 = No Confidence, 2 = Below Average Confidence, 3 = Average Confidence, 4 = Above Average Confidence, 5 = High Confidence

Objective six sought to determine the relationship between pre-service agricultural education teachers' age, sex, and perceived level of self-efficacy to teach selected welding skills standards. When comparing teachers' age and welding self-efficacy, no relationship was observed (Table 6). As such, the null hypothesis was accepted indicating that there was no statistically significant difference between age and welding self-efficacy.

Table 6

Relationship Among Pre-service Teachers' Age and Perceived Level of Self-efficacy to teach Selected Welding Skills Standards

Variable	Age
Welding Self-efficacy	-0.02

Because the category of sex contained two potential sub-categories (male and female), a Chi-Square test was employed because Chi-Square tests are better suited to provide more accurate information when dealing with two frequencies. As such, when comparing teachers' welding self-efficacy by sex, it was detected that no statistically significant difference was observed (Table 7). Therefore, the null hypothesis was accepted.

Table 7

Relationship Among Pre-service Teachers' Sex and Perceived Level of Self-efficacy to teach Selected Welding Skills Standards

Variable	Sex
Welding Self-efficacy	-0.00

Objective seven sought to determine the relationship between pre-service agricultural education teachers' final course grade and level of previous work experience in welding. It was found that there was no statistically significant relationship ($P = 0$) between previous work experience in welding and pre-service teacher's final course grade (Table 8). Thus, the null hypothesis was accepted.

Table 8

Relationship Among Pre-service Teachers' Final Course Grade and Previous Work Experience

Variable	Previous Work Experience in Welding
Final Course Grade	0.19

Objective eight sought to compare the pre-service agricultural education teachers' level of technical knowledge in welding prior to and at the end of instruction. On the 100 point examination, students averaged a grade of "F" ($M = 58.41$) prior to instruction. On the same examination at the end of instruction, students averaged a grade of "C" ($M = 70.21$). Students' mean knowledge scores grew nearly 12 percent (11.8%) throughout the semester. Standard deviations remained nearly constant. However, students' minimum and maximum scores grew by 12 percent on prior and end-of-instruction tests, respectively. Pre-service teachers demonstrated a statistically significant increase in welding technical knowledge ($p = .00$) at the end of instruction when compared to their "prior instruction" scores. Therefore, the null hypothesis was rejected in favor of the alternative hypothesis indicating there was a statistically significant difference in mean scores prior to and at the end of instruction ($p < .05$).

Table 9

Pre-service Teachers' Level of Technical Knowledge in Welding Before and After Instruction

Variable	<i>M</i>	SD	Range		<i>p</i> -value
			Minimum	Maximum	
			%	%	
Prior to Instruction ^a	58.41	13.42	28	84	.00*
End of Instruction ^b	70.21	13.43	40	96	

Note. Range = ^a0 – 100%, ^b0 – 100%; *p* = < .05

CHAPTER V

CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

Purpose of the Study

The purpose of this study was twofold: 1) to determine OSU pre-service agricultural education teachers' knowledge of mechanical agricultural skills standards related to welding; 2) to assess OSU pre-service agricultural education teachers' perceived levels of self-efficacy to teach welding skills standards in the Oklahoma secondary agricultural mechanics curriculum.

Research Objectives

1. Describe selected personal characteristics (age, sex, major, prior welding employment experience) of pre-service agricultural education teachers.
2. Compare pre-service agricultural education teachers' perceived level of self-efficacy to teach selected welding skills standards before and after instruction.
3. Compare pre-service agricultural education teachers' perceptions of importance to teach selected welding skills standards before and after instruction.
4. Determine the need for pre-service curriculum enhancement in welding, based on the perceptions (prior to and at the end of instruction) of pre-service agricultural education teachers, using the Borich needs assessment model.
5. Determine the relationship between pre-service agricultural education teachers' perceived level of confidence to teach selected welding skills standards and final course grade.

6. Determine the relationship between pre-service agricultural education teachers' age, sex, and perceived level of self-efficacy to teach selected welding skills standards.
7. Determine the relationship between pre-service agricultural education teachers' final course grade and level of work experience in welding.
8. Compare pre-service agricultural education teachers' level of technical knowledge in welding before and after instruction.

Population

The population for this study consisted primarily of pre-service agricultural education teachers enrolled in MCAG 3222–Metals and Welding at Oklahoma State University in the fall of 2009. A total of 58 participants completed both questionnaires, prior to and at the end of instruction.

Research Design

The research design used in the course of this study was descriptive-correlational. Researchers utilize correlations when attempting to determine the existence and magnitude of a relationship between two variables (Creswell, 2008). “Descriptive statistics present information that helps a researcher describe responses to each question in a database as well as determine overall trends in the distribution of the data” (Creswell, 2008, p. 638). Descriptive and inferential statistics were used in this study. Specifically, means, standard deviations, frequencies, and correlations were employed to answer research objectives. Additionally, the researcher utilized the Borich needs assessment model (Borich, 1980) to determine areas in need of welding improvement for pre-service teachers at OSU.

The instrument used in this study consisted of three sections. Section one of the instrument was utilized to capture pre-service teachers' self-perceived confidence and importance ratings on 26 welding skills standards. Section two was designed to measure the welding knowledge proficiency of pre-service teachers. Finally, section three was employed to gather personal characteristic data from survey participants. Measurements of knowledge, efficacy, and importance were collected prior to and at the end of instruction via survey research. The researcher utilized student survey responses for efficacy and importance to calculate MWDSs. MWDSs were used to determine where deficiencies existed so that curricular enhancement could be identified.

Data Collection

Data for this study were collected prior to and at the end of instruction in MCAG 3222–Metals and Welding during the fall 2009 semester. The survey instrument used to assess knowledge, confidence, and importance was identical for both data collection points. The initial survey was administered on August 17, 2009 to all students enrolled in the course ($n = 60$). The end-of-instruction survey was administered on November 23, 2009. Only students who completed both instruments were included in the study ($n = 58$). All skills standards utilized for the development of the instrument were reviewed within course content; thus, no questions were removed from the data set for the sake of maintaining accurate data.

Data Analysis

Identification of survey participants was necessary for data analysis in an effort to match each persons' data responses prior to and at the end of instruction. To achieve this task, all participants were issued a confidential, random numeric identifier. Participant identifiers remained constant on all scantron forms throughout the duration of the study. All scantron forms

were delivered to the University testing and assessment center at OSU for scanning and scoring. The testing center uploaded initial data into Statistical Package for the Social Sciences (SPSS) 16.0, 17.0 and/or Microsoft Office Excel (2007). Descriptive and inferential statistics (i.e., means, standard deviations, frequencies, *t*-tests, and chi square) were used to describe and explain relationships among study variables.

Additionally, to assess pre-service welding training needs of the potential teachers in this study, the Borich needs assessment model was employed. The Borich needs assessment model is a three step–data analysis tool that identifies the skills most needed for in-service and pre-service training. According to the rationale developed by Borich (1980), the model serves to evaluate the relationship between what a teacher is able to do and what a teacher should be able to do. The Borich model attempts to accomplish this feat by determining a MWDS for each construct or item in the study. For pre-service teachers involved in this study, MWDSs were determined by first subtracting teachers’ confidence rating from teachers’ importance rating for a particular skill which yielded a Discrepancy Score. Discrepancy scores were then multiplied by the mean importance rating for the designated skill, to produce a Weighted Discrepancy Score. After calculating a MWDS for each skill standard, the researcher ranked all skills standards from highest MWDS to lowest MWDS to determine the standards which were greatest in need of further instruction (Borich, 1980). By comparing prior instruction MWDS scores to end of instruction MWDS scores, implications could be made concerning growth caused from course content, as well as identifying areas in need of further training.

Summary of Findings

The greatest majority of participants in this study were males (74.14 %) who were 22 years of age and older (46.55 %). Over one half of the participants (58.62 %) had no formal

welding experiences prior to enrolling in the MCAG 3222–Metals and Welding course.

Incidentally, 10 participants (17%) had three or more years of welding experience.

It was concluded that the MCAG 3222–Metals and Welding course had a positive impact on pre-service teachers’ perceived abilities to perform welding tasks. This finding supports Bandura’s (1997) self-efficacy theory. Specifically, it can be implied that teachers’ achieved mastery experiences (Bandura, 1995) throughout the duration of the course, which enabled them to feel more confident in performing all welding skills standards. As such, these teachers should be more confident to teach these skills standards to their future students (Tschannen-Moran et al., 1998).

Conclusions

Objective 1: Describe selected personal characteristics (age, sex, major, prior welding employment experience) of pre-service agricultural education teachers.

The majority of participants in this study were male agricultural education majors who were 22 years of age and older. This finding is somewhat contradictory of Saucier et al’s. (2010) study which found that “the typical school-based agricultural education student teacher in Texas is female, 22 years of age, and from a rural community with less than 10,000 residents” (p. 12).

