A STUDY OF PRE-SERVICE AGRICULTURAL EDUCATION STUDENTS: KNOWLEDGE OF HORTICULTURE AND SELF-EFFICACY TO TEACH HORTICULTURE

By

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Bachelor of Science in Agricultural Education

Oklahoma State University

Stillwater, Oklahoma

2007

Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
in partial fulfillment of
the requirements for
the Degree of
MASTER OF SCIENCE
May, 2009

A STUDY OF PRE-SERVICE AGRICULTURAL

EDUCATION STUDENTS: KNOWLEDGE OF

HORTICULTURE AND SELF-EFFICACY

TO TEACH HORTICULTURE

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ACKNOWLEDGMENTS

I began the process of writing my thesis, and because of some struggles, I referred to my thesis as a natural disaster. I continued through the process, and began to overcome obstacles and persist through challenging moments. At this point, I changed my attitude and views about the thesis process, and referred to this amazing accomplishment as a polished stone which now possesses a shinny, glistening eye appeal. Dr. Edwards, you were exactly correct. It might not be a diamond, but I am proud of its "glistening" appeal. This end product could not have been developed without the support, guidance, and professional advice of key individuals: family members, committee members, faculty members in the Department of Horticulture Landscape Architecture, and colleagues.

Mom, Dad, Jonathan, Melissa, and Nicholas, thank you for your support through, not only the last four year I have lived in Oklahoma, but more importantly, the last 24 years. The struggles our family has witnessed and our strength to move forward through the last nine years has proven just how tough our family is. Grandpa Kennel and Lewe would both be proud; we are persistent, true to our beliefs, and understand the importance of celebration! To my Oklahoma family, Jim and Linda Ward, thank for being my support post, Oklahoma tour guide, and friend.

Dr. Leising, thank you for your "24 hour life and thesis advice center." You are an amazing educator and great friend. I appreciate your editorial advice and your dedication to my success. I will always appreciate the Oklahoma armadillos.

Dr. Edwards and Dr. Blackwell, your advice, support, and ideas through the last four years as an undergraduate and also as a graduate student will always be used in my classroom. Dr. Kahn and Dr. Smith, your assistance the last two years is greatly appreciated. As a graduate student, you have provided me the opportunity to enrich my horticulture knowledge and apply my teaching skills as the teaching assistant in Horticulture 1013.

To my fellow graduate students, as a cohort group, we have held tightly together and truly want each other to succeed: we are in this together. This is the only group of individuals that I have ever met that will discuss educational theory at a cookout! I loved every minute. I am such a fortunate individual to have had the opportunity to meet and interact with such an influential group of people, thanks. Carmen Russell, the "New Buckeye" in Oklahoma, you are an amazing individual. Just think, it only took us 900 miles to meet each other.

Dallas Krout, Brent Haken, Chad Atteberry, and Amber Atteberry, I have learned from you as agricultural educators the past two years, and I will always remember the memories of Oklahoma. Crystal Cowen, thanks for talking to me four years ago. We have become inseparable friends and will continue to be great friends. Chance and Lacey Owen, all of the stories we have and the adventures at the Cedar Ridge Ranch will never be forgotten.

To the reader of this document, thank you for using this to assist you in providing clarity to a topic you are researching or attempting to learn about. This is one small piece of literature available; however, it can provide insight for agricultural educators and one example of how theory can inform practice. Good luck with your future endeavors!

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CHAPTER I

INTRODUCTION

Background and Setting

Approximately one-half of the 11,000 secondary agricultural educators in the United States teach horticulture courses (National FFA Organization, 2008). Moreover, "research suggests that a good teacher is the single most important factor in boosting [student] achievement, more important than class size, the dollars spent per student, or the quality of textbooks and materials" (Wallis, 2008, p. 28). In 2007, 1,948 (7.4 %) secondary agricultural education students enrolled in horticulture courses, out of the 26, 316 students enrolled in Oklahoma agricultural education programs (Oklahoma Department of Career and Technology Education, 2008).

Horticulture is an important and diverse industry in the United States. Major content areas of horticulture include: nursery, floriculture, landscape, and turf (McMahon, Kofranek, & Rubatzky, 2007). This industry provides 1,964,339 jobs and generated 147.8 billion dollars in 2002 (Hall, Hodges, & Haydu, 2005). Krause et al. (2004) emphasized the economic impact of horticulture in the United States when they stated, "Horticulture is one of the fastest growing enterprises in U.S. agriculture…" and "…it produces over 10% of all income from agricultural products" (p.375).

The No Child Left Behind Act (NCLB) was designed to ensure all students were being held to the same expectations; therefore, teachers need to be accountable for their practice and related student learning outcome. Martin, Fritzsche, and Ball (2006) stated, "Accountability will be enforced primarily through yearly standardized testing to measure student performance" (p. 100). 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.

Agricultural educators in Oklahoma are required to be competent in five different agricultural content areas, which are agricultural business, marketing, and communications; animal science; plant and soil science; agricultural mechanics; and natural resources (Leising, Edwards, Ramsey, Weeks, & Morgan, 2005). Included in these five areas is plant and soil science, which encompasses horticulture. At Oklahoma State University, agricultural education students are required to successfully complete Horticulture 1013-Principles of Horticultural Science. This course provides agricultural education pre-service students the horticultural knowledge and skills needed to teach secondary high school students horticultural subject matter, thus, satisfying the Oklahoma Commission for Teacher Preparation standards.

Large enrollments of students in secondary agricultural education horticulture classes in both Oklahoma and the United States broadly demand that teachers be competent in horticultural knowledge and skills (Franklin, 2008). Wingenbach, White, Degenhart, Pannkuk, and Kujawski (2007) stated:

> 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 CTWE [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. (pp. 114-115)

Teachers need to be comfortable (i.e., self-confident) in teaching horticultural science in addition to understanding the technical knowledge. Findings from a study on pre-service agricultural education students' knowledge and teaching comfort level concluded that, "As pre-service teachers' knowledge increased, so did their teaching comfort and vice versa…" (Wingenbach et al., 2007, p. 123).

According to Leising et al. (2005), candidates enrolled at Oklahoma State University who were preparing to teach agricultural education, earned the lowest mean grade point average (2.35) in Horticulture 1013-Principles of Horticultural Science, when compared to other required agricultural core content courses. Because the mean grade point average was the lowest compared to other required agricultural courses, it raised questions regarding the horticultural knowledge pre-service teacher candidates had acquired.

Knobloch and Whittington (2002) reported that when an agricultural educator has a high level of self-efficacy, he or she will be more effective teaching agricultural content to students than teachers who possess a low level of self-efficacy. Stripling, Ricketts, Roberts, and Harlin (2008) paraphrased Albert Bandura when they posited,

> Competent teachers and the expected skills they ought to possess may be the most important factors contributing to the success of students. Confidence in one's ability to be a skillful, effective, and competent teacher is important because this confidence generally leads to fulfillment of these expectations. (p. 120)

Due to a lower grade point average of pre-service agricultural education students in Horticulture 1013, and the need for teachers to be competent and confident to teach horticulture, research is needed to determine the horticulture knowledge pre-service agricultural education students have attained and their perceived level of self-efficacy to teach horticulture.

Statement of the Problem

The Oklahoma Commission for Teacher Preparation (OCTP) requires agricultural education teachers to be competent in the subject matter they will be expected to teach. Pre-service agricultural education teacher candidates at Oklahoma State University earned a lower grade point average in Horticulture 1013-Principles of Horticultural Science compared to other required agricultural courses, indicating less knowledge and skill. Therefore, the need existed to determine the pre-service teachers' knowledge of horticulture and their perceived self-efficacy to teach horticulture.

Purpose of the Study

The purposes of this research study were to determine pre-service agricultural education students' knowledge of horticulture, their perceived self-efficacy and importance of teaching horticulture in secondary agricultural education, and their perceptions of needed skills standards pertaining to horticulture.

Research Objectives

1. Describe selected characteristics (age, gender, major, academic course work in horticulture, and horticulture work experience) of the pre-service agricultural education students enrolled in Horticulture 1013-Principles of Horticultural Science during the fall semester 2008.
2. Determine the students' perceived self-efficacy to teach selected horticulture skills standards and their perceived importance of teaching the selected horticulture skills standards in secondary agricultural education.
3. Determine the need for pre-service education in horticulture, based on self-efficacy and importance perceptions of pre-service agricultural education students enrolled in Horticulture 1013-Principles of Horticultural Science, prior to and at the end of instruction, using the mean weighted discrepancy score approach (Borich, 1980).
4. Compare the pre-service agricultural education students' knowledge of selected horticulture skills standards, prior to the start of instruction and at the end of instruction, in Horticulture 1013-Principles of Horticultural Science.
5. Determine the relationship between the pre-service agricultural education students' perceived self-efficacy to teach selected horticulture skills standards and their knowledge of horticulture and years of horticulture work experience.

Scope of the Study

This study included pre-service agricultural education students enrolled in the course, Horticulture 1013-Principles of Horticultural Science, during the fall 2008 semester at Oklahoma State University.

Limitations

1. The results of this study can only be generalized to those pre-service agricultural education students enrolled in Horticulture 1013-Principles of Horticultural Science in the fall 2008 semester at Oklahoma State University.
2. No other instruments used to determine pre-service agricultural education students' knowledge of horticulture, self-efficacy to teach horticulture, and importance of teaching horticulture existed.

Assumptions

The assumptions for this study included the following:

- All agricultural education students enrolled in Horticulture 1013-Prinicples of Horticultural Science will become certified secondary agricultural educators.
- The instrument used elicited accurate responses.
- All respondents provided honest expressions of their knowledge and perceptions.
- All respondents fully understood the questions they were asked.
- Pre-service agricultural education students had a basic understanding of the purpose and curriculum of secondary agricultural education in public schools.

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 nonformal settings" (Phipps, Osborne, Dyer, & Ball, 2008, p. 527).

Confidence: "Self-Assurance, a state of trust" (Mish et al., 2004, p. 152).

Horticulture: "The study of crops that require intense and constant care, from planting through delivery to the consumer" (McMahon, Kofranek, & Rubatzky, 2007, p. 576).

Importance: "The quality or state of being important: moment, significance" (Mish et al., 2004, p. 361).

Mean Weighted Discrepancy Score (MWDS): "…A discrepancy analysis that identifies the two polar positions of *what is* and *what should be*" (Borich, 1980, p. 39).

Oklahoma Commission for Teacher Preparation (OCTP): "An organization to develop, implement and facilitate competency-based teacher preparation, candidate assessment, and professional development systems" (Oklahoma Commission for Teacher Preparation, 2008, p. 3).

Oklahoma Department of Career and Technology Education (ODCTE):

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: “People’s beliefs about their capabilities to exercise control over events that affect their lives” (Bandura, 1989, p. 1175).

Skills Standards: “Outline of 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” (Oklahoma Department of Career and Technology Education, 2007, Tools For Success section, ¶ 2).

CHAPTER II

REVIEW OF LITERATURE

Introduction

In education, it is essential for the educator to be confident teaching content in which he or she has been prepared to teach. Research revealed that the more competent a teacher is about his or her subject matter, the higher one's self-efficacy to teach the related subject matter will be (Wingenbach, White, Degenhart, Pannkuk, & Kujawski, 2007). Darling-Hammond and Baratz-Snowden (2005) posited, "Being prepared to teach subject matter requires deep knowledge of the content itself, the process for learning this content, and the nature of student thinking, reasoning, understanding, and performance within a subject area" (p. 17). In addition, Wright, Horn, and Sanders (1997) found that even though teachers varied on levels of effectiveness, the teacher was the most important factor influencing student achievement. Moreover, pre-service agricultural education students must be properly prepared to educate students in multiple agricultural contexts including horticulture (Schlautman & Silletto, 1992).

The purpose of this chapter was to summarize the research literature relative to self-efficacy and how self-efficacy relates to teacher competence and educational needs as perceived by teachers. This review of literature was divided into the following areas: Introduction, Theoretical and Conceptual Framework, Teacher Efficacy, Collective Efficacy, Agricultural Education Teachers' Content Competence, Determining Educational Needs of Pre-service Agricultural Educators, and Summary.

Theoretical and Conceptual Framework

Self-Efficacy Theory

The theoretical framework was based on self-efficacy theory (Bandura, 1997). According to Bandura (1997), "Perceived self-efficacy is the beliefs in one's capabilities to organize and execute the courses of action required to produce a given attainment" (p. 3). Self-efficacy differs from other expectancy beliefs, because it is based on a specific belief to obtain a predetermined outcome (Pajares, 1996). In this study, confidence to teach horticulture standards and self-efficacy are used interchangeably based on instrument development work done by Bandura (2006). Bandura (1989) expounded on the idea that as an individual's perceived self-efficacy increased, he or she would set higher goals. In addition to raising goals, the individual also will be able to endure and achieve difficult tasks or goals (Bandura, 1992).

Wingenbach et al. (2007) found that pre-service teachers' sense of self-efficacy to teach increased when their content knowledge level increased. Johnson, Ferguson, and Lester (2000) concluded that students who had used computer applications or believed they had a high skill level for operating selected computer applications had a high confidence level when using selected computer applications. Providing rationale for investigating pre-service educators' perceived self-efficacy, Zarafshani, Knobloch, and Aghahi (2008) stated, "General self-efficacy is a trait-like construct of a set of expectations people use to determine how successful they believe they can be or perform in a wide range of new and challenging situations" (p. 72).

In multiple types of efficacy (i.e., teacher efficacy or collective efficacy), the foundation of efficacy develops from four sources of information: mastery experiences, vicarious experiences, verbal persuasion, and physiological state (Bandura, 1997). Bandura (1997) stated, “Each of the four modes of conveying information about personal capabilities has its distinctive set of efficacy indicators” (p. 79).

Personal mastery experience is a source of efficacy based on its effect through an individual’s perception of his or her capability when goals are obtained or not per a specific task (Bandura, 1997). Johnson et al. (2000) concluded students who used computer skills in multiple courses had a higher perceived level of self-efficacy toward using the computer. This study supports the importance of mastery experience and its impact on self-efficacy.

Modeling is a method in which the second source of efficacy, vicarious experience, is obtained (Bandura, 1997). 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).

The third source of efficacy is verbal persuasion, where another individual provides feedback about an individual’s capabilities (Bandura, 1997). This can be structured feedback in the forms of positive or negative reinforcement.

Bandura (1997) identified the fourth source of efficacy as it related to an individual’s physiological state. Involved here is an individual’s level of stress, or lack of, and how these physiological aspects affect self-efficacy.

Learning Community Conceptual Model

Learning in a community (Darling-Hammond & Bransford, 2005) was utilized as the conceptual framework in this study. Teacher learning is the foundation of learning in a community which may implications for teacher education, such as providing meaning coursework allowing the pre-service teacher to develop his or her content knowledge (Darling-Hammond & Bransford, 2005). Figure 1 depicts five values teachers should gain through a teacher preparation program. The five values are vision, understanding, practices, dispositions, and tools (Darling-Hammond & Bransford, 2005). As pre-service students enter a teacher education program, a vision should be developed by the student to establish an idea or model which demonstrates effective teaching characteristics and a well developed foundation of content knowledge.

The vision developed by a pre-service teacher impacts all other values: understanding, practices, dispositions, and tools. According to Darling-Hammond and Bransford (2005), the following statements describe each value. “Understanding” is the value in which a prospective educator develops pedagogical and content knowledge of a specific subject area; examples include agriculture, mathematics, construction engineering, and reading. “Practice” is an application process where a prospective educator would organize and execute lessons, per his or her specified content area. “Dispositions” could be abstract thought or structured reflection upon practicing the teaching and learning process of both the students and teacher. The value “Tools,” consists of items such as educational theories, teaching methods, and lesson plans, which the educator uses to construct and organize effective learning experiences (Darling-Hammond & Bransford, 2005).

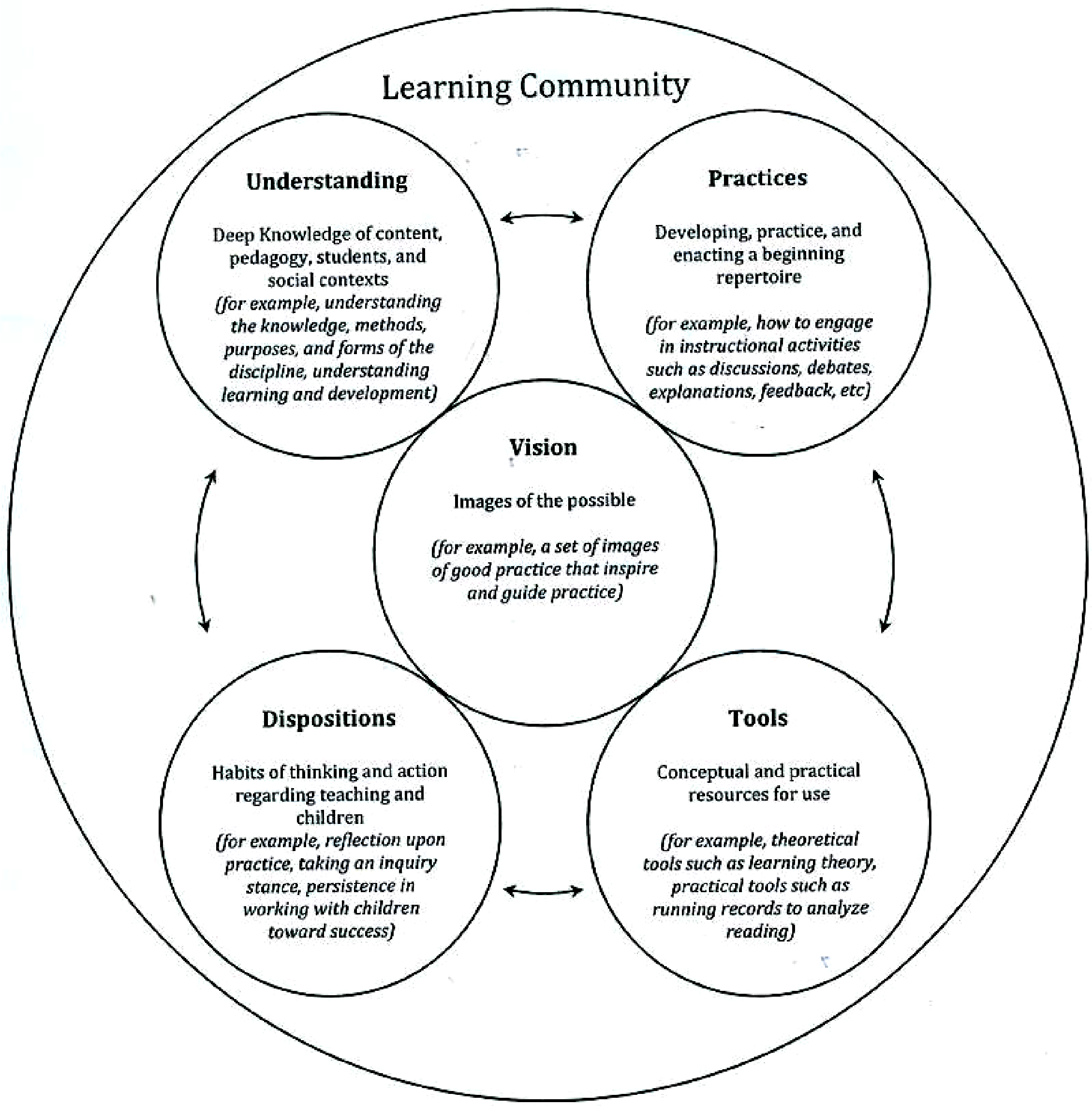

Figure 1. Learning Community. Note: From *Preparing teachers for a changing world: What teachers should learn and be able to do* (p. 386), by L. Darling-Hammond and J. Bransford (Eds), 2005, San Francisco: Jossey-Bass. Copyright 2005 by John Wiley & Sons, Inc.

Darling-Hammond and Baratz-Snowden (2005) stated, "Being prepared to teach subject mater requires deep content knowledge of the content itself, the process for learning this content, and the nature of student thinking, reasoning, understanding, and performance within a subject area" (p. 17). Content knowledge is one piece of the value "understanding." This is a value that educators must develop and organize to effectively educate youth.

