ASSESSING THE IMPACT OF VICARIOUS EXPERIENCES ON PRESERVICE ELEMENTARY SCIENCE TEACHER EFFICACY AND PRESERVICE ELEMENTARY TEACHER EFFICACY

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ELEMENTARY TEACHER EFFICACY

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CHAPTER 1

INTRODUCTION

Background

Teacher efficacy is a powerful idea with a long, sordid and controversial history. The first teacher efficacy study was influenced by Rotter's (1966) social learning theory and focused on teacher's beliefs about where control lies in student learning. Later studies would move away from this influence and would be more directly influenced by Bandura's social cognitive theory (Bandura, 1977). More recently there has been a movement to develop teacher efficacy instruments that focused on more specific contexts of teaching such as science teaching efficacy. In this atmosphere of competing theories and competing contexts, a sense of confusion has arisen regarding the most appropriate way to understand and measure teacher efficacy. Researchers were intrigued by the need to address certain central issues that are fundamental in understanding the practical application of teacher efficacy to effective teaching and student learning in specific classroom contexts.

Many questions arose regarding the study of teacher efficacy. How do specific classroom dynamics impact teacher efficacy? Does the Teacher Efficacy Scale (TES) (Gibson & Dembo, 1984), which has formed much of the basis for our understanding of teacher efficacy, even measure teacher efficacy? Does the idea of a general teacher efficacy with a low level of specificity even exist? Ultimately, does teacher efficacy need to be captured within a specific classroom context and environment to have meaningful practical significance and application for effective student learning? The current study attempts to bring some clarity to these issues by looking at the impact that field experiences (Vicarious experiences) have on preservice elementary science teacher efficacy and preservice elementary teacher efficacy.

Teacher efficacy has been defined as “the extent to which the teacher believes he or she has the capacity to affect student performance” (Berman, McLauglin, Bass, Pauly & Zellman, 1977, p. 137) or a “teachers’ belief or conviction that they can influence how well students learn, even those that may be difficult or unmotivated” (Guskey & Passaro, 1994, p. 4). According to Tschannen-Moran et al. (1998) “the research suggests that teachers’ sense of efficacy plays a powerful role in schooling” (p. 234). There has been extensive research over the last three decades to formulate a unified theory of efficacy and to develop valid, reliable instruments that could measure efficacy levels in teachers, especially elementary teachers.

Vicarious experiences are one of the four main sources that influence the efficacy of the individual teacher (Bandura, 1997). Vicarious experiences are also a common component of teacher education programs. However, little research has been done to evaluate the impact of vicarious learning experiences in the context of perceived preservice teacher efficacy and perceived preservice science teacher efficacy. The vicarious experiences in this study occurred in elementary public school classrooms where the preservice elementary teachers conducted their field observations. The type of vicarious experience was dependant on the specific variables that existed in the specific classroom where the individual preservice teachers observed. For the specific variables associated with the research questions see Table 11 and 14 in Chapter 4.

Statement of the Problem

Teacher efficacy has been positively correlated with the amount of effort a teacher will expend in a teaching environment and the level of persistence a teacher will show in the face of obstacles (Tschannen-Moran et al., 1998). However, there have been no studies that have looked at the impact that vicarious experiences in teacher preparation programs have on the construct of preservice elementary teacher efficacy and preservice elementary science teacher efficacy.

Purpose of the Study

The purpose of this study was to investigate the impact vicarious experiences had on perceived preservice elementary teacher efficacy and perceived preservice elementary science teacher efficacy.

Research Questions

The research questions that guided this study were:

Research Question 1

What is the impact of a vicarious learning experience (preservice teacher field experiences) on perceived preservice elementary teacher efficacy and preservice elementary science teacher efficacy?

Research Question 2

What is the impact of the characteristics of the field experience classroom, within the given school where the educational field experience occurred, on perceived preservice elementary teacher efficacy and perceived preservice elementary science teacher efficacy?

Theoretical Perspective

The first formal efficacy research began over two decades ago when the RAND organization, influenced by Rotter's (1966) social learning theory, added two items to an already existing questionnaire (Armor et al., 1976). With the findings of the two RAND organization items the construct of teacher efficacy was first formulated. In these early RAND studies, teachers were asked to designate their level of agreement with two efficacy item statements (Armor et al., 1976). The total of the scores on the two RAND items was called *teacher efficacy* (TE), a concept that professed to indicate the degree to which a teacher believed that the consequences of learning and student motivation were controlled by the teacher (Tschannen-Moran et al., 1998).

In the late 1970's a second line of efficacy thought developed directly from Bandura's social cognitive theory and his construct of self-efficacy (Bandura, 1977). Bandura (1997) defined self-efficacy as "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (p. 3). "Self-efficacy is a future-oriented belief about the level of competence a person expects he or she will display in a specific situation" (Tschannen-Moran et al., 1998, p. 207). He also proposed that "self-efficacy beliefs influence thought patterns and emotions that enable actions in which people expend substantial effort in pursuit of goals, persist in the face of adversity, rebound from temporary setbacks, and exercise some control over events that affect their lives" (Tschannen-Moran et al., 1998, p. 210).

Bandura's theory and his construct of self-efficacy would later influence the development of such efficacy instruments as the Teacher Efficacy Scale (Gibson and Dembo, 1984), the Ashton Vignettes (Ashton, Buhr, & Crocker, 1984), the Science Teaching Efficacy Belief Instrument (STEBI) (Riggs & Enochs, 1990), the Ohio State Teacher Efficacy Scale (Tschannen-Moran et al., 1998) and many others.

With the development of the Teacher Efficacy Scale (TES) by Gibson and Dembo (1984) two factors of teacher efficacy were identified: The first factor, General Teacher Efficacy (GTE) related to the teacher's belief about the impact of external factors, such as hostility in the home or economic factors of gender, race or class, contrasted to the influence of the schools and teachers. The second factor, Personal Teacher Efficacy (PTE), related to the teachers' belief in their ability to overcome the factors that make learning difficult for students.

Because teacher efficacy is believed to be both subject-matter and context specific (Tschannen et al., 1998), Riggs and Enochs (1990) developed the Science Teaching Efficacy Belief Instrument (STEBI) to measure efficacy of science teaching. The authors identified two uncorrelated factors within STEBI, which they named *personal science teaching efficacy* (PSTE) and *science teaching outcome expectancy* (STOE). Thus, the instrument measured both PSTE and STOE. The PSTE scale indicated teachers' belief in their ability to perform a given behavior; the outcome STOE scale indicates the teachers' belief that effective teaching can change behaviors (Riggs & Enochs, 1990).

Significance of the Study

The significance of this study concerns the impact of vicarious experiences on the construct of teacher efficacy. Teacher efficacy is an indicator of teacher performance and success. This study will help to determine what role, if any; vicarious experiences play in impacting teacher efficacy. The results of this research will be significant for the elementary education faculty at the studied university in evaluating the effectiveness of vicarious experiences as a tool in preparing preservice elementary teachers to enter the teacher work force. The research findings could also benefit those attempting to incorporate vicarious events (e.g., elementary field experiences) into their preservice elementary teacher education curriculum. Furthermore, the findings of this study may be beneficial to those considering the degree and role that vicarious experiences should play in their preservice secondary teacher education programs. Evidence from this study could also be useful in furthering continued research related to elementary preservice teachers since a lack of research associated with efficacy and vicarious experiences in elementary preservice teachers exists.

This study will also help to bring some understanding to the impact that specific classroom variables have on preservice elementary teacher efficacy and preservice elementary science teacher efficacy. Furthermore, the study will help to assess the reliability of the Teacher Efficacy Scale (TES) (Gibson & Dembo, 1984). Lastly, this study will attempt to bring some understanding to the specific level of teacher efficacy that is needed to have practical meaningful significance in the elementary classroom.

Definition of Terms

ExCEL- The ExCEL (Excellence in Collaborative and Experiential Learning) Program is a collaborative partnership between the College of Education and Evergreen Public Schools. Open to elementary education majors in their final semester before student teaching, the program features a three-day a week full day internship in a public school classroom in which teacher candidates are partnered with expert classroom teachers. Candidates return to the OSU campus one day a week for Semester Y methods classes. The ExCEL program is run by a team of OSU COE faculty members who work together to mentor students in their placements at the elementary school and also teach the ExCEL sections of methods classes, closely connecting course content with field experiences. The ExCEL program runs both fall and spring semesters, partnering with Driftwood Elementary in the fall and Norwood Elementary in the spring. Both schools are close to the OSU campus and each offers a richly diverse student population and talented, enthusiastic faculty and leadership. ExCEL program participants gain experience in almost every aspect of elementary school teaching and develop productive relationships with a variety of educational professionals. Many ExCEL students choose to stay in their placement classroom for student teaching so that they receive a full year of supported internship before starting their first job. Elementary Education majors interested in participating in ExCEL may apply for the program during the second semester of their junior year. A program representative will speak in classes about the program each semester, and invitations to apply will be posted around the college.

General Teacher Efficacy (GTE): The teacher's belief about the power of external factors, such as violence in the home or economic realities of gender, race or class, compared to the influence of teachers and schools (Ashton, Olejnik, Crocker, & McAuliffe, 1982); also known as teacher outcome expectancy.

Indefinable Factor 2 (IF2): Second TES factor from the study. Items associated with this factor were 2, 3, 5, 8, 12, 13, 15, 20 and 27. Based on the non-associated nature of these items a common construct factor, such as TE, was deemed indefinable.

Personal Science Teaching Efficacy (PSTE): teachers' belief in their ability to perform a given behavior (Riggs & Enochs, 1990).

Personal Teaching Efficacy (PTE): The teacher's belief in their ability to overcome factors that could make learning difficult for students (Tschannen-Moran et al., 1998); in the context of the TES, PTE is referred to as self-efficacy (Gibson and Dembo, 1984).

Preservice elementary teacher: University student majoring in elementary education who has not completed his/her educational certification. The student has not begun teaching formally and has not received his/her teaching certificate.

Science Teaching Efficacy Belief Instrument (STEBI): Science teacher efficacy instrument designed to measure PTSE and STOE. The instrument consists of 25 items (Riggs & Enochs, 1990).

Science Teaching Efficacy Belief Instrument B (STEBI-B): Science teacher efficacy instrument designed to measure PTSE and STOE. The instrument consists of 23 items from the STEBI. The STEBI-B is identical to the STEBI except items 20 and 25 have been removed and the verb tenses of some of the 23 items have been changed to accommodate preservice teachers. These changes were made so the instrument, which was originally designed for inservice teachers, could be used with preservice teachers (Enochs & Riggs, 1990).

Science Teaching Outcome Expectancy (STOE): the teachers' belief that effective teaching can result in student learning (Riggs & Enochs, 1990).

Teacher efficacy: "the extent to which the teacher believes he or she has the capacity to affect student performance" (Berman, McLauglin, Bass, Pauly & Zellman, 1977, p. 137) or "teachers' belief or conviction that they can influence how well students learn, even those that may be difficult or unmotivated" (Guskey & Passaro, 1994, p. 4).

Teaching Efficacy (TE): Teach efficacy (TE) in the context of the TES refers to outcome expectancy (Gibson and Dembo, 1984).

Teacher Efficacy Scale (TES): Teacher efficacy instrument designed to measure personal teacher efficacy (PTE) and teacher efficacy (TE). The instrument consists of 30 items with a Likert scale ranging from 1 (Strongly disagree) to 6 (Strongly Agree). Gibson and Dembo (1984) found, after performing factor analysis, that sixteen of the original 30 items had acceptable reliability coefficients.

Vicarious experiences: Within the context of teacher efficacy, a vicarious experience refers to observing another individual teaching. Within the context of this study it refers to the preservice teacher's educational field experiences.

Composition of the Dissertation

The dissertation is composed of five chapters. Chapter 1 is the introduction which consists of a background introduction, statement of the problem, purpose of the study, research questions, theoretical perspective, significance of the study, definition of terms and composition of the dissertation. Chapter 2 describes the current literature that is essential to the study including an introduction and a description of the following: teacher efficacy, teacher efficacy research-inservice teachers, teacher efficacy research-preservice teachers, vicarious experience and preservice teacher early field experiences. Chapter 3 describes the methodology of the study. Chapter 4 describes the results of the study and Chapter 5 describes the summary conclusions and recommendations of the study.

CHAPTER II

REVIEW OF LITERATURE

Introduction

This chapter describes the current literature that is essential to the study. The concept of teacher efficacy is described followed by current research on inservice teacher efficacy. Next, current preservice teacher efficacy research is discussed followed by Bandura's concept of vicarious experience and, finally, a description of preservice teacher early field experiences.

Teacher Efficacy

According to Tschannen-Moran, Woolfolk-Hoy, and Hoy, W. (1998), teacher efficacy was first defined by the RAND organization "as the extent to which teachers believed they could control the reinforcement of their actions, that is, whether control of reinforcement lay within themselves or the environment" (p.202). Bandura's (1977) social cognitive theory and his construct of self-efficacy, defined as "a cognitive process in which people construct beliefs about their capacity to perform at a given level of attainment" (Tschannen-Moran et al., 1998, p.203), provided a theoretical foundation for the construct of teacher efficacy as a specific type of self-efficacy. Tschannen-Moran et al. (1998) defined teacher efficacy as the "teacher's belief in his or her capacity 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).

Gibson and Dembo (1984), equipped with the theories of the RAND researchers and the conceptual ideas of Bandura, developed the first reliable teacher efficacy instrument, the Teacher Efficacy Scale (TES). Since the development of the Teacher Efficacy Scale in the early 1980's, researchers have developed a plethora (Gibson & Dembo, 1984; Ashton, Buhr, & Crocker, 1984; Riggs & Enochs, 1990; Tschannen-Moran et al., 1998) of teacher efficacy instruments with the hope of understanding this powerful construct (Tschannen-Moran et al., 1998).

Teacher Efficacy Research—Inservice Teachers

Over the last 25 years there have been numerous studies, using many different efficacy instruments that have shown that a teacher's sense of efficacy is a strong indicator of the teacher's ability to be a productive, successful teacher. In this section some of the more historically important research findings concerning teacher efficacy will be addressed.

The first formal efficacy research began over two decades ago when the RAND organization added two items to an already existing questionnaire (Armor et al., 1976). With the findings of the two RAND organization items the construct of teacher efficacy was first formulated. In these early RAND studies teachers were asked to designate their level of agreement with two efficacy statements (Armor et al., 1976). The total of the scores on the two RAND items was called teacher efficacy (TE), a concept that professed to indicate the degree to which a teacher believed that the consequences of learning and student motivation were controlled by the teacher (Tschannen-Moran et al., 1998). The first RAND item, "When it comes right down to it, a teacher really can't do much because most of a student's motivation and performance depends on his or her home environment" (Armor et al., 1976), would be labeled general teaching efficacy (GTE) by future efficacy researchers. The second item, "If I really try hard, I can get through to even the most difficult or unmotivated students" (Armor et al., 1976), would be labeled as personal teaching efficacy (PTE) by future researchers (Tschannen-Moran et al., 1998). Armor et al (1976), using the two RAND items in the context of reading programs employed in Los Angeles schools, found teacher efficacy (TE) was strongly correlated to reading achievement variation among minority students.

In the late 1970's a second line of efficacy thought developed directly from Bandura's social cognitive theory and his construct of self-efficacy (Bandura, 1977). Bandura (1997) defined self-efficacy as "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (p. 3). "Self-efficacy is a future-oriented belief about the level of competence a person expects he or she will display in a specific situation" (Tschannen-Moran et al., 1998, p. 207). He also proposed that "self-efficacy beliefs influence thought patterns and emotions that enable actions in which people expend substantial effort in pursuit of goals, persist in the face of adversity, rebound from temporary setbacks, and exercise some control over events that affect their lives" (Tschannen-Moran et al., 1998, p. 210). Bandura's theory and his construct of self-efficacy would later influence the development of such efficacy instruments as the Teacher Efficacy Scale (Gibson and Dembo, 1984), the Ashton Vignettes (Ashton, Buhr, & Crocker, 1984), the Science Teaching Efficacy Belief Instrument (STEBI) (Riggs & Enochs, 1990), the Ohio State Teacher Efficacy Scale (Tschannen-Moran et al., 1998) and many others. Bandura, after years of providing information for his ever-developing theory, offered his own Teacher Self-Efficacy Scale

(Bandura, 1997). The instrument he developed is a 30-item instrument with seven subscales: efficacy to enlist community involvement, efficacy to influence decision making, instructional efficacy, disciplinary efficacy, efficacy to enlist parental involvement, efficacy to influence school resources, and efficacy to create a positive school climate (Bandura, 1997). Bandura's Teacher Self-Efficacy Scale uses a nine-point Likert-type scale with response choices ranging from nothing (1) to a great deal (9) for each item.

With the development of the Teacher Efficacy Scale (TES) by Gibson and Dembo (1984) two factors of teacher efficacy were identified: General Teacher Efficacy (GTE) or the teacher's belief about the impact of external factors, such as hostility in the home or economic factors of gender, race or class, contrasted to the influence of the schools and teachers and Personal Teacher Efficacy (PTE), the teachers' belief in their ability to overcome the factors that make learning difficult for students. Gibson and Dembo, using the TES, found that teachers who display a low sense of efficacy were more likely to instruct the class as a whole than to divide the class into small groups for instruction. They also found that low efficacy teachers were more likely to criticize students for an incorrect answer and were less likely to persist with a student in a difficult situation. Podell and Soodak (1993), again using the TES, found that there was a direct correlation between teacher efficacy and a teacher's decision to refer a student to special education. They found teachers with higher levels of PTE were more willing to work with students who were experiencing problems rather than refer them to a special education program.

Coladarci (1992) conducted a study to assess commitment to teaching. The subjects were composed of a random sample of 364 elementary-level Maine teachers.