Over one half of the participants in this study had no formal welding experience prior to enrolling in the MCAG 3222–Metals and Welding course. Nearly 25 percent of these participants had between one and three years of welding experience, and 10 participants (17%) had in excess of three years of welding experience prior to taking the course of interest. Based on previous research by Knobloch and Whittington (2002) it can be assumed that teachers’

former welding experience would be important in improving teachers' overall level of self-efficacy.

Objective 2: Compare pre-service agricultural education teachers' perceived level of self-efficacy to teach selected welding skills standards before and after instruction.

It was concluded that the MCAG 3222–Metals and Welding course had a positive impact on students' perceived levels of confidence to perform necessary welding tasks. Overall, students gained 1.30 points of confidence (on a 5–point Lykert scale) on all welding skills standards at the end of instruction. This finding aligns with Bandura's (1997) self-efficacy theory in that efficacy is based on experience. As such, perhaps these students were able to achieve mastery experiences (Bandura, 1995) on these welding skill standards throughout the duration of the course, which enabled them to feel more confident at performing all welding skills standards. As such, these teachers should be more confident at teaching these skills standards to their future students because efficacy leads to successful teaching (Tschannen-Moran et al., 1998).

Prior to enrolling in MCAG 3222–Metals and Welding, pre-service teachers were most confident in their ability to perform the skills standards related to welding safety. Teachers were least confident in their ability to perform skills standards related to brazing. Conversely, at the end of the semester, pre-service teachers remained most confident at performing the welding safety construct. This finding contradicts numerous research studies regarding the professional development needs of current agricultural education teachers in the area of safety (Dyer & Andreasen, 1999; Forsythe, 1983; Foster, 1986; Jarrett, 1967; McKim et al., 2010; McMahon,

1975; Rosencrans, 1996; Saucier et al., 2010a; Saucier et al., 2010b; Strong, 1975; Swan, 1992).

At the end of the semester, students were least confident in their welding knowledge.

Objective 3: Compare pre-service agricultural education teachers' perceptions of importance to teach selected welding skills standards before and after instruction.

Pre-service teachers perceived welding safety to be the most important skill standard prior to and at the end of instruction. This conclusion supports a previous finding by Slusher (2009) who found that general farm safety was a highly sought after competency of agricultural industry experts when employing high school graduates in the animal science industry. Further, pre-service teachers rated all 26 welding skills standards “above average” in importance. This finding exceeds the conclusion drawn by McKim et al. (2010) who noted that “nearly all of the competencies [of Wyoming agriculture teachers] were determined to be at least of average importance, nearly half of which were perceived as being of above average importance” (p. 140).

Overall importance means from beginning to end of instruction assessments showed an increase of +.21 points on a 5-point scale. Although this increase is not as steep as the perceived change in confidence, it should be noted that importance ratings were higher than confidence ratings for all skills standards. So, there was not as much room for growth in this area. Further, it should be noted that the importance ratings were higher than confidence ratings on each of the welding skills standards throughout the duration of the course. This finding aligns with previous research by Radhakrishna and Bruening (1994) and Robinson, Garton, and Vaughn (2007) who found that graduates typically rate items more important than they do their ability to perform them.

Objective 4: Determine the need for pre-service curriculum enhancement in welding, based on the perceptions (prior to and at the end-of-instruction) of pre-service agricultural education teachers, using the Borich needs assessment model.

Pre-service teachers' agricultural mechanics skill needs changed from "shielding gas selection and usage," "the purpose in using flux in brazing," and "proper set up of equipment for oxy-acetylene cutting," prior to instruction to "welding equipment settings, such as wire speed, temperature and polarity," "shielding gas selection and usage," and "identification of welding errors, such as improper travel speed and excessive arc length" at the end of instruction. Overall, six skills standards remained the same throughout the duration of the course. Specifically, these six were "shielding gas selection and usage," "proper set up of equipment for oxy-acetylene cutting," "safety rules for handling oxy-acetylene welding gasses and equipment," "orange peel cutting of mild steel pipe using a plasma cutter or and oxy-fuel torch," "welding equipment setting such as wire speed, temperature and polarity," and "electrode identification and selection." This finding is similar to research conducted by Saucier et al. (2010) who noted that two of the five most pressing professional development needs consisted of helping agricultural education student teachers in Texas make repairs to agricultural mechanics laboratory equipment and practice safety in the shop while handling dangerous and hazardous materials. However, the findings listed above refute research conducted by Johnson, Schumacher, and Stewart (1990) who found that agricultural mechanics laboratory management in-service training needs of practicing teachers in Missouri were primarily based in agricultural mechanics safety.

Objective 5: Determine the relationship between pre-service agricultural education teachers' perceived level of confidence to teach selected welding skills standards and final course grade.

At the end of instruction, pre-service teachers perceived themselves to be “above average” in their ability to teach welding skills standards. Teachers’ final course grade in MCAG 3222–Metals and Welding resulted in a “C” (78.07%), which produced a positive, low relationship, according to Davis’s (1971) convention. Further, this finding was statistically significant, thus supporting Bandura’s (1997) theory of self-efficacy that as an individual’s belief in his or her abilities to perform a given task increases, so does that person’s performance.

Objective 6: Determine the relationship between pre-service agricultural education teachers' age, gender, and perceived level of self-efficacy to teach selected welding skills standards.

In reference to research objective number six, there was a low, negative relationship that existed when comparing teachers’ age and welding self-efficacy. As such, this finding was not statistically significant. Therefore, it can be concluded that pre-service teachers’ age and their level of welding self-efficacy were not closely related. Further, when comparing sex and welding self-efficacy, it was noted that no statistically significant relationship existed. This finding contradicts research by Lafferty (2004) who found that females felt incompetent at teaching various agricultural mechanics skills.

Objective 7: Determine the relationship between pre-service agricultural education teachers' final course grade and level of work experience in welding.

When comparing previous work experience in welding and pre-service teacher’s final course grade, no statistically significant relationship was found. This finding is interesting as Bandura’s (1997) theory would imply that positive experience would lead to higher levels of performance. Knobloch and Whittington (2002) found that former teaching experience

improved teachers' overall level of self-efficacy. However, this study did not yield similar results. Perhaps these pre-service teachers did not receive positive experiences in their previous work settings and thus had to “unlearn” bad habits once they enrolled in MCAG 3222 – Metals and Welding.

Objective 8: Compare pre-service agricultural education teachers' level of technical knowledge in welding before and after instruction.

It was noted that pre-service agricultural education teachers improved their scores on their knowledge of welding by nearly 12 percent. OSU pre-service teachers went from failing the knowledge test prior to instruction to passing the same test with a grade of “C” at the end of instruction. This improvement in student achievement was determined to be statistically significant. As such, it can be concluded that the 16-week MCAG 3222–Metals and Welding course allowed students to improve their level of technical welding knowledge significantly.

Recommendations for Future Research

It is recommended that this study be replicated in other states. It is possible that the results would be similar to the findings in this study. Yet, different states might be emphasizing skills other than welding. For instance, with the prominence of “green” energy (i.e., alternative energy), it stands to reason that some teacher preparation programs might be introducing or considering integrating alternative energy into their existing curriculum to better serve students' needs in the 21st century. Agricultural mechanics courses are a natural “fit” for teaching students about alternative energy and the implications it has on agricultural education. As such, it is important to determine what other bordering states are teaching their pre-service teachers in agricultural mechanics. Further studies should also assess ways to integrate alternative energy principles into the existing agricultural mechanics curriculum at OSU.

In that spirit, future research should assess pre-service teachers' knowledge and self-efficacy to teach other agricultural mechanics content areas outside of welding. For instance, what knowledge and level of self-efficacy do teachers possess in areas such as concrete, plumbing, and electricity? Future studies should explore these phenomena.

Future studies should also assess why these pre-service teachers had the least amount of growth in welding safety. Former research (Saucier et al., McKim et al.) has indicated that safety is always a recommendation for in-service training and professional development workshops regarding current agricultural education teachers. Perhaps teachers were most confident in teaching the welding safety construct because they were exposed to a high level of safety precautions as secondary agricultural education students. Bandura (1995) stated that the physiological and emotional states of individuals can impact a person's self-efficacy. Therefore, maybe these students have been influenced by their former teachers to practice safety and are thus more confident in their abilities to perform and teach safety. Regardless, future research should explore this phenomenon more closely due to the liability associated with safety, especially as it relates to teaching secondary students in the agricultural mechanics laboratory.

Future research should also be conducted with current teachers in the field to determine their needs regarding welding skills. Specifically, this study could be replicated with a cross-section of teachers in the profession. Then, their results could be compared with the results of this study to determine if the deficiencies of technical skills identified in this study are consistent across the profession. If the responses are congruent with this study's findings, then wholesale changes to the curriculum should occur.