Teacher Efficacy

Bandura's theory of self-efficacy has been used by researchers to define and rationalize teacher efficacy for a long period of time (Tschannen-Moran, Woolfolk Hoy, & Hoy, 1998). "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 et al. 1998, p. 233). The cyclical nature of teacher efficacy initially begins by utilizing the four sources of efficacy proposed by Bandura: mastery experience, verbal persuasion, vicarious experience, and physiological arousal (state) (see Figure 2). A teacher then processes these sources of efficacy, and then further analyzes his or her teaching practices and knowledge of teaching. The final aspect involves his or her reflection of teacher practices, which leads to the development of new sources of teaching efficacy. In 2006, Whittington, McConnell, and Knobloch conducted a study addressing teacher efficacy and attempted to answer the question, Are novice agricultural education teachers in Ohio confident in teaching? They concluded that the teachers who participated in their study were confident in teaching; moreover, they identified teachers' student teaching experience and class preparation time as having the most influence on teach efficacy.

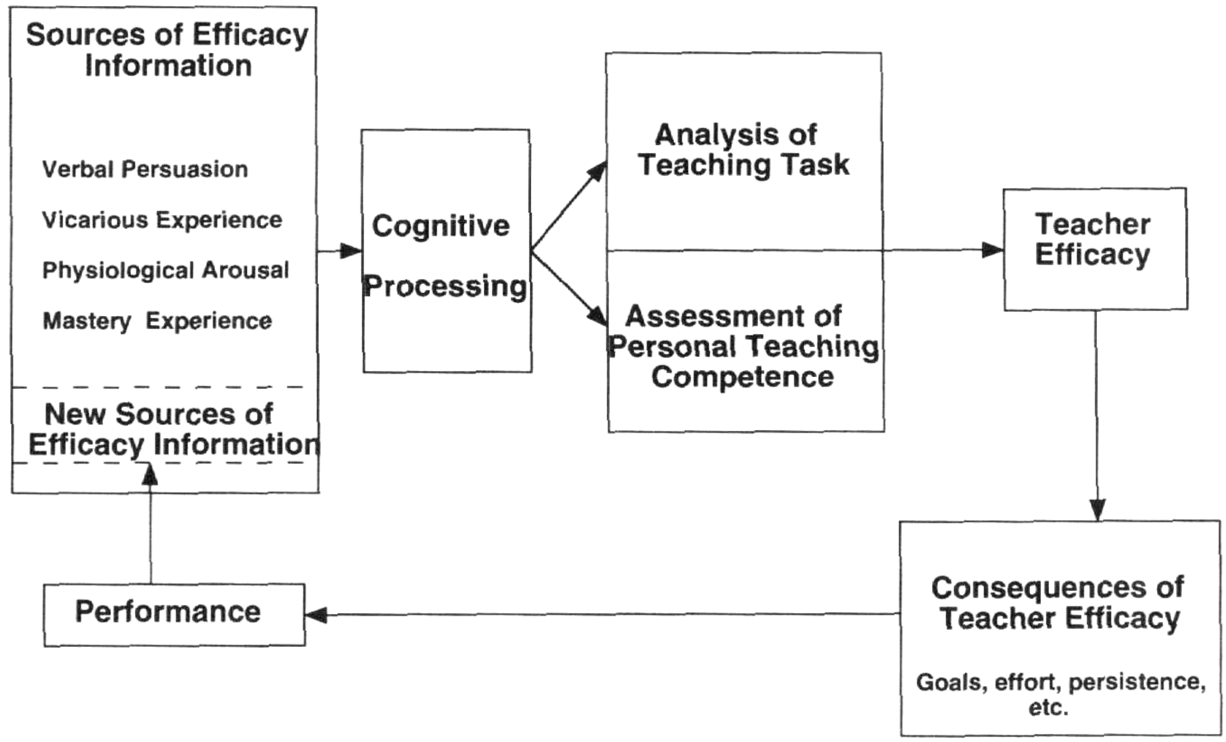

Figure 2. The cyclical nature of teacher efficacy. Note. From "Teacher efficacy: Its meaning and measure," by M. Tschannen-Moran, A. Woolfolk Hoy, & W. K. Hoy, 1998, *Review of Educational Research*, 68(2), p. 228.

Teacher efficacy has the potential to impact teacher commitment to educate youth, be persistent when completing challenging tasks, and to affect student motivation and student achievement (Gibson & Dembo, 1984; Knobloch & Whittington, 2002; Tschannen-Moran et al., 1998). Teacher and student behaviors are influenced positively and negatively by teacher efficacy. In addition, time management is a behavior affected by teacher efficacy (Woolfolk Hoy & Davis, 2004). Tschannen-Moran et al. (1998) stated, "Not only does perceived self-efficacy for teaching influence student achievement, but so does collective efficacy" (p. 241).

Collective Efficacy

Within a school system, teachers possess individual teacher efficacy and the concept of collective efficacy is constructed based on the whole school as one, including all teachers' perceived teacher efficacy (Goddard, Hoy, & Woolfolk Hoy, 2000). Collective efficacy's conceptual outline in Figure 3 displays the theoretical underpinnings of the four sources of efficacy proposed by Bandura (1997). Additionally, aspects of teacher efficacy outlined by Tschannen-Moran et al. (1998) are transparent within the circular process of collective efficacy. Goddard et al. (2000) concluded, "Collective teacher efficacy is a significant predictor of student achievement in both mathematics and reading achievement" (p. 500).

Multiple definitions of collective efficacy exist, but the following three definitions are most prevalent in the literature. Bandura (1997) defined collective efficacy as "A groups' shared belief in its conjoint capabilities to organize and execute courses of action required to produce given levels of attainments" (p. 477). Similarly, Goddard et al. (2000) defined collective efficacy as "An emergent group-level attribute, the product of the interactive dynamics of the group members" (p. 482). In 2004, Goddard, Hoy, and Woolfolk Hoy refined their definition by stating, "For schools, perceived collective efficacy refers to the judgment of teachers in a school that the faculty as a whole can organize and execute the courses of action required to have a positive effect on students" (p. 4).

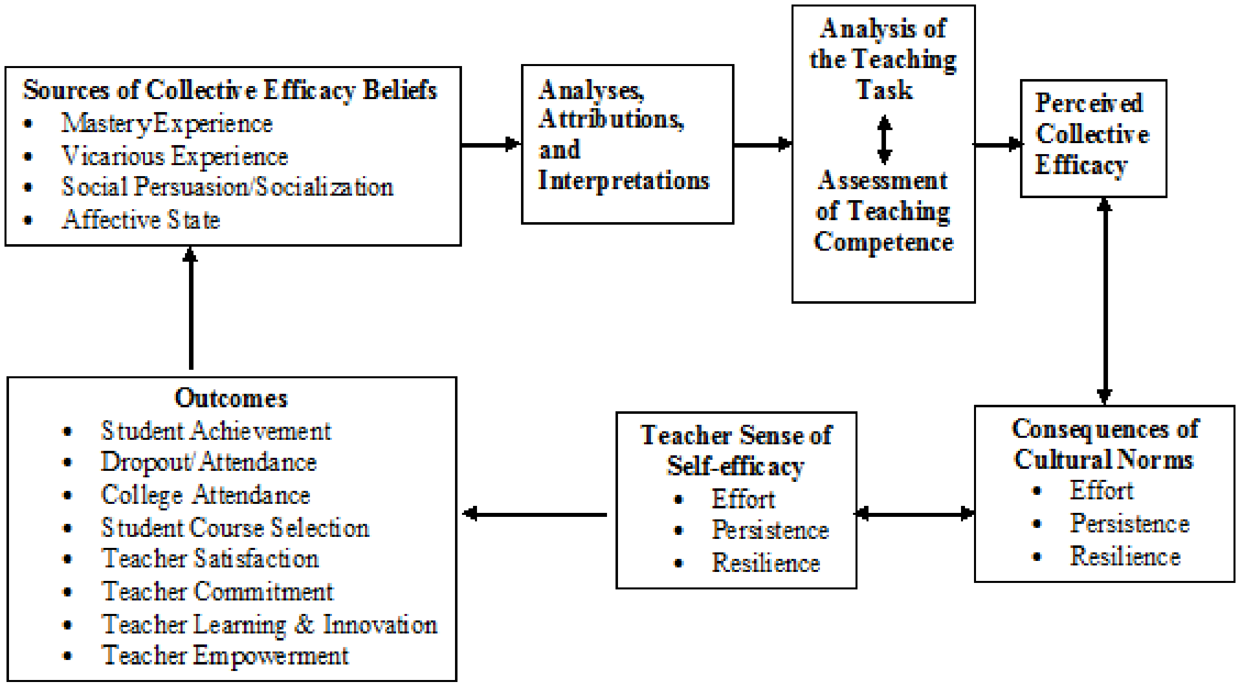

Figure 3. Proposed model of the formation, influence, and change of perceived collective efficacy in schools. Note. From "Collective efficacy beliefs: Theoretical developments, empirical evidence, and future directions," by R. D. Goddard, W. K. Hoy, A. Woolfolk Hoy, 2004, *Educational Researcher*, 33(3), p. 11.

Self-efficacy theory has three primary dynamics that impact education: "The efficacy judgments of students (cf. Parjares, 1994, 1997), teachers' beliefs in their own instructional efficacy, and teachers' beliefs about the collective efficacy of their school (Goddard, Hoy, & Woolfolk Hoy, 2000)," (as cited in Goddard et al., 2004, p. 3). These three distinctions of self-efficacy illustrate the interconnectedness of the sources of efficacy needed by teachers to make crucial educational decisions. Moreover, as a source of efficacy, competence impacts teachers' ability to create unique learning experiences, and ultimately their ability to impact student achievement (Bandura, 1982).

Agricultural Education Teachers' Content Competence

Darling-Hammond and Baratz-Snowden (2005) posited, "Teachers must know the subject matter they will teach and understand how to organize curriculum in light of both students' needs and the school's learning objectives" (p. 14). Additionally, Findlay and Drake (1989) stated, "Competence in one's professional work role is important in the overall learning process" (p. 46). Wingenbach et al. (2007) stated:

> 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 CTWE [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. (pp. 114-115)

According to Roberts, Dooley, Harlin, and Murphrey (2006), "The law operationalized 'Highly Qualified' using three criteria: full certification, a bachelor's degree, and competence in subject matter and teaching" (p. 1).

At Oklahoma State University, students enrolled in agricultural education meet these three criteria by completing all graduation requirements and certification requirements outlined by the Oklahoma Commission for Teacher Preparation (OCTP) (Leising et al., 2005). Darling-Hammond (2000) elaborated on the standards and competencies outlined by the National Council for Accreditation of Teacher Education (NCATE) and the Interstate New Teacher Assessment and Support Consortium

(INTASC). Moreover, Darling-Hammond (2000) listed specific standards that prospective teachers must demonstrate, including "knowledge of subject matter and how to teach it to students" (p. 175).

Cochran-Smith and Lytle (1999) outlined three conceptions of knowledge that a teacher encounters through formal education and his or her professional career. The three conceptions describe the relationship between knowledge and practice and essential developmental stages of a teacher's educational career. The first conception is identified as knowledge-*for*-practice. This is knowledge gained mainly prior to actual teaching and would consist of subject matter and pedagogical methods. Second, the conception identified as knowledge-*in*-practice, is the knowledge a teacher gains from actual teaching experience and modifications to teaching practices. As educators complete lessons, provide assessments, or develop new curricula, they reflect on those experiences, use additional resources and modify current practices. Knowledge-*of*-practice is the third conception of teacher learning and according to Cochran-Smith and Lytle (1999):

> …teacher learning is not to be taken as a synthesis of the first and second conceptions. Rather, it is based on fundamentally different ideas: That practice is more than practical, that inquiry is more than an artful rendering of teachers' practical knowledge, and that understanding that knowledge needs of teaching means transcending the idea that the formal-practical distinction captures the universe of knowledge types. (pp. 273-274)

This study primarily investigated knowledge-*for*-practice because of its focus on pre-service education (Cochran-Smith & Lytle, 1999). Embedded in this relationship is the knowledge a teacher gains through formal education in preparation for the teaching profession (Cochran-Smith & 1999). Feiman-Nemser (2001) stated, "If teachers are responsible for helping students learn worthwhile content, they must know and understand the subjects they teach" (p. 1017). Additionally, the knowledge teachers gain from pre-service education is knowledge which average people in society would generally not know (Cochran-Smith & Lytle, 1999). Pre-service education is where a teachers gains the pedagogical skills and content knowledge, per his or her discipline, within the knowledge-*for*-practice relationship (Cochran-Smith & Lytle, 1999).

Agricultural educators in Oklahoma are required to be competent in five different core agricultural content areas and pedagogical standards specified by the OCTP and NCATE. The core agricultural content areas are agricultural business, marketing, and communications; animal science; plant and soil science; agricultural mechanics; and natural resources (Leising et al., 2005). Horticulture is encompassed in the plant and soil science content area. At Oklahoma State University, agricultural education students are required to complete the course Horticulture 1013-Principles of Horticultural Science. This course addresses the horticultural knowledge and skills needed by pre-service agricultural education candidates to teach secondary students enrolled in agricultural education programs (Leising et al., 2005).

The Oklahoma Department of Career and Technology Education developed learning objectives which agricultural educators use to guide learning experiences in their classrooms. These "guides" were organized by subject area, one being horticulture, and the objectives are operationalized as skills standards.

> The skills standards are an outline of 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. (Oklahoma Department of Career and Technology Education, 2007, Tools For Success section, ¶ 2)

In addition to being used to guide learning experiences, the skills standards were also used to develop competency tests, which were given to students who are preparing for jobs in specific agricultural contexts.

In 2007, there were 1,948 (7.4 %) Oklahoma secondary agricultural education students enrolled in horticulture courses, out of the total 26,316 students enrolled in agricultural education programs in Oklahoma (Oklahoma Department of Career and Technology Education, 2008). Krause et al. (2004) emphasized the economic impact of horticulture in the United States: "Horticulture is one of the fastest growing enterprises in U.S. agriculture…" and "…It produces over 10% of all income from agricultural products" (p. 375).

Researcher has identified that the horticulture industry is important, however the research literature in agricultural education revealed few studies identifying agricultural educators' competence in horticulture. Regarding horticulture content knowledge, Lamberth (1983) identified 108 horticulture competencies based on greenhouse management and landscape design. Moreover, Franklin (2008) concluded that "Agricultural education teachers in Arizona have a limited horticulture background, in terms of number of college hours completed, and years of horticulture work experience obtained before entering teaching" (p. 12). Rothenberger and Stewart (1995) found that Missouri agricultural education students enrolled in horticulture courses gained more knowledge when taught using a greenhouse facility. In addition, Cano and Metzger (1995) found that Ohio agricultural educators were teaching horticulture at lower levels of cognition 84% of the time.

Determining Educational Needs of Pre-service Agricultural Educators

Researchers have investigated the relationship between a teacher's perception of knowledge, perceived importance, and perceptions of ability to perform a task (Borich, 1980). However, Roberts et al. (2006) stated, "Competency in subject matter and pedagogy is more subjective, and thus more difficult to measure" (p. 1). According to Goddard et al. (2004):

> Efficacy judgments are beliefs about individual or group capability, not necessarily accurate assessments of those capabilities. This is an important distinction because people regularly over- or underestimate their actual abilities, and these estimations may have consequences for the courses of action they choose to pursue and the effort they exert in those pursuits. Over- or underestimating capabilities also may influence how well they use the skills they possess. (p. 3)

The Borich needs assessment model is a systematic process used to examine pre-service and in-service needs of educators utilizing a mean weighted discrepancy score (MWDS) which is an examination of two constructs, i.e., perceived importance and self-efficacy. This method of needs assessment is an alternative to traditional direct assessment of needs previously utilized in teacher education (Barrick, Ladewig, & Hedges, 1983; Borich, 1980; Edwards & Briers, 1999; Newman & Johnson, 1994).

Borich (1980) elaborated on the uses of the model with one being "…a practical decision framework for program improvement" (p. 39). Moreover, this model is a way to analyze "what is" and "what should be" (p. 39). Barrick et al. (1983) found that the Borich model is valid; utilizing two or more constructs such as importance and self-efficacy, would be legitimate to configure conclusions for in-service needs. Borich (1980) asserted that the model could be utilized to determine pre-service education and inservice education needs for teachers.

Duncan, Ricketts, Peake, and Uesseler (2006) employed the Borich needs assessment model to identify technical agriculture, teaching and learning, and program management pre-service and in-services needs of Georgia agricultural education teachers. Relying on the same needs assessment model, Garton and Robinson (2006) sought to determine a ranking of employability skills needed by agricultural education graduates using their perceptions of importance and competence regarding each employability skill.

Summary

Darling-Hammond and Baratz-Snowden (2005) stated, "Teachers must know the subject matter they will teach and understand how to organize curriculum in light of both students' needs and the school's learning objectives" (p. 14). In addition to being competent in the subject matter they teach, teachers who have a high level of self-efficacy to teach the subject mater will also increase student achievement (Tschannen-Moran et al., 1998).

Undergirding these two concepts of teacher education is the theory of self-efficacy proposed by Bandura (1997) and the conceptual model, learning in a community, proposed by Darling-Hammond and Bransford (2005), which were used as the theoretical and conceptual basis for this study. Bandura (1997) stated, “Self-efficacy theory provides explicit guidelines on how to enable people to exercise some influence over how they live their lives” (p. 10). Feiman-Nemser (2001) further organized ideas about how pre-service students’ beliefs are associated with their learning experiences in teacher education programs.

Self-efficacy is a construct that has been operationalized through an educational lens. Goddard et al. (2000) and Tschannen-Moran et al. (1998) advanced the ideas of collective and teacher efficacy. These researchers, Bandura, and others have examined the efficacy constructs in terms of student achievement and a school’s collective success.

Teacher educators develop curricula to prepare pre-service teachers to enter the teaching profession; moreover, pre-service teachers begin their education with personal beliefs and attitudes about the subject matter they will teach (Feiman-Nemser, 2001). Therefore, it is essential for teacher education programs to organize multiple learning experiences that enable pre-service students to develop their content and pedagogical knowledge (Cochran-Smith & Lytle, 1999).

Identifying students’ perceptions of importance and self-efficacy regarding specific learning objectives, would create a more concise understanding of “what is” and “what should be” (Borich, 1980, p. 39). By targeting these constructs and calculating a mean weighted discrepancy score, the educational researcher and practitioner can better examine teacher preparation learning objectives and identify objectives to reinforce based on the pre-service teachers’ needs (Barrick et al., 1983; Edwards & Briers, 1999).

CHAPTER III

METHODOLOGY

Research Design

The research design for this study was descriptive correlation. According to Creswell (2005), correlations are used when the researcher has two variables or constructs and needs to determine if one variable or construct has any influence on the other. The researcher used an explanatory research design which is one type of correlational research. This design was used because the researcher was interested in the relationship or if one variable was affected by another variable (Creswell, 2005). The intent of this study was to describe the population of pre-service agricultural education students enrolled in Horticulture 1013-Principles of Horticultural Science during the fall 2008 semester, and was not to predict the influence of one variable on another.

Research Objectives

1. Describe selected characteristics (age, gender, major, academic course work in horticulture, and horticulture work experience) of the pre-service agricultural education students enrolled in Horticulture 1013-Principles of Horticultural Science during the fall semester 2008.
2. Determine the students' perceived self-efficacy to teach selected horticulture skills standards and their perceived importance of teaching the selected horticulture skills standards in secondary agricultural education.

3. Determine the need for pre-service education in horticulture, based on self-efficacy and importance perceptions of pre-service agricultural education students enrolled in Horticulture 1013-Principles of Horticultural Science, prior to and at the end of instruction, using the mean weighted discrepancy score approach (Borich, 1980).
4. Compare the pre-service agricultural education students' knowledge of selected horticulture skills standards, prior to the start of instruction and at the end of instruction, in Horticulture 1013-Principles of Horticultural Science.
5. Determine the relationship between the pre-service agricultural education students' perceived self-efficacy to teach selected horticulture skills standards and their knowledge of horticulture and years of horticulture work experience.

Institutional Review Board (IRB)

Federal regulations and Oklahoma State University policy require review and approval of all research studies that involve human subjects before investigators can begin their research. The Oklahoma State University office of University Research Services, through the Institutional Review Board (IRB), conducts this review to protect the rights and welfare of human subjects involved in biomedical and behavioral research. In compliance with the aforementioned policy, this study received proper review and was granted permission to proceed. The Institutional Review Board assigned the number AG0818 (see Appendix A) to the research project. Written consent for each subject was required by the IRB, and an appropriate document was developed to meet this requirement (see Appendix B).

Population

The population for this study included pre-service agricultural education students enrolled in the course, Horticulture 1013-Principles of Horticultural Science, at Oklahoma State University in the fall 2008 semester. A total of 22 pre-service agricultural education students were enrolled in the fall 2008 semester.