The TES (Gibson & Dembo, 1984) was administered to all subjects along with the teacher commitment question "Suppose you had it to do all over again: In view of your present knowledge, would you become a teacher?" (Coladarci, 1992, p. 328). After assessing the data it was found that the teachers who expressed a greater level of professional teaching commitment also tended to have higher levels of both PTE and GTE.

Allinder (1994) administered the TES and the Teacher Characteristics Scale (Fuchs, Fuchs, & Bishop, 1992) to 200 randomly selected elementary special education teachers from four Midwest states. Teachers who displayed high levels PTE were more willing to try a variety of teaching approaches and materials, use new and innovative teaching methods and exhibited a desire to find better ways of teaching. Teachers who display elevated levels of PTE were also more apt to have higher scores in the areas of organization, enthusiasm, and fairness. Finally, enthusiasm and clarity in teaching were found to be related to elevated GTE. Research has also shown that just as a teacher's efficacy level can influence a his or her behavior; a teacher's level of efficacy can also influence students' attitude toward the subject matter being taught and students' attitudes toward school. Woolfolk, Rosoff, and Hoy (1990) concluded that students of teachers who exhibited high PTE tended toward greater interest in school, higher evaluations of their high PTE teachers, and showed a greater awareness that what they were being taught was important.

Warren and Payne (1997) investigated middle school organizational patterns and their impact on teachers' efficacy among 81 eighth-grade teachers. They concluded that teachers who were placed on interdisciplinary teams with the same planning times had significantly higher PTE levels than teachers on interdisciplinary teams that did not have the same planning times. Teachers placed on interdisciplinary teams with the same planning times had higher PTE than teachers who were organized within their own department (Warren & Payne, 1997). In a similar study Reames and Spencer (1998) examined Georgia middle school teachers' perceptions of their work environment, their perceived efficacy, and their organizational commitment. The study included 275 full-time, certified teachers from 40 rural and metropolitan middle schools. Teachers completed a mailed survey that asked about demographics, organizational commitment, perceived efficacy, and the schoolwork culture (Reames & Spencer, 1998). Organizational structure and process variables were positively related to PTE. Process variables included collaboration, participatory decision-making, and supportive administrative leadership. Organizational structures included encouragement of innovation and risk taking, school goals and planning, and staff development to further goals (Reames & Spencer, 1998).

Teacher efficacy has also been linked to family involvement practices. Garcia (2004) conducted a study that utilized the Teacher Efficacy Scale (Gibson & Dembo, 1984) and the Family Involvement Teacher Efficacy Scale (Garcia, 2000). Prior educational research has shown that positive benefits, for the child, are incurred as parents become involved in that child's education. By utilizing these two instruments and a sample size of 110 urban elementary school teachers, Garcia concluded that elevated teacher efficacy was significantly correlated to and was also a predictor of five types of positive family involvement practices (Garcia, 2004).

The Ashton Vignettes were developed on the assumption that teacher efficacy can be context specific. Ashton, Buhr, and Crocker (1984) created a series of short literary sketches describing events a teacher might experience in the educational environment and asked teachers to make evaluations as to the possible causes involved in each written scenario known as the Ashton Vignettes (Tschannen-Moran et al., 1998). Two versions were developed and the second version, which asked teachers to compare themselves to other teachers, was significantly correlated with the two RAND items. Benz et al (1992) conducted a study in which they used the Ashton Vignettes (Ashton, Buhr, & Crocker, 1984) to assess perceptions of efficacy across a variety of educational situations with a variety of educators. They found college faculty, when compared to classroom teachers, student teacher supervisors and preservice teachers, had elavated self-efficacy for dealing successfully with a disobedient student, for self-motivation, and for preparation. They also found both college faculty and preservice teachers were more confident about their efficacy in environments involving student socialization than were classroom teachers (Benz et al., 1992). In a related study Webb and Ashton (1987), the developers of the Ashton Vignettes, asked 42 middle and high school teachers to assess situational and environmental factors that they believed affected a teacher's sense of efficacy. Six factors were identified: 1) inadequate salaries and low status, 2) excessive role demands, 3) lack of recognition and professional isolation, 4) uncertainty, 5) alienation and 6) low teacher morale.

Because teacher efficacy is believed to be both subject-matter and context specific (Tschannen et al., 1998), Riggs and Enochs (1990) developed the Science Teaching Efficacy Belief Instrument (STEBI) to measure efficacy of science teaching. The authors identified two uncorrelated factors within STEBI, which they named *personal science teaching efficacy* (PSTE) and *science teaching outcome expectancy* (STOE). Thus, the instrument measured both PSTE and STOE. The PSTE scale indicated teachers' belief in their ability to perform a given behavior; the outcome STOE scale indicates the teachers' belief that effective teaching can change behaviors (Riggs & Enochs, 1990).

Using the Science Teaching Efficacy Belief Instrument (STEBI), Riggs & Jesunathadas (1993) found elementary teachers with higher personal science teaching efficacy (PSTE) scores reported spending more time teaching science and were more apt to spend the needed time to develop the science concept being taught. Watters and Ginns (1995) found that teachers with a higher sense of PSTE tended to have a higher level of enjoyment associated with science activities. Elementary teachers who were involved in a one-year science education training program who displayed low PSTE were less inclined to want to teach science and made smaller numbers of changes in their beliefs about how students could learn science. They also used less class time teaching science, were rated weaker by those who were observing them, and used a text-based teaching approach more often (Riggs, 1995).

Czerniak (1999) used the STEBI to assess and compare the science teacher efficacy levels of science teachers who taught in either a middle school organizational structure or a junior high school organizational structure. After analysis Czerniak (1999) found that science teachers who were part of a middle school model versus a junior high model had significantly higher levels of science teaching outcome expectancy (STOE). Czerniak speculated that that these findings add merit to the use of a middle school model over a junior high model since middle school organizational structures "provide teachers with the necessary support needed to remain committed to student learning" (Czerniak, 1999, p.36).

Chun and Oliver (2000) conducted research into the quantitative examination of teacher self-efficacy and knowledge of the nature of science. They conducted a longitudinal study on 31 middle school science teachers in the southeastern part of the United States. All 31 participating teachers had been science teachers for over 5 years. Four sets of instruments were administered to the participants over a three-year period including the STEBI. During the three years of the study the middle school science teachers participated in summer workshops. "The workshops were designed to enhance middle school teachers' understanding about the nature and structure of science as well as pedagogical knowledge to teach science" (Chun & Oliver, 2000, p. 3). The STEBI was administered to the subjects five times during the study. A pretest and posttest were given during the first year workshop, at the second year workshop, and a posttest during the last year workshop (Chun & Oliver, 2000). Chun and Oliver (2000) concluded that scores of PSTE and STOE both increased and paralleled each other over the five test times. These findings add merit to the use of the type of workshops mentioned above to increase middle school science teachers' self-efficacy and thereby make them more productive teachers.

Rubeck and Enochs (1991) attempted to investigate an even more specific level of efficacy by distinguishing efficacy associated with chemistry teaching from efficacy associated with science teaching. Enochs, Smith, and Huinker (2000) further developed a similar instrument to measure efficacy of mathematics teaching while Coladarci and

Breton (1997) used a modified instrument to measure efficacy in the framework of special education (Tschannen-Moran et al., 1998).

Teacher Efficacy Research—Preservice Teachers

In this section some of the more important findings concerning preservice teacher efficacy are addressed.

Evans and Tribble (1986), using the TES, compared the perceived teaching problems of 179 preservice elementary and secondary teachers with their level of efficacy. They found that preservice teachers who had elevated efficacy scores were more likely to have elevated levels of professional commitment. Czerniak (1989), using a revised Science Teaching Efficacy Belief Instrument (dubbed the STEBI-B) (Enochs & Riggs, 1990), found that the level of personal science teaching efficacy (PSTE) could be positively correlated to confidence in teaching elementary science effectively and negatively correlated to science teaching anxiety. Czerniak (1989) found preservice elementary teachers with high self-efficacy "had less anxiety toward teaching science, were more likely to use open-ended inquiry and student-directed teaching strategies, and were more confident about teaching elementary science effectively" (Czerniak & Schriver, 1994, p. 77).

Czerniak and Schriver (1994), in a related study, examined elementary preservice science teachers' beliefs and behavior related to self-efficacy. The 2-year longitudinal study used the Science Teacher Self-Efficacy Instrument modified by Czerniak (1989) from the Gibson and Dembo (1984) Teacher Efficacy Scale. Using this modified instrument, Czerniak and Schriver found that "preservice teachers who were in the top 20% of the class on science teaching self-efficacy seemed to display greater conviction that they could successfully help children learn science" (Czerniak & Schriver, 1994, p. 85). These preservice teachers, in order to become better educators, "analyzed their own strengths and weaknesses and sought to help all children learn" (Czerniak & Schriver, 1994, p. 85). High-level efficacy preservice teachers "selected strategies that they thought would help children learn science, and they used the educational theories they had learned in their methods class" (Czerniak & Schriver, 1994, p. 85). In contrast to the preservice teachers who were in the top 20% of the class on science teaching self-efficacy, the preservice teachers who were in the bottom 20% of the class on science teaching self-efficacy were unsure of their abilities to be successful teachers in the science classroom. They were overly concerned about noise in the teaching environment and regularly worried about student misconduct. They blamed others for their failures and avoided examining their own skills (Czerniak & Schriver, 1994).

There is also research to suggest that student teaching can have an impact on overall teacher efficacy. Teaching experience gained during the student teaching time when evaluated by the TES has been shown to increase personal teaching efficacy (Hoy & Woolfolk, 1990) while general teaching efficacy has been shown to decrease during student teaching (Hoy & Woolfolk, 1990; Spector, 1990). This may be due to over-optimism that is challenged when the student teacher faces the difficulties of the teaching assignment (Tschannen-Moran et al., 1998). Student teachers with elevated PTE were also rated higher on classroom management, questioning behavior and lesson-presenting behavior by the teachers supervising them (Saklofske, Michaluk, & Randhawa, 1988).

Emmer and Hickman (1990), using an adapted TES, found that preservice elementary and secondary teachers that show high teacher efficacy levels in all three subscales (personal teaching efficacy, efficacy for classroom management and discipline and external influences) tend to use classroom management strategies that are aimed at increasing desirable responses through encouragement, praise, rewards, and attention. They also found that preservice teachers, with an elevated sense of personal teacher efficacy, when faced with student discipline problems, were more apt to ask for help.

Efficacy has also been related to student control issues (Woolfolk & Hoy, 1990). Preservice teachers with low GTE and PTE or high GTE and low PTE, as measured by the TES tended to have a negative view of students' motivation, relied on punishment to get students to study, and had a tendency to enforce stringent classroom rules. These findings are in contrast to preservice teachers who were high in both GTE and PTE. Student teachers with high GTE and PTE efficacy scores tended to be more humanistic in their manner of classroom control. Both PTE and GTE of preservice teachers are malleable and may be affected differently by experiences. Social persuasion and vicarious experiences, such as those encountered in college coursework, seem to have a greater effect on preservice teachers' GTE (Watters & Ginns, 1995). In contrast, actual teaching experiences, such as those encountered in student teaching, seem to exert a greater influence on PTE (Housego, 1992; Hoy & Woolfolk, 1990), although GTE may also change (negatively) during student teaching (Hoy & Woolfolk, 1990; Spector, 1990).

Schoon's and Boone's (1998) work with preservice elementary teachers using the STEBI-B (Enochs & Riggs, 1990) has shown there is an association between elementary teachers' low science efficacy beliefs and alternative science concepts. The study found that holding certain alternative concepts about science such as planets can only be seen with a telescope, dinosaurs lived the same time as cave-men, and that north is toward the top of a map of Antarctica were linked to subjects with low science teacher efficacy. The study also found that preservice teachers that held fewer numbers of alternative concepts had significantly higher efficacy levels (Schoon & Boone, 1998).

Current reform in teacher education has focused on the need for improvement of preservice training (National Research Council, 1996). With this in mind Wingfield and Ramsey (1999) conducted a study that examined the effect of a one-semester site-based program where preservice teachers participated in authentic classroom and school experiences during their methods class. “The site experiences included: teaching experiences within the assigned classroom, teaching experiences during the methods classes, feedback from the university cluster coordinator, peer and site-based teacher, observation of the site-based teacher, and methods class assignments, text, instruction and instructor” (Wingfield & Ramsey, 1999, p. 2). The participants for the study consisted of 131 undergraduate elementary preservice teachers who completed the STEBI-B (Enochs & Riggs, 1990) at the beginning and end of the fifteen-week site-based program. A substantial increase in efficacy from pretest to posttest was noted. Wingfield and Ramsey (1999) concluded that the results indicated that the experiences of the one-semester program had a significant impact on the preservice teacher’s science teaching efficacy beliefs. They also speculated that the additional vicarious teaching experiences may have positively impacted the subjects’ science teaching efficacy. These vicarious teaching experiences specifically included observations of the methods instructor, other preservice teachers and classroom teachers (Wingfield & Ramsey, 1999).

King and Wiseman (2001) conducted a study with the purpose of examining differences in science teaching efficacy beliefs among students enrolled in two versions of a methods course in an elementary science teaching program. One group of preservice elementary teachers was enrolled in a semester long interdisciplinary methods class and another group of preservice elementary teachers was enrolled in a semester long more "traditional" non-interdisciplinary methods class. Both groups were given the STEBI-B (Enochs & Riggs, 1990) after the methods class. When the results of the STEBI were compared between both groups, neither PSTE nor STOE were found to be significantly different. They concluded their study by stating that if the role of integrated instruction in the elementary curriculum is considered, "the findings of their study suggest that teaching in an integrated fashion and planning interdisciplinary units would seem to be no more effective than traditional teaching in terms of developing the science teaching efficacy of the students" (King & Wiseman, 2001, p. 149).

Moseley, Reinke, and Bookout (2002) used Sia's (1992) Environmental Education Efficacy Belief Instrument to evaluate the effect a 3-day outdoor environmental education program would have on 72 participating preservice teachers. The Environmental Education Efficacy Belief Instrument (Sia, 1992), which is based on the STEBI (Enochs & Riggs, 1990), assesses outcome expectancy and self-efficacy in an environmental education teaching beliefs context. All items are based upon a 5-point Likert-scale response. Moseley, Reinke and Bookout (2002) found that the preservice teacher's self-efficacy was high before the 3-day program and remained unchanged immediately after the program. The preservice teacher's efficacy was then checked approximately 7 weeks after the conclusion of the 3-day program and it had dropped significantly. No change in the outcome expectancy of the subjects was observed over the complete length of the study. The authors accredited the lack of efficacy change during the workshop to the positive characteristics of the 3-day program. The drop in efficacy, approximately 7 weeks after the program, "was believed to have resulted from the preservice teachers reevaluation of their ability to teach as they learned more about teaching methodologies" (Moseley, Reinke & Bookout, 2002, p. 9).

There are also data to suggest that the number of high school science subjects studied can have a long term effect on the science efficacy of preservice teachers. Mulholland, Dorman and Odgers (2004) used the STEBI-B to assess the science efficacy of 314 elementary preservice teachers. They found that the preservice teachers' PSTE scores were positively related to the number of science classes studied at the high school level but not to their STOE scores. Completing two science teaching classes with the preservice teacher training program also had a significant positive effect on the PSTE but not on the STOE of the subjects.

Utley, Moseley and Bryant (2005) explored the impact an elementary methods course and student teaching had on both science and mathematics preservice teacher efficacy. Their study, which used both the STEBI-B and the Mathematics Teacher Efficacy Beliefs Instrument (MTEBI) (Huinker & Enochs, 1995), found both a positive and negative relationship between science and mathematics teaching efficacy in their sample population of elementary preservice teachers. Specifically, as the preservice teachers progressed in their methods courses their mathematics and science teacher efficacy also increased significantly. Both science and mathematics efficacy showed a slight decrease after student teaching.

Wagler and Moseley (2006) conducted a study to investigate the effects of a secondary content-specific methods course and student teaching on preservice teacher efficacy. The instrument used in the study was the "The Ohio State Teacher Efficacy Scale" (OSTES).The study employed a single group, pretest-posttest I-posttest II design. The repeated measures ANOVA indicated no significant change in overall teacher efficacy from the beginning of the secondary methods course until the end of student teaching; however, overall efficacy did increase significantly after the secondary methods course but by the end of student teaching had returned to its original pre-secondary methods course level. Classroom management efficacy over all three test times – before and after methods course and after student teaching - was unchanged. Instructional strategies efficacy was shown to be statistically significant and positively affected by the secondary methods course, but no significant change in instructional strategies efficacy was detected after student teaching. No significant change in student engagement efficacy was found immediately following the methods course but student engagement efficacy significantly decreased after student teaching.

Vicarious Experience

Bandura's (1997) construct of self-efficacy is influenced by four sources of information, which are (1) enactive mastery experience, (2) vicarious experience, (3) verbal persuasion, and (4) physiological and affective states. Mastery experience is considered the actual act of teaching by the individual. Physiological and affective states or physiological arousal are physiological effects an individual experiences during the teaching act. Vicarious experiences, within the context of teacher efficacy, refers to observing another individual teach. Verbal persuasion is the result of information about teaching conveyed to the preservice teacher or inservice teacher by someone perceived to be an authority. Tschannen-Moran et al. (1998) and other educational researchers had utilized Bandura's four sources of efficacy in their teacher efficacy models and instruments. For the purpose of this study we will focus on the source of vicarious experience and how it influences the construct of self-efficacy.

Within the context of vicarious experience, modeling is an effective mode for enhancing self-efficacy. An example of this in the context of teacher efficacy would be a preservice teacher who observes, as a participating observer or as a passive observer, a teaching event. In this scenario, the teacher as the model in the context of the vicarious event would have the potential to influence the teaching efficacy of the observer (i.e., preservice teacher).