This group of pre-service teachers should be followed throughout the early stages (~first three years) of their career as teachers. Longitudinal data should be accumulated which would help researchers determine which skills teachers learn in the field and how and if they improve on their deficiencies while teaching. Further, because experience leads to self-efficacy (Bandura, 1997; Knobloch & Whittington, 2002), it is important to identify if and when teachers become confident in their abilities to fully master and use all agricultural mechanics welding equipment.

Lastly, future research should be conducted on these teachers' future students to determine how teacher self-efficacy affects student performance. For instance, because mastery experience is the most effective way of creating self-efficacy (Bandura, 1997), it would be important to determine if the pre-service teachers who had higher self-efficacy and knowledge scores per this study were able to assist their students in achieving higher end-of-the-year state-mandated examination scores as opposed to the students of teachers who had lower self-efficacy and knowledge scores.

Recommendations for Practice

Faculty at higher education institutions should be concerned about improving their clienteles' employability (Robinson, 2006). In this case, the clientele are future secondary agricultural education teachers who will likely instruct students enrolled in agricultural mechanics courses. As such, it is recommended that the MCAG 3222–Metals and Welding course be modified to focus more on “shielded gas selection and usage,” “proper setup of equipment for oxy-acetylene cutting,” “safely rules for handling oxy-acetylene welding gasses and equipment,” “orange peel cutting of mild steel pipe using a plasma cutter or oxy-fuel torch,” “welding equipment, such as wire speed, temperature and polarity,” and “electrode identification

and selection.” These six skills should be a priority of the course due to their top ten ranking prior to and at the end of instruction based upon students’ MWDS.

Further, because students rated all skills as “above average importance,” then they all should be retained in the MCAG 3222–Metals and Welding course. However, the course curriculum should be enhanced to emphasize the six previously mention skills. Then, once those skills are satisfied, it is recommended that emphasis be placed on helping students “identify welding errors, such as improper travel speed and excessive arc length,” as this skill went from being last in terms of a skill needed for curriculum enhancement prior to instruction to the third most needed skill for curriculum enhancement at the end of the semester.

Because there was a statistically significant relationship between pre-service teachers’ self-efficacy and final course grade, it is recommended that MCAG 3222–Metals and Welding continue allowing student experiences in welding in an effort to increase their level of mastery. Perhaps these students could work in groups or teams to receive additional “observation and modeling” regarding effective welding practices. Badura (1997) noted the impact vicarious learning can have on an individual’s level of self-efficacy. So, perhaps students’ efficacy would elevate higher if they worked in teams to achieve tasks.

Implications

Why is it that these pre-service teachers appear to have the lowest need for additional information regarding safety as a construct area? Could it be these students struggle to self-regulate? Perhaps they are overly confident in their ability to practice safety while welding. Knobloch and Whittington (2002) found that student teachers can be overly confident in their abilities to perform certain skills related to teaching. So, perhaps these teachers are similar to the

student teachers in Knobloch's and Whittington's study in age and maturity level, and they too were overly confident in their abilities. Or, maybe these students are confident in their own ability to practice safety but have not yet fully considered the extent to which they will have to "model" safety to secondary students.

Another interesting finding was the fact that prior work experience did not affect teachers' level of self-efficacy. Why not? It would seem that through Bandura's (1997) self-efficacy theory that experience would enhance self-efficacy. Perhaps the type of experience students received was not positive. "Unlearning" bad habits can be time consuming and difficult. As such, current agricultural education teachers should monitor the instruction being offered in secondary agricultural mechanics courses in an effort to ensure that students receive positive experiences in welding.

REFERENCES

- Andelt, L. L., Barrett, L. A., & Bosshamer, B. K. (1997). Employer assessment of the skill preparation of students from the college of agricultural sciences and natural resources University of Nebraska-Lincoln: Implications for teaching and curriculum. *North American Colleges and Teachers of Agriculture (NACTA) Journal*, 41(4), 47–53.
- Ary, D., Jacobs, L. C., & Razavieh, A. (2002). *Introduction to research in education* (6th ed.). Wadsworth/Thomson Learning Inc., Belmont: CA.
- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, 84(2), 191–215.
- Bandura, A. (1982a). The self and mechanisms of agency. In J Suls (Ed.), *Psychological Perspectives on the Self*, (Vol. 1) (pp. 3–39). Cambridge, England: Cambridge University Press.
- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.
- Bandura, A. (1994). Self Efficacy. In V.S. Ramachaudran (Ed.), *Encyclopedia of Human Behavior*, 4, 71–81.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. Washington DC: R R Donnelley & Sons Company.
- Barrick, K. R., Ladewig, H. W., & Hedges, L. E. (1983). Development of a systematic approach to identifying technical inservice needs of teachers. *The Journal of American Association of Teacher Educators in Agriculture*, 24(1), 13–19.

- Bear, W. F. (1986). *Planning, organizing and teaching agricultural mechanics*. Kfar Sava: Hobar Publications.
- Borich, G. D. (1980). A needs assessment model for conducting follow-up studies. *Journal of Teacher Education*, 31(3), 39–42.
- Burley, W. W., Hall, B. W., Villeme, M. G., & Brockmeier, L. L. (1991, April). *A path analysis of the mediating role of efficacy in first-year teachers' experiences, reactions, and plans*. Paper presented at the Annual Meeting of the American Educational Research Association, Chicago.
- Carnevale, A. P., Gainer, L. J., & Villet, J. (1990). *Training in America*. Jossey-Bass Publishers: CA.
- Crawford, R. (1987, July). Agricultural education in the 1990s. *The Agricultural Education Magazine* 60, 13–14.
- Creswell, J. W. (2008). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (3rd ed.). Upper Saddle River, NJ: Pearson Education, Inc.
- Crunkilton J., & Krebs, A. (1982). *Teaching agriculture through problem solving* (3rd Edition). Danville, Illinois: The Interstate Publishers and Printers, Inc. Third edition.
- Davis, J. A. (1971). *Elementary survey analysis*. Englewood Cliffs, NJ: Prentice-Hall, Inc.
- Dillard, J. (1991, October). Agricultural mechanics. *The Agricultural Education Magazine*, 64(4), 6–7.
- Evers, F.T., J.C. Rush, & I. Berdrow. 1998. *The bases of competence. Skills for lifelong learning and employability*. Jossey-Bass Publishers, San Francisco.

- Findlay, H. J., & Drake, J. B. (1989). Influence of selected experiences on perceived levels of competence of secondary vocational agriculture teachers. *Journal of Agricultural Education*, 30(3), 46–53.
- Garton, B. L., & Chung, N. (1996). The inservice needs of beginning teachers of agriculture as perceived by beginning teachers, teacher educators, and state staff. *Journal of Agricultural Education*, 37(3), 52–58.
- Gibson, S., & Dembo, M. H. (1984) Teacher efficacy: A construct validation. *Journal of Educational Psychology*, 76(4), 569–582. doi: 10.1037/0022-0663.76.569.
- Graham, D. L. (2001) Employer perception of the preparation of agricultural and extension education graduates. *Journal of Southern Agricultural Education Research*, 51(1), 88–101.
- Harper, J., Buriak, P., & Hilton, J. (1989). Experts' opinions concerning the agricultural engineering technology/mechanization component of teacher education in agriculture. *Applied Engineering in Agriculture*, 11(1), 31–35.
- Hoy, W. K., & Miskel, C. G. (2005). *Educational administration: Theory, research, and practice* (7th ed.). Boston: McGraw-Hill.
- Hubert, D. J. (1996) *An assessment of agricultural mechanics course requirements in agriculture teacher education programs in the United States*. Unpublished master's thesis, Oklahoma State University, Stilwater, OK.
- Ingersoll, R. (1996). *Are high school teachers teaching core subjects without college majors or minors in those subjects* (Report No. NCES-96-839). Washington, DC: National Center for Educational Research. (ERIC Document Reproduction Service No. ED 395 720)

- Johnson, D. M., & Schumacher, L. G. (1989). Agricultural mechanics specialist's identification and evaluation of agricultural mechanics laboratory management competencies: A modified Delphi approach. *The Journal of Agricultural Education*, 30(3), 23–28.
- Johnson, D. M., Schumacher, L. G., & Stewart, B. R. (1990) An analysis of the agricultural mechanics laboratory management in-service needs of Missouri agricultural teachers, *Journal of Agricultural Education*, 31(2), 35–39.
- Kennel, E. G. (2009). *A study of pre-service agricultural education students: Knowledge of horticulture and self-efficacy to teach horticulture*. Unpublished master's thesis, Oklahoma State University, Stilwater, OK.
- Knobloch, N. A., Whittington, M. S. (2003). Differences in teacher efficacy related to career commitment of novice agriculture teachers. *Journal of Career and Technical Education*, 20(1), 87-98.
- Knobloch, N. A., & Whittington, M. S. (2002a). Factors that influenced beginning teachers' confidence about teaching in agricultural education. *Proceedings of the Annual Meeting of the AAAE Central Region Agricultural Education Research Conference*, St. Louis, MO.
- Knobloch, N. A., & Whittington, M. S. (2002b). Novice teachers' perceptions of support, teacher preparation quality, and student teaching experience related to teacher efficacy. *Journal of Vocational Education Research*, 27(3), 1–13.
- Lafferty, J. B. (2004). *An analysis of beginning Texas state agricultural science teachers' perceived importance and knowledge of basic agricultural mechanics competencies*. Unpublished master's thesis, Stephen F. Austin State University, Nacogdoches, TX.