Instrumentation

A review of the research literature found that no instruments were available to measure a student' s horticultural knowledge, perceived confidence to teach horticulture, and importance of horticulture skills standards relevant to Oklahoma secondary agricultural education curricula. Therefore, the researcher developed an instrument which included three sections: Section I, Perceived Confidence and Importance to Teach Horticulture Skills Standards (see Appendix C); Section II, Horticulture Knowledge (see Appendix D); and Section III, Demographic Information (see Appendix D).

Instrument: Section I-Perceived Confidence and Importance to Teach Horticulture Skills Standards.

This section of the instrument was developed to investigate the pre-service agricultural education students' perceived confidence (self-efficacy) to teach selected Oklahoma horticulture skills standards and their perceived importance of the selected Oklahoma horticulture skills standards. According to the Oklahoma Department of Career and Technology Education (2007),

> The skills standards are an outline of 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. (Tools For Success section, ¶ 2)

The selected Oklahoma horticulture skills standards identified for this study were cross-referenced with the course content for Horticulture 1013-Principles of Horticultural Science. After cross-referencing the Oklahoma skills standards and the course content, 27horticulture skills standards were identified and utilized to formulate section I.

In developing section I, the researcher used the construct confidence to measure a pre-service educator's self-efficacy to teach the selected skills standards (Bandura, 2006). To measure self-efficacy, the researcher used a five point summated rating scale ranging from 1 to 5 (Borich, 1980): "1" no confidence, "2" below average, "3" average confidence, "4" above average, and "5" high confidence. The perceived importance scale was also a summated rating scale ranging from 1 to 5 (Borich, 1980): "1" no importance, "2" low importance, "3" some importance, "4" much importance, and "5" high importance (Edwards & Briers, 1999).

Instrument: Section-II Horticulture Knowledge

The researcher used the Oklahoma Agricultural Education Horticulture Skills Standards, developed by the Oklahoma Department of Career and Technology Education, to guide the selection of the horticulture knowledge questions included on the horticulture knowledge test section of the instrument. These horticulture skills standards were used, because agricultural educators are expected to be able to teach these skills upon completion of their Bachelor's of Science degree and initial Oklahoma teaching license in agricultural education (Leising et al., 2005).

The researcher contacted the Oklahoma Department of Career and Technology Education and worked with the agricultural education assessment specialist to obtain a complete list of the Oklahoma horticulture skills standards. These standards were selected from three guides: greenhouse/nursery technician (OD36202), fruit/nut & vegetable field technician (OD36203), and landscape maintenance technician (OD36204) (see Appendix E) (Oklahoma Department of Career and Technology Education, 2007). After cross-referencing the Oklahoma horticulture skills standards to the course content of Horticulture 1013-Principles of Horticultural Science, the researcher selected 27 skills standards that were included in the course's content.

The selected skills standards were cross-referenced to the course test question bank to establish congruency between the course content and skills standards content. The questions in this test question bank had been used in the course for approximately ten consecutive semesters at Oklahoma State University and were considered valid by the faculty teaching the course. The researcher selected 27 questions from the Horticulture 1013-Principles of Horticultural Science question bank. Each test question used, was cross referenced directly to one of the Oklahoma agricultural education horticulture skills standards. A total of 27 different skills standards (see Appendix F) were included. These 27 questions composed the criterion-referenced horticulture knowledge test, section II of the instrument. When developing a criterion-referenced test, the examiner must develop questions that are congruent with the context in which students are tested (Wiersma & Jurs, 1990); therefore, the researcher only used questions in the context of horticulture; specifically the content taught in the course, Horticulture 1013-Principles of Horticultural Science (see Appendix G).

Questions selected for the horticulture knowledge test were reviewed by a panel of experts to determine if the questions addressed the selected Oklahoma horticulture skills standards. The panel consisted of two faculty members from the Department of Horticulture and Landscape Architecture; panelists both possessed a Ph.D. in Horticultural Sciences and had taught Horticulture 1013-Principles of Horticultural Science. Also, the panel consisted of three faculty members in the Department of Agricultural Education, Communication, and Leadership at Oklahoma State University, who had prior research experience in test construction and served as experts to review the organization and assessment format of the horticulture knowledge test, section II.

Instrument: Section III-Demographic Information

The population characteristics for this study were selected based on research literature. Similar to Johnson, Ferguson, and Lester (2000), the researcher collected data which included: age, gender, major, number of academic horticulture courses completed, and years of horticulture work experience. Moreover, Franklin (2008) stated, "Agricultural education teachers in Arizona have a limited horticulture background, in terms of number of college hours completed, and years of horticulture work experience obtained before entering teaching" (p. 12). So, the researcher developed questions to describe the pre-service students' horticulture work experience.

Validity

Creswell (2005) defined content validity as "The extent to which the questions on the instrument and the scores from these questions are representative of all the possible questions that a researcher could ask about the content or skills" (p. 164). Content validity of the instrument used in this study was addressed by utilizing a panel of experts consisting of two horticulture faculty members, two teacher educators in agricultural education, two agricultural educators possessing six or more years of experience teaching horticulture, and one agricultural communication faculty member (Wiersma & Jurs, 1990). The panel of experts reviewed the instrument to confirm face and content validity.

The researcher could not control for the threat of mortality (i.e., students resigning from the study) of students participating in the study. Students had the option to withdraw from the study at anytime.

Reliability

Reliability is addressed to determine if the instrument can be utilized multiple times and produce similar responses (Hambleton & Novick, 1973; Wiersma & Jurs, 1990). Criterion-referenced tests, such as the horticulture knowledge test in this study, do not require reliability coefficients (e.g., Cronbach's coefficient alpha) to address reliability, as do norm references tests (Wiersma & Jurs, 1990). However, Wiersma and Jurs (1990) posited eight ways to address reliability of a criterion-referenced test. The researcher took these ideas into consideration while working with the panel of experts to develop the instrument used in this study. Wiersma and Jurs (1990) found that if the researcher wanted to address test reliability, he or she should address the following criteria:

> *Homogeneous items:* When criterion-referenced test items emanate from 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 and 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 students: 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 student 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 responses will lower the test's reliability. Attention to the above factors will help promote reliable test scores. (p. 264)

For this study, the researcher addressed the suggestions posed by Wiersma and Jurs (1990) to increase reliability of the criterion-referenced test by doing the following: *Homogeneous items:* The questions utilized in the criterion-referenced test (section II) were directly cross-referenced with the Oklahoma agricultural education horticulture skills standards and the course Horticulture 1013-Principles of Horticultural Science (see Appendix F).

Discriminating items: All items on the instrument were analyzed using item difficulty scores calculated by the Oklahoma State University Assessment and Testing Center (see Appendix H).

Enough items: The criterion-referenced test represented 27 test questions and each question was cross-referenced to an Oklahoma horticulture skill standard. Twenty seven were used of the 278 total Oklahoma horticulture skills standards. These were representative of the skills standards taught in Horticulture 1013-Principles of Horticultural Science.

High quality copying and format: The instrument booklet was copied using a laser ink jet copier and the Scantron forms were professionally formatted by the Oklahoma State University Assessment and Testing Center. The panel of experts reviewed the format and the students involved in the field test also made suggestions to eliminate ambiguous wording.

Clear directions for the students: The students were provided written instructions explaining how to complete the Scantron forms.

A controlled setting: The instrument was administered in a classroom setting during a regularly scheduled class session on the Oklahoma State University Stillwater campus.

Motivating introduction: The detailed informed consent form included an introduction that informed the students how the data collected from the instrument would be utilized in the study.

Clear directions to the scorer: The Scantron forms completed by the study participants were electronically scored by the Oklahoma State University Assessment and Testing Center.

Field Test

This instrument was field tested on April 21, 2008, with pre-service agricultural education students enrolled in an agricultural education program planning course at Oklahoma State University. These students were pre-service agricultural education students and were required to enroll in Horticulture 1013-Principles of Horticultural Science to complete their degree requirements. The researcher administered the field test after receiving Institutional Review Board approval (see Appendix A) and providing all students with an informed consent form. A total of 44 students participated in the field test and were asked to write any comments about ways to clarify the wording of the instrument and to identify questions that were unclear or vague.

As a result of the field test, skills standards were edited for clarity and changes were made to the self-efficacy summated rating scale descriptors; striking “ability” and inserting “confidence” (Bandura, 2006). Prior to administering the instrument, the researcher field tested the instrument a second time with seven undergraduate students enrolled in the College of Agricultural Sciences and Natural Resources. Based on this field test, the researcher made no additional changes.

Data Collection

Data were collected by administering the same instrument prior to instruction and at the end of instruction in the course, Horticulture 1013-Principles of Horticultural Science. On Monday, August 18, 2008, during the fall 2008 semester, the researcher administered the instrument to all students enrolled in Horticulture 1013. The researcher administered the instrument again at the end of instruction on Monday, November 3, 2008, to only those students who completed the instrument on Monday, August 18, 2008.

All instruction addressing the skills standards except “temperature and moisture requirements for postharvest plant storage” had occurred prior to this date. Since this skill standard was not taught prior to the second administration, the researcher did not use the data from this skill standard collected prior to instruction or at the end of instruction.

The instrument was administered in two parts: first, Section I-Perceived Confidence and Importance to Teach Horticulture Skills Standards was administered, and secondly, Section II-Horticulture Knowledge Test, and Section III-Demographic Information. Instrument sections were administered in this order so students’ perceptions were not biased after completing Section II-Horticulture Knowledge Test.

Data Analysis

Through the data collection process, each student was assigned a number via a table of random numbers. This number was consistent on both Section I Scantron form and Sections II and III Scantron form for each student. The Scantron forms were taken to the Oklahoma State University Assessment and Testing Center where they were scored and scanned into a Statistical Package for the Social Sciences (SPSS) file, which was provided to the researcher. The programs SPSS 15.0 for windows and Microsoft Excel 2007 were utilized by the researcher to analyze the data.

The researcher used frequencies, means, and standard deviations to describe the population characteristics and to determine the pre-service agricultural education students’ self-efficacy to teach and perceived importance of, selected horticulture skills standards.

The Borich model was used to calculate a mean weighted discrepancy score (MWDS) (Borich, 1980), which enabled the researcher to systematically rank the horticulture skills standards. This allowed the researcher to identify "congruence between….what the teacher should be able to do and what the teacher can do" (Borich, 1980, p. 42). The need for pre-service and in-service training can be evaluated by using the Borich Model (Barrick, Ladewig, & Hedges, 1983; Borich, 1980). Barrick et al. (1983) concluded that "…using only the importance rankings or the knowledge rankings or the application rankings may not be valid. A combination of two or more rankings must be considered to form conclusions regarding inservice education needs" (p. 19).

The researcher computed a MWDS by first calculating a discrepancy score (DS) for each skill standard. A discrepancy score was calculated by subtracting each pre-service agricultural education student's confidence score from each student's importance score on each skill standard. Secondly, the researcher calculated a weighted discrepancy score. This was accomplished by multiplying each individual discrepancy score for a skill standard by the particular skill standard's mean importance score. This procedure was repeated for every skill standard and the product was the weighted discrepancy score. Next, the mean weighted discrepancy score (MWDS) was calculated by dividing the sum of the weighted discrepancy scores by the total number of pre-service agricultural education students who rated each skill standard (N = 22). Finally, the researcher ranked the skills standards highest to lowest, based on the mean weighted discrepancy score calculated for each skill standard (Barrick et al., 1983; Borich, 1980; Edwards & Briers, 1999; Newman & Johnson, 1994).

In this study, the researcher calculated a non-parametric Kendall's tau correlation coefficient between the students' self-efficacy to teach horticulture, horticulture knowledge achievement score, and years of horticulture work experience. A Kendall's tau correlation coefficient should be used "...when you have a small data set with a large number of tied ranks" (Field, 2000, p. 92). To classify the correlation coefficients, the researcher used conventions for describing correlations identified by Davis (1971). Correlations between .01 and .09 are negligible positive associations, correlations between .10 and .29 are low positive associations, correlations between .30 and .49 are moderate positive associations, correlations between .50 and .69 are substantial positive associations, correlations between .70 and .99 are very strong positive associations, and correlations of 1.00 is are perfect positive correlations (Davis, 1971).

Wingenbach et al. (2007) found a positive correlation, i.e., as pre-service agricultural education students' knowledge increased their perceived ability to teach increased. Bandura (1986) also concluded that a positive relationship existed between a student's knowledge level and his or her belief to successfully accomplish a task or objective. This supported the researcher's decision to calculate a correlation coefficient between students' self-efficacy to teach horticulture score, horticulture knowledge achievement score, and years of horticulture work experience.

CHAPTER IV

FINDINGS

Introduction

The purposes of this research study were to determine pre-service agricultural education students' knowledge of horticulture, their perceived self-efficacy and importance of teaching horticulture in secondary agricultural education, and to identify needed skills standards, as perceived by the students.

Study Design

The research design for this study was descriptive correlation. According to Creswell (2005), correlations are used when the researcher has two variables or constructs and needs to determine if one variable or construct has any influence on the other. The researcher used an explanatory research design which is one type of correlational research. This design was used because the researcher was interested in the relationship or if one variable was affected by another variable (Creswell, 2005). The intent of this study was to describe the population of pre-service agricultural education students enrolled in Horticulture 1013-Principles of Horticultural Science during the fall 2008 semester, and was not to predict the influence of one variable on another.

Population

The population for this study included pre-service agricultural education students enrolled in the course, Horticulture 1013-Principles of Horticultural Science, at Oklahoma State University in the fall 2008 semester. A total of 22 pre-service agricultural education students were enrolled in the fall 2008 semester.

Research Objectives

1. Describe selected characteristics (age, gender, major, academic course work in horticulture, and horticulture work experience) of the pre-service agricultural education students enrolled in Horticulture 1013-Principles of Horticultural Science during the fall semester 2008.
2. Determine the students' perceived self-efficacy to teach selected horticulture skills standards and their perceived importance of teaching the selected horticulture skills standards in secondary agricultural education.
3. Determine the need for pre-service education in horticulture, based on self-efficacy and importance perceptions of pre-service agricultural education students enrolled in Horticulture 1013-Principles of Horticultural Science, prior to and at the end of instruction, using the mean weighted discrepancy score approach (Borich, 1980).
4. Compare the pre-service agricultural education students' knowledge of selected horticulture skills standards, prior to the start of instruction and at the end of instruction, in Horticulture 1013-Principles of Horticultural Science.

5. Determine the relationship between the pre-service agricultural education students' perceived self-efficacy to teach selected horticulture skills standards and their knowledge of horticulture and years of horticulture work experience.

Findings by Research Objective

This section was organized to present the findings by research objective.

Objective 1: Describe selected characteristics (age, gender, major, academic course work in horticulture, and horticulture work experience) of the pre-service agricultural education students enrolled in Horticulture 1013-Principles of Horticultural Science during the fall semester 2008.

A total of 22 pre-service agricultural education students were enrolled in the course, Horticulture 1013-Principles of Horticultural Science. Of the total population, 11 students (50%) were 21 years old, seven (31.8%) were female, and 15 (68.2%) were male. Over 50% (12) of the pre-service agricultural education students reported a grade point average (GPA) ranging from 3.1-4.0, and 10 students indicated a GPA ranging from 2.1-3.0.

Of the pre-service agricultural education students who participated in this study, 63.6% (14) were majoring in only agricultural education; however, 36.4% (8) were earning a double major in agricultural education and animal science. Based on the university classification of students, the population included 4.5% (1) freshman (< 28 semester credit hours), 18.2% (4) sophomore (28-59 semester credit hours), 36.4% (8) junior (60-93 semester credit hours), and 40.9 % (9) senior (≥ 94 semester credit hours).

The majority (68.2%) of the agricultural education students who participated in this study did not report any years of horticulture work experience. Five students indicated one or more years of horticulture work experience. Only 27.3 % of the students previously participated in agricultural education horticulture activities, and 4.5% of the students previously participated in 4-H horticulture activities (Table 1). Of the total population (N = 22), 63.9% of the students reported they completed no high school horticulture courses, and 77.3% of the student had not completed any college horticulture courses (Table 2).

Objective 2: Determine the students' perceived self-efficacy to teach selected horticulture skills standards and their perceived importance of teaching the selected horticulture skills standards in secondary agricultural education.

Students' perceived level of self-efficacy to teach horticulture skills standards

To determine self-efficacy of the pre-service agricultural education students, a self-efficacy mean score was calculated for each of the skills standards (Table 3). Prior to instruction, students perceived their self-efficacy to teach the selected horticulture skills standards as "Below Average" (2.37). Two skills standards, "plant propagation using air layering" (1.59) and "techniques of seed stratification" (1.95), were perceived as "No Confidence" to teach. At the end of instruction, students perceived that they held "Average Confidence" for 20 of the 26 skills standards. However, the students perceived the remaining six skills standards as "Below Average" regarding self-efficacy to teach the horticulture skills standards (Table 3).

Table 1

Horticulture Experiences of Pre-service Agricultural Education Students (N = 22)

Experience Type	*f*	%
Horticulture work experience		
No work experience	15	68.2
Less than one year	2	9.1
1 to 3 years	5	22.7
More than 3 years	0	0
High school agricultural education or 4-H horticulture activities		
Not enrolled in either program	10	45.5
Did not participate in horticulture activities in either program	5	22.7
Participated in high school agricultural education only	6	27.3
Participated in 4-H only	1	4.5
Participated in both programs	0	0
Care for home plants		
Yes	13	59.1
No	9	40.9

Table 2

Number of Horticulture Courses Completed by Educational Level (N = 22)

	High School		College	
Number of horticulture courses completed	*f*	%	*f*	%
I have not completed any course work	14	63.9	17	77.3
1 to 2 course(s)	8	36.4	5	22.7
3 to 4 courses	0	0	0	0
5 to 6 courses	0	0	0	0
7 or more courses	0	0	0	0
Total	22	100	22	100

Prior to instruction, students had a higher self-efficacy to teach "operation of different kinds of turf/lawn mowers" (2.91), "irrigation of field grown plants" (2.91), "the effects of insufficient spacing of plants" (2.77), "maintenance practices of cool and warm season grasses" (2.64), and "the effects of overspraying and underspraying diseased plants" (2.59); however, all standards were classified as "Below Average" (2.00-2.99) (Table 3). Inversely, students perceived themselves as least efficacious to teach "techniques for grafting trees" (2.09), "techniques for applying rooting hormone" (2.05), "preparation techniques of growing media" (2.00), "techniques of seed stratification" (1.95), and "plant propagation using air layering" (1.59) (Table 3).

Table 3 also included the students' self-efficacy to teach the selected horticulture skills standards at the end of instruction in the course Horticulture 1013-Principles of

Horticultural Science. The students' highest perceived self-efficacy was "Average Confidence" in regards to teaching "techniques for applying rooting hormone" (3.77), "techniques for pinching plants" (3.73), "techniques of seed stratification" (3.73), "techniques for disbudding plants" (3.64), and "transplanting plant materials to the field" (3.59). Two skills standards rated as least efficacious prior to instruction were rated in the top five at the end of instruction relative to the other skills standards. At the end of instruction, the five skills standards for which pre-service students perceived they held the lowest self-efficacy were "preparation techniques of growing media" (2.95), "the effects of plant photoperiod regulation" (2.86), "maintenance of greenhouse irrigation systems" (2.82), "harvesting techniques of trees and shrubs" (2.77), and "identification of common turf diseases and pests" (2.59) (Table 3).

Overall, pre-service agricultural education students' self-efficacy to teach horticulture increased from prior to instruction (2.37) compared to the end of instruction (3.26). The students' self-efficacy mean scores were divided between "Average Confidence" (3.00-3.99) and "Below Average" (2.00-2.99) at the end of instruction. This differs from prior to instruction, because the majority of responses were "Below Average" (2.00-2.99). There were no notable differences within or among the three thematic areas greenhouse/nursery, fruit/nut & vegetable, and landscape maintenance.