Bandura (1997) points out that for many activities, such as swimming, proficiency and improvement can be measured. The criteria that denote when an individual is swimming are fairly well-defined. We can also quantify improvement by using a variable such as time. For many activities "there are no absolute measures of adequacy. Therefore, people must appraise their capabilities in relation to the attainments of others" (Bandura, 1997, p. 86). One of the ways this is done is by observing models performing tasks. Individuals seek out skilled models because these "competent models transmit knowledge and teach observers effective skills and strategies for managing environmental demands (Bandura, 1986). Acquisition of effective means raises beliefs of personal efficacy" (Bandura, 1997, p. 88).

When a person observes another similar individual successfully model a given event, efficacy beliefs are typically raised. Conversely, when a person observes another similar individual fail at modeling a given event, individual efficacy beliefs typically decline (Bandura, 1997). This is especially true if the individual observed is deemed competent by the observer. Competence at a given task, activity or event has been shown to be more effect at increasing efficacy than the age of the model, sex of the model or other personal characteristics (Bandura, 1997). “Model competence is an especially influential factor when observers have a lot to learn and models have much they can teach them by instructive demonstration of skills and strategies” (Bandura, 1997, p.101).

Bandura (1977) also proposes that models that convey productive coping techniques can even raise the efficacy of subjects who have experienced many confirmatory personal inefficacious events. On the contrary, subjects who possess high levels of efficacy when performing a given task can have their efficacy raised even higher “if the models teach them even better ways of doing things” (Bandura, 1997, p. 87). “Models who express confidence in the face of difficulties instill a higher sense of efficacy and perseverance in others than do models who begin to doubt themselves as they encounter problems (Zimmerman & Ringle, 1981)” (Bandura, 1997, p. 88).

Preservice Teacher Early Field Experiences

The research associated with field experiences among preservice teachers is limited. Much of the research conducted in this area occurred in the 1980’s and 1990’s with a few studies occurring in the last six years. Much of the major research has been conducted within the context of physical education. For most preservice teachers, early field experiences involve assisting, in some capacity, in an off-campus school environment (LaMaster, 2001). In the majority of cases the preservice teacher is working in the public school. The situational nature of early field experiences can range from observing teaching to active involvement in the teaching process. Early field experiences occur prior to the preservice teacher’s student teaching assignment (Dodds, 1989) and have been historically viewed as an important component in preservice teacher training programs (Paese, 1989). Because early field experiences are now seen as an essential component of preservice teacher training they have, over the past two decades, moved from a single early field experience to multiple early field experiences before student teaching. Dueck, Altmann, Haslett, and Latimer, (1984) believe these experiences "provide information to students so they can determine their suitability for the teaching profession, orient preservice teachers to schools, and begin the socialization process for potential teachers" (LaMaster, 2001, p. 28).

Early field experiences have historically been looked upon as an essential part of a teacher's socialization (Lasley, Applegate, & Ellison, 1986). Dodds (1989), in a related study on preservice teacher school socialization, stated "field experiences represent the closest juncture between formal teacher training in universities and on-the-job training in schools" (p.81). Paese (1984) assessed Early field experiences in terms of their positive benefits in developing the skills of effective teaching and also found that graduates of teacher education programs found early field experiences to be a helpful factor in their teacher training. By providing "real world" experiences, early field experiences also have the possibility of influencing future career decisions (Paese, 1987).

Paese (1989) lists seven teaching benefits that are achieved by incorporating EFE's into preservice teacher training. Among them is the ability of EFE's to help preservice teachers connect teaching theory to teaching practice, develop a more complete perception of students, gain a better understanding of their future inservice teaching responsibilities and have more of an opportunity to increase and improve their teaching skills.

A pilot study was conducted by the author during the spring semester of 2006. There were 50 participants (49 female, 1 male) who were preservice elementary education students enrolled in a course titled Early Lab and Clinical Experience in Elementary Education II at the university. The preservice teachers rated the teacher they observed during their educational field experience (see Appendix E minus questions 8 through 13) and completed the TES (see Appendix B). The results showed only a significant positive correlation between one undefined TES factor and item 1: Rate the quality of the lessons that your field experience teacher used. The undefined TES factor is associated with the teacher's internal skills and techniques applied to the teaching process. These skills and techniques are learned through teacher training and teacher experiences.

From the above literature review, it can be deduced that teacher efficacy has been positively correlated with many desirable teacher behaviors, but little research has been conducted to evaluate the impact of vicarious learning experiences in the context of perceived preservice teacher efficacy and perceived preservice science teacher efficacy. With this in mind, the purpose of this study was to investigate the effect of vicarious experiences on perceived preservice teacher efficacy and perceived preservice science teacher efficacy. The results should be most significant to the elementary education faculty at the studied university in evaluating the effectiveness of vicarious experiences as a tool in preparing preservice elementary teachers to enter the teacher work force. In a broader sense, the results of this study could benefit those attempting to incorporate vicarious events (e.g., elementary field experiences) into their teacher education curriculum.

CHAPTER III

METHODOLOGY

Introduction

This chapter describes the way in which the study was conducted. Each research question consists of the study participants, the testing instruments, the procedure and the data analysis needed to answer that specific research question.

The research methodology for the study was quantitative and is reflected in the way the data were collected and analyzed. Data were collected through the use of Likert-scale instruments and questionnaires that were analyzed through quantitative statistical procedures. For the purposes of this study, a quantitative methodology was preferable to a qualitative approach because it permitted a larger sample size, thereby making the findings and conclusions more generalizable.

Research Question 1

What is the impact of a vicarious learning experience (preservice teacher field experiences) on perceived preservice elementary teacher efficacy and perceived preservice elementary science teacher efficacy?

Study Participants

The participants for this part of the study consisted of 46 undergraduate elementary education students (preservice teachers) who were enrolled in a course titled

Early Lab and Clinical Experience in Elementary Education II at the university. Twelve of the 46 preservice teachers were also enrolled in the ExCEL program. The course involved direct observation and participation in classroom environments, kindergarten through eighth grade, and ran concurrent with seminars exploring multicultural education and integrated curricula.

Testing Instruments and Procedure

The Teacher Efficacy Scale (TES) is a teacher efficacy instrument designed to measure personal teacher efficacy (PTE) and teacher efficacy (TE). The instrument consists of 30 items with a Likert scale ranging from 1 (Strongly Disagree) to 6 (Strongly Agree). Gibson and Dembo (1984) found, after performing factor analysis, that sixteen of the original 30 items had acceptable reliability coefficients. For the current study all 30 items were used, and then factor analysis was conducted to evaluate what factors emerge within the specific test population.

Science Teaching Efficacy Belief Instrument B (STEBI-B): Science teacher efficacy instrument designed to measure PTSE and STOE. The instrument consists of 23 items from the STEBI. The STEBI-B is identical to the STEBI accept items 20 and 25 have been removed and the verb tenses of some of the 23 items have been changed to accommodate preservice teachers. Items 20 and 25 were removed because both cross-factor loaded. These changes were made so the instrument, which was originally designed for inservice teachers, could be used with preservice teachers (Enochs & Riggs, 1990). After thorough analyses, Enochs and Riggs (1990) concluded that the STEBI-B could be considered reliable and reasonably valid with a stable and unified factor structure.

The Educational Field Experience Teacher Rating and Preservice Teacher Questionnaire refers to the seven educational field experience inservice teacher rating items that have been validated as reflective of goals of the university teacher education program. The Preservice Teacher Questionnaire included items that helped assess the impact of the vicarious field experiences.

Early in the spring 2007 semester, before field experiences (vicarious experiences) began, subjects signed informed consent forms and provided limited demographic data by completing a brief questionnaire (see Appendix A). They then completed the STEBI-B (see Appendix C). The entire process took less than half an hour and occurred during a regularly scheduled class meeting on January 8, 2007. Near the end of the same semester, after field experiences were completed, subjects rated the teacher they observed during their educational field experiences and provided data about classroom events that occurred while doing their field experiences (see Appendix E), completed the TES (see Appendix B), and again completed the STEBI-B (see Appendix C). The entire process took less than half an hour and occurred during a regularly scheduled class meeting on April 23, 2007.

Data Analysis

For the purposes of data analysis and interpretation, this part of the study was treated as observational (the assignment of subjects into a treated group is outside the control of the investigator), where teacher efficacy, science teacher efficacy, the rating of the observed teacher, the gender of the subjects, the age of the subjects, number of lessons taught by the subject, content area taught by the subjects, science lessons taught by the subjects, teaching rating of the lessons taught by the subjects and number of times the subjects observed a science lesson being taught were the observed variables. The relationship of these variables was assessed using analysis of variance (ANOVA) and analysis of covariance (ANCOVA).

Research Question 2

What is the impact of the characteristics of the field experience classroom, within the given school where the educational field experience occurred, on perceived preservice elementary teacher efficacy and perceived elementary preservice science teacher efficacy?

Study Participants

The participants for this part of the study consisted of the same 46 preservice elementary teachers described above along with twenty inservice teachers whose classrooms served as sites for the preservice teachers' field experiences. Twelve of the 46 preservice teachers were also enrolled in the ExCEL program.

Testing Instruments and Procedure

The Classroom Demographic and Cooperating Teacher Questionnaire (see Appendix D) was a questionnaire that allowed the inservice teachers to record the ethnic demographics of the classes they teach, information about their school, and information about themselves. The preservice teachers delivered the questionnaire to their field experience inservice teachers midway through the spring 2007 semester. After granting informed consent, the inservice teachers completed the questionnaire, returned it to the preservice teacher that was observing them, who then returned it to the professor of their field experience course. The researcher collected the questionnaires from the professor.

Ethnic data collected from the preservice elementary teachers earlier (see Appendix A) were also used in this part of the study.

Data Analysis

For the purposes of data analysis and interpretation, this part of the study was treated as observational, where teacher efficacy, science teacher efficacy, the district in which the inservice teacher taught, the number of students the inservice teacher instructed each day, the grade instructed, the ethnicity of the inservice teacher's classroom where the field observation occurred, the number of students in the classroom who received free and reduced lunch, the age of the inservice teacher, the gender of the inservice teacher, the ethnicity of the inservice teacher, the number of years the inservice teacher had taught, the number of years the inservice teacher had taught at their current school and the number of years the inservice teacher had taught at their current grade level were the observed variables. The relationship of these variables was assessed using analysis of variance (ANOVA) and analysis of covariance (ANCOVA).

Assumptions and Limitations of the Study

Assumptions

The following assumptions were accepted:

1. The preservice elementary teachers understood the directions and the items on the testing instruments and responded to the items honestly, accurately, and to the best of their ability.

Limitations

The study was limited by the following:

1. Only one elementary field experience class with a specific set of components was studied. This prevents generalization to programs that do not resemble this course.
2. The study was conducted with preservice elementary teachers at a land-grant university. This prevents generalizations to other preservice teachers and to other types of elementary education programs at other universities.
3. The subjects were not randomly selected. Selection was determined by required enrollment in the methods courses.
4. The preservice teachers had many concurrent experiences during this phase of their teacher preparation, such as additional coursework, volunteering in public service work, substitute teaching, and/or part-time jobs. All of these experiences may have influenced the final results.
5. The possibility of confounding variables exists in the current study. With any preservice teacher, there were a number of variables that may have confounded the effects of each other. For example, the number of years of teaching experience of the inservice teacher may confound student ethnicity or school setting may confound the number of science lessons the preservice teacher taught.

CHAPTER IV

RESULTS

Introduction

This chapter describes the results and statistical analysis associated with the current study. The two research questions that define the current study are presented followed by statistics for the two testing instruments used in the study. Next, some analysis of the demographic data for the study participants is presented. Lastly, the results and statistical analysis associated with the study's two research questions are discussed.

Research Questions

Research Question 1

What is the impact of a vicarious learning experience (preservice teacher field experiences) on perceived preservice elementary teacher efficacy and preservice elementary science teacher efficacy?

Research Question 2

What is the impact of the characteristics of the field experience classroom, within the given school where the educational field experience occurred, on perceived preservice elementary teacher efficacy and perceived preservice elementary science teacher efficacy?

Testing Instruments Data Analysis

Principal Components Analysis

Principal Components Analysis (PCA) transforms a set of correlated variables into a smaller set of uncorrelated variables (Johnson, 1998). This uncorrelated set of variables is called the principal components. Using the PCA is advisable in determining the number of factors to use in factor analysis (FA) (Johnson, 1998). PCA found two components for each of the Science Teaching Efficacy Belief Instrument B (STEBI-B) pretest, STEBI-B posttest and the Teacher Efficacy Scale (TES) responses. For the STEBI-B pretest response variable, two principal components accounted for 40.3% of the variance. Two principal components accounted for 47.7% of the variance for the STEBI-B posttest response variables. Lastly, two principal components accounted for 28.8% of the variance for the TES variables. Thus, since two principal components are sufficient for all three response variables, factor analysis for each instrument were run with only two factors.

Factor Analysis

A factor analysis (FA) model summarizes a large set of possibly related response variables with a smaller set of uncorrelated response variables (Johnson, 1998). This smaller set of uncorrelated variables explains the relationships that exist between the large set of original variables. The set of 23 items for the STEBI-B (pretest and posttest) and the 30 items for the TES make up the three sets of possibly correlated variables. Once a smaller set of factors is determined, all other statistical analyses are performed on the underlying factors and not the original variables. Recall that PCA determined that two factors were identified for all three tests: the STEBI-B pretest, the STEBI-B posttest and the TES. Table 1 presents the factor loading for both factors for the STEBI-B pretest and STEBI-B posttest.

All STEBI-B factor loadings (PSTE and STOE), as identified by Enochs & Riggs (1990), loaded on their correct factor. Using a cutoff factor loading value of 0.45, all items on the STEBI-B loaded on either factor 1 (PSTE) or factor 2 (STOE). Values ranged from a low of 0.469 for item 7 to a high of 0.859 for item 18. There were some differences between the pretest and posttest regarding which items loaded on the two factors (PSTE and STOE) (See Table 1). To handle these differences, all PSTE items that loaded from the pretest and/or the posttest were combined and all STOE items that loaded from the pretest and/or the posttest were combined. Table 2 presents these combined factor loadings for the STEBI-B pretest and posttest. Item 6 was used as PSTE based on the original instrument (Enochs & Riggs, 1990) and item 9 was omitted from the current study based on incorrect factor loading.

Table 3 presents the factor loadings for the Teacher Efficacy Scale (TES). Note that for factor 1 three of the four items were Personal Teaching Efficacy (PTE) on the original Gibson and Dembo (1984) instrument. The fourth item, number 18: "If students are particularly disruptive one day, I ask myself what I have been doing differently," did not load on the original instrument nor was this item defined as PTE or TE, although it appears to be a PTE item based on its emphasis on self-efficacy.

Table 1

STEBI-B Original Factor Analysis

	Item #	Original Instrument Factor[c]	Loadings	
			Factor 1 PSTE	Factor 2 STOE
Pretest	1	STOE	-	0.625
	3	PSTE	0.709	-
	4	STOE	-	0.494
	6	PSTE[a]	-	0.594
	7	STOE	-	0.494
	8	PSTE	0.707	-
	11	STOE	-	0.761
	14	STOE	-	0.619
	15	STOE	-	0.654
	16	STOE	-	0.628
	17	PSTE	0.676	-
	18	PSTE	0.751	-
	19	PSTE	0.646	-
	20	PSTE	0.562	-
	21	PSTE	0.543	-
	22	PSTE	0.588	-
Posttest	1	STOE	-	0.713
	3	PSTE	0.519	-
	4	STOE	-	0.816
	5	PSTE	0.793	-
	6	PSTE[a]	0.734	-
	7	STOE	-	0.469
	8	PSTE	0.649	-
	9	STOE[b]	0.503	-
	12	PSTE	0.791	-
	13	STOE	-	0.506
	14	STOE	-	0.574
	16	STOE	-	0.639
	17	PSTE	0.709	-
	18	PSTE	0.859	-
	19	PSTE	0.778	-
	21	PSTE	0.775	-
	23	PSTE	0.695	-

Note. Cut off for Factor Loading of >.45
[a]Double Factor Loading. Item 6 was used as PSTE based on the original instrument (Enochs & Riggs, 1990).
[b]Incorrect Factor Loading, Item 9 was omitted from the current study.
[c]As identified by Enochs & Riggs, 1990

Table 2

STEBI-B Combined Factor Analysis

	Item #	Positive/Negative Wording	Original Instrument Factor	Loadings	
				Pretest	Posttest
	3	N	PSTE	0.709	0.519
	5	P	PSTE	0.326	0.793
	6	N	PSTE	0.375	0.734
	8	N	PSTE	0.707	0.649
	12	P	PSTE	0.367	0.791
Factor 1	17	N	PSTE	0.676	0.709
PSTE	18	P	PSTE	0.751	0.859
	19	N	PSTE	0.646	0.778
	20	N	PSTE	0.562	0.437
	21	N	PSTE	0.543	0.775
	22	P	PSTE	0.588	0.270
	23	N	PSTE	0.378	0.695
	1	P	STOE	0.625	0.713
	4	P	STOE	0.494	0.816
	7	P	STOE	0.494	0.469
Factor 2	11	P	STOE	0.761	0.314
STOE	13	N	STOE	0.203	0.506
	14	P	STOE	0.619	0.574
	15	P	STOE	0.654	0.420
	16	P	STOE	0.628	0.639

Note. Cut off for Factor Loading of >.45

Cronbach's Alpha Reliabilities

Cronbach's alpha is a measure of the internal reliability of an instrument. Interpretation of Cronbach's alpha presumes that an instrument consisting of K items is only a subset of all possible items that could be used to measure the topic of interest. Cronbach's alpha is the correlation between the total scores of any two random samples from the entire population of all possible items (Johnson, 1998). Thus, just as any correlation, Cronbach's alpha may range from 0 to 1, but generally any score above 0.7 is considered to be an acceptable indicator of the instrument's internal reliability (Johnson, 1998). Table 4 contains the Crombach's alpha reliabilities for the STEBI-B and TES.