- Leising, J., Edwards, C., Ramsey, J., Weeks, W., & Morgan, C. (2005). *Oklahoma commission for teacher preparation: Program report for agricultural education*. Unpublished manuscript, Oklahoma State University, Stillwater.
- Levine, M. (2005). College graduates aren't ready for the real world. *The Chronicle Review*, 51(24), 11
- Lewis, M. V. (2008). Effectiveness of previous initiatives similar to programs of study: Tech prep, career pathways, and youth apprenticeships. *Career and Technical Education Research*, 33(3), 165–188.
- Litt, M. D. (1988). Self-efficacy and perceived control: Cognitive mediators of pain tolerance. *Journal of Personality and Social Psychology*, 54, 194–160.
- Marso, R., & Pigge, F. (1997). A longitudinal study of persisting and nonpersisting teachers' academic and personal characteristics. *Journal of Experimental Education*, 65(3), 243
Retrieved from the Academic Search Premier data base.
- McKim, B. R., Saucier, P. R., & Reynolds, C. L. (2010). Laboratory management in-service needs of Wyoming secondary agriculture teachers. *Paper presented at the 2010 Western Region of the American Association for Agricultural Education Conference*, USA.
- Miller, G. (1991, October). Agricultural mechanics: A vanishing curriculum. *The Agricultural Education Magazine*, 64(4), 4.
- National Commission on Teaching and America's Future. (1996). *What matters most: Teaching for America's future*. New York: Author.
- National FFA Organization (2010). *FFA and agricultural statistics*. Retrieved from http://www.ffa.org/index.cfm?methods=c_about.stats

- Newman, M. E., & Johnson, D. M. (1994) In-service education needs of teachers of pilot agriscience courses in Mississippi. *Journal of Agricultural Education*, 35(1), 54–60.
- Nunnally, J. C. (1980). *Introduction to psychological measurement*. New York: McGraw-Hill.
- Oklahoma Commission for Teacher Preparation (2007) Oklahoma Subject Area Test. Study Guide.
- Oklahoma Commission for Teacher Preparation (2008). *About OCTP*. Retrieved from http://www.ok.gov/octp/About_OCTP/index.html.
- Oklahoma Department of Career and Technology Education (2008). *Agricultural education programs: Enrollment by course*. Unpublished raw data.
- Oklahoma Department of Career and Technology Education (2006). *Agriculture, food, & natural resources career cluster* (2006). Retrieved from http://www.okcareertech.org/testing/Skills_Standards/Agriculture_Career_Cluster.html.
- Oklahoma Department of Career and Technology Education (2010). *Agricultural education courses and standards* (2010). Retrieved, from <http://www.okcareertech.org/aged/ag%20standards1.htm>
- Oklahoma State University (2009-2010). *Student handbook for agricultural education and student teaching*. 1–34.
- Oliver, J. D., & Hinkle, D. E. (1982). Occupational education research: Selecting statistical procedures. *Journal of Studies in Technical Careers*, 4(3), 199 – 208.
- Phipps, L. J., Osborne, E. W., Dyer, J. E., & Ball, A. (2008). *Handbook on agricultural education in public schools*. Clifton Park, NY: Thomson Delmar Learning.
- Purcell, K., & Pitcher, J. (1996). Great expectations: *The new diversity of graduate skills and aspirations*. (London, IER/CSU).

- Radhakrishna, R. B., & Bruening, T. H. (1994). Pennsylvania study: Employee and student perceptions of skills and experiences needed for careers in agribusiness. *North American College Teachers of Agriculture Journal*, 38(1), 15–18.
- Roberts, G., Harlin, J., & Ricketts, J. (2006). A longitudinal examination of teaching efficacy of agricultural science student teachers. *Journal of Agricultural Education*, 47(2), 81–83.
- Roberts, G. T., Dooley, K. E., Harlin, J. F., & Murphrey, T. P. (2006). Competencies and traits of successful agricultural science teachers. *Journal of Career and Technical Education*, 22(2), 1–11.
- Robinson, J. S. (2006). *Graduates' and employers' perceptions of entry-level employability skills needed by agriculture, food and natural resources graduates*. Unpublished dissertation, University of Missouri-Columbia, MO.
- Robinson, J. S., Garton, B. L., & Terry, R. Jr. (2007). Identifying the employability skills needed in the workplace according to supervisors of college of agriculture, food and natural resource graduates. *Journal of Southern Agricultural Education Research*, 57(1), 95–109.
- Robinson, J. S., Garton, B. L., & Vaughn, P. R. (2007). Becoming employable: A look at graduates' and supervisors' perceptions of the skills needed for employability. *North American Colleges and Teachers of Agriculture (NACTA) Journal*, 51(2), 19–26.
- Rosencrans, C., Jr., & Martin, R. A. (1997). *The role of agricultural mechanization in the secondary agricultural education curriculum as viewed by agricultural educators*. Proceedings of the 24th Annual National Agricultural Education Research Meeting, 253–262.
- Ruffing, K. (2006). The history of career clusters. *Association of Career and Technical Education*. Retrieved from

<http://www.careerclusters.org/resources/publications/TheHistoryofCareerClusters> 2006.
pdf

Saucier, P. R., McKim, B. R., Murphy, T., & Terry, Jr., R. (2010). Professional development needs related to agricultural mechanics laboratory management for agricultural education student teachers in Texas. *Paper Presented at the 2010 Western Region of the American Association for Agricultural Education Conference, USA.*

Saucier, P. R., Terry, Jr. R., & Schumacher, L. G. (2009). Laboratory management in-service needs of Missouri agricultural educators. *Paper Presented at the Southern Region of the American Association for Agriculture Education Conference, USA*, 176–192.

Schmidt, S. J. (1990). Using writing to develop critical thinking skills. *North American Colleges and Teachers of Agriculture (NACTA) Journal*, 43(4), 31–38.

Schunk, D. H. (1987). Peer models and children's behavioral change. *Review of Educational Research*, 57 (2), 149–174. doi: 10.3102/00346543057002149.

Schunk, D. H. (1987). Self-efficacy and achievement behaviors. *Educational Psychology Review*, 1, 173–208. Doi: 10.1007/BF01320134.

Schunk, D. H. (1989). Self-efficacy and cognitive skill learning. In C. Ames & R. Ames (Eds.), *Research on motivation in education: Goals and cognitions, Volume 3*, 13–44. San Diego, CA: Academic.

Sherer, M., & Eadie, R., (1987), Employability skills: Keys to success. *Thrust* 17(2), 16–17.

Shinn, G. (1987). The time to improve your laboratory teaching. *The Agricultural Education Magazine*, 60(3), 16–17.

- Slusher, W. L. (2009) *An assessment of the animal science technical skills secondary agricultural education graduates need for employment in the animal science industry: A Delphi Study*. Unpublished thesis, Oklahoma State University, Stillwater, OK.
- States' Career Cluster Initiative. (2009). *National sample definitions* [Electronic version].
Retreived from <http://www.careerclusters.org/definitions.php>
- Talbert, B. A., Camp, W. G., & Heath-Camp, B. (1994). A year in the lives of three beginning agriculture teachers. *Journal of Agricultural Education*, 35(2), 31–36.
- Tschannen-Moran, M., & Woolfolk Hoy, A. (2001). Teacher efficacy: Capturing an elusive construct [Electronic Version]. *Teaching and Teacher Education*, 17, 783–805. doi: 10.1016/S0742-051X(01)00036-1.
- Tschannen-Moran, M., Woolfolk Hoy, A., & Hoy, W. K. (1998). Teacher efficacy: Its meaning and measure. *Review of Educational Research*, 68(2), 202–248. doi: 10.3102/00346543068662202
- Tyler, R. W. (1971). *Basic principles of curriculum and instruction*. Chicago, IL: University of Chicago Press.
- Walker, W. D. (2002). *Retention and attrition of Missouri agriculture teachers*. Unpublished doctoral dissertation, University of Missouri, Columbia.
- Wallis, C. (2008, February 25). How to make great teachers. *Time*, 28–34.
- Wiersma, W., & Jurs, S. G. (1990). *Educational measurement and testing (2nd ed.)*. Needham Heights, MA: Allyn and Bacon.
- Wilkinson, G. A. (1994). *Support for individualizing teacher induction Action in Teacher Education*, 16(2), 52–61.

