EARLY CHILDHOOD TEACHERS' SELF-EFFICACY TOWARD TEACHING SCIENCE: OUTCOMES OF PROFESSIONAL DEVELOPMENT

By

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EARLY CHILDHOOD TEACHERS' SELF-EFFICACY

TOWARD TEACHING SCIENCE: OUTCOMES OF

PROFESSIONAL DEVELOPMENT

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CHAPTER I

INTRODUCTION

The No Child Left Behind (NCLB) Act of 2001 attempted to make sure there was a standards-based education reform in all states:

> No Child Left Behind is based on the assumption that setting high standards and measurable goals can produce more positive individual outcomes in education. The Act expects states to develop assessments in literacy and numeracy to be given yearly to all students in certain grades, if those states are to receive federal funding for schools. The main goal of NCLB is for all students to test at the proficient level by the 2013-2014 school year. The Act does not assert a national achievement standard; standards are set by each individual state (NCLB, 2001).

Teaching of science in early childhood classrooms has slowly been decreasing (Tugel, 2004). As the years have passed, the subject of science has been put on the backburner while mathematics and language arts have taken center stage in the educational system. In addition, science can be an uncomfortable topic for teachers to teach due to lack of experience, confidence, materials, and support (Lee & Housel, 2003).

Early childhood teachers need to find ways to integrate science with other subjects in order to ensure children are receiving a well-rounded and full education. Professional development workshops explaining and demonstrating strategies for teaching and/or integrating science into other subjects are beneficial for teachers and students. According to Lumpe, Czerniak, Haney and Beltyukova (2012) the benefits for teachers who participated in professional development workshops are improved confidence, new strategies and tools for teaching science, and a support system of other teachers, among others. When teachers implement what they learn about integrating and teaching science in the classroom, children benefit from a well-rounded education that not only meets but also exceeds what is tested.

The purpose of the professional development workshop on which this research is based, was to strengthen teacher self-efficacy with regards to the teaching of science, as well as encourage the integration of science to language arts. Teachers from Northwestern Oklahoma participated in a professional development workshop at the Oklahoma State University campus. All workshop participants were invited to take part in the research component of the project. Those teachers who volunteered to participate in the study completed a pre-assessment instrument, which included: a demographic questionnaire, the Weisgram and Bigler Scale (2006), and concept maps, among others not relevant to this thesis research, as it is part of a broader study. Concept maps were completed and collected on days one and four of the summer workshop to evaluate teachers' knowledge of teaching science before and after completion of the workshop. Throughout the 30-hour professional development workshop, teachers participated in hands-on learning activities for teaching science that integrated literacy skills and were developmentally appropriate. A post assessment for the whole study included additional data collection later during the spring of 2012. The purpose of this study was to explore the impact of the professional development workshop on participants' efficacy.

Definitions

Concept map – a two-dimensional image that is used to represent the relationships among a learner's concepts related to a central theme or topic (Novak & Gowin, 1984).

In-service – practicing teachers; teachers currently teaching in a classroom (Wenner, 2001)

Outcome expectancy – a belief about the likelihood of a behavior leading to a specific outcome. Research shows that increments in outcome expectancy increases intentions to perform the behavior (Maddux, Sherer & Rogers, 1982).

Pre-service – teacher education students (Wenner, 2001)

Read-alouds – teacher directed activity where a teacher may read a story or reading passage with the purpose of assisting the children in understanding and elaborating on information being read and engages students in discussion by allowing them to make interpretations, offer suggestions, and ask questions to support their active involvement in the meaning-making process (Adapted from Heisey & Kucan, 2010 and Zimmerman & Hutchins, 2004).

Self-efficacy - beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments (Bandura, 1997)

TWBS score – score is based on responses to a modified questionnaire based on Weisgram and Bigler's subscale regarding science self-efficacy. It consists of 19 personal statements for participants to rate their opinion from 'strongly agree' to strongly disagree' (Weisgram & Bigler, 2006). The scale has a reliability alpha (Cronbach's) of 0.873.