Table 3

Comparison of Pre-service Agricultural Education Students' Self-efficacy to Teach Horticulture Skills Standards

	Self-efficacy				
	PI[a]		EI[b]		Mean
Skills Standards	*M*	*SD*	*M*	*SD*	Difference
Greenhouse/Nursery					
Transplanting techniques for trees that are bare-root or in liners	2.27	0.98	2.95	1.05	+ 0.68
Techniques for pinching plants	2.45	1.06	3.73	1.03	+ 1.28
The effects of insufficient spacing of plants	2.77	0.87	3.23	1.07	+ 0.46
Techniques for applying rooting hormone	2.05	1.13	3.77[c]	1.11	+ 1.72
Planting techniques for shrubs and trees: bare-root, container, and burlap	2.32	0.78	3.14	0.89	+ 0.82
Plant propagation using air layering	1.59[d]	0.96	3.18	1.05	+ 1.59
Techniques for disbudding plants	2.23	1.06	3.64	0.95	+ 1.41
Maintenance of greenhouse irrigation systems	2.27	0.98	2.82	0.96	+ 0.55
Scarification of seeds	2.36	1.14	3.45	1.01	+ 1.09
Application techniques of plant growth regulators	2.59	1.01	3.50	0.80	+ 0.91
The effects of plant photoperiod regulation	2.32	0.99	2.86	0.71	+ 0.54
Identification of bulbs, tubers, and tuberous roots	2.36	1.18	3.55	1.06	+ 1.19
Harvesting techniques of trees and shrubs	2.18	1.05	2.77	1.07	+ 0.59
Greenhouse/nursery composite mean	2.29		3.28		+ 0.99
Fruit/Nut & Vegetable					
Techniques for grafting trees	2.09	0.81	3.05	0.72	+ 0.96
Calculating seed germination percentages	2.45	1.18	3.32	1.04	+ 0.87
Techniques of seed stratification	1.95	0.90	3.73	0.94	+ 1.78[c]
Preparation techniques of growing media	2.00	0.87	2.95	0.90	+ 0.95
The hardening-off process of seedlings and cuttings	2.18	0.96	3.18	1.01	+ 1.00
Techniques for pruning trees	2.59	1.10	3.36	0.90	+ 0.77
Techniques for staking trees	2.45	0.96	3.23	1.11	+ 0.78
The effects of overspraying and underspraying diseased plants	2.59	1.14	3.09	0.68	+ 0.50
Irrigation of field grown plants	2.91	0.87	3.45	0.80	+ 0.54
Transplanting plant materials to the field	2.55	0.86	3.59	0.91	+ 1.04
Fruit/Nut & Vegetable Composite mean	2.38		3.30		+ 0.92
Landscape Maintenance					
Identification of common turf diseases and pests	2.55	1.10	2.59[d]	0.80	+ 0.04[d]
Maintenance practices of cool and warm season grasses	2.64	0.90	3.23	0.87	+ 0.59
Operation of different kinds of turf/lawn mowers	2.91[c]	1.02	3.50	1.06	+ 0.59
Landscape Maintenance Composite mean	2.70		3.11		+ 0.41
Overall Composite Mean	2.37		3.26		+ 0.89

Note. Self-efficacy scale: 1=No Confidence; 2=Below Average; 3=Average Confidence; 4=Above Average; 5=High Confidence

Note. [a] Prior to Instruction; [b] End of Instruction; [c] Maximum; [d] Minimum

Students' perceived importance of teaching the horticulture skills standards

The researcher sought to determine the importance of teaching selected horticulture skills standards, as perceived by pre-service agricultural education students. The overall composite mean score indicated minimal change in importance from prior to instruction (3.35) compared to the end of instruction (3.66) with a mean difference of + 0.31 (Table 4). The mean scores, prior to instruction and at the end of instruction, for all of the skills standards, ranged from 3.00 to 3.95 indicating "Some Importance" (Table 4).

Each skill standard was individually reviewed, and the researcher ranked the skills standards based on the mean level of importance. Prior to instruction, the most important skill standard reported by the pre-service students was to teach "the effects of overspraying and underspraying diseased plants" (3.95) and the least important was to teach "plant propagation using air layering" (3.00) as shown in table 4. At the end of instruction, the skill standard with the highest perceived level of importance was "identification of bulbs, tubers, and tuberous roots" (3.91) and the least important skill standard was "transplanting techniques for trees that are bare-root or in liners" (3.32). Although the importance mean scores, prior to and at the end of instruction, for the skills standards remained similar, that is "Some Importance," the mean scores did increase slightly at the end of instruction and the range of mean scores was smaller when compared to those mean scores prior to instruction (Table 4).

Table 4

Comparison of Pre-service Agricultural Education Students' Perception of Importance to Teach Horticulture Skills Standards

	Importance				
	PI[a]		EI[b]		Mean
Skills Standards	*M*	*SD*	*M*	*SD*	Difference
Greenhouse/Nursery					
Transplanting techniques for trees that are bare-root or in liners	3.27	0.88	3.32[d]	0.99	+ 0.05
Techniques for pinching plants	3.32	0.99	3.77	1.02	+ 0.45
The effects of insufficient spacing of plants	3.32	0.89	3.68	0.84	+ 0.32
Techniques for applying rooting hormone	3.14	1.13	3.82	0.73	+ 0.68
Planting techniques for shrubs and trees: bare-root, container, and burlap	3.32	0.84	3.64	1.00	+ 0.32
Plant propagation using air layering	3.00[d]	0.98	3.41	1.05	+ 0.41
Techniques for disbudding plants	3.23	1.07	3.82	0.96	+ 0.59
Maintenance of greenhouse irrigation systems	3.59	1.10	3.73	1.12	+ 0.14
Scarification of seeds	3.41	0.85	3.82	0.80	+ 0.41
Application techniques of plant growth regulators	3.23	0.81	3.77	0.81	+ 0.54
The effects of plant photoperiod regulation	3.14	1.04	3.50	0.74	+ 0.36
Identification of bulbs, tubers, and tuberous roots	3.82	0.80	3.91[c]	0.81	+ 0.09
Harvesting techniques of trees and shrubs	3.32	1.13	3.77	1.07	+ 0.45
Greenhouse/nursery composite mean	3.32		3.69		+ 0.37
Fruit/Nut & Vegetable					
Techniques for grafting trees	3.05	0.95	3.38	0.92	+ 0.33
Calculating seed germination percentages	3.50	1.14	3.55	0.80	+ 0.05
Techniques of seed stratification	3.23	0.92	3.77	0.92	+ 0.54
Preparation techniques of growing media	3.09	0.87	3.64	0.85	+ 0.55[c]
The hardening-off process of seedlings and cuttings	3.09	0.87	3.38	0.92	+ 0.29
Techniques for pruning trees	3.23	0.92	3.59	0.96	+ 0.36
Techniques for staking trees	3.09	0.92	3.55	0.96	+ 0.46
The effects of overspraying and underspraying diseased plants	3.95[c]	0.95	3.86	0.89	- 0.09[d]
Irrigation of field grown plants	3.68	0.89	3.77	0.97	+ 0.09
Transplanting plant materials to the field	3.55	1.06	3.77	0.81	+ 0.22
Fruit/nut & vegetable composite mean	3.35		3.62		+ 0.27
Landscape Maintenance					
Identification of common turf diseases and pests	3.82	0.91	3.73	0.98	- 0.09
Maintenance practices of cool and warm season grasses	3.55	0.86	3.64	0.95	+ 0.09
Operation of different kinds of turf/lawn mowers	3.09	0.92	3.64	0.90	+ 0.55
Landscape maintenance composite mean	3.48		3.67		+ 0.19
Overall composite mean	3.35		3.66		+ 0.31

Note. Importance scale: 1=No Importance; 2=Low Importance; 3=Some Importance; 4=Much Importance; 5=High Importance

Note. [a] Prior to Instruction; [b] End of Instruction; [c] Maximum; [d] Minimum

Objective 3: Determine the need for pre-service education in horticulture, based on self-efficacy and importance perceptions of pre-service agricultural education students enrolled in Horticulture 1013-Principles of Horticultural Science, prior to and at the end of instruction, using the mean weighted discrepancy score approach (Borich, 1980).

To address objective 3, the researcher calculated mean weighted discrepancy scores (MWDS) for each of the 26 Oklahoma horticulture skills standards (Borich, 1980). The MWDS were then used to rank the skills standards to further determine pre-service agricultural education students' perceptions of their horticulture instructional needs prior to and at the end of instruction (Table 5). The MWDS accounted for any discrepancies between the students' perceptions of self-efficacy and their perceived importance of teaching the selected horticulture skills standards. When one skill standard was compared to the other skills standards, a larger MWDS indicated a higher level of instructional need for that horticulture skill standard.

Of the skills standards ranked in the top ten prior to instruction, five remained in the top 10 at the end of instruction: "identification of common turf diseases and pests," "harvesting techniques of trees and shrubs," "maintenance of greenhouse irrigation systems," "the effects of overspraying and underspraying diseased plants," and "identification of bulbs, tubers, and tuberous roots." Figure 4 depicts a change in MWDS per the two observations. Prior to instruction, the MWDS were larger than the scores at the end of instruction. The range of MWDS prior to instruction (5.55 to 0.56) was similar to the end of instruction (4.24 to 0.17), but the MWDS were more similar at the end of instruction.

Table 5

Comparison of Horticulture Skills Standards Using Rankings by Mean Weighted Discrepancy Scores

Prior to Instruction			End of Instruction	
MWDS[a]	Rank	Skills Standards	Rank	MWDS[a]
5.55	1	Identification of bulbs, tubers, and tuberous roots	10	1.42
5.39	2	The effects of overspraying and underspraying diseased plants	4	2.99
4.86	3	Identification of common turf diseases and pests	1	4.24
4.73	4	Maintenance of greenhouse irrigation systems	3	3.39
4.23	5	Plant propagation using air layering	19	0.77
4.11	6	Techniques of seed stratification	25	0.17
3.77	7	Harvesting techniques of trees and shrubs	2	3.77
3.66	8	Calculating seed germination percentages	18	0.81
3.56	9	Scarification of seeds	11	1.39
3.55	10	Transplanting plant materials to the field	21	0.69
3.42	11	Techniques for applying rooting hormone	24	0.17
3.37	12	Preparation techniques of growing media	5	2.48
3.32	13	Planting techniques for shrubs and trees: bare-root, container, and burlap	7	1.82
3.27	14	Transplanting bare-root plants or liners	12	1.21
3.23	15	Techniques for disbudding plants	20	0.69
3.22	16	Maintenance practices of cool and warm season grasses	9	1.49
2.90	17	Techniques for grafting trees	15	1.08
2.87	18	Techniques for pinching plants	26	0.17
2.85	19	Irrigation of field grown plants	13	1.20
2.81	20	The hardening-off process of seedlings and cuttings	22	0.55
2.57	21	The effects of plant photoperiod regulation	6	2.23
2.05	22	Application techniques of plant growth regulators	16	1.03
2.05	23	Techniques for pruning trees	17	0.82
1.97	24	Techniques for staking trees	14	1.13
1.81	25	Effects of insufficient spacing of plants	8	1.67
0.56	26	Operation of different kinds of turf/lawn mowers	23	0.50

Note. [a] Mean Weighted Discrepancy Score (MWDS)

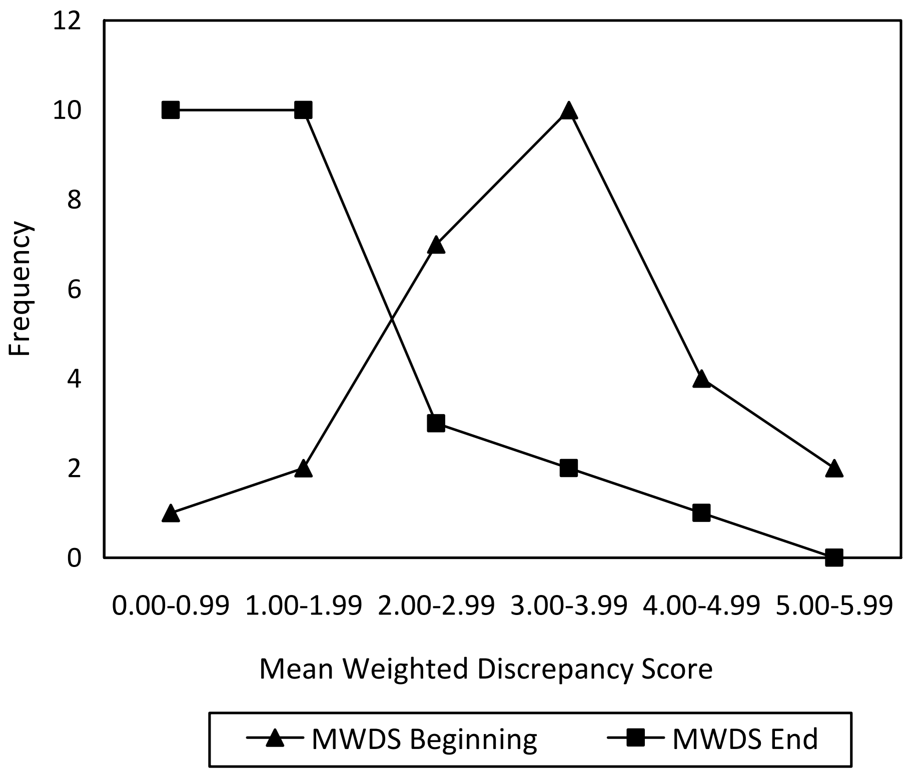

Figure 4. Frequency of MWDS in each grouping prior to and at the end of instruction.

Objective 4: Compare the pre-service agricultural education students' knowledge of selected horticulture skills standards, prior to the start of instruction and at the end of instruction, in Horticulture 1013-Principles of Horticultural Science.

The pre-service agricultural education students enrolled in Horticulture 1013-Principles of Horticultural Science, completed a 27 question criterion-referenced test prior to and at the end of instruction. It is important to note that only 26 questions were included in data analysis due to reasoning explained in chapter 3. The mean percent correct on the criterion-referenced test prior to instruction was 48.32% and the end of instruction mean was 62.96%. From the first administration to the second administration (Table 6), students increased their mean horticulture knowledge score 14.61%.

Table 6

Prior to Instruction and End of Instruction Horticulture Knowledge Test Scores(N = 22)

			Range	
	M	*SD*	Minimum (%)	Maximum (%)
Prior to Instruction Test	48.32	12.44	25.93	74.07
End of Instruction Test	62.96	14.14	33.33	88.89

The criterion-referenced test included three broad thematic areas: greenhouse/nursery, fruit/nut &vegetable, and landscape maintenance. The percent correct in each of the thematic areas increased from prior to instruction to the end of instruction (Table 7). This finding indicated greater knowledge acquisition of selected horticulture skills standards in each thematic area.

Table 7

Comparison of Pre-service Students' Thematic Horticulture Knowledge Test Scores Prior to Instruction and at the End of Instruction (N = 22)

			Range	
	M	*SD*	Minimum (%)	Maximum (%)
Prior to Instruction Test				
Greenhouse/Nursery	49.65	16.05	23.08	76.92
Fruit/Nut & Vegetable	48.64	18.85	10.00	90.00
Landscape Maintenance	37.88	31.36	0.00	100.00
End of Instruction Test				
Greenhouse/Nursery	63.99	15.46	38.46	84.62
Fruit/Nut &Vegetable	61.82	18.68	30.00	100.00
Landscape Maintenance	60.61	33.55	0.00	100.00

Objective 5: Determine the relationship between the pre-service agricultural education students' perceived self-efficacy to teach selected horticulture skills standards and their knowledge of horticulture and years of horticulture work experience.

To determine if a relationship existed between the pre-service agricultural education students' perceived self-efficacy to teach the selected horticulture skills standards, knowledge of the skills standards, and horticulture work experience, the researcher used a non-parametric correlation: Kendall's tau (τ) correlation coefficient (Field, 2000). The alpha was set *a priori* at the .05 level of significance. A summary of the correlation coefficients are displayed in Table 8. No statistically significant correlations were found between self-efficacy to teach horticulture skills standards, knowledge of horticulture, and years of horticulture work experience.

A low positive correlation was found between self-efficacy to teach horticulture and horticulture knowledge at the end of instruction; however, a negligible negative correlation was found prior to instruction (Davis, 1971). When graphically viewed as a scatterplot, the data points prior to instruction indicated a slightly negative trend (Figure 5). At the end of instruction, the data points displayed in a scatterplot showed a more positive trend (Figure 6).

Table 8

Kendall's tau (τ)Correlation Coefficient Between Perceived Self-efficacy, Horticulture Knowledge, and Work Experience: Prior to Instruction and at the End of Instruction

	Horticulture Knowledge		Work Experience	
	Prior To Instruction τ	End Of Instruction τ	Prior To Instruction τ	End Of Instruction τ
Self-efficacy	-.050	.178	.161	-.091

The researcher computed a Kendall's tau correlation coefficient to determine if a relationship existed between self-efficacy to teach horticulture and horticulture work experience (Table 8). A low positive correlation was found prior to instruction; however, a negligible negative correlation was found at the end of instruction (Davis, 1971).

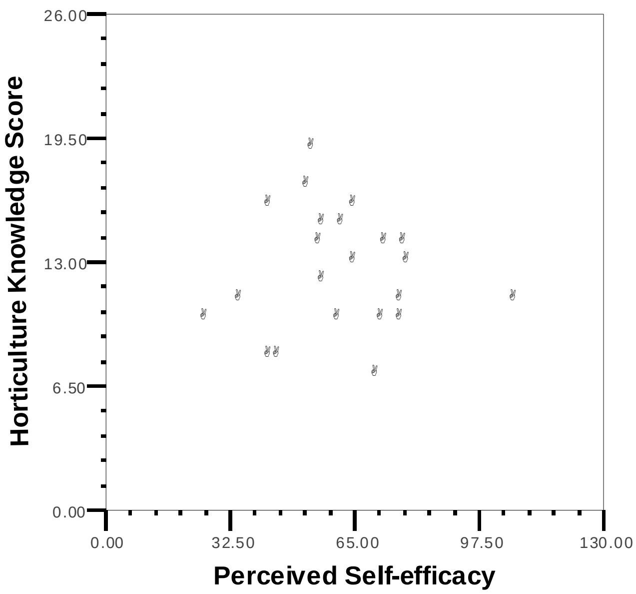

Figure 5. Scatterplot of student horticulture knowledge scores by student self-efficacy scores prior to instruction (Kendall's tau = -.050)

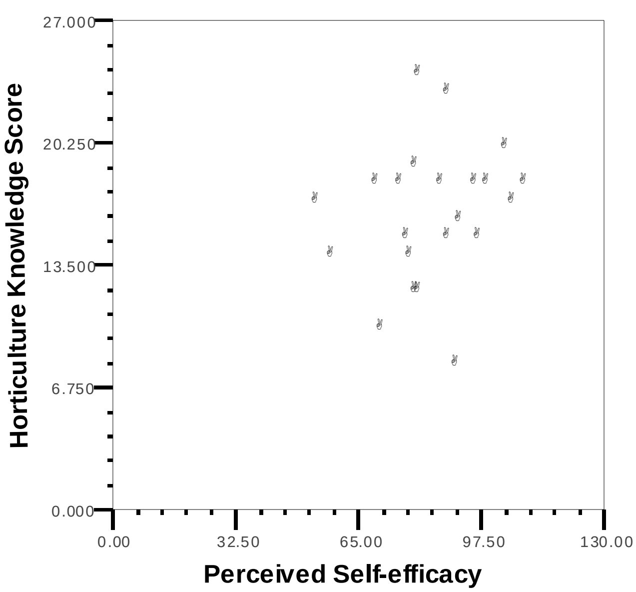

Figure 6. Scatterplot of student horticulture knowledge scores by student self-efficacy scores at the end of instruction (Kendall's tau = .178)

Table 9

Kendall's tau (τ) Correlation Coefficient Between Self-efficacy and Thematic Horticulture Knowledge

	Knowledge Score					
	Greenhouse/ Nursery		Fruit/Nut, & Vegetable		Landscape Maintenance	
	PI[a]	EI[b]	PI[a]	EI[b]	PI[a]	EI[b]
Self-efficacy to Teach	τ	τ	τ	τ	τ	τ
Greenhouse/Nursery	.181	.062				
Fruit/Nut & Vegetable			-.212	.191		
Landscape Maintenance					-.106	.075

Note. [a] PI = Prior to instruction and [b]EI = End of Instruction

The researcher calculated a Kendall's tau (τ) correlation coefficient to determine if a relationship existed between pre-service agricultural education students' self-efficacy to teach horticulture and knowledge of each thematic area: greenhouse /nursery, fruit/nut/vegetable, and landscape maintenance. Prior to instruction, a low positive correlation of .181 between self-efficacy and knowledge of greenhouse/nursery was found. At the end of instruction, the correlation became negligible, but remained positive (.062) (Davis, 1971). The relationship between self-efficacy and knowledge of fruit/nut/vegetable and landscape maintenance were both low negative correlations prior to instruction, but the correlations became slightly stronger (i.e., positive and negligible positive correlations) at the end of instruction, but no statistical significance was found.