- Wingenbach, G. J., White, J. M., Degenhart, S., Pannkuk, T., & Kujawski, J. (2007). Pre-service teachers' knowledge and teaching comfort levels for agricultural science and technology objectives. *Journal of Agricultural Education*, 48(2), 114–126.
- Whittington, M. S., McConnell, E., & Knobloch, N. A. (2006). Teacher efficacy of novice teachers in agricultural education in Ohio at the end of the school year. *Journal of Agricultural Education*, 47(4), 26–36.
- Wood, R., & Bandura, A. (1989). Social cognitive theory of organizational management. *Academy of Management Review*, 14(3), 361–384.

APPENDIX A
SURVEY INSTRUMENT SECTION I
PERCEIVED CONFIDENCE AND IMPORTANCE TO TEACH WELDING SKILL
STANDARDS

Section I: Perceived Confidence and Importance to Teach Welding Skills Standards

Directions: Please rate your level of **confidence** to teach the Agricultural Power and Technology Welding Technician Skills Standards and rate their **importance** in the secondary agricultural education curriculum. Please indicate your response on this scantron form using the #2 pencil provided.

ID NUMBER										SPECIAL CODES									
										A	B	C	D	E	F	G	H	I	J
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9

CONFIDENCE				
A	B	C	D	E
High Confidence	Above Average	Average Confidence	Below Average	No Confidence

IMPORTANCE				
A	B	C	D	E
High Importance	Much Importance	Some Importance	Low Importance	No Importance

GENERAL PURPOSE DATA SHEET IV form no. 76657

	CONFIDENCE					IMPORTANCE						
To teach:	X	X	X	X	X	X	X	X	X	X		
Selection and use of fire extinguishers	3	A	B	C	D	E	4	A	B	C	D	E
Selection of personal protective equipment (PPE) for welding	5	A	B	C	D	E	6	A	B	C	D	E
Appropriate eyewear selection for welding	7	A	B	C	D	E	8	A	B	C	D	E
Organization and maintenance of a clean and safe work area	9	A	B	C	D	E	10	A	B	C	D	E
Joint preparation for welding	11	A	B	C	D	E	12	A	B	C	D	E
Weld testing for strength and defects	13	A	B	C	D	E	14	A	B	C	D	E
Slag chipping (weld cleaning)	15	A	B	C	D	E	16	A	B	C	D	E
Welding equipment settings, such as wire speed, temperature & polarity	17	A	B	C	D	E	18	A	B	C	D	E
	19	A	B	C	D	E	20	A	B	C	D	E
Electrode identification and selection	21	A	B	C	D	E	22	A	B	C	D	E
Identification of major parts of gas metal arc welding (MIG) equipment	23	A	B	C	D	E	24	A	B	C	D	E
Shielding gas selection and usage	25	A	B	C	D	E	26	A	B	C	D	E
Identification of welding errors, such as improper travel speed and excessive arc length	27	A	B	C	D	E	28	A	B	C	D	E
Advantages of the gas metal arc welding (MIG) method	29	A	B	C	D	E	30	A	B	C	D	E
Proper setup of equipment for oxy-acetylene cutting	31	A	B	C	D	E	32	A	B	C	D	E
Lighting, flame adjustment and shut-down procedures of oxy-fuel welding equipment	33	A	B	C	D	E	34	A	B	C	D	E
	35	A	B	C	D	E	36	A	B	C	D	E
Proper surface preparation for brazing	37	A	B	C	D	E	38	A	B	C	D	E
Safety rules for handling oxy-acetylene welding gasses, and equipment	39	A	B	C	D	E	40	A	B	C	D	E
Advantages and disadvantages of brazing	41	A	B	C	D	E	42	A	B	C	D	E
The purpose of using flux in brazing	43	A	B	C	D	E	44	A	B	C	D	E
T-joint fillet welding, using shield metal arc welding in the flat and vertical up positions	45	A	B	C	D	E	46	A	B	C	D	E
Square groove butt joint welding, using shield metal arc welding in the flat position	47	A	B	C	D	E	48	A	B	C	D	E
Orange peel cutting of mild steel pipe, using a plasma cutter or oxy-fuel torch	49	A	B	C	D	E	50	A	B	C	D	E
Cutting mild steel plate at a 90 degree angle, using an oxy-fuel torch	51	A	B	C	D	E	52	A	B	C	D	E
Cutting a hole in mild steel plate, using an oxy-fuel torch	53	A	B	C	D	E	54	A	B	C	D	E
Cutting shapes in mild steel plate, using a plasma cutter	55	A	B	C	D	E	56	A	B	C	D	E
Manual operation of a plasma cutter	57	A	B	C	D	E	58	A	B	C	D	E
	59	X	X	X	X	X	60	X	X	X	X	X
	61	X	X	X	X	X	62	X	X	X	X	X
	63	X	X	X	X	X	64	X	X	X	X	X
	65	X	X	X	X	X	66	X	X	X	X	X
	67	X	X	X	X	X	68	X	X	X	X	X
	69	X	X	X	X	X	70	X	X	X	X	X
	71	X	X	X	X	X	72	X	X	X	X	X

APPENDIX B

OKLAHOMA DEPARTMENT OF CAREER AND TECHNOLOGY EDUCATION

AGRICULTURAL POWER AND TECHNOLOGY

WELDING TECHNICIAN SKILLS STANDARDS

**AGRICULTURAL POWER &
TECHNOLOGY
WELDING TECHNICIAN
SKILLS STANDARDS
OD46903**



careertech ✓
Testing
A Provider of Online Testing Solutions

Competency-Based Education: OKLAHOMA'S RECIPE FOR SUCCESS

BY THE INDUSTRY FOR THE INDUSTRY

Oklahoma's *CareerTech* system of competency-based education uses industry professionals and certification standards to identify the knowledge and abilities needed to master an occupation. This industry input provides the foundation for development of instructional materials that help prepare the comprehensively trained, highly skilled employees demanded by our workplace partners.

TOOLS FOR SUCCESS

CareerTech relies on three basic instructional components to deliver competency-based instruction: skills standards, curriculum materials, and competency assessments.

Skills standards provide the foundation for competency-based instruction in Oklahoma's *CareerTech* system. The skills standards outline the knowledge, skills, and abilities needed to perform related jobs within an industry. Skills standards are aligned with national skills standards; therefore, a student trained to the skills standards possesses technical skills that make him/her employable in both state and national job markets.

Curriculum materials contain information and activities that teach students the knowledge and skills outlined in the skills standards. In addition to complementing classroom instruction, curriculum resources provide supplemental activities to enhance learning and provide hands-on training experiences.

Competency Assessments test the student over material outlined in the skills standards and taught using the curriculum materials. When used with classroom performance evaluations, written competency assessments provide a means of measuring occupational readiness.

Although each of these components satisfy a unique purpose in competency-based education, they work together to reinforce the skills and abilities students need to gain employment and succeed on the job.

MEASURING SUCCESS

Written competency assessments are used to evaluate student performance. Results reports communicate competency assessment scores to students and provide a breakdown of assessment results by duty area. The results breakdown shows how well the student has mastered skills needed to perform major job functions and identifies areas of job responsibility that may require additional instruction and/or training.

Group analysis of student results also provides feedback to instructors seeking to improve the effectiveness of career and technology training. Performance patterns in individual duties indicate opportunities to evaluate training methods and customize instruction.

TRUE TO OUR PURPOSE

"Helping Oklahomans succeed in the workplace" defines the mission of Oklahoma *CareerTech* and its competency-based system of instruction. Skills standards, curriculum, and assessments that identify and reinforce industry expectations provide accountability for programs and assure *CareerTech*'s continued role in preparing skilled workers for a global job market.

Copyright 2006
Oklahoma Department of Career and Technology Education
All rights reserved

Printed in the United States of America by the
Oklahoma Department of Career and Technology Education
Stillwater, Oklahoma

The Oklahoma Department of Career and Technology Education does not discriminate on the basis of race, creed, color, national origin, sex, age, veteran status, or qualified handicap.