CHAPTER II

REVIEW OF THE LITERATURE

Early childhood classrooms have reduced the time teaching the area of science through the years in order to focus on language arts and mathematics. According to Tugel (2004), the teaching of science has been decreasing in schools since the implementation of No Child Left Behind (NCLB). Margaret Honey, president and CEO of the New York Hall of Science, stated NCLB "is discouraging the teaching of science courses, particularly at the elementary level, at a time when America [the United States] needs them the most" (Honey, 2011). Tugel (2004) states this is because the emphasis has been put on literacy and mathematics. This emphasis is because literacy and mathematics are the subjects assessed through standardized testing mandated by the No Child Left Behind Act of 2001 (Griffith & Scharmann, 2008).

Fulp (2002) states teachers feel underprepared to teach science within their classrooms and therefore minimize the time spent on science. The researcher found only twenty-one minutes per day were spent teaching the subject of science from Kindergarten through second grade in 2000. Fulp suggests teachers need to have professional development opportunities available to them in order to feel better prepared for teaching science within their classrooms in a way that does not take time from other subject areas. One way of doing this is by integrating science content with literacy instruction through read-alouds (Heisey & Kucan, 2010). These professional development opportunities also need to provide teachers with strategies to teach science through hands-on experiences (Copple & Bredekamp, 2009).

The current study will potentially determine how teacher self-efficacy influences teachers' ability and willingness to teach science. Participation in professional development opportunities support and encourage teachers to teach science, as well as supply them with new strategies for incorporating science in their classrooms, and provide opportunities to collaborate with other teachers.

A Brief Background of Teaching Science

Prior to the implementation of NCLB in 2001, the teaching of science was more prevalent in early childhood and primary grade classrooms although teachers still felt a lack of time for teaching the subject (Finson, Lisowski, Fitch, & Foster, 1996; Griffith & Scharmann, 2008; Hovey, 2005). With the enactment of NCLB came the promotion of standardized testing to make sure schools were accountable in meeting district, state, and national standards (Marx & Harris, 2006). These annual standardized tests focus on mathematics and language arts, which have led to teachers making sure they cover mathematics and language arts during the majority of their day while neglecting science instruction amongst other subjects and activities (Marx & Harris, 2006; Honey, 2011).

Teacher Efficacy and its Effect on Teaching Science

Lee and Housel (2003) state teachers tend to avoid teaching science due to low self-confidence which can relate to their self-efficacy. Bandura (1997) defines self-efficacy as "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (p. 3). One's self-efficacy can vary depending on the context and subject matter (Bandura, 1997; Tschannen-Moran & Woolfolk Hoy, 2001). In order to improve science teaching within early childhood classrooms, teachers' self-efficacy toward the subject of science needs to be high. High self-efficacy is desirable, as it has been demonstrated to influence teachers' goals, enthusiasm, persistence, and investment in teaching (Tschannen-Moran & Woolfolk Hoy, 2001).

When focusing specifically on teachers' self-efficacy for the subject of science, researchers have identified an association between their self-efficacy and their experience with the subject (de Laat & Watters, 1995; Tschannen-Moran & Woolfolk Hoy, 2001). Typically, subjects who had experienced more science courses with labs or had experience teaching science felt more comfortable and have a higher efficacy for the subject. This high self-efficacy leads to a higher confidence toward teaching science, and more child-centered lessons with developmentally appropriate, hands-on activities. Teachers with higher self-efficacy feel as though science is one way for children to develop critical thinking skills for real world situations. Haney, Lumpe, Czerniak, and Egan (2002) found teacher beliefs were predictors of the actions in which teachers implement science. Teachers with high self-efficacy are more likely to have a positive attitude toward science, maintain a balance between teacher-directed and students' independent work, and allow for student contributions (de Laat & Watters, 1995).

Teachers with low self-efficacy have been found to have a more difficult time teaching science in their classrooms. This can be because of their own limited background in science, as well as less experience in teaching science (de Laat & Watters, 1995). This lack of experience can lead to low confidence, lack of creativity in the use of materials, and using traditional teaching methods rather than allowing children to explore and experience science (de Laat & Watters, 1995).