Summary of Findings

1. Of the pre-service agricultural education students enrolled in the course, Horticulture 1013-Principles of Horticultural Science, 68.2% of the participants did not possess any years of horticulture work experience.
2. Of the total population (N=22), 63.9% of the students reported they completed no high school horticulture courses, and 77.3% of the students had not completed any college horticulture courses.
3. Prior to instruction, students' perceived self-efficacy to teach horticulture skills standards was "Below Average" (2.37), whereas, at the end of instruction, their self-efficacy was "Average Confidence" (3.26).
4. Prior to and at the end of instruction, pre-service agricultural education students perceived that teaching the horticulture skills standards held "Some Importance."
5. At the end of instruction, the highest ranking per-service horticulture instructional needs indicated were "identification of common turf diseases and pests," "harvesting techniques of trees and shrubs," and "maintenance of greenhouse irrigation systems" based on mean weighted discrepancy scores.
6. Students' horticulture knowledge increased from 48.32% prior to instruction to 62.96% at the end of instruction.
7. At the end of instruction, there was a low positive correlation (.178) between self-efficacy to teach and knowledge of horticulture skills standards; however this finding was not statistically significant.

CHAPTER V

CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

Summary

The purpose of this study was to determine pre-service agricultural education students' self-efficacy and perceived importance to teach horticulture. Also, the students' content knowledge of horticulture was determined at the beginning and at the end of instruction in the course, Horticulture 1013-Principles of Horticultural Science. Using the students' self-efficacy and importance scores, the researcher determined pre-service horticulture educational need using mean weighted discrepancy scores. Finally, this study explored if there was a relationship between the students' self-efficacy to teach horticulture and their knowledge of horticulture.

Research Objectives

1. Describe selected characteristics (age, gender, major, academic course work in horticulture, and horticulture work experience) of the pre-service agricultural education students enrolled in Horticulture 1013-Principles of Horticultural Science during the fall semester 2008.
2. Determine the students' perceived self-efficacy to teach selected horticulture skills standards and their perceived importance of teaching the selected horticulture skills standards in secondary agricultural education.

3. Determine the need for pre-service education in horticulture, based on self-efficacy and importance perceptions of pre-service agricultural education students enrolled in Horticulture 1013-Principles of Horticultural Science, prior to and at the end of instruction, using the mean weighted discrepancy score approach (Borich, 1980).
4. Compare the pre-service agricultural education students' knowledge of selected horticulture skills standards, prior to the start of instruction and at the end of instruction, in Horticulture 1013-Principles of Horticultural Science.
5. Determine the relationship between the pre-service agricultural education students' perceived self-efficacy to teach selected horticulture skills standards and their knowledge of horticulture and years of horticulture work experience.

Population

The population for this study included pre-service agricultural education students enrolled in the course, Horticulture 1013-Principles of Horticultural Science, at Oklahoma State University in the fall 2008 semester. A total of 22 pre-service agricultural education students were enrolled in the fall 2008 semester.

Design of the Study

The research design for this study was descriptive correlation. According to Creswell (2005), correlations are used when the researcher has two variables or constructs and needs to determine if one variable or construct has any influence on the other. The researcher used an explanatory research design which is one type of correlational research. This design was used because the researcher was interested in the relationship or if one variable was affected by another variable (Creswell, 2005). The intent of this study was to describe the population of pre-service agricultural education students enrolled in Horticulture 1013-Principles of Horticultural Science during the fall 2008 semester, and was not to predict the influence of one variable on another.

Data Collection

Data were collected by administering the same instrument prior to instruction and at the end of instruction in the course, Horticulture 1013-Principles of Horticultural Science. On Monday, August 18, 2008, during the fall 2008 semester, the researcher administered the instrument to all students enrolled in Horticulture 1013. The researcher administered the instrument again at the end of instruction on Monday, November 3, 2008, to only those students who completed the instrument on Monday, August 18, 2008. All instruction addressing the skills standards except “temperature and moisture requirements for postharvest plant storage” had occurred prior to this date. Since this skill standard was not taught prior to the second administration, the researcher did not use the data from this skill standard collected prior to instruction or at the end of instruction.

The instrument was administered in two parts: first, Section I-Perceived Confidence and Importance to Teach Horticulture Skills Standards was administered, and secondly, Section II-Horticulture Knowledge Test, and Section III-Demographic Information. Instrument sections were administered in this order so students’ perceptions were not biased after completing Section II-Horticulture Knowledge Test.

Data Analysis

Through the data collection process, each student was assigned a number via a table of random numbers. This number was consistent on both Section I Scantron form and Sections II and III Scantron form for each student. The Scantron forms were taken to the Oklahoma State University Assessment and Testing Center where they were scored and scanned into a Statistical Package for the Social Sciences (SPSS) file, which was provided to the researcher. The programs SPSS 15.0 for windows and Microsoft Excel 2007 were utilized by the researcher to analyze the data.

The researcher used frequencies, means, and standard deviations to describe the population characteristics and to determine the pre-service agricultural education students' self-efficacy to teach and perceived importance of, selected horticulture skills standards.

The Borich model was used to calculate a mean weighted discrepancy score (MWDS) (Borich, 1980), which enabled the researcher to systematically rank the horticulture skills standards. This allowed the researcher to identify "congruence between….what the teacher should be able to do and what the teacher can do" (Borich, 1980, p. 42). The need for pre-service and in-service training can be evaluated by using the Borich Model (Barrick, Ladewig, & Hedges, 1983; Borich, 1980). Barrick et al. (1983) concluded that "…using only the importance rankings or the knowledge rankings or the application rankings may not be valid. A combination of two or more rankings must be considered to form conclusions regarding inservice education needs" (p. 19).

The researcher computed a MWDS by first calculating a discrepancy score (DS) for each skill standard. A discrepancy score was calculated by subtracting each pre-service agricultural education student's confidence score from each student's importance score on each skill standard. Secondly, the researcher calculated a weighted discrepancy score. This was accomplished by multiplying each individual discrepancy score for a skill standard by the particular skill standard's mean importance score. This procedure was repeated for every skill standard and the product was the weighted discrepancy score. Next, the mean weighted discrepancy score (MWDS) was calculated by dividing the sum of the weighted discrepancy scores by the total number of pre-service agricultural education students who rated each skill standard (N = 22). Finally, the researcher ranked the skills standards highest to lowest, based on the mean weighted discrepancy score calculated for each skill standard (Barrick et al., 1983; Borich, 1980; Edwards & Briers, 1999; Newman & Johnson, 1994).

In this study, the researcher calculated a non-parametric Kendall's tau correlation coefficient between the students' self-efficacy to teach horticulture, horticulture knowledge achievement score, and years of horticulture work experience. A Kendall's tau correlation coefficient should be used "...when you have a small data set with a large number of tied ranks" (Field, 2000, p. 92). To classify the correlation coefficients, the researcher used conventions for describing correlations identified by Davis (1971). Correlations between .01 and .09 are negligible positive associations, correlations between .10 and .29 are low positive associations, correlations between .30 and .49 are moderate positive associations, correlations between .50 and .69 are substantial positive associations, correlations between .70 and .99 are very strong positive associations, and correlations of 1.00 is are perfect positive correlations (Davis, 1971).

Wingenbach et al. (2007) found a positive correlation, i.e., as pre-service agricultural education students' knowledge increased their perceived ability to teach increased. Bandura (1986) also concluded that a positive relationship existed between a student's knowledge level and his or her belief to successfully accomplish a task or objective. This supported the researcher's decision to calculate a correlation coefficient between students' self-efficacy to teach horticulture score, horticulture knowledge achievement score, and years of horticulture work experience.

Conclusions

The following conclusions were based on data collected for each of the five research objectives and the findings derived from the researcher's analysis and interpretation of the data.

Objective 1: Describe selected characteristics (age, gender, major, academic course work in horticulture, and horticulture work experience) of the pre-service agricultural education students enrolled in Horticulture 1013-Principles of Horticultural Science during the fall semester 2008.

The majority of pre-service agricultural education students in this study was male, and possessed similar characteristics including age, major, and grade point average when compared to studies conducted by Young and Edwards (2006) and Johnson, Ferguson, and Lester (2000). More than one-half of the population was classified as junior or senior students. Similar to Franklin (2008), over two-thirds of the population had no years of horticulture work experience. Also, the pre-service agricultural education students reported not being enrolled in any college-level horticulture courses before enrolling in Horticulture 1013-Principles of Horticulture Science.

Objective 2: Determine the students' perceived self-efficacy to teach selected horticulture skills standards and their perceived importance of teaching the selected horticulture skills standards in secondary agricultural education.

Regarding research objective two, the pre-service agricultural education students' mean self-efficacy score to teach horticulture skills standards increased from the beginning (2.37) to the end of instruction (3.26). The five skills standards with the highest self-efficacy score, "Average Confidence," were, "techniques for applying rooting hormone" (3.77), "techniques for pinching plants" (3.73), "techniques of seed stratification" (3.73), "techniques for disbudding plants" (3.64), and "transplanting plant materials to the field" (3.59). Notably, these particular skills standards were taught using applied teaching methods in the laboratory portion of the course Horticulture 1013. This conclusion was supported by Bandura (1997), that is, as students' range of mastery experiences expands, self-efficacy will increase or decrease depending on the experiences. The students' perceptions of importance in teaching the horticulture skills standards were similar prior to and at the end of instruction: "Some Importance."

Objective 3: Determine the need for pre-service education in horticulture, based on self-efficacy and importance perceptions of pre-service agricultural education students enrolled in Horticulture 1013-Principles of Horticultural Science, prior to and at the end of instruction, using the mean weighted discrepancy score approach (Borich, 1980).

Regarding research objective three, the pre-service students' horticulture instructional needs changed from "identification of bulbs, tubers, and tuberous roots" and "the effects of overspraying and underspraying diseased plants" at the beginning of instruction to "identification of common turf diseases and pests" and "harvesting techniques of trees and shrubs" at the end of instruction. However, five of the 10 highest ranked skills standards remained the same: "identification of common turf diseases and pests," "harvesting techniques of trees and shrubs," "maintenance of greenhouse irrigation systems," "the effects of overspraying and underspraying diseased plants," and "identification of bulbs, tubers, and tuberous roots."

Objective 4: Compare the pre-service agricultural education students' knowledge of selected horticulture skills standards, prior to the start of instruction and at the end of instruction, in Horticulture 1013-Principles of Horticultural Science.

Students' horticulture knowledge of the selected skills standards increased from the beginning to the end of instruction. Knowledge generally increased in all three thematic areas of horticulture: greenhouse/nursery, fruit/nut & vegetable, and landscape maintenance. Although there was an increase in horticulture knowledge prior to instruction compared to the end of instruction, it should be noted that the mean horticulture knowledge score was a grade of "D" (60-69%) at the end of the course, based on the grading scale for Horticulture 1013.

Objective 5: Determine the relationship between the pre-service agricultural education students' perceived self-efficacy to teach selected horticulture skills standards and their knowledge of horticulture and years of horticulture work experience.

Concerning research objective five, a low positive correlation existed at the end of instruction between the pre-service agricultural education students' horticulture knowledge and self-efficacy to teach horticulture. However, prior to instruction, a negligible negative correlation existed between horticulture knowledge and self-efficacy to teach horticulture. Although the correlation coefficients were not statistically significant, the relationships found were supported by Bandura's theory of self-efficacy (Bandura, 1997). As pre-service agricultural education students' horticultural knowledge increased, their self-efficacy to teach horticulture increased. Research in agricultural education by Wingenbach et al. (2007), reported similar findings. The correlation coefficients calculated between years of horticulture work experience and self-efficacy were also supported the theory of self-efficacy (Bandura, 1997). Students' years of horticulture work experience did not change during the study and students' self-efficacy increased from the beginning when compared to the end of instruction. Therefore, the negative relationship between years of horticulture work experience and self-efficacy found at the end of instruction was anticipated.

Recommendations

Recommendations for Research

Due to the small population size of this study, it is recommended that this study be replicated over multiple semesters to determine if a relationship exists between self-efficacy to teach horticulture and horticulture knowledge at Oklahoma State University and other pre-service agricultural education university program settings. Also, research should be conducted to determine if the pre-service agricultural education students' horticulture instructional needs at other universities are similar or different to those identified in this study.

Pre-service agricultural education students in this study, reported their self-efficacy to teach horticulture as "Average Confidence." Due to the relatively low self-efficacy reported, it raised questions relative to the self-efficacy of experienced Oklahoma agricultural educators' to teach horticulture and their knowledge of horticulture. Therefore, it is recommended to study the self-efficacy of current agricultural educators to better understand the role that experience may play regarding a teacher's perception of self-efficacy to teach horticulture.

The Oklahoma Department of Career and Technology Education identified horticulture as a content area to be taught in agricultural education programs. Moreover, Hall, Hodges, and Haydu, (2005) determined the horticulture industry continues to grow, thus the need for knowledgeable employees continues to grow. Therefore, research should be conducted to determine why some agricultural education programs include horticulture and others do not. Also, horticulture in-service education needs for agricultural educators should be studied using the Borich model to identify horticulture skills standards needed most by experienced educators. Borich (1980) maintained that the mean weighted discrepancy score approach and rankings derived, was an appropriate procedure for prioritizing the delivery of professional development topics for teachers.

Recommendations for Practice

The pre-service agricultural education students studied, possessed very little knowledge about horticulture prior to enrolling in Horticulture 1013. However, the majority of pre-service agricultural education students in this study reported they had been enrolled in either secondary agricultural education programs or participated in 4-H programs as youth. To assist students in gaining horticulture experience, agricultural educators and 4-H educators and volunteers should promote more educational experiences focused on the horticulture industry.

It was found in this study that students were most efficacious to teach skills standards that were learned in the laboratory portions of Horticulture 1013. Therefore, it is recommended that the instructors of Horticulture 1013-Principles of Horticultural Science should consider using additional applied teaching and learning methods when teaching students the horticultural principles and concepts. Furthermore, members of the

Department of Agricultural Education, Communications, and Leadership should work with members of the Department of Horticulture and Landscape Architecture to identify standards, developed by the Oklahoma Commission for Teacher Preparation, that are present in the horticulture curriculum; moreover, Oklahoma State University faculty members should determine if the existing Horticulture 1013 curriculum should be modified to incorporate additional standards.

Implications

Implications for Secondary Agricultural Education Programs

According to the Oklahoma Department of Career and Technology Education, horticulture is a career pathway that may be taught in secondary agricultural education programs. Based on the findings of this study, pre-service agricultural education students are entering college with minimal horticulture knowledge. According to Bandura (1997), individuals who have not had experience via the four sources of efficacy, that is, mastery experience, vicarious experience, physiological state, or verbal persuasion, would be expected to possess low self-efficacy regarding the accomplishment of a specific task. According to Feiman-Nemser (2001), pre-service students bring ideas about what their teacher preparation should encompass to their initial professional development experiences; therefore, students who have not been exposed to horticulture educational experiences or horticulture work experiences prior to college, may consider this context of agriculture less valuable than others. In addition, science principles taught in the context of horticulture could be made transparent in secondary agricultural education programs thus enabling students to better transfer their learning to post secondary education in agriculture that requires science knowledge..

Implications for Oklahoma Agricultural Education Teacher Preparation

Pre-service agricultural education students are required to complete the course, Horticulture 1013-Principles of Horticultural Science, as part of the requirements for teacher certification in the state of Oklahoma. This study concluded that a limited number of horticulture skills standards were being taught. Based on these findings, the Oklahoma skills standards should be cross-referenced with the Oklahoma State University horticulture curriculum to determine if additional courses are needed (Darling-Hammond & Bransford, 2005).

Implications for the Course Horticulture 1013-Principles of Horticultural Science

This study examined 26 of approximately 278 horticulture skills standards identified for the Oklahoma secondary agricultural education curriculum. These 26 skills standards, which were aligned with the content of Horticulture 1013, accounted for a small portion of the Horticulture 1013 content taught each semester. Thought should be given to the possibility of addressing more of the horticulture skills standards in the course. As noted in this study, a low positive relationship was found between horticulture knowledge and self-efficacy to teach horticulture. Additionally, to promote more interactive learning, one might include additional small scale application activities in the laboratory experience to apply additional scientific concepts taught in the lecture portion of the course. If additional application experiences were incorporated, pre-service agricultural education students' self-efficacy to teach horticulture may increase (Bandura, 1997).

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APPENDIX A

INSTITUTIONAL REVIEW BOARD APPROVAL FORM

Oklahoma State University Institutional Review Board

Date:	Friday, April 18, 2008
IRB Application No	AG0818
Proposal Title:	Pre-Service Agricultural Educators' Knowledge, Perceived Level of Self Efficacy, and Perceived Importance to Teach Horticulture Topics
Reviewed and Processed as:	Exempt

Status Recommended by Reviewer(s): Approved Protocol Expires: 4/17/2009

Principal Investigator(s):

Eric G. Kennel	James Leising
360 Ag Hall	139 Ag Hall
Stillwater, OK 74078	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

APPENDIX B

INFORMED CONSENT FORM

Okla. State Univ.
IRB
Approved 4/18/08
Expires 4/17/09
IRB # AG0818

Informed Consent

Project Title:

- Pre-Service Agricultural Educators' Knowledge, Perceived Level Of Self Efficacy, and Perceived Importance To Teach Horticulture Topics

Investigator:

- Eric G. Kennel, Masters of Science Graduate Student

Purpose:

- The purpose of this research study is to determine the knowledge, perceived level of self-efficacy to teach, and importance of horticulture among pre-service agricultural education students enrolled in Introduction to Horticulture at Oklahoma State University.
- Students enrolled in Introduction to Horticulture are the subjects asked to participate because this course is the foundation and only horticulture course which pre-service agricultural education students are required to enroll in to meet the graduation and agricultural education teacher credential requirements in the state of Oklahoma.
- The following information will be documented for two semesters (spring 2008 and fall 2008).
    - Demographic characteristics including gender, college classification, academic major, and previous horticulture experience.
    - Students' knowledge of horticulture.
    - Students' perceived level of self-efficacy to teach horticulture topics.
    - Students' perception of the importance of horticulture topics.

Procedures:

The subjects will be asked to…

- Complete the instrument titled Perceptions and Knowledge of Teaching Horticulture, which will be administrated as a Pilot Test (Participants in spring 2008 only) and as a Pre and Posttest (Participants in fall 2008 only).

- Within the instrument, subjects will be asked to…

    - Identify demographic areas: gender, college classification, academic major, and previous horticulture experience.
    - Answer 27 horticulture content questions.
    - Identify his/her perceived level of self-efficacy to teach selected horticulture Oklahoma Secondary Agricultural Education Skill Standards.
    - Indicate his/her perception of the importance of the selected horticulture Oklahoma Secondary Agricultural Education Skill Standards.

Okla. State Univ.
IRB
Approved 6/18/08
Expires 4/17/09
IRB# AG0818

Informed Consent

Risks of Participation:

- There are no risks associated with this project which are greater than those ordinarily encountered in daily life.

Benefits:

- The knowledge portion of the instrument will allow the subject to think about the content in which he/she will possibly utilize in future endeavors as an educator.
- The results from this study will assist teacher educators in agricultural education at Oklahoma State University in understanding how pre-service agricultural educators in the program perceive horticulture as part of the secondary agricultural education curriculum.
- Faculty who teach HORT 1013, Introduction to Horticulture, will be able to use the results in considering future course modifications to improve student learning.

Confidentiality:

- The subject's name will not be required on the instrument booklet or scantron form.
- The number on their instrument booklet and scantron form corresponds with the subject's name which was randomly assigned using a table of random numbers to eliminate subject identification by people other than Eric G. Kennel.
- Eric G. Kennel will possess one master list in an electronic format to identify subjects who are absent. This will allow the researcher to offer the opportunity to participate to those subjects not present. The master list will be shredded two months after the data is collected in fall semester of 2008.
- Eric G. Kennel will keep all the instrument booklets and scantron forms confidential by storing them in a locked private file cabinet in 108 Agriculture North.
- Eric G. Kennel will store the completed instruments in 108 Agriculture North in a locked confidential file cabinet for less than one year and then the documents will be shredded.
- The electronic data file consisting of the collected data will be stored on Eric G. Kennel's personal computer which is password protected and in a locked office 108 Agriculture North.
- The records of this study will be kept private. Any written results will report group findings and will not include information that will identify individuals. Research records will be stored securely and only researchers and individuals responsible for research oversight will have access to the records. It is possible that the consent process and data collection will be observed by research oversight staff responsible for safeguarding the rights and well being of people who participate in research.

Compensation:

- There is no compensation offered to students for participating in this study.