**AGRICULTURAL POWER AND TECHNOLOGY
WELDING TECHNICIAN
SKILLS STANDARDS
Frequency and Criticality Ratings**

Duty A: Maintain a Safe Work Environment

Duty B: Perform Shielded Welding

Duty C: Perform Gas Metal Arc Welding (GMAW)

Duty D: Perform Oxyfuel and Plasma Arc Cutting

Duty E: Perform Gas Tungsten Arc Welding (GTAW)

Duty F: Perform Oxyfuel Braze Welding

Frequency: represents how often the task is performed on the job. Frequency rating scales vary for different occupations. The rating scale used in this publication is presented below:

- 1 = less than once a week
- 2 = at least once a week
- 3 = once or more a day

Criticality: denotes the level of consequence associated with performing a task incorrectly. The rating scale used in this publication is presented below:

- 1 = slight
- 2 = moderate
- 3 = extreme

DUTY A: Maintain a Safe Work Environment

CODE	TASK	F/C
A.01	Interpret general safety information <ul style="list-style-type: none"> 1 • Hand signals 2 • Safety colors 3 • Fire extinguisher 4 • Emergency exits 5 • First aid 6 • Lifting 7 • Clothing 8 • Eye protection 	1/3
A.02	Organize/maintain a clean and safe work area	3/3
A.03	Comply with shop and equipment safety rules	3/3
A.04	Ventilate work area	2/3
A.05	Identify safety hazards	3/3
A.06	Report safety hazards in accordance with established procedure	1/3
A.07	Correct safety hazards	3/3
A.08	Maintain safety devices	3/3

OD46903: Welding Technician

A.09	Complete accident reports	1/3
A.10	Demonstrate knowledge and use of MSDS	1/3

DUTY B: Perform Shielded Welding

CODE	TASK	F/C
B.01	Make a pad in the horizontal position	3/3
B.02	Make a multiple pass T-joint fillet weld in the horizontal position <ul style="list-style-type: none"> • Test the prepared coupon 	2/3
B.03	Make a square groove butt joint weld in the horizontal position	3/3
B.04	Make a pad in the vertical up position	2/2
B.05	Make a T-joint fillet weld in the vertical up position <ul style="list-style-type: none"> • Test the prepared coupon 	3/3
B.06	Make a square groove butt joint weld in the vertical down position <ul style="list-style-type: none"> • Test the prepared coupon 	3/3
B.07	Make a pad in the overhead position	1/2
B.08	Make a lap joint fillet weld in the overhead position <ul style="list-style-type: none"> • Test the prepared coupon 	1/2
B.09	Make a single V-groove butt joint weld in the flat position and test <ul style="list-style-type: none"> • Test the prepared coupon 	2/3
B.10	Make a single V-groove butt joint weld in the horizontal position and test <ul style="list-style-type: none"> • Test the prepared coupon 	2/3
B.11	Make a single V-groove butt joint weld in the vertical up position and test	2/3
B.12	Make a single V-groove butt joint weld in the overhead position and test	1/2
B.13	Identify and interpret welding symbols	3/3
B.14	Prepare joints for welding	3/3
B.15	Demonstrate knowledge of common welding principles <ol style="list-style-type: none"> 1. Equipment material selection 2. Testing welds 3. Flux chipping 4. Heat 5. Weld defects 6. Rod identification and selection 	3/3
B.16	Identify characteristics of a good weld	3/3

DUTY C: Perform Gas Metal Arc Welding (GMAW)

CODE	TASK	F/C
C.01	Set up and shut down GMAW equipment using correct safety precautions <ol style="list-style-type: none"> 1. Identify the major parts of GMAW equipment 2. Shielding gases and their uses 3. Power sources for GMAW 	3/3
C.02	Construct a multiple pass T-joint fillet weld in the horizontal position with short arc	2/3
C.03	Construct a square groove butt joint in the flat position with short arc	3/3
C.04	Construct a square groove butt joint in the horizontal position with short arc	3/3
C.05	Construct a square groove butt weld in the vertical up position with short arc	3/3
C.06	Construct a square groove butt weld in the overhead position with short arc	1/1

OD46903: Welding Technician

C.07	Construct a T-joint fillet weld on mild steel in the horizontal position with short arc	3/3
C.08	Demonstrate knowledge of terms associated with the GMAW process <ul style="list-style-type: none"> 1 • Spray arc 2 • Advantages of the GMAW process 3 • Most common application of the GMAW process 	3/3
C.09	Identify factors to consider when selecting filler wire for the GMAW process	2/3
C.10	Identify common welding mistakes	3/3
C.11	Identify the characteristics of a good weld <ul style="list-style-type: none"> • Effects of electrode wire stickout on volts and amps 	3/3
C.12	Identify and interpret welding symbols	3/3
C.13	Use proper safety procedures for usage, storage, and transportation of bottled gas	3/3

DUTY D: Perform Oxyfuel and Plasma Arc Cutting

CODE	TASK	F/C
D.01	Set up equipment for oxyacetylene cutting	3/3
D.02	Turn on, light, adjust to a neutral flame, and turn off oxyacetylene cutting equipment	3/3
D.03	Make ninety degree cuts on mild steel and restart a cut	3/3
D.04	Make flame-beveled cut on mild steel plate	1/2
D.05	Cut hole in mild steel	3/3
D.06	Cut orange peel	2/2
D.07	Lay out pattern on mild steel plate	2/2
D.08	Perform safety inspections of equipment and accessories	3/3
D.09	Make minor external repairs to equipment and accessories (preventative maintenance only)	3/3
D.10	Set up for manual plasma arc cutting operations on plain carbon steel, aluminum, and stainless steel plate	2/2
D.11	Operate manual plasma arc cutting equipment	3/3
D.12	Perform shape cutting operations on plain carbon steel, aluminum, and stainless steel plate	3/3
D.13	Demonstrate knowledge of safety rules for handling oxygen, welding equipment, welding gases, and oxyfuel welding equipment	3/3

DUTY E: Perform Gas Tungsten Arc Welding (GTAW)

CODE	TASK	F/C
E.01	Set up and shut down GTAW equipment using correct safety precautions	3/3
E.02	Identify and interpret welding symbols	3/3
E.03	Use proper safety procedures for usage, storage, and transportation of bottled gas	3/3
E.04	Demonstrate knowledge of terms associated with the GTAW process <ul style="list-style-type: none"> • Spray arc 	3/3
E.05	Identify common welding mistakes	3/3
E.06	Identify the characteristics of a good weld	3/3
E.07	Construct a multiple pass T-joint fillet weld in the horizontal position	2/3

OD46903: Welding Technician

E.08	Construct a square groove butt joint in the flat position	3/3
E.09	Construct a square groove butt joint in the horizontal position	3/3
E.10	Construct a square groove butt weld in the vertical up position	3/3
E.11	Construct a square groove butt weld in the overhead position	1/1
E.12	Construct a T-joint fillet weld with aluminum in the horizontal position	3/3
E.13	Demonstrate knowledge of proper surface preparation for GTAW welding <ul style="list-style-type: none"> • Removing oxides from a clean metal surface 	2/2

DUTY F: Perform Oxyfuel Braze Welding

CODE	TASK	F/C
F.01	Braze weld a square groove butt joint	1/3
F.02	Braze weld a lap joint	1/3
F.03	Braze weld a tee or fillet joint	1/2
F.04	Demonstrate knowledge of terms associated with oxyacetylene braze welding <ol style="list-style-type: none"> 1. Identify advantages and disadvantages of braze welding 2. Differences between braze and fusion welding 3. Purposes for using flux 	2/2
F.05	Demonstrate knowledge of proper surface preparation for braze welding	2/2
F.06	Describe the reactions of molten bronze when the temperature of the base metal is too hot, too cold, and correct	2/2
F.07	Use proper safety procedures for usage, storage, and transportation of bottled gas	3/3
F.08	Demonstrate knowledge of safety rules for handling oxygen, welding equipment, welding gases, and oxyfuel welding equipment	3/3

APPENDIX C

SCANTRON & SURVEY INSTRUMENT PART II & III

WELDING KNOWLEDGE TEST & DEMOGRAPHIC SECTION

Section II: Welding Knowledge Test

Directions: Please select the best answer for each question and record your response on the scantron form provided.

- 1) Select the true statement about hazards.
 - a) If recommended procedures are followed, a shop will be free of hazards.
 - b) To provide a safe learning environment the risk associated with hazards must be maintained at an acceptable level.
 - c) Elimination of hazards is the only tool for managing risks.
 - d) None of these are true.
- 2) Select the true statement about personal protective equipment (PPE).
 - a) Using the correct PPE will eliminate the risks associated with the hazard.
 - b) Wearing PPE has no affect on accident rates.
 - c) Using the appropriate PPE will reduce the risks associated with a hazard.
 - d) Wearing PPE should be enforced for all new employees, but optional for experienced employees.
- 3) A type "A" fire extinguisher is recommended for extinguishing what type of fire?
 - a) Ordinary consumables (paper, wood, etc.)
 - b) Electrical Fire
 - c) Combustible metals (Phosphorus, Magnesium)
 - d) Grease and Oil
- 4) Please select the most appropriate response in regard to welding cylinder safety?
 - a) Keep oil and grease away from cylinders
 - b) Always secure upright cylinders
 - c) Never lift cylinders by their caps
 - d) All of these are true
- 5) It is an acceptable practice to light an oxy-acetylene torch with a butane lighter.
 - a) True
 - b) False
- 6) The common name for the shielded metal arc welding process is arc welding.
 - a) True
 - b) False
- 7) Which one of the following responses is not one of the five types of welds?
 - a) Surface
 - b) Groove
 - c) Butt
 - d) Slot