Wenner (2001) examined the differences between pre-service and in-service teachers' self-efficacy regarding the teaching of science and mathematics. He found 58% of pre-service and 71% of in-service teachers felt as though they could effectively teach science within their classrooms. Wenner (2001) also found 93% of pre-service teachers welcomed science questions from students, but only 32% felt like they could answer them. In contrast, only 83% of in-service teachers welcomed students questions about science, but 69% felt as though they could answer those questions correctly for their students. These results support de Laat and Watters' (1995) research about high and low self-efficacy relating to prior experiences with science.

Motivational Factors for Teaching Science

Wenner (2001), de Laat and Watters (1995) mentioned experience as a factor of teachers' willingness and ability toward teaching science. Ramey-Gassert, Shroyer, and Staver (1996) stated these factors could be both internal and external. The internal factors relate specifically to the teachers' self-efficacy, beliefs, and thought processes. Ramey-Gassert et al. (1996) also believed teachers' personal experiences with science, as well as their personalities, preparation, and professional development experiences are factors that will affect how often and effectively they would teach science within their classrooms. Cantrell, Young, and Moore (2003) found those teachers who had more than the required number of science courses in high school, therefore having more exposure to science, and who participated in extracurricular activities related to science in high school had a higher self-efficacy than those who took the minimum number of hours and did not participate in extracurricular activities. Cantrell et al. (2003) also found preparation for teaching science from college courses through creating and implementing lessons to be influential on teaching science in their own classrooms. Ramey-Gassert et al. (1996) mention teachers' attitudes, anxieties, and their outcome expectancy beliefs as internal factors that will relate to the quantity and quality of science lessons they teach.

According to Ramey-Gassert et al. (1996), external factors are those that are "beyond the teachers' direct or immediate control" (p. 292). These external factors can consist of availability and access to resources and time, and workplace environment within the school, mainly whether it is a supportive environment among administration and other colleagues. Lee and Housel (2003) listed classroom management, diverse learners and individual differences, and specific resources such as money, supplies, materials, and equipment as external factors. Cantrell et al. (2003) found the science teaching skills and strategies, as well as the self-efficacy of student teachers who were in a school environment for more than one semester, were impacted by the environment more than they were by the courses they took in preparation for student teaching. Wenner (2001) found teachers with low self-efficacy would accredit the lack of effectiveness in lessons to external factors such as home environment or the students' abilities. Gibson and Dembo (1984) asserted outcome expectancy associates with "teachers' beliefs that external factors such as student socioeconomic status, family background, or home environment limit their ability to impact student achievement" (p. 536).

Benefits of Professional Development for Teacher Efficacy

One of the factors mentioned which influences teacher self-efficacy toward science and their ability to teach science effectively in their classroom is professional development. Lee and Housel (2003) mention high quality science courses and workshops as positive external factors effecting teachers' self-efficacy toward teaching science. The National Science Teachers Association's (NSTA) (1999) *Position Statement on Informal Science Education* states, "informal science education complements, supplements, deepens, and enhances classroom science studies" (para. 5). They also stated teachers are adult learners through professional development. Those teachers who score high on the Personal Science Teaching Efficacy Belief (PSTE) were typically more interested in and involved in professional development opportunities according to Ramey-Gassert et al. (1996).

According to Lakshmanan, Heath, Perlmutter, and Elder (2011), the goal of professional development is to help teachers find new strategies to help expand upon students' learning. Richardson (1996) states another goal of professional development is to guide teachers' beliefs about teaching. Lakshmanan, et al. (2011) found a domino effect linking professional development to teacher efficacy, which is then linked to positive changes to teaching practices, and then goes on to be linked to a positive progression in student achievement. Bolinger (1988) reported that efficacy is increased through professional development programs that focus on refining the participants' teaching abilities and skills. Eshach (2003) found teachers had noteworthy changes occur in their beliefs after attending a 4-day workshop about how to teach science through an inquiry-based strategy. Duran, Ballone-Duran, Haney, and Beltyukova (2009) found professional development increased teacher understanding of inquiry-based strategies, confidence in teaching science, and helped teachers understand the benefits of collaboration.