Okla. State Univ.
IRB
Approved 4/18/08
Expires 4/17/09
IRB# AG0818

Informed Consent

Contacts:

Mr. Eric Gregory Kennel
Graduate Student
360 Agriculture Hall
Stillwater, OK 74078
(513) 266-2521
eric.kennel@okstate.edu

If you have questions about your rights as a research volunteer, you may contact;
Dr. Shelia Kennison, IRB Chair
219 Cordell North
Stillwater, OK 74078
(405) 744-1676
irb@okstate.edu

Participant Rights:

- **To be read out loud prior to administration of the instrument.**
- Please understand that your participation in this study is completely voluntary and you may discontinue or withdraw from the study at any point in time without reprisal or penalty. There are no risks or penalties that subjects will face if he/she withdraws from the study. Please contact Eric Gregory Kennel if you decide to withdraw from the study. There would be no reason for a subject to be terminated from the study.

Signatures:

I have read and fully understand the consent form. I sign it freely and voluntarily. A copy of this form has been given to me.

________________________ _______________

Signature of Participant *Date*

I certify that I have personally explained this document before requesting that the participant sign it.

________________________ _______________

Signature of Researcher *Date*

APPENDIX C

INSTRUMENT SECTION I

Section I: Perceived Confidence and Importance to Teach Horticulture Skill Standards

Directions: Please rate your level of **confidence** to teach the Oklahoma Secondary Agricultural Education Horticulture Skill Standards **and** rate their **importance** in the curriculum. Please indicate your response on the scantron form using the #2 pencil provided.

ID NUMBER: 21

SPECIAL CODES: A B C D E F G H I J

CONFIDENCE

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

IMPORTANCE

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

GENERAL PURPOSE DATA SHEET IV form no. 76657

To teach:	CONFIDENCE	IMPORTANCE
operation of different kinds of turf/lawn mowers	3 A B C D E	4 A B C D E
maintenance practices of cool and warm season grasses	5 A B C D E	6 A B C D E
identification of common turf diseases and pests	7 A B C D E	8 A B C D E
preparation techniques of growing media	9 A B C D E	10 A B C D E
calculating seed germination percentages	11 A B C D E	12 A B C D E
techniques of seed stratification	13 A B C D E	14 A B C D E
the hardening-off process of seedlings and cuttings	15 A B C D E	16 A B C D E
techniques for grafting trees	17 A B C D E	18 A B C D E
transplanting plant materials to the field	19 A B C D E	20 A B C D E
techniques for pruning trees	21 A B C D E	22 A B C D E
irrigation of field grown plants	23 A B C D E	24 A B C D E
the effects of overspraying and underspraying diseased plants	25 A B C D E	26 A B C D E
temperature and moisture requirements for postharvest plant storage	27 A B C D E	28 A B C D E
scarification of seeds	29 A B C D E	30 A B C D E
techniques for applying rooting hormone to plant cuttings	31 A B C D E	32 A B C D E
plant propagation using air layering	33 A B C D E	34 A B C D E
planting techniques for shrubs and trees: bare root, container, and burlap	35 A B C D E	36 A B C D E
techniques for staking trees	37 A B C D E	38 A B C D E
transplanting techniques for trees that are bare-root or in liners	39 A B C D E	40 A B C D E
techniques for disbudding plants	41 A B C D E	42 A B C D E
techniques for pinching plants	43 A B C D E	44 A B C D E
the effects of insufficient spacing of plants	45 A B C D E	46 A B C D E
the effects of plant photoperiod regulation	47 A B C D E	48 A B C D E
application techniques of plant growth regulators	49 A B C D E	50 A B C D E
identification of bulbs, tubers, and tuberous roots	51 A B C D E	52 A B C D E
maintenance of greenhouse irrigation systems	53 A B C D E	54 A B C D E
harvesting techniques of trees and shrubs	55 A B C D E	56 A B C D E
	57 XXXXXX	XXXXXX
	59 XXXXXX	XXXXXX
	61 XXXXXX	XXXXXX
	63 XXXXXX	XXXXXX
	65 XXXXXX	XXXXXX
	67 XXXXXX	XXXXXX
	69 XXXXXX	XXXXXX
	71 XXXXXX	XXXXXX

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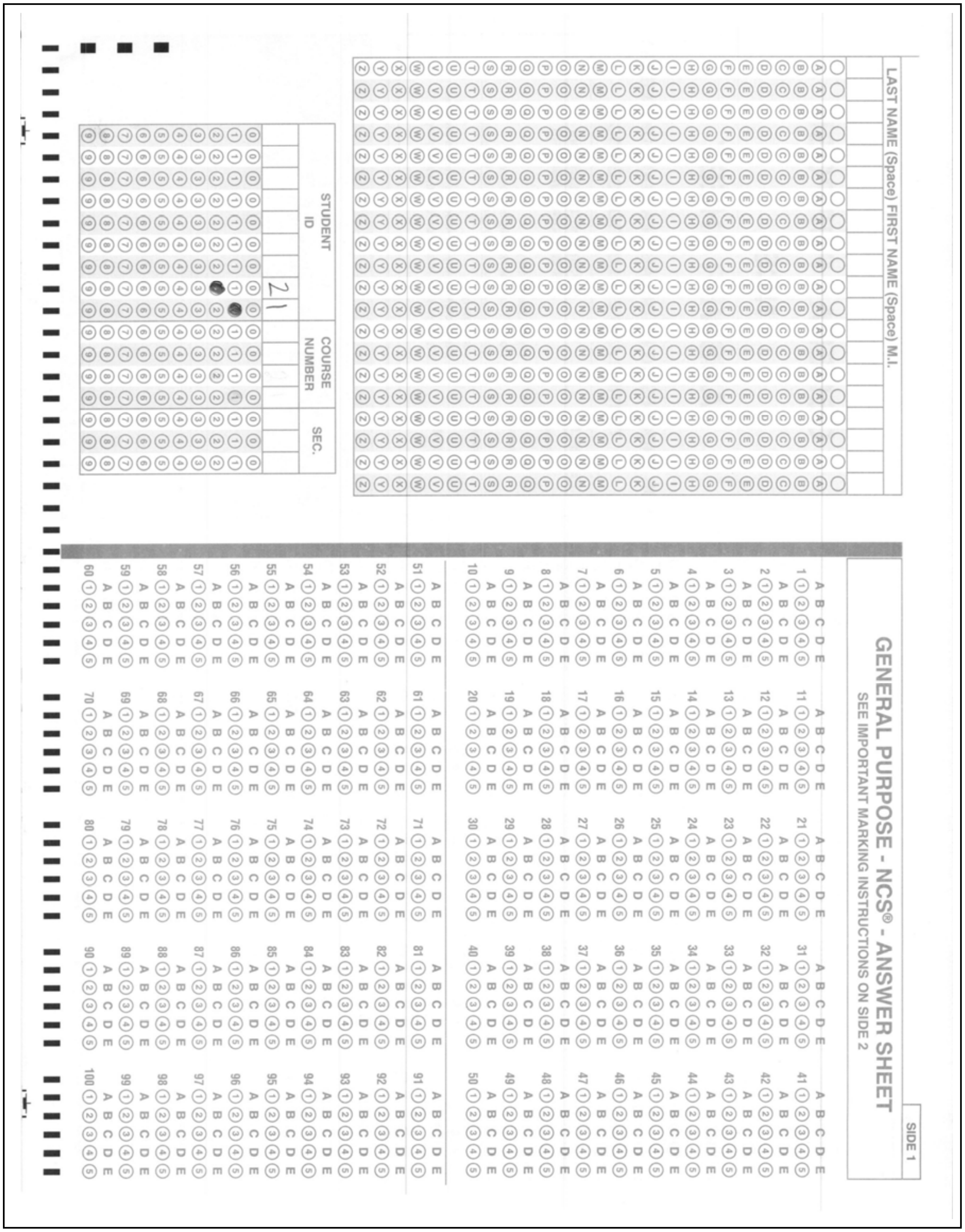
APPENDIX D

SCANTRON AND INSTRUMENT SECTIONS II AND III


GENERAL PURPOSE - NCS® - ANSWER SHEET
SEE IMPORTANT MARKING INSTRUCTIONS ON SIDE 2
SIDE 1
LAST NAME (Space) FIRST NAME (Space) M.I.
STUDENT ID
COURSE NUMBER
SEC.
21

Section II: Horticulture Knowledge

Directions: Please shade the most correct response on the attached **ORANGE** scantron form with the #2 pencil provided.

1. Many tree fruits, ornamental trees, and some vine fruits are from grafted plants. Reason(s) for grafting a scion (top) on to a different rootstock is (are)….

   a. To alter tree size.
   b. To provide resistance to soil-borne organisms.
   c. To provide tolerance to unfavorable soil conditions.
   d. To provide resistance to low winter temperatures.
   e. All of the above.

2. To determine the percent (%) germination of a crop, the grower would need to use the following formula…

   a. Total seeds planted ÷ total germinated seeds x 100
   b. Total seeds planted × total germinated seeds x 100
   c. Total germinated seeds ÷ total seeds planted x 100
   d. Total germinated seeds × total seeds planted x 100
   e. None of the above.

3. If a horticulturalist needed to satisfy physiological dormancy in a population of seeds, he/she should use which of the following method to break dormancy.

   a. Stratification
   b. Sterilization
   c. Scarification
   d. None of the above.

4. To reduce the likelihood of Spring Dead Spot on Bermuda grass, do not apply nitrogen fertilizer in the fall.

   a. True
   b. False

1

5. Tall fescue prefers to be grown in…

   a. Full sun
   b. Partial sun
   c. Full shade

6. Potting media containing ___________________ is mostly used in greenhouses and nurseries for growing of a variety of plants.

   a. Native soil
   b. Sterile media
   c. Organic matter
   d. None of the above

7. Plants tolerate freezing by "hardening," which is a metabolic response to low temperatures, this affects plants that are classified as…

   a. Perennials
   b. Biennials
   c. Artic plants
   d. All of the above

8. What is the proper time of year to prune conifers?

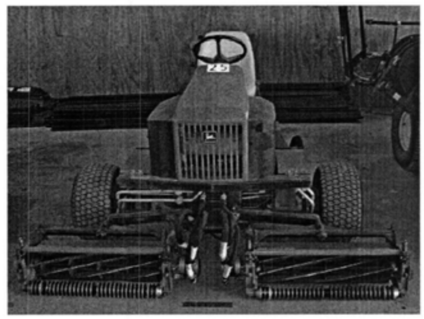
   a. Late winter
   b. Late spring
   c. Late summer

9. Choose the ONE statement that is TRUE.

   a. Newly-planted trees should never be staked.
   b. Newly-planted trees should be staked and braced so that the trunk cannot move.
   c. Newly-planted trees that require staking should be given some flexibility so that the trunk can move.

10. The image at the right is a….

a. Rotary mower
b. Reel mower
c. Push mower
d. None of the above



11. When planting a tree, one should back fill the hole with…

a. Native soil amended with sand.
b. Native soil only.
c. Native soil amended with peat moss.
d. Native soil amended with well-rotted manure.

12. The technique of "pinching" is one method used to break apical dominance in plants.

a. True
b. False

13. In general when applying chemicals on plants, the applicator must know the chemical's application rate because disorders could be caused by excess or deficient application.

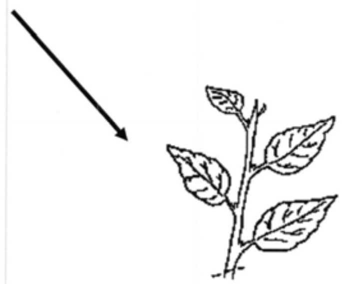
a. True
b. False

14. For optimal production in a grove, pecan trees need…

   a. 25% sunlight at Noon in the summer.
   b. 50% sunlight at Noon in the summer.
   c. 75% sunlight at Noon in the summer.
   d. 100% sunlight at Noon in the summer.

15. Should one recommend application of a rooting hormone to the type of cutting shown in the illustration?

   a. Yes
   b. No



16. When a home owner buys nursery plants to incorporate in his/her landscape, which type or types of plants could he/she purchase?

   a. Balled and burlapped
   b. Containerized
   c. Bare root
   d. All are acceptable to choose from.

17. In air-layering, the part to be rooted is left attached to the mother plant, from which it receives water and nutrients during rooting.

   a. True
   b. False

18. A "disbud pot mum" is produced by which disbudding technique?

    a. Center Bud Removal (CBR)
    b. Side Bud Removal (SBR)
    c. Zero Bud Removal (ZBR)

19. Of the two most common types of irrigation, sprinkler or drip, drip irrigation is the most efficient for containerized nursery production.

    a. True
    b. False

20. Scarification is a method used to break physiological dormancy.

    a. True
    b. False

21. When applying plant growth regulators (PGR) using a foliar spray, it is important to know if the PGR is also an effective drench, (meaning the plant can absorb the PGR through the roots).

    a. True
    b. False

22. A grower could use night interruption lighting or black cloth to manipulate the plant …..

    a. Turgidity
    b. Photoperiod
    c. Light saturation point
    d. None of the above

23. Which type of irrigation listed below is the most efficient in terms of water usage?

a. Drip irrigation
b. Flood Irrigation
c. Furrow Irrigation
d. Both “a” and “b”, which are equally efficient.

24. The mechanism(s) of plant food preservation include(s)…

a. Lowering temperature
b. Lowering free water content
c. Changing acid content of food
d. Killing undesirable microorganisms
e. All of the above

25. When planting trees in general, a grower should prepare a hole in the ground that is…

a. Three times the diameter of the root mass only.
b. Twice the diameter of the root mass only.
c. Twice the diameter of the root mass and the same depth as the root mass.
d. Three times the diameter of the root mass and the same depth as the root mass.

26. This image is of a…

a. Tuber
b. Corm
c. True bulb
d. Tuberous root

27. It is estimated that balling and burlapping retains about…

a. 5% of the plant's root system
b. 25% of the plant's root system
c. 50% of the plant's root system
d. 85% of the plant's root system

Section III: Background Information:

Directions: Please continue to mark the most correct answer by shading in the corresponding letter on the attached **ORANGE** scantron form using the #2 pencil provided.

28. Please indicate your college GPA:

a. 0 to 1.0
b. 1.1 to 2.0
c. 2.1 to 3.0
d. 3.1 to 4.0

29. What is your age?

a. 18
b. 19
c. 20
d. 21
e. 22 or older

30. What is your gender?

a. Female
b. Male

31. What is your college classification?

a. Freshman *(< 28 semester credit hours)*
b. Sophomore *(28 – 59 semester credit hours)*
c. Junior *(60 – 93 semester credit hours)*
d. Senior *(94 or more semester credit hours)*
e. Graduate Student

32. What is your academic major at OSU?

a. Agricultural Education
b. Animal Science/Agricultural Education Double Major
c. Horticulture
d. Landscape Architecture
e. Other

33. Have you completed high school course(s) in horticulture?

a. Yes
b. No

34. How many high school level courses of horticulture have you completed?

a. I have not completed any courses.
b. 1 to 2 course(s)
c. 3 to 4 courses
d. 5 to 6 courses
e. 7 or more courses

35. Have you completed a college academic course(s) in horticulture other than the course Introduction to Horticulture (HORT 1013)?

a. Yes
b. No

36. How many college level courses of horticulture have you completed?

a. I have not completed any courses.
b. 1 to 2 course(s)
c. 3 to 4 courses
d. 5 to 6 courses
e. 7 or more courses

37. Indicate how many years of work experience you have in the following areas of the horticultural industry (floriculture, greenhouse management, nursery management, pomology, olericulture, landscape architecture, and/or turfgrass management).

a. No work experience
b. Less than one year
c. 1 to 3 years
d. More than 3 years

38. Please indicate if you have participated in a horticulture program in 4-H or in high school agricultural education(Ag Ed):

a. *No,* I was not enrolled in either program.
b. *No*, I did not participate in horticulture activities in either program.
c. *Yes*, I participated in horticulture activities in an **Ag Ed program.**
d. *Yes*, I participated in horticulture activities in a **4-H program.**
e. *Yes*, I participated in horticulture activities in **both programs.**

39. Do you care for plants in your home or apartment?

a. Yes
b. No

9

APPENDIX E

OKLAHOMA DEPARTMENT OF CAREER AND TECHNOLOGY EDUCATION

HORTICULTURE SKILLS STANDARDS

HORTICULTURE GREENHOUSE/ NURSERY TECHNICIAN SKILLS STANDARDS
OD36202

ENDORSED BY
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GREENHOUSE GROWER'S ASSOCIATION
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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 *Career*Tech and its competency-based system of instruction. Skills standards, curriculum, and assessments that identify and reinforce industry expectations provide accountability for programs and assure *Career*Tech's continued role in preparing skilled workers for a global job market

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HORTICULTURE
GREENHOUSE/NURSERY TECHNICIAN
SKILLS STANDARDS
Frequency and Criticality Ratings

Duty A: Demonstrate Employability Skills
Duty B: Prepare Soil and Growing Media
Duty C: Propagate Horticultural Plants
Duty D: Grow Plants
Duty E: Control Disease, Weeds and Pests
Duty F: Irrigate Horticultural Crops
Duty G: Harvest Plants
Duty H: Store, Ship, Take Inventory, and Maintain Merchandise
Duty I: Sell Horticultural Products
Duty J: Operate Equipment
Duty K: Maintain and Repair Equipment and Facilities
Duty L: Monitor and Operate Environmental Controls
Duty M: Plant Identification

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: Demonstrate Employability Skills

CODE	TASK	F/C
A.01	Read, maintain, and follow schedule (responsible, arrive on time.)	3/3
A.02	Dress appropriately	2/2
A.03	Demonstrate an enthusiastic attitude	1/1
A.04	Interpret and follow written and oral directions	3/3
A.05	Use proper telephone skills	2/2
A.06	Use customer service skills	2/2
A.07	Determine daily assignments	2/2
A.08	Train other employees	1/1

A.09	Maintain a courteous and responsive attitude toward all customers and co-workers	3/3

DUTY B: Prepare Soil and Growing Media

CODE	TASK	F/C
B.01	Pasteurize growing media	3/3
B.02	Sterilize media with chemical soil sterilant • Heat • Steam • Chemical • Biological	3/3
B.03	Mix growing media • Media components • Breaking down a media recipe	3/3
B.04	Adjust pH of growing media • Acidity • Alkalinity • Nutrient availability • Optimum level of pH in plants	2/2
B.05	Incorporate fertilizer into growing media • Macronutrients (nitrogen, phosphorus, potassium) • Organic and inorganic • Soil testing	3/3
B.06	Store growing media • Procedures to prevent contamination • Sanitation	1/1

DUTY C: Propagate Horticultural Plants

CODE	TASK	F/C
C.01	Sow, stratify, and scarify seeds	3/2
C.02	Harden off seedlings	3/2
C.03	Transplant seedlings	3/2
C.04	Take cuttings	3/3
C.05	Apply root hormones • Dusting • Dipping • Spraying	3/3
C.06	Stick cuttings in medium • Sand • Vermiculite	2/1
C.07	Harden off cuttings	2/3
C.08	Propagate plants using air layering	2/2
C.09	Propagate plants by division	3/3
C.10	Operate mist system	3/3
C.11	Label stock plants and cuttings	3/3
C.12	Plant shrubs and trees • Bare-root • Container	3/3

	• Burlap	

DUTY D: Grow Plants

CODE	TASK	F/C
D.01	Transplant bare-root plants or liners	3/2
D.02	Prune plants	2/3
D.03	Pot plants	3/3
D.04	Label plants	3/3
D.05	Disbud plants	2/2
D.06	Stake plants	2/2
D.07	Pinch plants	2/2
D.08	Fertilize plants	2/2
D.09	Establish plant spacing • Competition for light, water, nutrients, and spacing • Effects of insufficient spacing	3/3
D.10	Regulate plant photoperiod	2/3
D.11	Apply growth regulator to crops	2/2
D.12	Plant and force bulbs, corms, tubers, and tuberous roots • Selection • Growing environments	2/2
D.13	Determine plant watering needs	3/3

DUTY E: Control Disease, Weeds, and Pests

CODE	TASK	F/C
E.01	Demonstrate safe handling, storage, and application of pesticides	3/3
E.02	Demonstrate first aid treatment for pesticides	1/3
E.03	Clean spray equipment after use	3/3
E.04	Read and interpret label	3/3
E.05	Recognize and remove weeds from potted plants	2/2
E.06	Remove weeds with power tools	2/2
E.07	Control weeds around the premises	2/2
E.08	Discuss greenhouse fumigation	1/3
E.09	Treat bulbs or corms to control insects or diseases	1/2
E.10	Scout for disease, insect problems, and unhealthy plants -Identify diseases found -Removal of diseased or infested plants -Insect and non-insect related damage	3/3
E.11	Apply mulches • Reasons for mulching • Varieties of mulches	2/2
E.12	Discuss Private Applicator's License	2/2