Table 3

TES Factor Analysis

	Item #	Positive/Negative Wording	Original Instrument Factor	Loadings
Factor 1 PTE	1	P	PTE	0.688
	14	P	PTE	0.791
	18	P	Undefined[a]	0.489
	19	P	PTE	0.928
Indefinable Factor 2	2	P	TE	0.550
	3	P	Undefined[a]	0.462
	5	P	Undefined[a]	0.675
	8	P	Undefined[a]	0.534
	12	P	PTE	0.458
	13	N	Undefined[a]	0.640
	15	P	PTE	0.554
	20	P	Undefined[a]	0.689
	27	P	TE	0.656

Note. Cut off for Factor Loading of >.45
[a]Non-Factor Loading on Original 30 Item Instrument (Gibson and Dembo, 1984).

Table 4

Crombach's Alpha Reliabilities

STEBI-B	Factor 1(PSTE)		Factor 2 (STEO)	
	Pretest	Posttest	Pretest	Posttest
	.846	.909	.727	.77
TES	Factor 1 (PTE)		Factor 2 (Indefinable Factor 2)	
	.798		.909	

Summary Testing Instrument Statistics

Table 5 presents the means, standard deviations, t-test values and probabilities for the pretest and posttest scores on the Science Teaching Efficacy Belief Instrument B (STEBI-B). Statistics for both factors personal science teacher efficacy (PSTE) and science teacher outcome expectancy (STOE) linked with the STEBI-B are presented for both the pretest and posttest. A t-Test ($\alpha = 0.10$) revealed that the PSTE posttest mean of 3.955 was significantly greater than the pretest mean of 3.777 ($t = -2.519$, $p = 0.015$). Similarly, the STOE posttest mean of 3.685 was significantly greater than the pretest mean of 3.492 ($t = -1.979$, $p = 0.054$).

Table 5

STEBI-B Summary Testing Instrument Statistics

	PSTE pretest	PSTE posttest	STOE pretest	STOE posttest
Mean	3.777	3.955	3.492	3.685
S.D.	0.524	0.603	0.527	0.535
t-Test	-2.519		-1.979	
P(t)	0.015		0.054	

Table 6 presents the means and standard deviations for the Teacher Efficacy Scale (TES). Both factors “Personal Teacher Efficacy (PTE)” and “Indefinable Factor 2 (IF2)” associated with the TES are presented for both the pretest and posttest. Indefinable Factor 2 (IF2) is the second TES factor identified in the present study. Items associated with this factor were 2, 3, 5, 8, 12, 13, 15, 20 and 27. Based on the non-associative nature of these items, a common construct factor, such as TE, was deemed invalid.

Table 6

TES Summary Testing Instrument Statistics

	PTE	IF2
Mean	4.446	4.592
S.D.	0.813	0.615

Study Participants' Demographic Data Analysis

Preservice Teachers

Forty-six preservice teachers agreed to participate in the study. Forty-five were female and one was male. Forty-one were White, four were American Indian/or Alaskan and one was Hispanic/Latino. Twelve of the 46 preservice teachers were also enrolled in the ExCEL program. The mean age of all 46 preservice teachers was 22. The minimum age was 20, the maximum age was 29, the median age was 22 and the standard deviation was 1.71.

Table 7 presents all 46 preservice teacher responses to the question "How many times did you teach a lesson?" from the preservice post data collection event (See Appendix E). "T" denotes preservice teachers who were in the traditional observation program and "E" denotes preservice teachers who participated in the ExCEL program. The ExCEL (Excellence in Collaborative and Experiential Learning) Program is a collaborative partnership between the College of Education and the local public school district. Open to elementary education majors in their final semester before student teaching (Semester Y), the program features a three-day a week full day internship in a public school classroom in which teacher candidates are partnered with expert classroom teachers. By observing the range of lessons taught, thirty-two of the thirty-five preservice elementary teachers who taught between 1 and 10 lessons were in the traditional observation program. Two traditional observation program preservice elementary teachers taught between 11-20 lessons. All preservice teachers who taught more than 21 lessons were in the ExCEL program.

Table 7

Preservice Teacher Question

Mean Lessons Taught	10
Minimum Lessons Taught	1
Maximum Lessons Taught	50
SD of Lessons Taught	13.623

Range of Lessons Taught	# of preservice teachers
1 to 10 Lessons Taught	32 T/3E
11 to 20 Lessons Taught	2 T
21 to 30 Lessons Taught	5 E
31 to 40 Lessons Taught	2 E
41 to 50 Lessons Taught	2 E

Note. T = Traditional elementary education program, E = ExCEL elementary education program.

Table 8 presents all 46 preservice teacher responses to the question "If you taught science, how many times did you teach a science lesson?" from the preservice post data collection event (See Appendix E). "T" denotes preservice teachers who were in the traditional observation program and "E" denotes preservice teachers who participated in the ExCEL program. By observing the range of science lessons taught, fourteen traditional observation program preservice elementary teachers taught no lessons. Eighteen traditional observation program and five ExCEL program preservice elementary teachers taught only one or two science lessons. One traditional observation program and one ExCEL program preservice elementary teacher taught three or four science lessons. Lastly, all preservice teachers who taught more than five science lessons were in the ExCEL program.

Table 8

Preservice Teacher Question

Mean Science Lessons Taught	1.67
Minimum Science Lessons Taught	0
Maximum Science Lessons Taught	10
SD of Science Lessons Taught	2.35
Range of Science Lessons Taught	# of preservice teachers
0 Science Lessons Taught	14 T
1-2 Science Lessons Taught	18 T/5 E
3-4 Science Lessons Taught	1 T/1 E
5-6 Science Lessons Taught	4 E
7-8 Science Lessons Taught	1 E
9-10 Science Lessons Taught	1 E

Note. T = Traditional elementary education program, E = ExCEL elementary education program.

Table 9 presents all 46 preservice teacher responses to the question "How many times did you observe a science lesson being taught?" from the preservice post data collection event (See Appendix E). Again, "T" denotes preservice teachers who were in the traditional observation program and "E" denotes preservice teachers who participated in the ExCEL program. An examination of the range of science lessons observed revealed that all 34 of the preservice elementary teachers in the traditional observation program observed nine or fewer lessons, while ten of the twelve ExCEL preservice teachers observed more than ten science lessons.

Table 9

Preservice Teacher Question

Mean Observed Science Lessons	8.09
Minimum Observed Science Lessons	0
Maximum Observed Science Lessons	45
SD of Observed Science Lessons	13.133
Range of Observed Science Lessons	# of preservice teachers
0-9 Observed Science Lessons	34 T/2 E
10-18 Observed Science Lessons	3 E
19-27 Observed Science Lessons	1 E
28-36 Observed Science Lessons	2 E
37-45 Observed Science Lessons	4 E

Note. T = Traditional elementary education program, E = ExCEL elementary education program.

Inservice Teachers

Twenty inservice teachers agreed to participate in the study. Nineteen were female and one was male. Eighteen were white and two were American Indian/or Alaskan. The mean age of all twenty inservice teachers was 44. The minimum age was 24, the maximum age was 59, the median was 40 and the standard deviation was 11.71

Table 10 presents all 20 inservice teacher responses to the questions (1) "How many years of teaching have you completed?"; (2) "How many years have you taught at your current school?"; and (3) "How many years have you taught at your current grade level?". These questions are from the inservice data collection event (See Appendix D).

Table 10

Select Inservice Teacher Questions

Mean # of years teaching completed	15.3
Minimum # of years teaching completed	1.5
Maximum # of years teaching completed	37
SD of # of years teaching completed	9.99
Mean # of years taught at your current school	5.725
Minimum # of years taught at your current school	1
Maximum # of years taught at your current school	25
SD of # of years taught at your current school	5.63
Mean # of years taught at current grade level	6.7
Minimum # of years taught at current grade level	1
Maximum # of years taught at current grade level	23
SD of # of years taught at current grade level	6.764

Introduction to Research Question 1 and 2 Analysis

In order to answer research questions 1 and 2 for the STEBI-B test, analysis of covariance (ANCOVA) was utilized. ANCOVA is a statistical procedure that tests a set of factors for significance on the response variable while removing the variance for which the covariant accounts. For both research questions, the response variable is the post-test score for the STEBI-B and the covariant is the pre-test score for the STEBI-B. The inclusion of the pre-test score into the model as a covariant can increase power because it accounts for additional variability had the covariant been left out of the model. Forward stepwise selection was used as a variable selection method for the final ANCOVA linear model. This variable selection method selects the most parsimonious set of factors for the ANCOVA linear model.

Research questions 1 and 2 for the TES were addressed using analysis of variance (ANOVA). ANOVA is a statistical procedure that relates a set of quantitative factors to a response variable. There is no covariant for the TES since it was given only one time.

The categories associated with each variable were based on the distribution of the data for each specific category. Because six out of ten of the variables were discrete (discontinuous) and because the data of several of the continuous variables were not normally distributed, the responses were grouped into a manageable number of categories. There was an attempt to equalize the number of subjects in each category in order to pick up true existing differences between the categories. Appendix F contains tables detailing the makeup of each of these categories for variables related to preservice teachers, inservice teachers, and field experience classrooms.

Table 11

Variables and Categories Associated with Research Question 1

Variable	Categories			
Age of preservice teacher	< 22 years (N = 22)	≥ 22 years (N = 24)		
Gender of preservice teacher	Male (N = 1)	Female (N = 45)		
Ethnicity of preservice teacher	White (N = 41)	Amer. Ind. or Alaskan (N = 4)	Hispanic/ Latino (N = 1)	
Rating of the inservice field experience teacher by the preservice teacher	Likert Scale 1-5 (Poor to Excellent)			
Number of lessons the preservice teacher taught	1 (N = 12)	2-4 (N = 10)	5-10 (N = 13)	12-50 (N = 11)
Number of science lessons the preservice teacher taught	0 (N = 14)	1 (N = 22)	2-10 (N = 10)	
Self-rating of the science lessons taught by the preservice teacher	Likert Scale 1-5 (Poor to Excellent)			
Self-rating of all lessons taught by the preservice teacher	Likert Scale 1-5 (Poor to Excellent)			
Number of science lessons the preservice teacher observed	0 (N = 13)	1-2 (N = 12)	3-10 (N = 13)	15-45 (N = 8)
Was the preservice teacher part of the ExCEL program?	ExCEL (N = 12)	Non-ExCEL (N = 34)		

Research Question 1 Analysis

Table 11 lists the variables associated with research question 1: “What is the impact of a vicarious learning experience (preservice teacher field experiences) on perceived preservice elementary teacher efficacy and preservice elementary science teacher efficacy?" Each variable is presented along with the categories related to that variable.

STEBI-B Results

For both factors 1 and 2, the ANCOVA model for research question 1 had no statistically significant independent variables (α = 0.10).

TES Results

The ANOVA model for factor 1 of the TES did not have any significant independent variables (α = 0.10). However, the ANOVA model for factor 2 of the TES did have a statistically significant independent variable, the age of the preservice teacher. Table 12 contains the ANOVA results. The means resulting from the ANOVA are given in Table 13.

Research Question 2 Analysis

Table 14 lists the variables associated with research question 2: "What is the impact of the characteristics of the field experience classroom, within the given school where the educational field experience occurred, on perceived preservice elementary teacher efficacy and perceived preservice elementary science teacher efficacy?" Each variable is presented along with the categories related to that variable.

Table 12

Age of Preservice Teacher ANOVA

	Df	Sum of Sq	Mean Sq	F Value	Pr(F)
Age of Preservice Teacher	1	1.09242	1.092424	3.017598	0.08936196*
Error	44	15.92878	0.362018		

*p< .10

Table 13

Age of Preservice Teacher Means

Variable	Mean of TES
Age of Preservice Teacher (Below 22 years of age)	4.757
Age of Preservice Teacher (22 years of age or older)	4.449

STEBI-B Results

The final ANCOVA model for research question 2, factor 1 of the STEBI-B test includes three independent variables as well as the covariate. Table 15 contains the ANCOVA model results. In the ANCOVA table, 'Group' refers to the collective effect of the independent variables in the model while 'Covariate' refers to the effect of the covariate (the pre-test score on the STEBI-B) on the response variable (the post-test score of the STEBI-B).

Table 14

Variables and Categories Associated with Research Question 2

Variable	Categories				
Name of the inservice teachers school	Schools 1 through 7				
Name of the inservice teachers district	Districts 1 through 3				
Number of students the inservice teacher instructed per day	16-17 (N = 5)	22-25 (N = 6)	19-20 (N = 5)	62-147 (N = 4)	
Grade the inservice teacher instructs	1st-2nd (N = 6)	3rd (N = 6)	4th-7th (N = 8)		
Percentage of Hispanic/Latino students the inservice teacher instructs each day	0% (N = 8)	3.1%-11.8% (N = 7)	21%-75% (N = 5)		
Percentage of Black students the inservice teacher instructs each day	0%-4.5% (N = 4)	5.3%-8.1% (N = 4)	10.2%-12.5% (N = 4)	14.8%-18.2% (N = 5)	20%-77.3% (N = 3)
Percentage of White students the inservice teacher instructs each day	10.2%-50% (N = 7)	52.9%-73.7% (N = 7)	75%-95% (N = 6)		
Percentage of Asian/Pacific Islander students the inservice teacher instructs each day	0% (N = 12)	1.4%-12% (N = 8)			
Percentage of American Indian/or Alaskan students the inservice teacher instructs each day	0%-2.7% (N = 10)	4%-57.9% (N = 10)			
Percentage of other ethnicity students the inservice teacher instructs each day	0% (N = 13)	4%-18.8% (N = 7)			
Percentage of students the inservice teacher instructs that receive free and reduces lunch	9.7-36.8% (N = 5)	58.8-100% (N = 15)			
Age of the inservice teacher	≤40 years (N = 10)	>40 years (N = 10)			
Gender of the inservice teacher	Male (N = 1)	Female (N = 19)			
Ethnicity of the inservice teacher	White (N = 18)	American Indian/Alaskan (N = 2)			
Number of years teaching the inservice teacher had completed	2.5 yrs-11 yrs (N = 10)	15 yrs-37 yrs (N = 10)			

Table 14 Cont'd.

Variables and Categories Associated with Research Question 2

Number of years the inservice teacher had been at their current school	1 year (N = 5)	2 yrs-3 yrs (N = 5)	4 yrs-7 yrs (N = 5)	8 yrs-25 yrs (N = 5)
Number of years the inservice teacher had taught at their current grade level		1 yr-3 yrs (N = 12)	5 yrs-23 yrs (N = 8)	
Was the preservice teacher part of the ExCEL program?		ExCEL (N = 12)	Non-ExCEL (N = 34)	

Table 15

ANCOVA Model Results for Research Question 2, Factor 1 of the STEBI-B

	Df	Sum of Sq	Mean Sq	F Value	Pr(F)
Group	3	1.023479		2.563234	0.09360104*
Covariate	1	3.079642	3.079642	23.13828	0.00022924*
Error	15	1.996460	0.133097		

*p< .10

The test for the significance of the covariate in the model resulted in an F test statistic of F* = 23.13828 and an estimated p-value 0.0002292445. The overall F test for equality of the means for each level of the independent variable was F* = 2.563234 and had an estimated significance level of 0.09360104. The significant predictors for the ANCOVA model included the inservice teacher ethnicity (p = 0.0832), the inservice teacher gender (p = 0.0065), and the number of free lunch students (p = 0.0197). Table 16 contains the means for factor 1 of the STEBI-B posttest associated with the ANCOVA linear model. Adjusted means are computed for each category of each independent variable holding all other variables, including the covariate, constant using their respective mean values.

Table 16

Means for Factor 1 of the STEBI-B Posttest Associated with the ANCOVA

Variable	Mean of Posttest STEBI-B
Ethnicity of the inservice teacher (White)	3.892
Ethnicity of the inservice teacher (American Indian/or Alaskan)	3.243
Gender of the inservice teacher (Male)	3.513
Gender of the inservice teacher (Female)	3.621
Percentage of students the inservice teacher instructs that receive free and reduces lunch (9.7%-36.8%)	3.711
Percentage of students the inservice teacher instructs that receive free and reduces lunch (58.8%-100%)	3.423

Table 17

ANCOVA Model Results for Research Question 2, Factor 2 of the STEBI-B

	Df	Sum of Sq	Mean Sq	F Value	Pr(F)
Group	5	2.76232		8.681305	0.00083516*
Covariate	1	0.385161	0.3851610	6.05234	0.02866086*
Error	13	0.827299	0.0636384		

*p< 0.10

Factor 2 of the STEBI-B yielded an ANCOVA model with four independent variables. Table 17 presents the ANCOVA results. Note that the test for the significance of the covariate yielded a significant F test (F* = 6.052, p = 0.0287). The test for overall equality of the group means was also significant (F* = 8.681, p = 0.00084). The significant predictors for the ANCOVA model included the percentage of Asian/Pacific Islander students (p = 0.0865), the percentage of Hispanic/Latino students (p = 0.0005), the percentage of American Indian/or Alaskan students (p = 0.0293), and the indicator variable for ExCEL program participation (p = 0.0064).

Table 18 contains the means for each level of each independent variable.