Professional development can help teachers recognize science as a part of life, which they can then instill the same idea in their students (Eshach, 2003). Dewey (1916) believed science should be taught to children in a way they can understand and apply to their everyday life. According to the National Research Council (NRC) (1996), the National Science Education Standards (NSES) (National Academy of Sciences, 1996) states professional development should actively engage teachers through scientific investigations, which incorporate content, the science process, opportunities for reflection, and collaboration with others. Professional development should also encourage participants to be life-long learners (NRC, 1996).

Current Study

The purpose of the professional development program was to support early childhood teachers' development for teaching science in their classrooms as well as improving teacher self-efficacy. Early childhood teachers from seven public school districts in the Northwest region of Oklahoma participated in a 30-hour professional development workshop at Oklahoma State University. Workshop participants were invited to be part of the current research study. Volunteer teachers completed a demographic questionnaire, the Weisgram and Bigler Scale, in order to determine their self-efficacy toward teaching science, and completed pre- and post- concept maps about their knowledge of teaching science. The teachers also participated in developmentally appropriate, hands-on learning activities for teaching science in early childhood classrooms through read-alouds, which were led by faculty from the department of Human Development and Family Science Early Childhood Education (ECE) Program at the university.

The current study was guided by three research questions. The questions consisted of 1) what were the gains, if any, of the teachers' knowledge about teaching science as measured before and after attending a 30-hour professional development workshop through concept maps? The hypothesis was that there would be an improvement in teachers' knowledge about teaching science from the beginning to the end of the workshop. 2) Is there a relationship between the teachers' efficacy about teaching science and the concept map scores? It was hypothesized that there would be a positive correlation between what teachers know about teaching science and their efficacy. 3) What is the relationship between the teachers' demographics and teachers' efficacy about teaching science? Specifically: how did the teachers attain early childhood certification (tested, add on with courses, major, not certified in ECE), their level of education (Bachelor's or Master's), how many years they have been teaching, and how many years they have been teaching in an early childhood classroom.

CHAPTER III

METHODOLOGY

The purpose of the study was to find whether professional development opportunities impact self-efficacy, and if it leads teachers to incorporate more science lessons in their classrooms after attending the workshop. The professional development aimed at promoting continuous learning for teachers while developing their self-efficacy toward teaching science.

Participants

Twenty-nine early childhood prekindergarten to third grade teachers from seven Northwestern Oklahoma school districts volunteered to participate in this research. The school districts represented were Arnett, Enid, Gage, Guymon, Hooker, Mooreland, and Oklahoma City. The number of participants from each district can be found in Table 1.

Table 1
Number of Teachers and Schools from Each Participating School Districts

School District	Number of participants	Number of schools
Arnett School District	1	1
Enid School District	12	7
Gage School District	3	1
Guymon School District	3	2
Hooker School District	5	1
Mooreland School District	4	1
Oklahoma City Public Schools	1	1
Total	29	14

All subjects were participants in a teacher professional development workshop funded by a grant from the Oklahoma State Regents for Higher Education's Improving Teacher Quality, Title II Professional Development Program (2011). The grant required one of the participating districts to be categorized as a high-need local education agency (LEA). The first requirement for a school to be classified as a high-need LEA is that it serves not fewer than 10,000 children from families with incomes below the poverty line, or for which not less than 20% of the children served by the agency are from families with incomes below the poverty line. The second requirement to be classified as LEA is not having 100% of teachers teaching in the academic subjects or grade levels that the teachers were trained to teach, or for which there is a high percentage of teachers with emergency, provisional, or temporary certification or licensing. Table 2 shows which requirements are met by each district.

Table 2
Participating School Districts and Their LEA Qualifications.

Name of School District	County	20%+ of Student Population in Poverty	Less than 100% Highly Qualified Status	LEA
Arnett	Ellis	NO	NO	NO
Enid	Garfield	YES	YES	YES
Gage	Ellis	YES	YES	YES
Guymon	Texas	NO	NO	NO
Hooker	Texas	NO	NO	NO
Mooreland	Woodward	NO	NO	NO
Oklahoma City Public Schools	Oklahoma	NO	YES	NO