DUTY F: Irrigate Horticultural Crops

CODE	TASK	F/C
F.01	Irrigate field and container-grown plants • Methods • Tools	3/3
F.02	Discuss irrigation systems	2/2

DUTY G: Harvest Plants

CODE	TASK	F/C
G.01	Collect, label, clean, and store seeds	1/1
G.02	Discuss ball trees and shrubs • Manual vs. mechanical	1/1
G.03	Select and prepare plant materials for shipment	3/2
G.04	Grade plant materials • Recognize problems • Quality control and plant damage	1/2
G.05	Inventory plants • Recordkeeping • Availability of product	3/3
G.06	Groom plants for sale • Remove dead leaves • Pinching • Pruning	3/3
G.07	Load and move potted plants to parking area or house	2/2

DUTY H: Store, Ship, Take Inventory, and Maintain Merchandise

CODE	TASK	F/C
H.01	Prepare beds for winter storage of plant materials • Heeling in methods • Cold frames • Microfoam and mulching • Temperature control • Moisture regulation	2/2
H.02	Check received merchandise and plant materials against invoice listings • Quality and numbers • Insects and disease	3/3
H.03	Keep current inventory of products	2/3
H.04	Load delivery vehicle • Proper loading and handling techniques • Wind protection • Sequence the drops	3/3
H.05	Deliver products to customer • Being on time • Representing the company • Quality of service • Driving record	3/3

DUTY I: Sell Horticultural Products

CODE	TASK	F/C
I.01	Use good customer relations	3/3
I.02	Interpret warranties and guarantees for customers • Understand company policy	3/3
I.04	Build (counter and table-top) displays • Facing shelves	1/1
I.05	Build exterior displays • Basic marketing	1/1
I.06	Design and letter show cards	1/1
I.07	Present sales information to customer	3/3
I.08	Prepare sales invoice • Write legibly	2/3
I.09	Deliver products to customer	2/2
I.10	Price horticultural products • Basic understanding of profit • Calculate standard markups, markdowns, and profit	1/1
I.11	Operate cash register • Make change	3/3

DUTY J: Operate Equipment

CODE	TASK	F/C
J.01	Edge a sidewalk with edger	1/1
J.02	Rake leaves with a blower	1/1
J.03	Prepare soil with rotary tiller	1/1
J.04	Mow grass with a mower (rotary or reel-type)	2/2
J.05	Cut grass with string trimmer	2/2
J.06	Compact a newly seeded or sodded lawn with roller	2/2
J.07	Aerate sod	2/3
J.08	Maintain equipment	2/3
J.09	Clean and lubricate equipment • Check oil, battery, radiator, air cleaner, tire pressure	2/3
J.10	Wear proper attire while operating equipment • Safety guards	3/3

DUTY K: Maintain and Repair Equipment and Facilities

CODE	TASK	F/C
K.01	Store flammable materials	2/3
K.02	Prepare equipment for winter storage • Clean, repair, repaint	1/2
K.03	Construct temporary growing structures	2/2
K.04	Sharpen hand tools and blades	2/2
K.05	Perform preventative maintenance on equipment	2/3
K.06	Perform minor engine tune-up	1/2

K.07	Service engine, oil, and filters	1/1
K.08	Clean work area	3/3
K.09	Dispose of waste materials	1/3
K.10	Clean and lubricate equipment	3/3
K.11	Maintain pesticide application equipment • Certification requirements	2/2
K.12	Discuss growing structure heating and cooling systems	3/3
K.13	Order repair parts for equipment • Locate model number and serial number • Identify parts for ordering	1/1

DUTY L: Monitor and Operate Environmental Controls

CODE	TASK	F/C
L.01	Monitor automatic devices to control greenhouse temperature, humidity, and ventilation	3/3
L.02	Install heating cables or mats	1/3
L.03	Discuss shade and black cloth	2/2

DUTY M: Plant Identification

CODE	TASK	F/C
M.01	Properly identify the following cut flowers and foliage: • Alstroemeria • Baby's breath • Bird of Paradise • Carnation • Cattleya orchid • Chrysanthemum • Chrysanthemum, Pompon • Cymbidium • Daffodil • Delphinium • Eucalyptus • Fern, Flat • Fern, Leatherleaf or Baker's • Gardenia • Gerbera Daisy • Gladiola • Heather • Huckleberry • Iris • Lemon Leaf or Salal • Marguerite Daisy • Plumosa • Protea • Ranunculus • Rose, Hybrid Tea • Rose, Floribunda or Sweetheart	3/3

	• Rubrum Lily • Scotch Broom • Snapdragon • Statice, seafoam • Stephanotis • Tulip	
M.02	Properly identify the following deciduous trees: • Ash, Green • Birch, River • Crabapple, Flowering • Cypress, Bald • Dogwood, Flowering • Elm, Lacebark • Goldenrain Tree • Honeylocust, Thornless • Maple, Silver • Maple, Sugar • Oak, Pin • Oak, Water • Pear, Bradford • Pistache, Chinese • Purple-leaved Plum • Redbud. Eastern • Russian Olive • Sweetgum, American • Sycamore or American Plane Tree • Weeping willow	3/3
M.03	Properly identify the following deciduous shrubs: • Althea, or Rose-of-Sharon • Barberry, Japanese • Crape Myrtle • "Crimson Pygmy" Barberry • Euonymus, Winged • Flowering Quince • Forsythia or Golden Bell • French Hybrid Lilac • Honeysuckle, Tatarian • Jasmine, Winter • Lilac, Persian • "Linwood Gold" Forsythia • Persian Lilac • Potentilla • Privet • Roses • Spirea, Anthony Waterer	3/3
M.04	Properly identify the following evergreens: • Arborvitae, Oriental • Cedar, Atlas • Cedar, Incense • Creeping Juniper • Juniper, Chinese	3/3

	• Juniper, Rocky Mountain • Pine, Austrian • Pine, Mugo • Pine, Scotch • Pine, Ponderosa • Pine, Slash • Red Cedar, Eastern • Spruce, Colorado Blue	
M.05	Properly identify the following broad-leaved evergreen trees: • Holly, American • Laurel, Cherry • Magnolia, Southern • Oak, Live	3/3
M.06	Properly identify the following garden annuals: • Ageratum • Alyssum • Amaranthus • Balsam (Lady's Slipper) • Begonia • Bells of Ireland • Browallia • Calendula • Calliopsis • Capiseum (Ornamental pepper) • Carnation (annual) • Castor Bean • Celosia (Cockscomb) • Centaurea (Cornflower) • Chrysanthemum (annual) • Cleome (Spiderflower) • Coleus • Cosmos • Dianthus (annual pinks) • Dusty Miller • Gaillardia (annual) • Geranium (seed) • Gomphrena (Globe Amaranth) • Helichrysum (Strawflower) • Impatiens (Sultana) • Lobelia • Marigold • Matricaria (Feverfew) • Nasturtium • Nicotiana (Flowering tobacco) • Nierembergia (Cupflower) • Pansy • Periwinkle • Petunia • Phlox, Drummond (annual) • Portulaca (Rose Moss) • Rudbeckia (Coneflower)	3/3

	• Salvia • Scabiosa (Pincushion flower) • Snapdragon • Sweet peas • Verbena • Zinnia	
M.07	Properly identify the following garden biennials: • Foxglove • Hollyhock • Lunaria (Money plant) • Sweet William	3/3
M.08	Properly identify the following flowering perennials: • Alyssum (perennial) • Asclepias (Butterfly flower) • Candytuft Evergreen • Canna • Columbine • Coreopsis • Chrysanthemum • Daylily • Gaillardia • Hibiscus (Rose Mallow) • Hosta • Iris, Bearded or German • Liatris • Lilly • Peony • Poppy • Phlox (Summer) • Phlox (Creeping) • Pinks • Red Hot Poker • Rudbeckia • Salvia (Farinacea) (Nemorosa)	3/3
M.09	Properly identify the following ground covers and vines: • Ajuga • Andorra Juniper • Bishop's Weed • Boston Ivy • Chinese Wisteria • Euonymus Coloratus • English Ivy • Gray Santolina • Gray Sedum • Japanese Garden Juniper • Liriope • Monkey Grass – Liriope • Mondo Grass – Ophiopogon • Moneywort • Pachysandra • Potentilla	3/3

	• Purple Leaf Winter Creeper Euonymous • Santolina • Sedum • Variegated Liriope • Vinca Major • Vinca Minor	
M.10	Properly identify the following bulbs: • Crocus • Daffodils • Hyacinth • Jonquils • Narcissus • Tulips	3/3
M.11	Properly identify the following trees: • Amur Maple • Bald Cypress • Bradford Pear • Chinese Pistache • Crape Mrytle • Flowering Crabapple • Flowering Dogwood • Fruitless Mulberry • Green Ash • Goldenrain Tree • Japanese Maple • Lacebark Elm • Live Oak • Newport Plum • Redbud • Red Maple • Red Oak • River Birch • Russian Olive • Southern Magnolia • Sugar Maple • Sweetgum • Sycamore • Water Oak • Yaupon Holly	3/3
M.12	Properly identify the following broadleaved evergreen shrubs: • Azalea • Burford Holly • "Carissa" Holly • Dwarf Chinese Holly • Dwarf Yaupon Holly • Dwarf nandina • "Emerald Gaiety" Euonymous • Fraser's Photinia • Glossy Abelia • Gold Dust Aucuba • "Gold Spot" Euonymous	3/3

	• Green Euonymous • Japanese Boxwood • "Manhattan" Euonymous • Nandina • "Victory" Pyracantha	
M.13	Properly identify the following conifers: • Austrian Pine • Canaerti Juniper • Colorado Blue Spruce • Compact Andorra Juniper • Dwarf Alberta Spruce • Pyramidal Arborvitae • Pfitzer Juniper • Scotch Pine • Slash Pine	3/3

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HORTICULTURE
LANDSCAPE MAINTENANCE TECHNICIAN
SKILLS STANDARDS
Frequency and Criticality Ratings

Duty A: Employability Skills

Duty B: Operate Light Equipment

Duty C: Organize Work Supplies For Daily Tasks

Duty D: Maintain Grounds

Duty E: Calibrate and Apply Pesticides and Fertilizers

Duty F: Maintain Equipment

Duty G: Utilize Safety Procedures

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:

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DUTY A: Employability Skills

CODE	TASK	F/C
A.01	Communicate with customers (i.e. problem solving skills, communication skills, interaction skills, positive attitude, etc.)	3/3
A.02	Interpret and follow written and oral directions	3/3
A.03	Determine daily work assignments	3/2
A.04	Dress appropriately	3/2
A.05	Communicate with co-workers	3/2
A.06	Maintain a courteous and responsive attitude toward all customers and co-workers	3/3
A.07	Work ethic, attendance	3/3

DUTY B: Operate Light Equipment

CODE	TASK	F/C
B.01	Operate small chain saw, edgers, trimmers, and blowers	3/3
B.02	Operate utility vehicles (standard transmission) • Shifting	2/2
B.03	Identify and use hand rake	2/2

A.09	Apply customer relations skills	1/2
A.10	Carry out duties in a prompt manner	2/2
A.11	Estimate product value and amount • Basic math skills	3/3

DUTY B: Perform Clerical/Administrative Functions

CODE	TASK	F/C
B.01	Monitor supply and stock inventory • Record keeping • Balance sheets • Spreadsheets	1/1
B.02	Maintain equipment inventory	1/1
B.03	Store stock and supplies	2/2
B.04	Use basic computer skills	2/2
B.05	Maintain chemical inventory and log • Material Safety Data Sheets (MSDS)	3/3

DUTY C: Prepare Soil and Growing Media

CODE	TASK	F/C
C.01	Collect soil samples and interpret results	1/2
C.02	Mix growing media • Growing media components • pH levels	2/2
C.03	Keep and maintain records	1/3
C.04	Dispose of media	1/2
C.05	Incorporate/apply fertilizer into growing media	1/3
C.06	Store plant material (coolers, inside) or prepare for winter	1/3
C.07	Haul topsoil	1/2
C.08	Spread topsoil to establish a grade • Operate a transit	1/1
C.09	Incorporate soil amendments • Change soil pH	1/2
C.10	Prepare seedbed/pot	1/2
C.11	Prepare flats	1/1
C.12	Calculate fertilizer formula	1/2

DUTY D: Propagate and Establish Horticulture Plants

CODE	TASK	F/C
D.01	Test seeds for germination percentage • Percentages • Calculate amount • Metric conversions	1/1
D.02	Sow seeds	2/2
D.03	Store seeds	1/3

DUTY G: Utilize Safety Procedures

CODE	TASK	F/C
G.01	Use safety with chemicals • Handling • Storage • Personal Protective Equipment (PPE) • Material Safety Data Sheets (MSDS)	3/3
G.02	Use personal and equipment safety • Shields • Guards • Safety equipment • Proper clothing	3/3
G.04	Use general safety • Lifting • Slips, trips and falls	3/3

HORTICULTURE
FRUIT/NUT & VEGETABLE
FIELD TECHNICIAN
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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 *Career*Tech and its competency-based system of instruction. Skills standards, curriculum, and assessments that identify and reinforce industry expectations provide accountability for programs and assure *Career*Tech's continued role in preparing skilled workers for a global job market

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Stillwater, Oklahoma

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HORTICULTURE
FRUIT/NUT & VEGETABLE/FIELD TECHNICIAN
SKILLS STANDARDS
Frequency and Criticality Ratings

Duty A: Utilize Employability Skills

Duty B: Perform Clerical/Administrative Functions

Duty C: Prepare Soil and Growing Media

Duty D: Propagate and Establish Horticultural Plants

Duty E: Grow Plants

Duty F: Monitor/Control Disease, Weeds, and Pests

Duty G: Irrigate Crops

Duty H: Harvest Product

Duty I: Store, Ship, Take Inventory, and Maintain Merchandise

Duty J: Sell Products

Duty K: Operate and Maintain Equipment

Duty L: Utilize Safety Procedures

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: Utilize Employability Skills

CODE	TASK	F/C
A.01	Arrive on time to work	3/3
A.02	Use initiative, when applicable	3/2
A.03	Work ethic, attendance	3/3
A.04	Maintain a courteous and responsive attitude toward all customers and co-workers	3/3
A.05	Demonstrate professionalism	3/3
A.06	Compose written communication legibly using correct grammar, spelling, and format	2/2
A.07	Interpret and follow written and oral directions	3/3
A.08	Respond appropriately to compliments, complaints, conflicts, and criticism	3/2

A.09	Apply customer relations skills	1/2
A.10	Carry out duties in a prompt manner	2/2
A.11	Estimate product value and amount • Basic math skills	3/3

DUTY B: Perform Clerical/Administrative Functions

CODE	TASK	F/C
B.01	Monitor supply and stock inventory • Record keeping • Balance sheets • Spreadsheets	1/1
B.02	Maintain equipment inventory	1/1
B.03	Store stock and supplies	2/2
B.04	Use basic computer skills	2/2
B.05	Maintain chemical inventory and log • Material Safety Data Sheets (MSDS)	3/3

DUTY C: Prepare Soil and Growing Media

CODE	TASK	F/C
C.01	Collect soil samples and interpret results	1/2
C.02	Mix growing media • Growing media components • pH levels	2/2
C.03	Keep and maintain records	1/3
C.04	Dispose of media	1/2
C.05	Incorporate/apply fertilizer into growing media	1/3
C.06	Store plant material (coolers, inside) or prepare for winter	1/3
C.07	Haul topsoil	1/2
C.08	Spread topsoil to establish a grade • Operate a transit	1/1
C.09	Incorporate soil amendments • Change soil pH	1/2
C.10	Prepare seedbed/pot	1/2
C.11	Prepare flats	1/1
C.12	Calculate fertilizer formula	1/2

DUTY D: Propagate and Establish Horticulture Plants

CODE	TASK	F/C
D.01	Test seeds for germination percentage • Percentages • Calculate amount • Metric conversions	1/1
D.02	Sow seeds	2/2
D.03	Store seeds	1/3

	• Mechanisms that keep seeds viable	
D.04	Stratify seeds	1/2
D.05	Harden off seedlings	1/3
D.06	Transplant seedlings	1/3
D.07	Take and label cuttings • Label legibly • Moisture resistant pen	3/3
D.08	Topwork trees	1/2
D.09	Graft trees	1/2
D.10	Propagate plants using layering	1/2
D.11	Use reference materials to find spacing for species during propagation	1/1
D.12	Label planted specimens	2/3
D.13	Plant shrubs and trees • Bare-root • Container • Balled & Burlap	2/2
D.14	Transplant plant materials to the field	2/2

DUTY E: Grow Plants

CODE	TASK	F/C
E.01	Thin fruit • Hard • Mechanical • Chemical	2/2
E.02	Thin plants • Hard • Mechanical • Chemical	1/2
E.03	Prune plants	1/3
E.04	Prune trees	1/3
E.05	Layer weed barrier • Permeable vs. poly	1/2
E.06	Plant cover crops • Clovers and other legumes • Maturity • Timing • Planning	2/2
E.07	Apply mulch to a planting bed • Purpose •Controls temperature •Weeds •Moisture •Cleanliness of fruit	1/1
E.08	Stake plants	1/2
E.09	Pinch plants	1/3
E.10	Take leaf sample	1/2
E.11	Prepare fertilizer solution	1/3

	• Dilution rates • Irrigation system timing • Fertilizers	
E.12	Fertilize plants	1/3
E.13	Remove and report dead plants	1/2
E.14	Monitor plant wounds • Recognize causes of wound • Mechanical • Insect/pest	2/2

DUTY F: Monitor/Control Disease, Weeds, and Pests

CODE	TASK	F/C
F.01	Recognize common weed species	3/3
F.02	Remove weeds • Manually • With power tools • With tractor drawn mechanical cultivators	3/3
F.03	Dust crops	1/3
F.04	Apply herbicides • Qualifications needed to apply herbicides	1/3
F.05	Control animal pests • Seasons • Protection laws • Types of traps	1/3
F.06	Set out poisoned bait to eradicate rodents	1/3
F.07	Clean spray equipment after use	1/3
F.08	Recognize and report disease and insect damage	2/2
F.09	Monitor insects and use results to control pests • Concepts of Integrated Pest Management	1/2
F.10	Set out traps to monitor pests	1/1
F.11	Build traps • Teddars and cone traps • Install pheromone	1/1
F.12	Mix and apply chemicals • Proper methods of mixing • Disposal of chemicals and containers • Stickers, spreaders	2/3
F.13	Spray diseased plants • Dangers of overspraying • Problems of underspraying	1/3
F.14	Identify and report spray damage	1/2
F.15	Report and remove diseased plants	1/3
F.16	Demonstrate first-aid treatment for pesticides • Read labels and instructions on pesticides • Use eyewash	3/3

DUTY G: Irrigate Crops

CODE	TASK	F/C
G.01	Read a tensiometer • Record readings	1/1
G.02	Turn water on and off	3/3
G.03	Repair irrigation equipment • Basic repairs •drip •overhead •pivot •wheel •flood	2/2
G.04	Install parts of an irrigation system • Lay lines • PVC fittings • Winterize • Frost protection	1/2
G.05	Set time control valves (clocks)	1/2
G.06	Regulate overhead irrigation system • Time clocks • Mist system	1/3
G.07	Regulate drip irrigation system	1/3
G.08	Irrigate field grown plants	2/3
G.09	Identify water requirements of various crops	3/3

DUTY H: Harvest Product

CODE	TASK	F/C
H.01	Prepare orchard floor • Cultivate rows	1/2
H.02	Gather containers	1/2
H.03	Harvest product • methodology • overview of horticultural crops and how they are harvested (peaches, pecans) • Mechanical harvesting	3/3
H.04	Post harvest handling of product • Grade and clean product • Package product	2/2

DUTY I: Store, Ship, Take Inventory, and Maintain Merchandise

CODE	TASK	F/C
I.01	Keep current inventory of products	3/2
I.02	Load delivery vehicle	3/2
I.03	Deliver products to customer	3/2
I.04	Bunch, pack, and/or wrap products for shipment • Temperature and moisture requirements	3/2
I.05	Store products	2/2

	• Temperature and moisture requirements	
I.06	Assemble shipping containers	3/2
I.07	Package orders for shipment	3/2

DUTY J: Sell Products

CODE	TASK	F/C
J.01	Stock shelves and maintain quality control	3/2
J.02	Label harvested products by variety	3/3
J.03	Write and report customer's telephone orders	3/3
J.04	Build displays (counter and table-top)	2/2
J.05	Complete sales invoice	3/3
J.06	Present sales information to customer • Pricing • Product knowledge • Culture information	3/3
J.07	Keep grounds attractive and clean	2/2