Table 18

Means for Factor 2 of the STEBI-B Posttest Associated with the ANCOVA

Variable	Mean of Posttest STEBI-B
Percentage of Asian/Pacific Islander students the inservice teacher instructs each day (0%)	3.727
Percentage of Asian/Pacific Islander students the inservice teacher instructs each day (1.4%-12%)	3.556
Percentage of Hispanic/Latino students the inservice teacher instructs each day (0%)	3.817
Percentage of Hispanic/Latino students the inservice teacher instructs each day (3.1%-11.8%)	3.301
Percentage of Hispanic/Latino students the inservice teacher instructs each day (21%-75%)	3.807
Percentage of American Indian/or Alaskan students the inservice teacher instructs each day (0%-2.7%)	3.512
Percentage of American Indian/or Alaskan students the inservice teacher instructs each day (4%-57.9%)	3.771
ExCEL preservice teacher	3.456
Non-ExCEL preservice teacher)	3.827

Table 19 contains the Tukey simultaneous confidence intervals to determine where the means are significantly different. Tukey simultaneous confidence intervals are necessary when considering the independent variable for Hispanic/Latino students the inservice teacher instructs each day since there are three levels. Thus, we will compare all levels of Hispanic/Latino students the inservice teacher instructs each day with a controlled experimentwise error rate of 0.10. Note that the Posttest STEBI-B means for categoriesl 0% and 3.1%-11.8% are different as are the means for categories 3.1%-11.8% and 21%-75%. However, the means for categories 0% and 21%-75% are not statistically different.

Additionally, point estimates for the mean differences appear in the "Estimate" column. For example, the mean for 0% Hispanic/Latino students is 3.817. The adjusted mean for 3.1%-11.8% Hispanic/Latino students is 3.301. Their difference between these means is 0.516. Concerning the "Interval" column, if the interval does not contain 0 then the means are statistically significant. If the range is all positive numbers then the first mean is larger. If the range is all negative numbers, then the first mean is smaller.

Table 19

Tukey Simultaneous Confidence Intervals for Factor 2 of the STEBI-B

Comparison level	Estimate	Interval
0% compared to 3.1-11.8%	0.516	(0.182, 0.850)*
0% compared to 21-75%	0.009	(-0.413, 0.432)
3.1-11.8% compared to 21-75%	0.507	(-0.873, -0.140)*

*Significant interval

TES Results

Table 20 contains the results of the ANOVA for TES factor 1. Note that the percentage of Hispanic/Latino students the inservice teacher instructs each day was the only significant independent variable (F = 2.8977, p = 0.082621). Additionally, the means for TES for each category of Hispanic/Latino students the inservice teacher instructs each day are given in Table 21.

Table 20

ANOVA for TES Factor 1

	Df	Sum of Sq	Mean Sq	F Value	Pr(F)
Percentage of Hispanic/Latino students the inservice teacher instructs each day	2	3.22567	1.612835	2.8977	0.082621*
Error	17	9.46183	0.556578		

*p< 0.10

Table 21

TES Factor 1 Means for Hispanic/Latino Students

Variable	Mean of TES
The percentage of Hispanic/Latino students the inservice teacher instructs each day (0%)	5.031
The percentage of Hispanic/Latino students the inservice teacher instructs each day (3.1%-11.8%)	4.107
The percentage of Hispanic/Latino students the inservice teacher instructs each day (21%-75%)	4.700

Table 22 contains the Tukey simultaneous confidence intervals to determine where the means are significantly different. Tukey simultaneous confidence intervals are necessary when considering the independent variable for Hispanic/Latino students the inservice teacher instructs each day since there are three levels. Thus, we will compare all levels of Hispanic/Latino students the inservice teacher instructs each day with a controlled experimentwise error rate of 0.10. Note that the means for TES are different for categories 0% and 3.1%-11.8% Hispanic/Latino students the inservice teacher instructs each day, but not for categories 0% and 21-75% or categories 3.1%-11.8% and 21%-75%. Additionally, the point estimate (Estimate) is the difference between the means. For example, 5.031-4.107 = 0.924 is the estimated difference between 0% and 3.1-11% Hispanic/Latino students. Concerning the "Interval" column, if the interval does not contain 0 then the means are statistically significant. If the range is all positive numbers then the first mean is larger. If the range is all negative numbers then the first mean is smaller.

Table 22

Tukey Simultaneous Confidence Intervals for Factor 1 of the TES

Comparison level	Estimate	Interval
0% compared to 3.1-11.8%	0.924	(0.075, 1.770)*
0% compared to 21-75%	0.331	(-0.604, 1.270)
3.1-11.8% compared to 21-75%	-0.593	(-1.550, 0.368)

*Significant interval

Table 23 contains the results of the ANOVA for TES factor 2. Jefferson Middle School, one of seven schools where tie inservice teachers taught, was the only significant independent variable in this model (F = 4.641841, p = 0.04499545). The mean TES Factor 2 score at Jefferson Middle School was lower when compared to the mean score of the other schools (See Table 24).

Table 23

ANOVA for TES Factor 2

	Df	Sum of Sq	Mean Sq	F Value	Pr(F)
Jefferson Middle School	1	1.141358	1.141358	4.641841	0.04499545
Error	18	4.425926	0.245885		

Table 24

Means for TES Factor 2

Variable	Mean of TES
Jefferson Middle School	3.833
Schools other than Jefferson Middle School	4.630

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Introduction

This chapter describes the conclusions and recommendations associated with the study. The two research questions that define the current study are presented followed by the testing instruments conclusions and study participants demographic conclusions. Next, the conclusions associated with the study's two research questions are discussed. Lastly, recommendations for future research, implications for practice and concluding remarks will be presented.

Research Questions

Research Question 1

What is the impact of a vicarious learning experience (preservice teacher field experiences) on perceived preservice elementary teacher efficacy and preservice elementary science teacher efficacy?

Research Question 2

What is the impact of the characteristics of the field experience classroom, within the given school where the educational field experience occurred, on perceived preservice elementary teacher efficacy and perceived preservice elementary science teacher efficacy?

Testing Instruments Conclusions

Principal Components Analysis

Principal Components Analysis (PCA) was performed on the Science Teaching Efficacy Belief Instrument B (STEBI-B) pretest responses, STEBI-B posttest responses and the Teacher Efficacy Scale (TES) responses. Johnson (1998) advises using PCA to determine the number of factors to use in factor analysis (FA). For the STEBI-B pretest response variables, two principal components accounted for 40.3% of the variance. Two principal components accounted for 47.7% of the variance for the STEBI-B posttest response variables. With both the STEBI-B pretest and STEBI-B posttest this percentage of variance further validated the use of a two-factor model. The STEBI-B posttest variance level was 7.4% higher than the STEBI-B pretest further strengthening the argument for two STEBI-B factors for both the pretest and the posttest. When comparing the TES variance, which is 28.8% for the TES variables, to both the STEBI-B pretest and posttest variance, the TES variables is 11.5% lower than the STEBI-B pretest response variables and 18.9% lower than the variance for the STEBI-B posttest response variables. Even though the amount of variance associated with the TES was lower than the STEBI-B, the percentage of variance still suggests the use of a two-factor model.

In conclusion, the PCA validated that two principal components are sufficient for both the STEBI-B pretest and posttest and the TES although the amount of variance accounted for was lower for the TES than the STEBI-B pretest and posttest. Based on the PCA results, the factor analysis was run with only two factors for both the STEBI-B and the TES.

Factor Analysis

Factor analysis was conducted using a two-factor model for both the STEBI-B pretest and STEBI-B posttest. Factor loading measures the contribution of the factor, for example PSTE, to the STEBI-B response. Table 1 presents the factor loading for both factors for the STEBI-B pretest and STEBI-B posttest at a cut off for factor loading of >.45. Note that the items that loaded for factor 1 [Personal Science Teaching Efficacy (PSTE)] correspond to items concerning PSTE, as identified by Enochs and Riggs in their original instrument analysis (1990), with the exception of item 9 in the posttest. Conversely, the items that loaded for factor 2 [Science Teaching Outcome Expectancy (STOE)] correspond to items concerning STOE, as identified by Enochs and Riggs in their original instrument analysis (1990), with the exception of item 6 for the pretest. This leads to a clear interpretation for these two factors based on the PCA, the factor analysis and the commonality between this study's factor loading and that of Enochs and Riggs' (1990) original study. With confidence we can conclude that, in the current study, two factors, PSTE and STOE, were measured by the STEBI-B. This is consistent with findings of other researchers have found (King & Wiseman, 2001; Mulholland, Dorman & Odgers, 2004).

Factor analysis was also conducted using a two-factor model for the TES. Table 3 presents the factor loadings for the TES. Note that for factor 1 [Personal Teacher Efficacy (PTE)] three of the four items are PTE on the original Gibson and Dembo (1984) instrument. The fourth item, item 18: "If students are particularly disruptive one day, I ask myself what I have been doing differently," did not load on the original instrument nor was defined on the original instrument as PTE or TE but is a PTE item based on its emphasis on self-efficacy and locus of control. Note that for factor 2 [Teacher Efficacy (TE)] we have TE items, PTE items and items that did not load on either factors of the original 30-Item Instrument (Gibson & Dembo, 1984). This leads to a very clear interpretation for these two factors based on the PCA, the factor analysis and the commonality and discrepancy between this study's factor loading and Gibson and Dembo's (1984) original study factor loading. With confidence we can conclude that, in the current study, one factor, PTE, was measured by the TES. The second factor deemed TE in the original Gibson and Dembo (1984) instrument was not identified in the current study. Rather a second factor was indefinable based on the non-associated nature of the items that loaded on it. As pointed out previously, the items that loaded for this factor were TE items, PTE items, and items that did not load on any factor on the original 30 Item Instrument (Gibson and Dembo, 1984). This second factor in the current study associated with the TES has been, for this study, named Indefinable Factor 2 (IF2). The problematic nature of the TES is consistent with what other researchers have found and eliminates the ability to draw any conclusions associated with factor 2 of the TES. The problematic nature of the TES and the past research related to the instrument will be discussed in greater detail in the section labeled "The Problematic Nature of the Teacher Efficacy Scale."

Cronbach's Alpha Reliabilities

Cronbach's alpha is a measurement that assesses the internal reliability of an instrument. Cronbach's alpha was performed on the STEBI-B for factor 1 (PSTE) and factor 2 (STOE) for both the pretest and the posttest data. Cronbach's Alpha was also performed on the TES for factor 1 (PTE) and factor 2 (IF2) for the TES's single data set

(See table 4). Cronbach's alpha may range from 0 to 1, and generally, any score above 0.7 is considered an indicator of good internal reliability.

All STEBI-B Cronbach's Alpha reliability results were above the 0.7 cut off that defines satisfactory internal reliability of an instrument. Concerning the specific STEBI-B Cronbach's Alpha reliability results it should be noted that the internal reliability of the instrument increased from the pretest to the posttest for both factor 1 (PSTE) and factor 2 (STOE). This trend further increases the validity of conclusions associated with the STEBI-B. The TES Cronbach's Alpha reliability results are also above the 0.7 cut off that defines satisfactory internal reliability of an instrument. In conclusion, all Crombach's alpha values related to both instruments used in this study were above 0.7 indicating we have sufficient internal reliability to assess the internal factors of these instruments.

Summary Testing Instrument Statistics

Means, standard deviations, t-test values and probabilities for the pretest and posttest scores were calculated for both factors of the STEBI-B (See Table 5). There was found a significant difference between the PSTE pretest and the PSTE posttest with the PSTE pretest score of 3.777 increasing to 3.955 for the PSTE posttest. There was also found a significant difference between the STOE pretest and the STOE posttest with the STOE pretest score of 3.492 increasing to 3.685 for the STOE posttest. For both PSTE and STOE all means for the pretest and the posttest were between the STEBI-B Likert Scale categories of "Uncertain (3)" and "Agree (4)."

Perhaps the overall increase that is observed in both PSTE and STOE is indicative of the positive efficacious events the preservice teachers experienced during CIED 3430

(Early Lab and Clinical Experience in Elementary Education II) and in their inservice teacher's classroom over the testing time. Note that the pretest mean scores are moderately positive and the increase that we see over the study time is small. The case maybe that this tendency to be just above "Uncertain (3)" is due to the preservice teacher's general anxieties, fears, and lack of self-confidence associated with understanding science and science teaching during the study time. This relationship has been well documented in the responses of preservice elementary teachers (Czerniak, 1989; Enochs & Riggs, 1990; Czerniak & Schriver, 1994).

Mean and standard deviation were calculated for factor 1 (PTE) of the TES (See Table 6). The mean for PTE was 4.446. The PTE mean was between the TES Likert Scale categories of "Agree slightly more than disagree (4)" and 'Moderately agree (5)." Again, the level of PTE at the conclusion of the treatment was moderately positive. This tendency to be just above "Agree slightly more than disagree (4)" is maybe indicative of the preservice teachers' experiences in their teacher training. In most cases they have very little, if any, teaching experiences or other experiences within a given school system to serve as a basis for their teacher self-efficacy beliefs. This inexperience is evident in their moderately positive responses associated with what they believe their teaching abilities are.

The mean and standard deviation were also determined for factor 2 (IF2) of the TES (See Table 6). The mean for IF2 was 4.592. The IF2 mean was also between the TES Likert Scale categories of "Agree slightly more than disagree (4)" and 'Moderately agree (5)" but, considering the indefinable nature of this factor, no conclusions can drawn.

Study Participants Demographic Conclusions

Preservice Teachers

Table 7 summarizes all 46 preservice teacher responses to the question “How many times did you teach a lesson?” from the preservice post data collection event. From the table it is apparent that there is a wide range in the number of lessons the preservice teachers taught during the treatment time. The great majority of the preservice teachers taught between 1and10 lessons with only 2 out of 35 of the preservice teachers in this category being in the ExCEL program. Two traditional preservice teachers taught between 11 and 20 lessons while the remaining preservice teachers who taught from 21 to 50 lessons were enrolled in the ExCEL program.

Table 8 summarizes all 46 preservice teacher responses to the question “If you taught science, how many times did you teach a science lesson?” The number of science lessons the preservice teachers taught during their field experience ranged from 0 to 10. As with the previous question, the traditional preservice teachers were grouped on the lower end of the range while the ExCEL program preservice teachers were grouped on the higher end of the range.

Table 9 summarizes all 46 preservice teacher responses to the question “How many times did you observe a science lesson being taught?” As with the previous two preservice questions, there is a similar trend where the traditional preservice teachers were grouped on the lower end of the range and the ExCEL program preservice teachers were grouped on the higher end of the range of science lessons observed. Thirty-four out of 36 preservice teachers observed between 0 and 9 lessons. Only the ExCEL preservice teachers observed from 10 to 45 lessons.

In conclusion, the general trends we observed were the ExCEL preservice teachers are teaching more lessons, teaching more science lessons, and observing more science lessons. The traditional preservice teachers are teaching fewer lessons, teaching fewer science lessons, and observing fewer science lessons. The results are indicative of the constraints placed on the preservice teachers by their participation in either the Traditional or ExCEL program.

Inservice Teachers

Table 10 summarizes all 20 inservice teacher responses to the questions (1) "How many years of teaching have you completed?"; (2) "How many years have you taught at your current school?"; and (3) "How many years have you taught at your current grade level?". With all three questions the responses disclosed a wide range of years. This is apparent by observing the "Minimum number of years," "Maximum number of years" and "SD of number of years" of all three questions. The "Mean number of years teaching completed" is also much larger than the "Mean number of years taught at your current school" and the "Mean number of years taught at current grade level." Obviously, this is to be expected since both "Mean number of years taught at your current school" and "Mean number of years taught at current grade level" are subcomponents of the "Mean number of years teaching completed."

Seventeen of the 20 inservice teachers have 7 or more years of teaching experience with a maximum of 25 years of teaching experience (see Table 10). This is not surprising considering the desire of the preservice teacher faculty to place preservice teachers in observation classrooms with inservice teachers who have many successful years of teaching experience. Eleven of the 20 inservice teachers have taught between 1 and 4 years at their current school. Thirteen of the 20 inservice teachers have taught between 1 and 5 years at their current grade level.

Research Question 1

"What is the impact of a vicarious learning experience (preservice teacher field experiences) on perceived preservice elementary teacher efficacy and preservice elementary science teacher efficacy?"

Research Question 1 Conclusions

STEBI-B Factor 1 and 2 Results

Table 11 lists the variables and categories associated with research question 1. For both STEBI-B factors PSTE and STOE, the ANCOVA model for research question 1 had no statistically significant independent variables ($\alpha = 0.10$).

TES Factor 1 and 2 Results

Table 11 lists the variables and categories associated with research question 1. The ANOVA model for TES factor 1 (PTE) had no significant independent variables ($\alpha = 0.10$). However, the ANOVA model for TES factor 2 (IF2) of the TES did have one statistically significant independent variable, the age of the preservice teacher ($p = 0.089$). Table 12 contains the ANOVA results. Unfortunately, the problematic nature of TES factor 2 (IF2) eliminates the ability to draw any conclusions associated with factor 2 of the TES. The problematic nature of the TES and the past research related to the instrument is discussed in greater detail below in the section labeled "The Problematic Nature of the Teacher Efficacy Scale."

Research Question 2

"What is the impact of the characteristics of the field experience classroom, within the given school where the educational field experience occurred, on perceived preservice elementary teacher efficacy and perceived preservice elementary science teacher efficacy?"

Research Question 2 Conclusions

STEBI-B Factor 1 Results

Table 14 lists the variables and categories associated with research question 2. The significant predictors for the ANCOVA model for research question 2, factor 1 (PSTE) of the STEBI-B test included the inservice teacher ethnicity ($p = 0.0832$), the inservice teacher gender ($p = 0.0065$), and the number of free lunch students in the classroom ($p = 0.0197$). The conclusions associated with these three statistically significant variables are addressed below in this order.

Inservice Teacher Ethnicity.