Sampling Procedure

The sampling procedure was one of convenience. Participating teachers attended the summer workshop entitled "Beyond Read Aloud: Integrating Science and Literacy While Meeting the Needs of Diverse Learners" at Oklahoma State University. The purposes of the research project were explained, as well as what the volunteers would participate in, such as completing a pretest the first morning and a posttest during the spring of 2012, after full completion of the training program. In order to follow university procedures for the Institutional Review Board (IRB), the participants were given a few minutes to read information about the surveys and determine whether they were willing to volunteer as participants in the research study. Consent forms were distributed while researchers explained that there were benefits, and no likely risks, to participants. Participants were receiving a stipend for attending the training, so they were reassured that completing the pre- and posttests related to the research in no way impacted their pay or training. Consent forms were used to document those who chose to be engaged in continued professional development through guided collaboration with OSU's ECE faculty during the 2011-2012 academic year. Teachers also committed to being an active member of the electronic community of learners. School administrators committed to supporting the involvement of the OSU Teacher Quality Grant Education Program in their school district. In addition, they supported the commitment of teachers to collaborate with OSU by allowing teachers to implement learned instructional strategies during the 2011-2012 academic year.

Program Design

Julia Atiles, Jennifer Jones, Vicki Ehlers, and Sheila Rowland from Oklahoma State University's Department of Human Development and Family Science Early Childhood Education Program, Leslie Baldwin and Melanie Page from OSU's college of Arts & Sciences (Departments of Communication Sciences and Disorders and Psychology, respectively), and designated school administrators (e.g. principals and/or curriculum directors) communicated and collaborated to conduct all project activities ranging from planning, implementation, and evaluation.

Project activities consisted of 1) a 30-hour professional development workshop for all participants at the Oklahoma State University campus, held from May 31 through June 3, 2011; 2) follow up individual classroom observations and mini–workshops held at the seven districts' sites with the teacher teams from each district. These individual site visits took place during Fall

2011 and Spring 2012 semesters; and 3) ongoing qualitative and quantitative evaluation and research activities. The goal of all activities was to support teachers' development of strategies for integrated teaching of science and language arts with all students.

Professional Development Workshop

Increasing the teaching and learning of science in Early Childhood classrooms through language arts curriculum.

The professional development workshop engaged teachers in hands-on lesson planning activities. For example, teachers were introduced to Dr. Seuss' *Bartholomew and the Oobleck*. In addition to science information about solids and liquids, the book is excellent for young readers as it is imaginative and rhyming. The workshop showed teachers how utilizing appropriate materials can support their efforts to differentiate instruction for their diverse students and individualize the learning experiences. The materials and strategies presented in the workshop illustrated the ways in which children can learn vocabulary, or express their understanding through pictures, attempt to read the story, write their own story, or utilize other media to represent their understanding. The integrated curriculum model that was demonstrated was a vehicle for teaching English Language Arts and Literacy in Science in a way that respects each students' developmental state, be it in reading and/or writing skills, and acquisition of vocabulary, as well as draws on the funds of knowledge of every child. For full detail of the content of the training see Appendix A.

Two individual follow-up sessions were scheduled with each participating district. Teachers were observed in their classroom and had the opportunity to present their lesson plans and share their experiences with each other. Atiles and Jones were available to discuss the effectiveness of the new approach. At the end of the day, all participating teachers in a school or district gathered to discuss their experiences, how the summer training changed their teaching, barriers, if any, to the teaching of integrated science and literacy lessons, and whether or not they utilized the materials they were given in the summer. These sessions were often followed up with the sending of specific literature for the teachers that address particular problems brought to the attention of Atiles and Jones. Every effort was made to involve school administrators during the visits. However, in some cases, Atiles and Jones did not meet the principals as they were often in meetings away from the building. The individual classroom observations and mini workshops/after school meetings held by OSU faculty at the seven districts' sites seemed to strengthen the individual school teams.

Developing a community of learners that supports teachers' collaboration when integrating science and literacy in a classroom of diverse learners.

The community of learners was an online/web based system for sharing lesson plans and discussions. It was intended to provide a support system as teachers developed and implemented lessons that taught science through literacy activities. Lesson plan and sharing of reflections helped scaffold teachers' creative thinking about how to effectively teach science and language arts in an integrated way while meeting PASS and Common Core Standards. Information and communication technologies (ICT) were used to engage teachers in discussing teaching practices and experiences, to help overcome teachers' isolation, to connect individual teachers to a larger teaching community on a continuous and sustainable basis, and to promote teacher-to-teacher collaboration. The intent was for the community of learners to remain as a tool that sustained learning and good teaching practices after the grant ended.