DUTY K: Operate and Maintain Equipment

CODE	TASK	F/C
K.01	Prepare soil with tillage equipment	1/2
K.02	Calibrate a sprayer	1/3
K.03	Operate equipment	3/3
K.04	Maintain equipment • Sharpen blades • Service drive belts • Clean equipment	3/3
K.05	Lubricate equipment	3/3
K.06	Report malfunctions, failure, and/or damage of equipment	3/3
K.07	Prepare equipment for winter storage	1/2

DUTY L: Utilize Safety Procedures

CODE	TASK	F/C
L.01	Use safety with chemicals • Handling • Storage • Personal Protective Equipment (PPE) • Material Safety Data Sheets (MSDS)	3/3
L.02	Use personal and equipment safety • Shields • Guards • Safety equipment • Proper clothing	3/3
L.03	Use general safety • Lifting • Slips, trips and falls	3/3

APPENDIX F

KNOWLEDGE QUESTIONS CROSS-REFERENCED WITH THE OKLAHOMA HORTICULTURE SKILLS STANDARDS AND COURSE TOPICS IN HORTICULTURE 1013

Instrument Question Number	Skills Standards	Horticulture Thematic Area	Oklahoma Career Tech Identification	HORT 1013 Fall Topic Dates
1	Graft trees	F/N/V	D.09	October 22, 2008
2	Test seeds for germination percentages	F/N/V	D.01	September 8, 2008
3	Stratification	F/N/V	D.04	September 8, 2008
4	Recognize common turf problems	L/M	D.05	October 15, 2008
5	Maintain cool and warm season grasses	L/M	D.01	October 15, 2008
6	Prepare growing media components	F/N/V	C.02	September 15, 2008
7	Harden off seedlings	F/N/V	D.05	October 20, 2008 & September 15, 2008
8	Prune trees	F/N/V	E.04	October 8, 2008
9	Stake plants	F/N/V	E.08	October 8, 2008
10	Identify and operate mowers	L/M	B.05	October 20, 2008 (Lab)
11	Transplant bare-root or liners	G/N	D.01	October 8, 2008
12	Pinching plants	G/N	D.07	August 25, 2008
13	Overspraying and underspraying of diseased plants	F/N/V	F.13	September 29, 2008 (Lab)
14	Establish plant spacing and the effects of insufficient spacing	G/N	D.09	October 27, 2008
15	Applying rooting hormone	G/N	C.05	August 25, 2008 (Lab)
16	Planting shrubs and trees: bare root, container, burlap	G/N	C.12	October 6, 2008
17	Plant propagation using air layering	G/N	C.08	August 25, 2008
18	Disbudding plants	G/N	D.05	October 13, 2008 (Lab)

Instrument Question Number	Skills Standards	Horticulture Thematic Area	Oklahoma Career Tech Identification	HORT 1013 Fall Topic Dates
19	Discuss irrigation systems	G/N	F.02	October 6, 2008
20	Scarification of seeds	G/N	C.01	September 8, 2008
21	Application of growth regulators to a plant	G/N	D.11	September 29, 2008 (Lab)
22	Regulating plant photoperiod	G/N	D.10	September 10, 2008
23	Irrigate field grown plants	F/N/V	G.08	September 8, 2008 (Lab)
~~24~~	~~Store products: temperature and moisture requirements~~	~~F/N/V~~	~~I.05~~	~~November 24, 2008~~
25	Transplant plant material to the field	F/N/V	D.14	October 8, 2008
26	Planting and selection of bulbs, corms, tubers, tuberous roots	G/N	D.12	September 17, 2008
27	Discuss the harvest of ball trees and shrubs	G/N	G.02	October 6, 2008

APPENDIX G

PRINCIPLES OF HORTICULTURAL SCIENCE FALL 2008 COURSE TOPIC SCHEDULE

HORT 1013: PRINCIPLES OF HORTICULTURAL SCIENCE
FALL 2008 COURSE SCHEDULE

WEEK	DATE	READ	THEORY TOPIC	LAB TOPIC
1	Aug. 18	Chapter 1	Welcome & Course Overview	**READ BEFORE LAB: Yoder's Pot Mum Cultural Tips** (http://www.yoder.com/growers/chrysanthemum/potmums-fleurettes/short_days.aspx) **Change through Scientific Inquiry:** Writing Hypotheses and Designing Experiments **Exp. #1: Effects of Plant Growth Regulators, Pinching, Disbudding, and Light on Scheduling of Floral Crops (PINK SHEET)** – Pot mums and poinsettias, and write hypothesis on effect of daylength.
	Aug. 20	Chapters 1 & 3	Role of Horticulture in the World	
2	Aug. 25	Chapter 8	Vegetative Propagation of Plants, including Micropropagation	**Exp. #1:** Write hypothesis on effect of pinching. **Exp. #2: Effects of Auxin and Plant Source on Rooting of Herbaceous Cuttings (GREEN SHEET)** – Propagate plants vegetatively, and write hypothesis on effect of IBA on rooting.
	Aug. 27	Chapter 14 (sections: Vegetative Prop. & Microprop.)	Structure of Higher Plants **Quiz #1 over weeks 1 and 2** is available 6:30PM today through 6:30PM Sept. 2.	
3	Sept. 1		NO CLASS: LABOR DAY	NO LAB: LABOR DAY
	Sept. 3	Chapter 15 (sections: Naming & Classifying)	Naming and Classifying Plants	**Exp. #1:** Pinch mums. TA and staff will pinch mums, allowing 6-8 leaves to remain on each cutting.
4	Sept. 8	Chapter 14 (section: Sexual Prop.)	Sexual Propagation of Plants	**Exp. #1:** Move mums to SD in TGH#1. **Exp. #2:** Examine cuttings. Pot rooted cuttings. **Exp. #3: Effects of Physical and Physiological Barriers on Seed Germination (YELLOW SHEET)** – Sow seeds for scarification, and write hypotheses on effects of scarification and stratification. **Exp. #4:** Sow F_2 tomato seeds **(BLUE SHEET)**.
	Sept. 10	Chapter 9	Stages of Growth and Development **Quiz #2 over weeks 3 and 4** is available 6:30PM today through 6:30PM Sept. 16.	
5	Sept. 15	Chapter 23	Floriculture: Production of Bedding and Potted Plants	**Rubric:** Assessing writing and analytical skills. **Exp. #1:** Apply PGRs to mums and write hypotheses on effects of PGRs. **Exp. #2:** Examine cuttings. Pot rooted cuttings. **Exp. #3:** Diagram seedlings and discuss types of germination. Sow seeds to be stratified (controls will be sown later). **Exp. #4:** Examine F_2 tomato seedlings.
	Sept. 17	Chapters 25 and 23 (section: bulb crops)	Residential and Public Landscapes **Quiz #3 over week 5** is available 6:30PM today through 6:30PM Sept. 23.	
6	Sept. 22		Maintaining Plants in the Indoor Environment	**Exp. #2:** Examine cuttings and air layer. Collect and submit team's stem tip cutting data. **Exp. #3:** Collect and submit team's germination data. **Exp. #4:** Examine F_2 tomato seedlings.
	Sept. 24		**EXAM I over weeks 1-5 in:** **AGH 343 for section 001 students** **ANSI 126 for section 002 students**	

HORT 1013: PRINCIPLES OF HORTICULTURAL SCIENCE
FALL 2008 COURSE SCHEDULE

WEEK	DATE	READ	THEORY TOPIC	LAB TOPIC
7	Sept. 29	Chapter 14 (sections: Basic Genetic Concepts in Plant Sci. & Biotechnology)	Genetics and Plant Breeding	**Exp. #1:** Apply PGRs to mums. **Exp. #2:** Interpret Student's t-test statistical analysis of stem tip cutting data. Examine other cuttings and pot rooted cuttings. **Exp. #4:** Examine F_2 tomato seedlings.
	Oct. 1	Chapter 14 cont'd.	Genetics and Plant Breeding, cont'd. **Quiz #4 over weeks 6 and 7** is available 6:30PM today through 6:30PM Oct. 7.	
8	Oct. 6	Chapter 21	Nursery Production with Dr. Cole	**Exp. #2: ANALYTICAL ESSAY EXAM**
	Oct. 8	Chapter 22	Landscape Trees and Ornamental Shrubs **Quiz #5 over week 8** is available 6:30PM today through 6:30PM Oct. 14.	**Exp. #1:** Apply Pro-Gibb to mums. **Exp. #4: Determining Inheritance of Single, Independent Genes in Tomato (BLUE SHEET)**: Observe and discuss mutant seedling marker phenotypes and associated genotypes. Collect and submit F_2 tomato seedling data.
9	Oct. 13	Chapter 24	Turfgrass Adaptation and Selection with Dr. Bell	**Exp. #1:** Disbud mums, and write hypothesis on effect of SBR. **Exp. #3:** Remove stratified packs from cooler and sow non-stratified seeds. **Exp. #4:** Write hypotheses. Statistically analyze F_2 tomato seedling data via χ^2 statistical analysis, and then interpret.
	Oct. 15	Chapter 24 cont'd.	Establishing and Maintaining a Turfgrass Lawn **Quiz #6 over week 9** is available 6:30PM today through 6:30PM Oct. 21.	
10	Oct. 20	Chapters 4 & 5	Climatic Influences on Plants	**Class meets at OSU Botanical Garden Education Building. Park on south side of building.** **Tour:** Breeding for and Evaluation of Turfgrass Tolerance to Temperature Extremes and Droughty Soil. **Exp. #4: ANALYTICAL ESSAY EXAM** **Exp. #3**: TA or Dr. Kahn will monitor germination of stratified vs. non-stratified seeds.
	Oct. 22	Chapter 19	Flowering and Fruiting in Fruit and Nut Crops **Quiz #7 over week 10** is available 6:30PM today through 6:30PM Oct. 28.	
11	Oct. 27	Chapter 19 cont'd.	Oklahoma's Fruit & Nut Industry with Dr. Smith	**Class meets at Cimarron Valley Research Station in Perkins, OK. Park adjacent to Herman Heinrichs Education Center.** **Tour:** Cimarron Valley Research Station **Exp. #3:** TA or Dr. Kahn will collect physiological dormancy germination data.
	Oct. 29	Chapter 19 cont'd. and chapter 10	Production of Grapes for the Wine Industry with Dr. Stafne **Quiz #8 over week 11** is available 6:30PM today through 6:30PM Nov. 4.	
12	Nov. 3	Chapter 18	Vegetable Production	**Exp. #3:** Observe seedlings, and interpret Student's t-test statistical analysis of seed dormancy data.
	Nov. 5		**EXAM II over weeks 6-11 in:** **AGH 343 for section 001 students** **ANSI 126 for section 002 students**	

HORT 1013: PRINCIPLES OF HORTICULTURAL SCIENCE
FALL 2008 COURSE SCHEDULE

WEEK	DATE	READ	THEORY TOPIC	LAB TOPIC
13	Nov. 10	Chapters 6 & 13	Soil and Plant Nutrients	**Exp. #3: ANALYTICAL ESSAY EXAM**
	Nov. 12	Chapter 6 cont'd. and chapter 12	Soil/Plant Water Relations and Water Management **Quiz #9 over weeks 12 and 13** is available 6:30PM today through 6:30PM Nov. 18.	**Exp. #1:** Collect and submit data.
14	Nov. 17	Chapter 7	Integrated Management of Weeds, Insects, and Diseases	**Exp. #1:** Interpret ANOVA and Duncan's multiple range statistical analyses of data. Take mums home.
	Nov. 19	Chapter 11	Photosynthesis and Respiration **Quiz #10 over week 14** is available 6:30PM today through 6:30PM Nov. 25.	
15	Nov. 24	Chapter 26	Post-Harvest Handling of Horticultural Products with Dr. Maness	**Exp.#1: ANALYTICAL ESSAY EXAM**
	Nov. 26		NO CLASS: THANKSGIVING HOLIDAY	Take poinsettia home.
16	Dec. 1	Chapter 26 cont'd.	Processing and Preservation of Horticultural Products with Dr. McGlynn	**Class meets at FAPC 1st Floor Lobby.** Tour: Oklahoma Food and Agricultural Products Research and Technology Center (http://www.fapc.okstate.edu/) with Dr. McGlynn.
	Dec. 3		**REVIEW/HELP SESSION** – Come with questions, and Dr. Kahn will provide the answers!	
FINALS	**Wednesday, Dec. 10, 10-11:50 AM**		**CUMULATIVE FINAL EXAM in:** **AGH 343 for section 001 students** **ANSI 126 for section 002 students**	

APPENDIX H

PERCENT DIFFICULTY OF HORTICULTURE KNOWLEDGE QUESTIONS FROM FIELD TEST

Number of Students = 45 * Indicates the correct response

SECT. 001	1	A	B	C	D	*E	OMITS	DIFFICULTY =	75.556%
		2	4	3	2	34	0	DISCRIMINATION =	0.355
SECT. 001	2	A	B	*C	D	E	OMITS	DIFFICULTY =	64.444%
		12	3	29	0	1	0	DISCRIMINATION =	-0.114
SECT. 001	3	*A	B	C	D	E	OMITS	DIFFICULTY =	53.333%
		24	0	20	1	0	0	DISCRIMINATION =	0.250
SECT. 001	4	*A	B	C	D	E	OMITS	DIFFICULTY =	48.889%
		22	23	0	0	0	0	DISCRIMINATION =	0.383
SECT. 001	5	*A	B	C	D	E	OMITS	DIFFICULTY =	51.111%
		23	17	5	0	0	0	DISCRIMINATION =	0.414
SECT. 001	6	A	*B	C	D	E	OMITS	DIFFICULTY =	33.333%
		2	15	27	1	0	0	DISCRIMINATION =	0.225
SECT. 001	7	A	B	C	*D	E	OMITS	DIFFICULTY =	33.333%
		20	6	4	15	0	0	DISCRIMINATION =	0.472
SECT. 001	8	A	*B	C	D	E	OMITS	DIFFICULTY =	35.556%
		18	16	11	0	0	0	DISCRIMINATION =	0.127
SECT. 001	9	A	B	*C	D	E	OMITS	DIFFICULTY =	68.889%
		1	13	31	0	0	0	DISCRIMINATION =	0.347
SECT. 001	10	A	*B	C	D	E	OMITS	DIFFICULTY =	60.000%
		15	27	0	3	0	0	DISCRIMINATION =	0.213
SECT. 001	11	A	*B	C	D	E	OMITS	DIFFICULTY =	51.111%
		3	23	18	1	0	0	DISCRIMINATION =	0.549
SECT. 001	12	*A	B	C	D	E	OMITS	DIFFICULTY =	71.111%
		32	13	0	0	0	0	DISCRIMINATION =	0.403
SECT. 001	13	*A	B	C	D	E	OMITS	DIFFICULTY =	91.111%
		41	4	0	0	0	0	DISCRIMINATION =	0.211
SECT. 001	14	A	*B	C	D	E	OMITS	DIFFICULTY =	15.556%
		1	7	20	17	0	0	DISCRIMINATION =	0.116
SECT. 001	15	*A	B	C	D	E	OMITS	DIFFICULTY =	80.000%
		36	9	0	0	0	0	DISCRIMINATION =	0.352
SECT. 001	16	A	B	C	*D	E	OMITS	DIFFICULTY =	82.222%
		5	2	1	37	0	0	DISCRIMINATION =	0.362
SECT. 001	17	*A	B	C	D	E	OMITS	DIFFICULTY =	73.333%
		33	12	0	0	0	0	DISCRIMINATION =	0.268
SECT. 001	18	A	*B	C	D	E	OMITS	DIFFICULTY =	55.556%
		16	25	4	0	0	0	DISCRIMINATION =	0.554
SECT. 001	19	*A	B	C	D	E	OMITS	DIFFICULTY =	80.000%
		36	9	0	0	0	0	DISCRIMINATION =	0.153

SECT. 001	20	A	*B	C	D	E	OMITS	DIFFICULTY =	33.333%
		30	15	0	0	0	0	DISCRIMINATION =	0.394
SECT. 001	21	*A	B	C	D	E	OMITS	DIFFICULTY =	91.111%
		41	4	0	0	0	0	DISCRIMINATION =	0.167
SECT. 001	22	A	*B	C	D	E	OMITS	DIFFICULTY =	82.222%
		0	37	5	3	0	0	DISCRIMINATION =	0.169
SECT. 001	23	*A	B	C	D	E	OMITS	DIFFICULTY =	68.889%
		31	1	3	10	0	0	DISCRIMINATION =	0.466
SECT. 001	24	A	B	C	D	*E	OMITS	DIFFICULTY =	64.444%
		4	3	4	5	29	0	DISCRIMINATION =	0.321
SECT. 001	25	A	B	*C	D	E	OMITS	DIFFICULTY =	75.556%
		2	4	34	5	0	0	DISCRIMINATION =	0.341
SECT. 001	26	*A	B	C	D	E	OMITS	DIFFICULTY =	82.222%
		37	1	2	5	0	0	DISCRIMINATION =	0.201
SECT. 001	27	*A	B	C	D	E	OMITS	DIFFICULTY =	22.222%
		10	7	10	18	0	0	DISCRIMINATION =	0.598

VITA

Eric Gregory Kennel

Candidate for the Degree of

Master of Science

Thesis: A STUDY OF PRE-SERVICE AGRICULTURAL EDUCATION STUDENTS: KNOWLEDGE OF HORTICULTURE AND SELF-EFFICACY TO TEACH HORTICULTURE

Major Field: Agricultural Education

Biographical:

Personal Data: Eric Gregory Kennel was born January 29, 1985, in Cincinnati, Ohio and was raised in Okeana, Ohio. He is the son of Gregory J. Kennel and Constance A. Kennel and the oldest brother of Jonathan Kennel, Melissa Kennel, and Nicholas Kennel.

Education: Associate of Science in Pre-Agricultural Education at The Ohio State University Agricultural Technical Institute; Bachelor of Science in Agricultural Education at Oklahoma State University; Completed the requirements for the Master of Science in Agricultural Education at Oklahoma State University, Stillwater, Oklahoma in May, 2009.

Experience: Teaching Assistant in the Department of Horticulture and Landscape Architecture at Oklahoma State University.

Professional Memberships: American Association for Agricultural Education, member; National Association of Agricultural Educators, member; North American Colleges and Teachers of Agriculture, member; Phi Theta Kappa, member; Phi Kappa Phi, member.

Name: Eric Gregory Kennel Date of Degree: May, 2009

Institution: Oklahoma State University Location: Stillwater, Oklahoma

Title of Study: A STUDY OF PRE-SERVICE AGRICULTURAL EDUCATION STUDENTS: KNOWLEDGE OF HORTICULTURE AND SELF-EFFICACY TO TEACH HORTICULTURE

Pages in Study: 142 Candidate for the Degree of Master of Science

Major Field: Agricultural Education

Scope and Method of Study:
This study included pre-service agricultural education students (N = 22) enrolled in the course, Horticulture 1013-Principles of Horticultural Science, during the fall 2008 semester at Oklahoma State University. The purposes of this descriptive correlational study were to determine pre-service agricultural education students' knowledge of horticulture, their perceived self-efficacy and importance of teaching horticulture in secondary agricultural education, and to identify horticulture skills standards most needed by pre-service agricultural education students.

Findings and Conclusions:
It was found that over two-thirds (68.2%) of the agricultural education students who participated in this study did not possess any years of horticulture work experience. Additionally, 63.9% reported they completed no high school horticulture courses, and 77.3% of the student had not completed any college horticulture courses. Prior to instruction in Horticulture 1013, the students reported their self-efficacy to teach the horticulture skills standards as "Below Average," whereas at the end of instruction, the students perceived their self-efficacy to teach the selected skills standards as "Average Confidence." It was revealed that students' horticulture knowledge mean test score increased from 48.32% prior to instruction to 62.96% at the end of instruction. However, even though there was an increase in horticulture knowledge, prior to instruction compared to the end of instruction, it should be noted that the mean horticulture knowledge test score was a "D" grade (60-69%) at the end of the course, based on the Horticulture 1013 grading scale. In addition to self-efficacy and horticulture knowledge, the researcher sought to identify horticulture instructional needs of the pre-service agricultural education students utilizing mean weighted discrepancy scores (MWDS). At the end of instruction, the researcher ranked the 27 Oklahoma horticulture skills standards, based on student MWDS. The two most needed horticulture skills standards as perceived by the students in this study were, "identification of common turf diseases and pests" and "harvesting techniques of trees and shrubs."

ADVISER'S APPROVAL: Dr. James Leising