The mean of posttest STEBI-B for factor 1 (PSTE) of the ethnicity of the inservice teacher for White and American Indian/or Alaskan is presented in Table 16. The mean posttest PSTE score of preservice teachers in classrooms with white inservice teachers was 0.649 higher than a preservice teacher who was in an observation classroom with an American Indian/or Alaskan inservice teacher. The posttest mean score of the preservice teachers in observation classrooms with white inservice teachers had a Likert-scale score close to "Agree (4)" (Mean = 3.892), while the mean score of the preservice teachers in observation classrooms with American Indian/or Alaskan inservice teachers had a mean Likert-scale score much closer to "Uncertain (3)" (Mean = 3.243).

The moderate increase (0.649) in the preservice teachers' PSTE seen in White versus American Indian/or Alaskan inservice teachers may reflect the preservice teachers' educational experiences associated with their teacher's ethnicity during elementary, high school and college. The moderate increase (0.649) in the preservice teachers' PSTE seen in White versus American Indian/or Alaskan inservice teachers may also reflect the high White ethnicity percentage (89.130%) of the preservice teachers during the study time. The moderate decrease we observed in the preservice teachers' PSTE related to the inservice teacher's ethnicity could be an issue of the White preservice teachers' inability to relate to or find commonality with the American Indian/or Alaskan inservice teacher. Conversely, the moderate increase could be consistent with the White preserivce teacher's ability to relate to or find commonality with the White inservice teacher or the White inservice teachers providing a more supportive teaching experience for the preservice teachers.

Although the statistical techniques used are reliable, the 0.649 decrease in the PSTE score of preservice teachers who were in an observation classroom with an American Indian/or Alaskan inservice teacher could be an artifact of the small sample size of American Indian/or Alaskan inservice teachers (2 out of 20). This small sample size makes the probability of falsely concluding differences in the mean more likely. In conclusion, preservice teachers who were in classrooms with American Indian/or Alaskan inservice teachers had lower PSTE than preservice teachers who were in classrooms with white inservice teachers.

Inservice Teacher Gender.

The mean of posttest STEBI-B for factor 1 of the gender of the inservice teacher for male and female is presented in Table 16. The mean posttest PSTE scores of preservice teachers in observation classrooms with female inservice teachers were 0.108 higher than that of preservice teachers in classrooms with male inservice teachers. Preservice teachers in an observation classroom with female inservice teachers and preservice teachers in an observation classroom with male inservice teachers both had Likert-scale scores almost directly between "Agree (4)" and "Uncertain (3)." The mean of preservice teachers' posttest PSTE was 3.621 if they were in a classroom with a female inservice teacher and 3.513 if they were in a classroom with a male inservice teacher.

The slight increase (0.108) we see in the preservice teachers' PSTE in female versus male inservice teachers is consistent with the preservice teacher's educational experiences during their own elementary, high school and college years. This is also consistent with the high female percentage (97.826%) of the preservice teachers during the study time. The small decrease we observe in the preservice teachers' PSTE related to being placed with a male inservice teacher could be an issue of the female preservice teacher's inability to relate to or find commonality with the male inservice teacher. Conversely, the slight increase could be consistent with the female preserivce teacher's ability to relate to or find commonality with the female inservice teacher. Note that when comparing inservice teacher ethnicity versus inservice teacher gender, inservice teacher ethnicity had a larger negative impact (0.649) than inservice teacher gender (0.108).

Although the statistical techniques used are reliable, the 0.108 decrease in the PSTE score of preservice teachers who were in an observation classroom with a male inservice teacher could be an artifact of the small sample size of male inservice teachers (1 out of 20). This small sample size makes the probability of falsely concluding differences in the mean more likely and could explain the differences that are observed. In conclusion, preservice teachers who were in classrooms with male inservice teachers had lower PSTE than preservice teachers who were in classrooms with female teachers.

Percentage of Students that Received Free and Reduced Lunch.

The mean of posttest STEBI-B for factor 1 of the percentage of students who received free and reduced lunch in the inservice teacher's classroom between 9.7% and 36.8% and from 58.8% - 100% is presented in Table 16. Based on this data we can conclude that if a preservice teacher was in an observation classroom with a percentage of students who received free and reduced lunch that fell between 9.7 and 36.8% their posttest STEBI-B factor 1 (PSTE) score would be 0.288 higher than a preservice teacher who was in an observation classroom with a percentage of students who received free and reduced lunch between 58.8% and 100%. The posttest mean score of the preservice teacher in an observation classroom with a lower percentage of students who received free and reduced lunch between 9.7% and 36.8% had a Likert-scale score closer to "Agree (4)" (Mean = 3.711) versus the mean score of the preservice teacher in an observation classroom with a percentage of students that received free and reduces lunch from 58.8% to 100% had a Likert-scale score between the midpoint of "Agree (4)" and "Uncertain (3)" (Mean = 3.423).

The slight increase (0.288) we see in the PSTE of preservice teachers in classrooms where 9.7% to 36.8% of students received free and reduced lunch versus preservice teachers in classrooms where 58.8% to 100% of students received free and reduced lunch is due to the negative socioeconomic environmental factors linked to the student population. The preservice teachers' perceptions of these negative environmental factors, when present in the classroom, lead them to believe the level of learning that could occur is less than in other environments. The preservice teacher becomes aware that the student's level of learning has decreased and their belief about their own ability to teach science is affected. In conclusion, preservice teachers who were in classrooms with higher percentages of students receiving free and reduced lunch had lower PSTE than preservice teachers who were in classrooms with lower percentages of students receiving free and reduced lunch.

STEBI-B Factor 2 Results

Factor 2 (STOE) of the STEBI-B yielded an ANCOVA model with four independent variables. The significant predictors for the ANCOVA model included the percentage of Asian/Pacific Islander students ($p = 0.0865$), the percentage of American Indian/or Alaskan students ($p = 0.0293$), the percentage of Hispanic/Latino students ($p = 0.0005$), and the indicator variable for ExCEL preservice teacher ($p = 0.0064$). The conclusions associated with these four statistically significant variables will be addressed in this order.

Percentage of Asian/Pacific Islander Students.

The mean of posttest STEBI-B for factor 2 (STOE) of the inservice teacher who instructs either 0% or between 1.4% and 12% Asian/Pacific Islander students is presented in Table 18. Based on this data we can conclude that if a preservice teacher was in an observation classroom with no Asian/Pacific Islander students their posttest STEBI-B factor 2 (STOE) score would be 0.171 higher than a preservice teacher who was in an observation classroom with between 1.4% and 12% Asian/Pacific Islander students. The posttest mean score of the preservice teacher in an observation classroom with a no Asian/Pacific Islander students had a Likert-scale score closer to “Agree (4)” (Mean = 3.727) versus the mean score of the preservice teacher in an observation classroom with between 1.4% and 12% Asian/Pacific Islander students had a Likert-scale score between the midpoint of “Agree (4)” and “Uncertain (3)” (Mean = 3.556).

The slight decrease (0.171) in the preservice teachers’ STOE when Asian/Pacific Islander students are present in the observation class could be linked to the proportion of Asian/Pacific Islander students in the class. In the class with no Asian/Pacific Islander students there does not exist a very small Asian/Pacific Islander minority group. In the class with between 1.4% and 12% Asian/Pacific Islander students, there exists a definitive or noticeably small minority group. The presence of a very small minority group of Asian/Pacific Islander students and the social dynamic it creates in the classroom could be the reason for a decrease in the preservice teachers’ STOE. Conversely, the lack of an Asian/Pacific Islander minority group dynamic could account for the positive increase in STOE. In conclusion, preservice teachers who were in classrooms with higher percentages of Asian/Pacific Islander students had lower STOE than preservice teachers who were in classrooms with lower percentages of Asian/Pacific Islander students.

Percentage of Hispanic/Latino Students.

The mean of posttest STEBI-B for factor 2 of the percentage of Hispanic/Latino students the inservice teacher instructs each day for no Hispanic/Latino students (0%), between 3.1% and11.8%, and from 21% to 75% is presented in Table 18. Table 19 also contains the Tukey simultaneous confidence intervals to determine where the means are significantly different since there are three levels. Note that the Posttest STEBI-B factor 2 means for level 0% and level 3.1% to 11.8% are different as are the means for level 3.1% to 11.8% and level 21% to 75%. However, the means for level 0% and 21% to 75% are not statistically different.

Based on this data we can conclude that if a preservice teacher was in an observation classroom with no Hispanic/Latino students (0%) their posttest STEBI-B factor 2 (STOE) score would be 0.570 higher than a preservice teacher who was in an observation classroom with between 3.1% and 11.8% Hispanic/Latino students. We can also conclude that if a preservice teacher was in an observation classroom with 21% to 75% Hispanic/Latino students their posttest STEBI-B factor 2 (STOE) score would be 0.506 higher than a preservice teacher who was in an observation classroom with 3.1 to 11.8% Hispanic/Latino students.The posttest mean score of the preservice teacher in an observation classroom with a no (Mean = 3.817) and 21% to 75% (Mean = 3.807) Hispanic/Latino students had a Likert-scale score close to "Agree (4)" versus the mean score of the preservice teacher in an observation classroom with 3.1% to 11.8% Hispanic/Latino students had a Likert-scale score closer to "Uncertain (3)" (Mean = 3.301).

The drop in STEBI factor 2 (STOE) we observe in the range from 3.1% to 11.8% Hispanic/Latino students could be linked to the proportion of Hispanic/Latino students in the class. In the classes with no Hispanic/Latino students there does not exist a very small Hispanic/Latino minority group as is the case in the class with 21% to 75% Hispanic/Latino students where as in the classes with 3.1% to 11.8% Hispanic/Latino students there exists a definitive small minority group. As with the Asian/Pacific Islander students, the presence of a very small minority group and the social dynamic it creates in the classroom could be decreasing the preservice teachers' STOE. Conversely, the lack of a Hispanic/Latino minority group dynamic could account for the positive increase in STOE. In conclusion, preservice teachers who were in classrooms with no Hispanic/Latino students had higher STOE than preservice teachers who were in classrooms with small percentages of Hispanic/Latino students. We can also conclude that preservice teachers who were in classrooms with high percentages of Hispanic/Latino students had higher STOE than preservice teachers who were in classrooms with small percentages of Hispanic/Latino students.

Percentage of American Indian/or Alaskan Students.

The mean of posttest STEBI-B for factor 2 of the percentage of American Indian/or Alaskan students the inservice teacher instructs each day for 0% to 2.7% and 4% to 57.9% is presented in Table 18. Based on this data we can conclude that if a preservice teacher was in an observation classroom with 4% to 57.9% American Indian/or Alaskan students their posttest STEBI-B factor 2 (STOE) score would be 0.259 higher than a preservice teacher who was in an observation classroom with 0% to 2.7% American Indian/or Alaskan students. The posttest mean score of the preservice teacher in an observation classroom with a 4% to 57.9% American Indian/or Alaskan students had a Likert-scale score closer to "Agree (4)" (Mean = 3.771) versus the mean score of the preservice teacher in an observation classroom with 0% to 2.7% American Indian/or Alaskan students had a Likert-scale score between the midpoint of "Agree (4)" and "Uncertain (3)" (Mean = 3.512).

Perhaps the small increase (0.259) we see in classes with 4% to 57.9% American Indian/or Alaskan students versus classes with 0% to 2.7% American Indian/or Alaskan students is a product of the preservice teachers' positive attitude toward the American Indian. The state of Oklahoma has a long tradition of celebrating the American Indian. This positive environmental influence, in the lives of the preservice teachers, is reflective in their STOE beliefs linked to the percentage of American Indian/or Alaskan students in the classes they observed. In conclusion, preservice teachers who were in classrooms with higher percentages of American Indian/or Alaskan students had higher STOE than preservice teachers who were in classrooms with lower percentages of American Indian/or Alaskan students.

ExCEL preservice teacher.

The mean of posttest STEBI-B for factor 2 of the ExCEL preservice teacher or Non-ExCEL (Traditional) preservice teacher is presented in Table 18. Based on this data we can conclude that if a preservice teacher was not in the ExCEL program their posttest STEBI-B factor 2 (STOE) score would be 0.371 higher than a preservice teacher who was in the ExCEL program. The posttest mean score of the preservice teacher not in the ExCEL program had a Likert-scale score closer to "Agree (4)" (Mean = 3.827) versus the mean score of the preservice teacher in the ExCEL program had a Likert-scale score between the midpoint of "Agree (4)" and "Uncertain (3)" (Mean = 3.456).

The phenomenon we observe where the ExCEL preservice teachers' STOE mean scores were 0.371 lower could be due to the more intense requirements placed upon the preservice teachers in the ExCEL program versus the more minimal requirements the non-ExCEL (Traditional) preservice teachers must complete. One example of this would be teaching load (See Table 7 and 8) where the ExCEL preservice teachers taught many more lessons than the non-ExCEL preservice teachers. This phenomenon has been observed with different groups of preservice teachers in the past. Wagler and Moseley (2006) noticed a similar trend with secondary preservice teachers during their student teaching. Overall Teacher Efficacy as measured by the Teachers' Sense of Efficacy Scale (originally titled the Ohio State Teacher Efficacy Scale) saw a significant increase after the secondary methods course, but by the end of student teaching had returned to its original pre-secondary methods course level. Hoy and Woolfolk (1990), when using the TES, also noted a decline of general teaching efficacy after the student teaching assignment. Tschannen-Moran et al.(1998) suggest this observed phenomenon may be due to over-optimism that is challenged when the student teacher faces the difficulties of the student teaching assignment. My opinion is that the teaching demands placed upon the ExCEL students ultimately serve a positive long term purpose associated with the ExCEL preservice teacher's future STOE. I believe the ExCEL students, because they have experienced a more demanding preservice teacher experience, will not be as easily overwhelmed and will be better equipped to deal with the demands they will face during student teaching. The ExCEL preservice teachers may not experience as great of a drop during student teaching versus the non-ExCEL (Tradiional) preservice teachers in their teacher efficacy. Again, this is a speculative assumption and should be pursued as a future research study. In conclusion, preservice teachers who were not in the ExCEL program had higher STOE than preservice teachers who were in the ExCEL program.

TES Factor 1 Results

Percentage of Hispanic/Latino Students.

Only one variable, the percentage of Hispanic/Latino students the inservice teacher instructs each day, was found to be significantly linked to TES factor 1 (PTE) (See Table 20). The p value of the variable "Percentage of Hispanic/Latino students the inservice teacher instructs each day" ($\alpha = 0.10$) was 0.08262137.

Additionally, the means for TES factor 1 (PTE) at each level of Hispanic/Latino students the inservice teacher instructs each day are given in Table 21. Table 22 contains the Tukey simultaneous confidence intervals to determine where the means are significantly different. Tukey simultaneous confidence intervals are necessary when considering the independent variable for Hispanic/Latino students the inservice teacher instructs each day since there are three levels. Only 0% Hispanic/Latino students the inservice teacher instructs each day compared to 3.1% to 11.8% Hispanic/Latino students the inservice teacher instructs each day was found to be significant. The mean TES factor 1 (PTE) values for 0% was 5.031. The mean TES factor 1 (PTE) values for 3.1% to11.8% was 4.107.

Based on this data we can conclude that if a preservice teacher was in an observation classroom with no Hispanic/Latino students their TES factor 1 (PTE) score would be 0.924 higher than a preservice teacher who was in an observation classroom with 3.1 to 11.8% Hispanic/Latino students. The mean score of the preservice teacher in an observation classroom with no Hispanic/Latino students would have a Likert-scale score of "Moderately agree" versus the mean score of the preservice teacher in an observation classroom with 3.1% to 11.8% Hispanic/Latino students would have a Likert-scale score of "Agree slightly more than disagree."

Again as with the STEBI-B factor 2 results linked to percentage of Hispanic/Latino students, it can be speculated that the drop in TES factor 1 (PTE) we observe in the 3.1% to 11.8% Hispanic/Latino students could be linked to the proportion of Hispanic/Latino students in the class. In the class with no (0%) Hispanic/Latino students there obviously does not exist a very small Hispanic/Latino minority group as is the case in the class with 21% to 75% Hispanic/Latino students, but in the class with 3.1% to 11.8% Hispanic/Latino there exists a definitive small minority group. The presence of a very small minority group and the possible ethnic tension it creates in the classroom could be decreasing the preservice teachers PTE. Conversely, the lack of a Hispanic/Latino minority group dynamic could account for the positive increase in TES factor 1 (PTE). Note that conclusions related to this factor, based on the problematic nature of the TES, are extremely speculative at best. In conclusion, preservice teachers who were in classrooms with no Hispanic/Latino students had higher PTE than preservice teachers who were in classrooms with small percentages of Hispanic/Latino students.

TES Factor 2 Results

Table 23 contains the results of the ANOVA for TES factor 2. Note that the only significant independent variable was Jefferson Middle School. Unfortunately, the problematic nature of TES factor 2 (IF2) eliminates the current researcher's ability to draw any conclusions associated with factor 2 of the TES. The problematic nature of the TES and the past research related to the instrument will be discussed in greater detail in the section below labeled "The Problematic Nature of the Teacher Efficacy Scale."

The Problematic Nature of the Teacher Efficacy Scale

The Teacher Efficacy Scale (TES) (Gibson & Dembo, 1984) has been problematic since its creation. Thirty items were presented in the original 1984 article but only sixteen of the original thirty items loaded on the two factors that were defined as Personal Teaching Efficacy (PTE) and Teaching Efficacy (TE). The remaining fourteen items, even though they did not load on any factor, were included in the original instrument. This led to much confusion as to which items should be administered when using the instrument. Some studies have used the original thirty items, while others have used the original sixteen factor-loading items. When using either the sixteen-item instrument or a modified version of the sixteen-item instrument, problems arise such as items loading on the wrong factor, items not loading on any factor, and multiple factors arising beyond the original two factors Gibson and Dembo found (Soodak & Podell, 1993; Lin & Gorrell, 1998). Based on the past problematic nature of the TES some researchers have even taken the drastic step of reducing and modifying Gibson's and Dembo's original instrument to twenty items (Woolfolk & Hoy, 1990) and then to only ten items (Hoy & Woolfolk, 1993).