Measurement Approaches

The current study was guided by three research questions. The questions consisted of 1) what were the gains, if any, of the teachers' knowledge about teaching science as measured before and after attending a 30-hour professional development workshop through concept maps? The hypothesis was that there would be an improvement in teachers' knowledge about teaching science from the beginning to the end of the workshop. 2) Is there a relationship between the teachers' efficacy about teaching science and the concept map scores? It was hypothesized that there would be a positive correlation between what teachers know about teaching science and their efficacy. 3) What is the relationship between the teachers' demographics and teacher efficacy about teaching science? Specifically: how did the teachers attain early childhood certification (tested, add on with courses, major, not certified in ECE), their level of education (Bachelor's or Master's), how many years they have been teaching, and how many years they have been teaching in an early childhood classroom.

Concept Maps

Novak and Gowin (1984) explain how concept maps are used to depict relationships between concepts and the central theme or topic. The concepts can be depicted with boxes or circles with lines connecting them to the main topic or theme. Each concept can then have smaller ideas stemming off from it. These smaller ideas may also be connected to each other through cross-links (Novak & Cañas, 2008). Hough, O'Rode, Terman, and Weissglass (2007) stated concept maps can be used as an assessment tool in order to evaluate understandings on a certain theme or topic before and after it is introduced. Concept maps assist in making connections between prior knowledge and newly acquired knowledge (Gallenstein, 2005). In relation to making connections between prior and new knowledge, Novak and Cañas (2008) stated concept maps can be used to identify "valid and invalid ideas held by students" (p. 5). Along with assessing understanding of topics, Gallenstein (2005) stated concept maps are a good tool for assessing how well students meet academic standards. They also allow for visual documentation of what students' have learned as well as providing opportunities for reflection of their own understanding (Hough et al., 2007).

This study used concept maps as a pre- and post- assessment tool. Participants were asked to create concept maps with "TEACHING SCIENCE" as the central concept. They were then asked to make their map of everything they know about teaching science. For both the pre- and post- concept maps, teachers were given 10 to 15 minutes to work, but they were able to take more time if needed. Teachers were reminded to connect their concepts with lines so that they were easy to follow.

The pre and post concept maps were used to determine changes in the participants' knowledge about teaching science from the beginning to the end of the summer professional development workshop. The maps were first scored quantitatively using the measures outlined in Table 3, which was adapted from Hough, O'Rode, Terman, and Weissglass (2005). In addition, a qualitative review was completed in order to find whether participants' knowledge about teaching science changed from the beginning to the end of the workshop. Figure 1 is an example of a pre-concept map, and Figure 2 is an example of a post concept map. Together they show the change in complexity from Day 1 to Day 4 of the summer professional development workshop.

Table 3
Description of Concept Map Structural Variables

Word	**Definition**	**Use**
Width	Greatest number of concepts at one level on the map; the widest point on the map	The width is a measure of breadth of knowledge.
Depth	Total number of levels on a map; length of the longest chain on the map	The depth is a measure of the depth of a person's knowledge.
Heirarchical Structure Score (HSS)	Width + Depth	HSS measures the complexity of the map structure.

Note: Adapted from Hough, O'Rode, Terman, and Weissglass (2005).