- 8) Which one of the following types of electrodes should be used when completing welds with a shielded metal arc welding machine in the overhead position?
- a) Fill-freeze
 - b) Fast-freeze
 - c) Fast-fill
 - d) Low hydrogen
- 9) In the American Welding Society electrode classification system, the first two numbers printed on the electrode indicate _____?
- a) Welding position
 - b) Types of coating and current
 - c) Tensile strength
 - d) The flux constituents
- 10) The slag that forms on a shielded metal arc weld is a byproduct of the electrode and serves no useful purpose.
- a) True
 - b) False
- 11) In the _____ metal transfer process the molten metal droplets are smaller in diameter than the welding wire.
- a) Short circuiting
 - b) Spray arc
 - c) Globular
 - d) Pulse
- 12) A common problem of gas metal arc welding machines is erratic wire feed.
- a) True
 - b) False
- 13) Mig welders are considered to have a continuous electrode.
- a) True
 - b) False
- 14) A MIG welder will have controls or mechanisms to adjust the _____?
- a) Feed roll tension
 - b) Spool over-run
 - c) Feed roll groove size
 - d) All of these mechanisms
- 15) When a gas metal arc welder is changed from .030 wire to .045 wire, no other machine components need to be changed.
- a) True
 - b) False
- 16) When using a plasma arc cutting system it is very important to _____.
- a) Hold the torch at the correct angle
 - b) Insure the compressed gas flow and pressure is correct
 - c) Maintain the correct standoff
 - d) Follow all of these procedures

- 17) A _____ controls the flow of gas at the handle of an oxy-fuel torch.
- a) Flow regulator
 - b) Striker
 - c) Hand Valve
 - d) Pressure regulator
- 18) The primary cause of an oxy-acetylene flashback is _____.
- a) Touching the tip to the work
 - b) A clogged tip
 - c) An excessive work distance
 - d) An oversized tip
- 19) Oxy-fuel flame cutting is most appropriate to cut which of the following materials _____.
- a) Copper
 - b) Aluminum
 - c) Stainless steel
 - d) Mild and alloy steel
- 20) Whenever a cylinder on an oxy-fuel system is changed, the connections should be checked for leaks by _____.
- a) Passing a flame around the connection
 - b) Holding your hands close to the connection
 - c) Using soapy water
 - d) Any of these methods would be appropriate
- 21) Brazing can be used to join some dissimilar metals that cannot be joined by fusion welding.
- a) True
 - b) False
- 22) What happens if a brazed joint is overheated?
- a) The metal becomes more active
 - b) The metal becomes too viscous
 - c) Nothing happens if the joint is cooled quickly
 - d) The zinc may burn out of the filler material
- 23) Which of the following _____ is (are) required to achieve sound brazed joints.
- a) Correct Joint design
 - b) Clean surfaces
 - c) Correct filler metals
 - d) All of these conditions
- 24) The primary function of an oxy-fuel regulator is to _____?
- a) Control the flow of gasses
 - b) Maintain a constant gas working pressure
 - c) Control both the pressure and flow of the welding gasses
 - d) None of these is a primary function
- 25) In the oxy-fuel process, a brazing filler rod should melt from the heat of the metal not the heat of the flame.
- a) True
 - b) False

Section III: Background Information

- 26) How old are you?
- a) 18
 - b) 19
 - c) 20
 - d) 21
 - e) 22 or older
- 27) What is your Gender?
- a) Female
 - b) Male
- 28) What is your college GPA?
- a) 4.0
 - b) 3.0-3.99
 - c) 2.0-2.99
 - d) 0.0 -1.99
- 29) What is your college classification?
- a) Graduate student
 - b) Senior (94 or more credit hours)
 - c) Junior (60-93 credit hours)
 - d) Sophomore (29-59 credit hours)
 - e) Freshman (28 credit hours or less)
- 30) What is your academic major at OSU?
- a) Agricultural Education
 - b) Animal Science
 - c) Agricultural Education-Animal Science Double Major
 - d) Industrial/Civil Engineering
 - e) Other
- 31) Have you previously completed; welding or metal fabrication courses while you were in high school?
- a) Yes
 - b) No

32) How many years of welding or metal fabrication courses did you complete in high school, or at a career-tech center while attending high school?

- a) 0
- b) 1
- c) 2
- d) 3
- e) 4 or more

33) Are you a certified welder?

- a) Yes
- b) No

34) Indicate how many years of work experience you have in any of the following areas: welding, metal fabrication, metal design, metallurgy, metal shop management.

- a) No work experience
- b) Less than one year
- c) 1 to 2 years
- d) 2 to 3 years
- e) More than 3 years

35) Have you ever competed in a competitive event which involved welding? (mark all which apply to you)

- a) Yes, I participated in a welding competitive event in agricultural education (FFA)
- b) Yes, I participated in a welding competitive event in 4H.
- c) Yes, I participated in a welding competitive event through a career & technology program.
- d) Yes, I participated in a welding competitive event, in a program other than the examples listed above.
- e) NO, I have never participated in a welding competitive event.

APPENDIX D

PERCENT DIFFICULTY MEASURES FOR WELDING KNOWLEDGE FROM

PILOT TEST #1 DATA

Number of Students = 5

* Indicates the correct response

SECT. 001	1	A 2	*B 3	C 0	D 0	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	60.000% 1.035
SECT. 001	2	A 1	B 0	*C 4	D 0	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	80.000% 0.715
SECT. 001	3	*A 5	B 0	C 0	D 0	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	100.000% 0.000
SECT. 001	4	A 1	B 0	C 0	*D 3	E 0	OMITS 1	DIFFICULTY DISCRIMINATION	= =	60.000% 0.106
SECT. 001	5	A 0	*B 5	C 0	D 0	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	100.000% 0.000
SECT. 001	6	*A 5	B 0	C 0	D 0	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	100.000% 0.000
SECT. 001	7	A 0	B 1	*C 0	D 4	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	0.000% 0.000
SECT. 001	8	A 0	*B 1	C 3	D 1	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	20.000% 0.747
SECT. 001	9	A 0	B 2	*C 2	D 1	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	40.000% 0.955
SECT. 001	10	A 3	*B 2	C 0	D 0	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	40.000% 0.955
SECT. 001	11	A 0	*B 4	C 1	D 0	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	80.000% 0.552
SECT. 001	12	*A 2	B 3	C 0	D 0	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	40.000% 0.424
SECT. 001	13	*A 5	B 0	C 0	D 0	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	100.000% 0.000
SECT. 001	14	A 0	B 0	C 0	*D 5	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	100.000% 0.000
SECT. 001	15	A 0	*B 5	C 0	D 0	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	100.000% 0.000
SECT. 001	16	A 0	B 0	C 0	*D 5	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	100.000% 0.000
SECT. 001	17	A 2	B 0	*C 2	D 1	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	40.000% 0.955
SECT. 001	18	A 5	*B 0	C 0	D 0	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	0.000% 0.000
SECT. 001	19	A 0	B 0	C 0	*D 5	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	100.000% 0.000

SECT. 001	20	A	B	*C	D	E	OMITS	DIFFICULTY	=	100.000%
		0	0	5	0	0	0	DISCRIMINATION	=	0.000
SECT. 001	21	*A	B	C	D	E	OMITS	DIFFICULTY	=	60.000%
		3	2	0	0	0	0	DISCRIMINATION	=	0.504
SECT. 001	22	A	B	C	*D	E	OMITS	DIFFICULTY	=	60.000%
		0	2	0	3	0	0	DISCRIMINATION	=	0.239
SECT. 001	23	A	B	C	*D	E	OMITS	DIFFICULTY	=	100.000%
		0	0	0	5	0	0	DISCRIMINATION	=	0.000
SECT. 001	24	A	*B	C	D	E	OMITS	DIFFICULTY	=	0.000%
		0	0	5	0	0	0	DISCRIMINATION	=	0.000
SECT. 001	25	*A	B	C	D	E	OMITS	DIFFICULTY	=	60.000%
		3	2	0	0	0	0	DISCRIMINATION	=	1.035

COURSE NUMBER: MCAG3222
SECTION NUMBER:
INSTRUCTOR: LILEIBY
MULTIPLE TESTS? NO
NUMBER OF QUESTIONS: 25
STARTING QUESTION NUMBER: 1
ENDING QUESTION NUMBER: 25
ALPHABETIZE STUDENTS? YES
PRINT INDIVIDUAL STUDENT SHEETS? NO
DATA SET NAME: Leiby_Pilot 1.dat

The Scoring Key used for this exam:

B C A D B A C B C B B A A D B D C B D C A D D B A

Questions 1 - 25: 1.000 pt each

APPENDIX E

PERCENT DIFFICULTY MEASURES FOR WELDING KNOWLEDGE FROM

PILOT TEST #2 DATA

Number of Students = 23

* Indicates the correct response

SECT. 001	1	A 5	*B 13	C 4	D 1	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	56.522% 0.307
SECT. 001	2	A 4	B 0	*C 19	D 0	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	82.609% 0.251
SECT. 001	3	*A 21	B 1	C 1	D 0	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	91.304% 0.108
SECT. 001	4	A 0	B 0	C 1	*D 22	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	95.652% 0.284
SECT. 001	5	A 4	*B 19	C 0	D 0	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	82.609% 0.386
SECT. 001	6	*A 19	B 4	C 0	D 0	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	82.609% 0.251
SECT. 001	7	A 2	B 2	*C 0	D 19	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	0.000% 0.000
SECT. 001	8	A 3	*B 11	C 5	D 4	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	47.826% 0.332
SECT. 001	9	A 2	B 4	*C 14	D 3	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	60.870% 0.264
SECT. 001	10	A 15	*B 8	C 0	D 0	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	34.783% 0.498
SECT. 001	11	A 4	*B 11	C 5	D 3	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	47.826% 0.058
SECT. 001	12	*A 15	B 8	C 0	D 0	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	65.217% 0.435
SECT. 001	13	*A 19	B 4	C 0	D 0	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	82.609% 0.296
SECT. 001	14	A 3	B 0	C 0	*D 20	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	86.957% -0.093
SECT. 001	15	A 2	*B 21	C 0	D 0	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	91.304% 0.594
SECT. 001	16	A 0	B 2	C 0	*D 21	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	91.304% 0.047
SECT. 001	17	A 6	B 0	*C 11	D 6	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	47.826% 0.400
SECT. 001	18	A 9	*B 10	C 3	D 1	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	43.478% 0.175
SECT. 001	19	A 1	B 3	C 3	*D 16	E 0	OMITS 0	DIFFICULTY DISCRIMINATION	= =	69.565% 0.622

SECT. 001	20	A	B	*C	D	E	OMITS	DIFFICULTY	=	73.913%
		0	4	17	2	0	0	DISCRIMINATION	=	0.676
SECT. 001	21	*A	B	C	D	E	OMITS	DIFFICULTY	=	82.609%
		19	4	0	0	0	0	DISCRIMINATION	=	0.116
SECT. 001	22	A	B	C	*D	E	OMITS	DIFFICULTY	=	26.087%
		2	12	3	6	0	0	DISCRIMINATION	=	-0.091
SECT. 001	23	A	B	C	*D	E	OMITS	DIFFICULTY	=	86.957%
		0	1	2	20	0	0	DISCRIMINATION	=	0.110
SECT. 001	24	A	*B	C	D	E	OMITS	DIFFICULTY	=	17.391%
		7	4	10	2	0	0	DISCRIMINATION	=	0.245
SECT. 001	25	*A	B	C	D	E	OMITS	DIFFICULTY	=	91.304%
		21	2	0	0	0	0	DISCRIMINATION	=	0.169

COURSE NUMBER: MCAG3233
SECTION NUMBER:
INSTRUCTOR: LILEIBY
MULTIPLE TESTS? NO
NUMBER OF QUESTIONS: 25
STARTING QUESTION NUMBER: 1
ENDING QUESTION NUMBER: 25
ALPHABETIZE STUDENTS? YES
PRINT INDIVIDUAL STUDENT SHEETS? NO
DATA SET NAME: leiby_pilot 2.dat

The Scoring Key used for this exam:

B C A D B A C B C B B A A D B D C B D C A D D B A

Questions 1 - 25: 1.000 pt each

APPENDIX F

WELDING KNOWLEDGE & CONFIDENCE

PRE-SURVEY ORAL INSTRUCTIONS

Welding Knowledge & Confidence Pre-Survey Instruction

First and foremost let me say thank you for agreeing to help by taking today's survey. Please note that your participation in this survey is completely voluntary and you are at no point obligated to complete the survey. You are free to leave the **study** at any time without concerns of repercussions. (Please note if you are filling out this survey during class time and you opt not to participate in the study, you may be asked to complete an alternative assignment similar in length and difficulty to the original survey.) Your decision to participate in the study does not affect your course grade nor will it affect any future course grade.

In the research you are about to assist, data will be collected using a survey. The Welding Knowledge and Confidence Survey is broken into three parts. In section one you will be provided a skill standard for welding and asked to rate your confidence to teach a given welding skill standard.

For example you may be provided with the skill standard: "Selection and use of fire extinguishers." At this point I would like you to rate your confidence to teach "Selection and use of fire extinguishers." On the answer sheet provided, I would like you to rate your confidence to teach... on a scale of "A-F." "**A**" meaning you have no confidence to teach a given standard and "**F**" meaning you are highly confident in your ability to teach a given skill standard.

In the latter half of section one you will be asked to provide your opinion concerning the importance of a skill standard in the curriculum. You will be asked to rank your perceived importance on a scale from "A-F" similar to the one described earlier where "**A**" indicates a standard of "**No Importance**" and "**F**" indicates a condition of high perceived importance.

Section 2 will be based as a multiple choice welding knowledge test. I understand you may not know all of the answers in this section, however, please make all efforts possible to select the most correct answer in your opinion.

Section 3 is your opportunity to provide some information about you. In this section we will ask you some background information questions just to gain a better idea about the population of individuals which we are surveying.

- Finally, - Please fill out the survey.
- Please fill out the survey completely.
 - Please answer all questions accurately and honestly.
 - Know that there is no time limit.
 - Once again thank you for your assistance.
 - If you have any questions in regard to the study or survey please let me know and I will do my best to answer your question.



Brian Leiby

APPENDIX G INSTITUTIONAL REVIEW BOARD APPROVAL LETTER

Oklahoma State University Institutional Review Board

Date: Monday, July 20, 2009
IRB Application No AG0922
Proposal Title: A Study of Pre-Service Agricultural Education Students: Knowledge of Welding and Self Efficacy to Teach Welding
Reviewed and Processed as: Exempt

Status Recommended by Reviewer(s): Approved Protocol Expires: 7/19/2010

Principal Investigator(s):

Brian L. Leiby	James Leising
4424 W. McElroy	139 Ag Hall
Stillwater, OK 74074	Stillwater, OK 74078

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

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

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

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

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

Sincerely,



Shelia Kennison, Chair
Institutional Review Board

VITA

Brian Lee Leiby

Candidate for the Degree of

Masters of Science

Thesis: PRE-SERVICE AGRICULTURAL EDUCATION TEACHERS' KNOWLEDGE
AND PERCEIVED SELF-EFFICACY TO TEACH WELDING

Major Field: Agricultural Education

Biographical:

Personal Data: Brian Lee Leiby was born December 14, 1985, in Gravite, Arkansas and was raised in Powell, Missouri. He is the son of the late Ronald R. Leiby and June B. Leiby and the youngest brother of Sarah Baker and Bonnie Leiby.

Education: Associate of Science in Agricultural Education from Northeastern Oklahoma A&M College; Bachelor of Science in Agricultural Education from Oklahoma State University; Master of Science in Agricultural Education at Oklahoma State University, Stillwater, Oklahoma in July 2010.

Experience: Teaching Assistant in the Department of Bio-Systems Agricultural Engineering at Oklahoma State University.

Professional Memberships: Missouri Association for Career and Technical Educators, Phi Theta Kappa, Alpha Tau Alpha

Name: Brian Lee Leiby

Date of Degree: December, 2010

Institution: Oklahoma State University

Location: Stillwater, Oklahoma

Title of Study: PRE-SERVICE AGRICULTURAL EDUCATION TEACHERS
KNOWLEDGE AND PERCEIVED SELF-EFFICACY TO TEACH
WELDING

Pages in Study: 117

Candidate for the Degree of Master of Science

Major Field: Agricultural Education

Scope and Method of Study: This study included pre-service agricultural education teachers (N = 58) enrolled in the course MCAG 3222 – Metals and Welding, during the fall semester 2009 at Oklahoma State University. The purposes of this descriptive correlational study were to determine pre-service agricultural education teachers' knowledge of welding and perceived self-efficacy and importance of teaching selected welding skills standards in secondary agricultural education. Additionally, this study sought to identify welding skills standards most needed by pre-service agricultural education teachers at Oklahoma State University.

Findings and Conclusions: It was found that over one half of study participants (58.62 %) had no former welding employment experience. Prior to enrolling in MCAG 3222 – Metals and Welding pre-service teachers rated their self-efficacy to teach welding skills standards as "Below Average," after instruction pre-service teachers rated their ability as "Above Average." Also, pre-service teachers enrolled in the study witnessed nearly a 12 % increase in knowledge test (mean) scores prior to instruction (58.41 %) and (70.21 %) at the end of instruction. In addition to measurements of self-efficacy and knowledge, the researcher sought to identify welding instructional needs of pre-service agricultural education teachers' utilizing the Borich Needs Assessment Model and mean weighted discrepancy scores (MWDS). After instruction it was determined that pre-service teachers were most in need of additional instruction in the areas of "welding equipment settings, such as wire speed, temperature and polarity" and "shielding gas selection and usage."

ADVISER'S APPROVAL: Dr. Jeremy Shane Robinson