In 2005, Denzine, Cooney and McKenzie used "modern confirmatory factor-analytic techniques to investigate the validity of the hypothesized dimensions of the TES" (Denzine, Cooney & McKenzie, 2005, p. 689). The twenty-item Woolfolk and Hoy (1990) instrument was used. Confirmatory factor analysis was employed to assess the goodness-of-fit for multiple proposed factor models. All models were either rejected or deemed inconsistent with social learning theory. Ultimately, Denzine, Cooney and McKenzie suggested that the results of their study "call into question the use of the TES and the interpretation of a large body of literature purported to study the relationship of teachers' self-efficacy beliefs to important educational outcomes" (Denzine, Cooney & McKenzie, 2005, p. 689).

Based on the difficult historical nature of the TES, Denzine's, Cooney's and McKenzie's (2005) findings and the inability to define TES factor 2 (IF2) in the current study a few recommendations and general statements are in order. First, the Teacher Efficacy Scale (Gibson & Dembo, 1984) should be considered invalid in measuring self-efficacy and outcome expectancy in preservice elementary teachers and should not be used in future research studies. Secondly, as Denzine, Cooney and McKenzie have similarly stated, all past studies that have used the TES to assess self-efficacy and outcome expectancy in preservice elementary teachers should be considered extremely speculative at best. Third, any conclusions based on either factor of the TES in the current study should also be considered extremely speculative. In contrast, the current study's "Testing Instruments Data Analysis" section brings further validation of the STEBI-B instrument as a more accurate measure of the construct of science teacher efficacy and the two related components of PSTE and STOE.

The Specific Nature of Teaching Efficacy

Based on the current study and the TES findings the specific nature of teaching efficacy should be addressed. I would like to suggest that the construct of a general teaching efficacy as exemplified by the Teacher Efficacy Scale (TES) (Gibson & Dembo, 1984) and other instruments is a fallacy. The term general teacher efficacy should not be confused with the first RAND item, "When it comes right down to it, a teacher really can't do much because most of a student's motivation and performance depends on his or her home environment" (Armor et al., 1976), which was labeled *general teaching efficacy (GTE)* by efficacy researchers. When I speak of general teaching efficacy it is in reference to a teaching efficacy that is subject non-specific and situation non-specific, which the TES is intended to capture, versus a subject specific and situation specific teaching efficacy, which the Science Teaching Efficacy Belief Instrument B (STEBI-B) is designed to measure (Enochs & Riggs, 1990). What differentiates the STEBI-B from the TES and similar general teaching efficacy instruments is that the TES lacks specificity. General teaching efficacy decontextualizes the teaching task and assumes the existence of a generic type of teaching. General teaching efficacy also assumes that all teaching disciplines require the same skills and that all learning environments are equal. If the teacher is teaching language arts, social studies, mathematics or science the general teacher efficacy instruments that have been designed all assume that the same skills and environments exist for all disciplines at all grade levels.

Because general teaching efficacy assumes teaching is both subject non-specific and situation non-specific the construct a general teaching efficacy instrument is ultimately trying to measure is rendered meaningless. Both of these assumptions are false. The reality is that the skills that are needed to effectively teach first graders reading, third graders music, fifth graders mathematics, and seventh graders science are very different. The idea that a single instrument can be designed in such a way to capture the contextual differences between these tasks and these environments is an assumption that does not hold merit against the large body of evidence that would suggest these teaching tasks and learning environments are quite different.

Recommendations for Future Research

Many of the significant variables related to both the preservice teacher's science efficacy scores and preservice teacher's efficacy scores are linked to ethnicity variables. Because the ethnicity of the inservice teachers and the students present in the inservice teacher's classes are found to be significantly correlated to the preservice teacher's efficacy scores, a more in-depth study of the interaction of these variables needs to be pursued. Based on the recommendations of the current study to discontinue the use of the TES, the proposed future research study would focus only on the subject-matter specific area of science teaching efficacy and the impact ethnicity has on the preservice teacher's efficacy and the inservice teacher's efficacy. The research design would include a mixed methods approach that incorporates both quantitative data and qualitative data. The quantitative data would consist of the STEBI-B and other demographic data. The qualitative data would consist of audio and video interviews and classroom observations. The study would be longitudinal and would follow preservice teachers as they enter the university, through their preservic teacher training, and 3 to 5 years into their inservice teaching careers.

A large scale study focusing on the subject of small minority group dynamics and inservice science teaching efficacy would also further clarify the speculative conclusions associated with the current study. Inservice teachers with few minority students would be identified and the science teaching efficacy of these inservice teachers would be collected. This data would be compared to classrooms where no small minority group exists to see if correlations exist between science teaching scores and small minority groups.

A comparative study looking at preservice and inservice teachers' attitudes toward American Indian students would also further clarify the cautious speculative conclusions associated with the current study. Data would be collected comparing attitudes toward American Indians students from state to state. This would bring merit to the cautious speculative conclusion that the small increase in STOE we see in classes with 4% to 57.9% American Indian/or Alaskan students versus classes with 0% to 2.7% American Indian/or Alaskan students is a product of the preservice teachers' positive attitude toward the American Indian.

The current study's findings associated with the decrease in STOE in the ExCEL preservice teachers also merits further research. The ExCEL and non-ExCEL (Traditional) preservice teachers need to be assessed as they enter and exit their student teaching to see what impact student teaching has on their STOE and PSTE. A study of this nature would add merit to the conclusions associated with the current study and the preservice teachers in the ExCEL program. Mainly, the lower STOE mean observed in the ExCEL program participants is perhaps due to the more intense requirements placed upon the preservice teachers in the ExCEL program versus the more minimal requirements the non-ExCEL (Traditional) preservice teachers must complete.

Further studies specifically addressing vicarious experiences would also be pursued. A quantitative study that would compare two groups of preservice elementary teachers during their field observations would be pursued. One group would be identified that observed in schools where they observed no science being taught and another group would be identified that observed many science lessons being taught. The data would be further broken down into groups by percentage of science lessons observed. The STEBI-

B would be given at the beginning and end of the field observations to assess the impact of these vicarious science teaching experiences on the preservice elementary teachers science efficacy.

To further address the impact of vicarious experiences on preservice teachers' efficacy two groups of preservice secondary science teachers would be identified. One group would have had a high percentage of inquiry-based science college courses and the other would have had a large percentage of traditional lecture-based science courses. Both groups would be given the STEBI-B to assess whether correlations exist between the type of science college course taken and the preservice secondary science teachers' STEBI-B scores.

Implications for Practice

Based on the conclusions of the current study some of the characteristics (gender and ethnicity) of the cooperating teacher may have negatively affected the preservice teacher's efficacy. Some of the characteristics (ethnicity and socioeconomic status) of the students in the cooperating teacher's classroom may have also negatively affected the preservice teacher's efficacy. Lastly, the rigors of a specific preservice teacher training program (ExCEL) may have negatively affected the preservcie teacher's efficacy.

Preservice teacher efficacy research suggests that positively increasing preservice teacher efficacy increases effective teaching. In light of this, the question can be asked: Should preservice teachers be placed in diverse teaching environments and rigorous preservice teacher training programs even if these environments decrease their preservice teacher efficacy? I believe they should.

Highly effective teachers modify their teaching methodologies to meet the diverse needs of their students. Effective teacher training programs must educate future teachers about these differences and give them the techniques and strategies necessary to meet the specific needs of the majority of students in their future classrooms. What is crucial to the preservice teachers' training is the opportunity to apply these techniques and strategies in actual classrooms with actual students while a nurturing support network, composed of the inservice teacher, the preservice teacher's university instructors and the preservice teacher's peers, is still available. This type of nurturing preservice environment is the best place to experience a drop in teacher efficacy because of these diverse teaching environments, cognitively understand why this drop has occurred, acquire the skills needed to overcome the challenge and return to a healthy teacher efficacy level. Without these types of diverse learning environments and the teaching skills that can be gained from participation in them, the preservice teacher is thrust into student teaching and may experience an even greater decline in preservice teacher efficacy when the nurturing support network is decreased (Wagler & Moseley, 2006; Hoy & Woolfolk, 1990).

Concluding Remarks

In conclusion, gender, ethnicity, socioeconomic status and participation in the ExCEL program were found to impact the preservice teacher's efficacy. In some cases these factors influenced the preservice teacher's efficacy in a detrimental way. Even though the preservice teacher's efficacy was lowered, I believe it is imperative that the preservice teachers be allowed to observe and teach in classrooms where diversity exists. Many of these preservice teachers have not experienced classrooms where other cultures are represented and issues of poverty are faced on a daily basis. These preservice teachers must be allowed to learn from these experiences in the classrooms and become future teachers who can create classrooms environments where all students, no matter what their differences are, can learn and succeed.

I also believe that this study shows that the Teacher Efficacy Scale is not a reliable instrument in capturing teacher efficacy. The instrument has a long history of well-documented problems, and this study is yet another example of why the TES should be retired.

Lastly, I believe this study shows that general teacher efficacy does not exist. General teacher efficacy decontextualizes teaching from the specific students and factors that this very study addresses. This study shows that these specific factors matter, and to exclude them from an instrument, renders teacher efficacy meaningless and lacking practical significance in the classroom. What teacher efficacy research needs are researchers who are willing to take the time and effort to develop teacher efficacy instruments that can capture teacher efficacy in specific contexts such as seventh grade science, first grade reading, or eleventh grade literature classes. Only by doing this will we fully understand this elusive construct and be better equipped to create effective learning environments for all students.

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APPENDICES

APPENDIX A

INFORMED CONSENT

Project Title: Elementary Preservice Teacher Efficacy Study

Investigators: Mr. Ron Wagler, Environmental Sciences doctoral student; Dr. Richard J. Bryant, Assistant Professor, School of Teaching and Curriculum Leadership, OSU.

Purpose: The purpose of this study is to gain a better understanding of what influences preservice teacher efficacy. Consequently, we are asking students to voluntarily participate in this study by providing data related to their perceived efficacy.

Procedures: The data for this study will be collected from two questionnaires you fill out and one you give and collect from your inservice observation teacher. This source of data will be part of your regular participation in this course and will require no additional time or effort on your part. You will only be included if you provide consent below. Your involvement will be limited to the time it will take you to fill out the two questionnaires and give and collect the questionnaire from your inservice observation teacher. The total time will be 20-30 minutes on two occasions throughout the semester and the time it takes for you to give and collect the questionnaire from your inservice observation teacher.

Risks of Participation: There are no known risks associated with this study that are greater than those ordinarily encountered in daily life. If at any point you experience discomfort or have questions or concerns, researchers will be available to discuss these with you.

Benefits: As a research participant, you will be exposed to the conduct of scientific research and may gain insights into the nature of research. You may also gain greater knowledge and understanding of yourself as a learner and future professional educator.

Confidentiality: For the purposes of this study, you will be assigned a numerical identifier. All data collected will be rendered completely anonymous and will be associated only with the numerical identifier. All information containing the participant's name (including his/her consent form) will be kept separate from numbered materials and in a secure place (in a locked filing cabinet in a locked campus office), and the numerical identifiers and any other identifying information will be destroyed once the data have been analyzed. All data analysis will be conducted using only numerical identifiers to ensure participants' anonymity, and the results of the study will reported using only aggregate data and summary statistics. Only the investigators named above will have access to the raw data, and only Dr. Bryant will have access to the list of participants' names and their numerical identifiers. The OSU IRB has the authority to inspect consent records and data files to assure compliance with approved procedures.

Compensation: You will receive no compensation for participating, nor will you be penalized for choosing not to participate.

Contacts: If you have questions about the study or your participation in it, you may contact Dr. Richard Bryant (405-744-8005, richard.bryant@okstate.edu) or Mr. Ron Wagler (405-707-9871, ron.wagler@okstate.edu). For information on subjects' rights, contact Dr. Sue Jacobs, IRB Chair, 219 Cordell North, phone: 405-744-1676, email: irb@okstate.edu

Participant Rights: Participation is voluntary and you will not be penalized if I choose not to participate. You are free to withdraw your consent and end your participation in this study at any time without penalty by notifying Dr. Bryant or Mr. Wagler.

Signatures:

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

_________________________________ _________________________________

Signature Name (printed)

I certify that I have personally explained all elements of this form to the subject or his/her representative before requesting the subject or his/her representative to sign it.

_________________________________ Date: ______________________

Signature of Project Director or authorized representative

Demographic Questions

Please answer the following questions about yourself.

Name (Please print) ________________________________

What is your age? ________

What is your gender? ________

What is your ethnicity? Choose one of the following:

a. □-Black
b. □-White
c. □-Hispanic/Latino
d. □-Asian/Pacific Islander
e. □-American Indian/or Alaskan
f. □-Other: ___________________

APPENDIX B

TES

Please indicate the degree to which you agree or disagree with each statement below by circling the appropriate number to the right of each statement.	Strongly disagree	Moderately disagree	Disagree slightly more than agree	Agree slightly more than disagree	Moderately agree	Strongly agree
1. When a student does better than usual, many times it is because I exerted a little extra effort.	1	2	3	4	5	6
2. The hours in my class have little influence on students compared to the influence of their home environment.	1	2	3	4	5	6
3. If parents comment to me that their child behaves much better at school than he/she does at home, it would probably be because I have some specific techniques of managing his/her behavior which they may lack.	1	2	3	4	5	6
4. The amount that a student can learn is primarily related to family background.	1	2	3	4	5	6
5. If a teacher has adequate skills and motivation, she/he can get through to the most difficult students.	1	2	3	4	5	6
6. If students aren't disciplined at home, they aren't likely to accept any discipline.	1	2	3	4	5	6
7. I have enough training to deal with almost any learning problem.	1	2	3	4	5	6
8. My teacher training program and/or experience has given me the necessary skills to be an effective teacher.	1	2	3	4	5	6
9. Many teachers are stymied in their attempts to help students by lack of support from the community.	1	2	3	4	5	6
10. Some students need to be placed in slower groups so they are not subjected to unrealistic expectations.	1	2	3	4	5	6
11. Individual differences among teachers account for the wide variations in student achievement.	1	2	3	4	5	6
12. When a student is having difficulty with an assignment, I am usually able to adjust it to his/her level.	1	2	3	4	5	6
13. If one of my new students cannot remain on task for a particular assignment, there is little that I could do to increase his/her attention until he/she is ready.	1	2	3	4	5	6
14. When a student gets a better grade than he usually gets, it is usually because I found better ways of teaching that student.	1	2	3	4	5	6
15. When I really try, I can get through to most difficult students.	1	2	3	4	5	6
16. A teacher is very limited in what he/she can achieve because a student's home environment is a large influence on his/her achievement.	1	2	3	4	5	6

17. Teachers are not a powerful influence on students achievement when all factors are considered.	1	2	3	4	5	6
18. If students are particularly disruptive one day, I ask myself what I have been doing differently.	1	2	3	4	5	6
Please indicate the degree to which you agree or disagree with each statement below by circling the appropriate number to the right of each statement.	Strongly disagree	Moderately disagree	Disagree slightly more than agree	Agree slightly more than disagree	Moderately agree	Strongly agree
19. When the grades of my students improve it is usually because I found more effective teaching approaches.	1	2	3	4	5	6
20. If my principal suggests I change some of my class curriculum, I would feel confident that I have the necessary skills to implement the unfamiliar curriculum.	1	2	3	4	5	6
21. If a student masters a new math concept quickly, this might be because I knew the necessary steps in teaching that concept.	1	2	3	4	5	6
22. Parent conferences can help a teacher judge how much to expect from a student by giving the teacher an idea of the parents' values toward education, discipline, etc.	1	2	3	4	5	6
23. If parents would do more with their children, I could do more.	1	2	3	4	5	6
24. If a student did not remember information I gave in a previous lesson, I would know how to increase his/her retention in the next lesson.	1	2	3	4	5	6
25. If a student in my class becomes disruptive and noisy, I feel assured that I know some technique to redirect him quickly.	1	2	3	4	5	6
26. School rules and polices hinder my doing the job I was hired to do.	1	2	3	4	5	6
27. The influence of a student's home experience can be overcome by good teaching.	1	2	3	4	5	6
28. When a child progresses after being placed in a slower group, it is usually because the teacher has had a chance to give him/her extra attention.	1	2	3	4	5	6
29. If one of my students couldn't do a class assignment, I would be able to accurately assess whether the assignment was at the correct level of difficulty.	1	2	3	4	5	6
30. Even a teacher with good teaching abilities may not reach many students.	1	2	3	4	5	6

APPENDIX C

STEBI-B

Please indicate the degree to which you agree or disagree with each statement below by circling the appropriate number to the right of the statement.

1	2	3	4	5
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

Statement	Strongly Disagree				Strongly Agree
1. When a student does better than usual in science, it is often because the teacher exerted a little extra effort.	1	2	3	4	5
2. I will continually find better ways to teach science.	1	2	3	4	5
3. Even if I try very hard, I will not teach science as well as I will most subjects.	1	2	3	4	5
4. When the science grades of students improve, it is often due to their teacher having found a more effective teaching approach.	1	2	3	4	5
5. I know the steps necessary to teach science concepts effectively.	1	2	3	4	5
6. I will not be very effective in monitoring science activities.	1	2	3	4	5
7. If students are underachieving in science, it is most likely due to ineffective science teaching.	1	2	3	4	5
8. I will generally teach science ineffectively.	1	2	3	4	5
9. The inadequacy of a student's science background can be overcome by good teaching.	1	2	3	4	5
10. The low science achievement of some students cannot generally be blamed on their teachers.	1	2	3	4	5
11. When a low-achieving child progresses in science, it is usually due to extra attention by the teacher.	1	2	3	4	5
12. I understand science concepts well enough to be effective in teaching elementary science.	1	2	3	4	5

	Strongly Disagree				Strongly Agree
13. Increased effort in science teaching produces little change in some students' science achievement.	1	2	3	4	5
14. The teacher is generally responsible for the achievement of students in science.	1	2	3	4	5
15. Students' achievement in science is directly related to their teacher's effectiveness in science teaching.	1	2	3	4	5
16. If parents comment that their child is showing more interest in science at school, it is probably due to the performance of the child's teacher.	1	2	3	4	5
17. I will find it difficult to explain to students why science experiments work.	1	2	3	4	5
18. I will typically be able to answer students' questions. 5		1	2	3	4
19. I wonder if I will have the necessary skills to teach science.	1	2	3	4	5
20. Given a choice, I will not invite the principal to evaluate my science teaching.	1	2	3	4	5
21. When a student has difficulty understanding a science concept, I will usually be at a loss as to how to help the student understand it better.	1	2	3	4	5
22. When teaching science, I will usually welcome student questions.	1	2	3	4	5
23. I do not know what to do to turn students on to science.	1	2	3	4	5

APPENDIX D

February 28, 2007

Dear Inservice Teacher,

Thank you for your contribution to the teaching profession by assisting OSU in the preparation of future elementary and middle school teachers.

The preservice teacher who observes in your classroom is participating in a research project at Oklahoma State University. This study is examining ways to improve the preparation of elementary teachers. We are inviting you to participate in this study by completing a short questionnaire. The total time required for your participation is expected to be less than 30 minutes. The data collected will be rendered completely anonymous. Participating in this study is voluntary; you may choose not to participate in this study without penalty.

If you agree to participate, please read and sign the enclosed informed consent form and complete the "Classroom Demographic and Teacher Questionnaire." Place both documents in the envelope provided, seal it, and give it to the OSU student who observes your Wednesday classes. The OSU student will return it to campus for you.

If you have any questions regarding this research project, please contact one of us.

Thank you,

Ron Wagler
405-707-9871

Dr. Richard Bryant
405-744-8005

INFORMED CONSENT

Project Title: Elementary Preservice Teacher Efficacy Study

Investigators: Mr. Ron Wagler, Environmental Sciences doctoral student and Dr. Richard J. Bryant, Assistant Professor, School of Teaching and Curriculum Leadership, OSU.

Purpose: The purpose of this study is to gain a better understanding of what influences preservice teacher efficacy. Consequently, we are asking students to voluntarily participate in this study by providing data related to their perceived efficacy.

Procedures: The data for this study will be collected from the questionnaire you fill out. This source of data will be part of your regular participation in this course and will require no additional time or effort on your part. You will only be included if you provide consent below. Your involvement will be limited to the time it will take you to fill out the single questionnaire. The total time will be 20-30 minutes. This is the time it will take to complete the questionnaire in class.

Risks of Participation: There are no known risks associated with this study that are greater than those ordinarily encountered in daily life. If at any point you experience discomfort or have questions or concerns, researchers will be available to discuss these with you.

Benefits: As a research participant, you will be exposed to the conduct of scientific research and may gain insights into the nature of research. You may also gain greater knowledge and understanding of yourself as a learner and future professional educator.

Confidentiality: For the purposes of this study, you will be assigned a numerical identifier. All data collected will be rendered completely anonymous and will be associated only with the numerical identifier. All information containing the participant's name (including his/her consent form) will be kept separate from numbered materials and in a secure place (in a locked filing cabinet in a locked campus office), and the numerical identifiers and any other identifying information will be destroyed once the data have been analyzed. All data analysis will be conducted using only numerical identifiers to ensure participants' anonymity, and the results of the study will reported using only aggregate data and summary statistics. Only the investigators named above will have access to the raw data, and only Dr. Bryant will have access to the list of participants' names and their numerical identifiers. The OSU IRB has the authority to inspect consent records and data files to assure compliance with approved procedures.

Compensation: You will receive no compensation for participating, nor will you be penalized for choosing not to participate.

Contacts: If you have questions about the study or your participation in it, you may contact Dr. Richard Bryant (405-744-8005, richard.bryant@okstate.edu) or Mr. Ron Wagler (405-707-9871, ron.wagler@okstate.edu). For information on subjects' rights, contact Dr. Sue Jacobs, IRB Chair, 219 Cordell North, phone: 405-744-1676, email: irb@okstate.edu

Participant Rights: Participation is voluntary and you will not be penalized if I choose not to participate. You are free to withdraw your consent and end your participation in this study at any time without penalty by notifying the Dr. Bryant or Mr. Wagler.

Signatures:

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

__________________________________ __________________________________
Signature Name (printed)

__________________________________ Date: ________________________
Signature of Project Director or authorized representative

Classroom Demographic and Cooperating Teacher Questionnaire

Please print the full name of the Oklahoma State University preservice teacher that observes you____.

General and Student Information

1. What is the name of your school? ___________________________
2. What district is your school in? ____________________________________
3. How many students do you instruct per day? ______
4. What grades do you instruct? _______
5. How many (number per ethnic group) of the following do you instruct per day? Hispanic/Latino students ______; Black students ________; White students_______; Asian/Pacific Islander students_______; American Indian/or Alaskan students_______.

   How many students of an ethnicity not listed above do you instruct per day? _______
6. How many of the students you instruct receive free and reduces lunch? __________

Teacher Information

7. What is your age? ________
8. What is your gender? ________
9. What is your ethnicity? Choose one of the following:

   a. □-Black
   b. □-White
   c. □-Hispanic/Latino
   d. □-Asian/Pacific Islander
   e. □-American Indian/or Alaskan
   f. □-Other: __________________

10. How many years of teaching have you completed?________
11. How many years have you taught at your current school?_______
12. How many years have you taught at your current grade level? ________

APPENDIX E

Educational Field Experience Teacher Rating and Preservice Teacher Questionnaire

Name (Please print) ________________________________

The following 7 items refer *to the* ***classroom teacher*** *you worked with this semester in your field experiences.* *If you worked with more than one teacher, please respond based upon the teacher you worked with the most. Indicate your response by circling the appropriate number to the right of the statement using the following scale:*

1	**2**	**3**	**4**	**5**
Poor	Fair	Good	Very Good	Excellent

	Poor				Excellent
1. Rate the quality of the lessons that your field experience teacher used.	1	2	3	4	5
2. Rate how well your field experience teacher taught the lessons.	1	2	3	4	5
3. Rate how well the students learned the content of the lessons.	1	2	3	4	5
4. Rate how well your field experience teacher engaged the students in the lessons.	1	2	3	4	5
5. Rate how well your field experience teacher managed the classroom (students, materials and time).	1	2	3	4	5
6. Rate how well your field experience teacher created a positive learning environment.	1	2	3	4	5
7. Overall, how would you rate your field experience teacher?	1	2	3	4	5

The questions below refer to ***you*** *during your field experiences this semester.*

8. How many times did you teach a lesson? ______

9. Please list the subjects you taught lessons in:____________________________________
____
____

10. If you taught science, how many times did you teach a science lesson? ______________

11. Consider all the science lessons you taught; how would you rate your science teaching?

1	**2**	**3**	**4**	**5**
Poor	Fair	Good	Very Good	Excellent

12. Consider all the lessons you taught; how would you rate your teaching?

1	**2**	**3**	**4**	**5**
Poor	Fair	Good	Very Good	Excellent

13. How many times did you observe a science lesson being taught? _________

APPENDIX F

Categorization of Variables for Statistical Analysis

Preservice Teacher's Age (yrs)	Category	N
20		
20		
20		
21		
21		
21		
21		
21		
21		
21		
21	1	22
21		
21		
21		
21		
21		
21		
21		
21		
21		
21		
21		
22		
22		
22		
22		
22		
22		
22		
22		
22		
22		
22		
22	2	24
22		
22		
22		
22		
22		
22		
22		
22		
23		
26		
28		
29		

Preservice Teacher's Lessons Taught	Category	N
1		
1		
1		
1		
1		
1	1	12
1		
1		
1		
1		
1		
1		
2		
2		
3		
3		
3	2	10
3		
3		
4		
4		
4		
5		
5		
5		
5		
6		
6		
6	3	13
6		
7		
8		
8		
9		
10		
12		
13		
25		
25		
30		
30	4	11
30		
39		
40		
50		
50		

Categorization of Variables for Statistical Analysis (Continued)

Preservice Teacher's Science Lessons Taught	Category	N
0		
0		
0		
0		
0		
0		
0	1	14
0		
0		
0		
0		
0		
0		
0		
1		
1		
1		
1		
1		
1		
1		
1		
1		
1		
1	2	22
1		
1		
1		
1		
1		
1		
1		
1		
1		
1		
1		
2		
3		
4		
5		
5	3	10
6		
6		
6		
8		
10		

Preservice Teacher's Science Lessons Observed	Category	N
0		
0		
0		
0		
0		
0		
0	1	13
0		
0		
0		
0		
0		
0		
1		
1		
1		
1		
1		
1	2	12
1		
1		
2		
2		
2		
2		
3		
3		
5		
5		
5		
6		
6	3	13
7		
8		
9		
9		
10		
10		
15		
20		
30		
35	4	8
40		
40		
45		
45		

Categorization of Variables for Statistical Analysis (Continued)

Number of Students Taught Per Day	Category	N
16	1	5
16		
17		
17		
17		
19	2	6
19		
19		
19		
20		
20		
22	3	5
22		
22		
22		
25		
62	4	4
64		
128		
147		

Grade Taught	Category	N
1st	1	6
1st		
2nd		
2nd		
2nd		
2nd		
3rd	2	6
3rd		
3rd		
3rd		
3rd		
3rd		
4th	3	8
4th		
4th		
5th		
5th		
5th		
6th		
7th		

Categorization of Variables for Statistical Analysis (Continued)

% Hispanic Students	Category	N	% Black Students	Category	N	% White Students	Category	N
0.0%	1	8	0.0%	1	4	10.2%	1	7
0.0%			0.0%			18.2%		
0.0%			4.5%			28.0%		
0.0%			4.5%			34.0%		
0.0%			5.3%	2	4	42.1%		
0.0%			5.3%			45.5%		
0.0%			5.9%			50.0%		
0.0%			8.1%			52.9%	2	7
3.1%	2	7	10.2%	3	4	57.9%		
4.5%			11.8%			60.9%		
5.0%			12.5%			64.7%		
5.0%			12.5%			68.4%		
6.3%			14.8%	4	5	70.0%		
11.8%			15.0%			73.7%		
11.8%			15.8%			75.0%	3	6
21.1%	3	5	17.6%			77.3%		
22.7%			18.2%			77.3%		
32.0%			20.0%	5	3	82.4%		
51.7%			26.6%			90.3%		
75.0%			77.3%			95.0%		

Categorization of Variables for Statistical Analysis (Continued)

% Asian Students	Category	N
0.0%	1	12
0.0%		
0.0%		
0.0%		
0.0%		
0.0%		
0.0%		
0.0%		
0.0%		
0.0%		
0.0%		
0.0%		
1.4%	2	8
3.1%		
5.9%		
5.9%		
9.1%		
10.5%		
11.8%		
12.0%		

% American Indian Students	Category	N
0.0%	1	10
0.0%		
0.0%		
0.0%		
0.0%		
0.0%		
0.0%		
0.0%		
1.6%		
2.7%		
4.0%	2	10
4.5%		
4.5%		
5.3%		
6.3%		
6.3%		
10.0%		
12.5%		
36.8%		
57.9%		

% Other Students	Category	N
0.0%	1	13
0.0%		
0.0%		
0.0%		
0.0%		
0.0%		
0.0%		
0.0%		
0.0%		
0.0%		
0.0%		
0.0%		
0.0%		
4.0%	2	7
4.5%		
6.3%		
13.6%		
13.6%		
17.6%		
18.8%		

Categorization of Variables for Statistical Analysis (Continued)

% Students on Free or Reduced Lunch	Category	N	Inservice Teacher's Age	Category	N	Inservice Teacher's Sex	Category	N
9.7%			24			F		
10.5%			25			F		
20.0%	1	5	31			F		
29.7%			32			F		
36.8%			35	1	10	F		
58.8%			36			F		
68.2%			36			F		
68.2%			38			F		
68.4%			40			F		
68.8%			40			F	1	19
68.8%			47			F		
70.0%			51			F		
70.6%	2	15	52			F		
75.0%			54			F		
76.5%			54	2	10	F		
80.0%			55			F		
81.8%			55			F		
81.8%			55			F		
95.9%			56			F		
100.0%			59			M	2	1

Categorization of Variables for Statistical Analysis (Continued)

Inservice Teacher's Ethnicity	Category	N	Inservice Teacher's Total Years Experience	Category	N	Inservice Teacher's Years at Current School	Category	N
White			1.5			1		
White			2.5			1		
White			3			1	1	5
White			7			1		
White			8	1	10	1		
White			8			2		
White			9			2.5		
White			10			3	2	5
White	1	18	10			3		
White			11			3		
White			15			4		
White			19			6		
White			20			6	3	5
White			20			7		
White			23	2	10	7		
White			23			8		
White			25			8		
White			27			11	4	5
Am. Ind.	2	2	27			14		
Am. Ind.			37			25		

Categorization of Variables for Statistical Analysis (Continued)

Inservice Teacher's Years in Current Assgnment	Category	N
1	1	12
1.5		
2		
2		
2		
2		
2.5		
3		
3		
3		
3		
3		
5	2	8
6		
7		
7		
19		
19		
20		
23		

APPENDIX G

Oklahoma State University Institutional Review Board

Date: Tuesday, December 12, 2006

IRB Application No ED06213

Proposal Title: Elementary Preservice Science Teacher Efficacy Pilot Study

Reviewed and Processed as: Exempt

Status Recommended by Reviewer(s): Approved Protocol Expires: 12/11/2007

Principal Investigator(s)

Ronald R. Wagler 1823 W. 10th St. Stillwater, OK 74074	Richard Bryant 245 Willard 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,

Sue C Jacobs

Sue C. Jacobs, Chair
Institutional Review Board

VITA

Ronald Robert Wagler

Candidate for the Degree of Environmental Science

Doctor of Philosophy or Other

Thesis: ASSESSING THE IMPACT OF VICARIOUS EXPERIENCES ON PRESERVICE ELEMENTARY SCIENCE TEACHER EFFICACY AND PRESERVICE ELEMENTARY TEACHER EFFICACY

Major Field: Environmental Science

Biographical:

Personal Data: Born in Peoria, Illinois, on February 23, 1967, the son of Richard and Gail Wagler.

Education: Graduated from Limestone High School, Bartonville, Illinois in May, 1985; received Bachelor of Science in Biology from Southern Illinois University, Carbondale, Illinois in December, 1990; received Master of Science in Zoology from Oklahoma State University in August of 2003. Completed the requirements for the Doctor of Philosophy in Environmental Science at Oklahoma State University, Stillwater, Oklahoma in December, 2007.

Experience: Employed as research scientist, Abbott Laboratories, Abbott Park, Illinois, 1991 to 1992; employed as a Secondary Science Teacher, Uptown School, Chicago, Illinois, 1992-1999; employed as a teaching assistant, Oklahoma State University, Department of Zoology, Stillwater, Oklahoma, 2000-2003; employed as a Faculty Lecturer, Oklahoma State University, Department of Zoology, Stillwater, Oklahoma, 2003-2004; employed as a National Science Foundation Graduate Teaching Fellow, Stillwater, Oklahoma, 2004-2007; employed as an Adjunct Professor, Oklahoma State University, School of Teaching and Learning Curriculum, Stillwater, Oklahoma, 2006-Present.

Professional Memberships: National Science Teachers Association, Oklahoma State University College of Education Graduate Student Association, Oklahoma Science Teachers Association, Oklahoma Association of Teacher Educators, Oklahoma State University Society of Environmental Scientists.

Name: Ronald Robert Wagler Date of Degree: December, 2007

Institution: Oklahoma State University Location: Stillwater, Oklahoma

Title of Study: ASSESSING THE IMPACT OF VICARIOUS EXPERIENCES ON PRESERVICE ELEMENTARY SCIENCE TEACHER EFFICACY AND PRESERVICE ELEMENTARY TEACHER EFFICACY

Pages in Study: 126 Candidate for the Degree of Doctor of Philosophy

Major Field: Environmental Science

Scope and Method of Study: The purpose of this study was to investigate the impact of vicarious experiences (preservice teacher field experiences) on perceived preservice science teacher efficacy and perceived preservice teacher efficacy. The participants for the study were 46 preservice elementary education students who were enrolled in CIED 3430 (Early Lab and Clinical Experience in Elementary Education II) at a large Midwestern state university and 20 classroom inservice teachers. A pretest was administered early in the spring 2007 semester, before the preservice teachers did their field experience and consisted of demographic questions and the STEBI-B. A posttest was administered at the end of the spring 2007 semester, after the preservice teachers had completed their field experiences, and consisted of demographic questions, a rating of the teachers they observed during their educational field experience, the STEBI-B and the TES. The field experience classroom inservice teachers provided personal, professional, and classroom data in the middle of the spring 2007 semester. All data were analyzed using analysis of variance (ANOVA) and analysis of covariance (ANCOVA).

Findings and Conclusions: Factors of gender, ethnicity, socioeconomic status and preservice teacher program placement were found to be significant predictors of preservice teachers' efficacy scores. Even though, in some cases, these factors negatively impacted preservice teacher efficacy, preservice teachers should be placed in these environments when support is most available. The Teacher Efficacy Scale (Gibson & Dembo, 1984) is invalid. Even the construct of a general teacher efficacy is questionable.

ADVISER'S APPROVAL: Richard Bryant