Figure 1
Pre Concept Map about Teaching Science

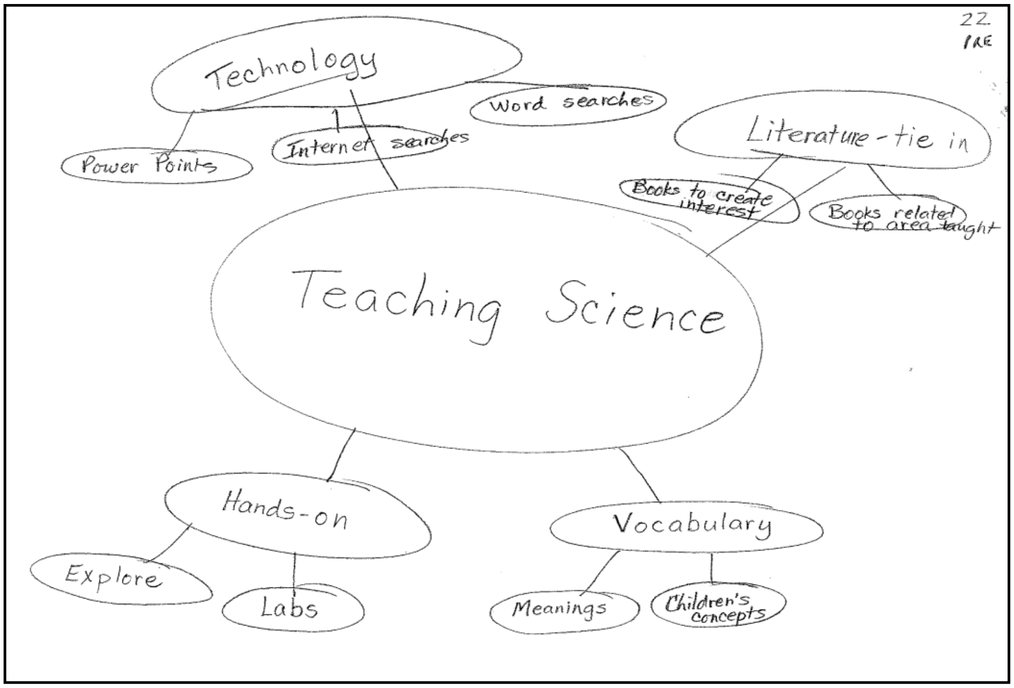
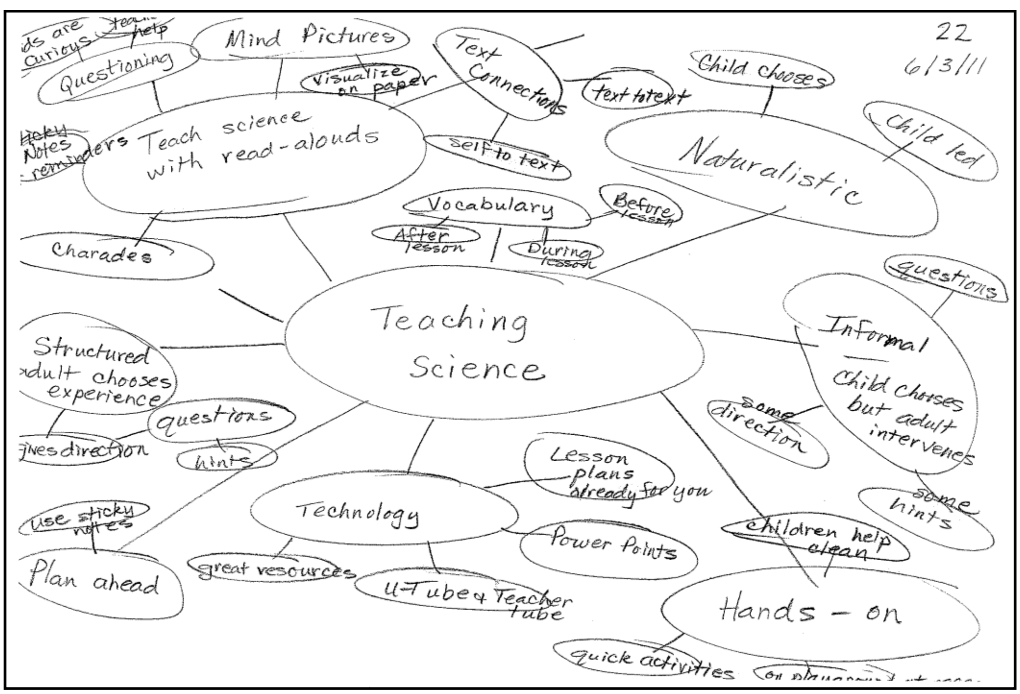


Figure 2
Post Concept Map about Teaching Science



The Weisgram and Bigler Scale

Participants completed a modified version of an instrument developed by Weisgram and Bigler (2006) to examine the roles of altruistic values, egalitarianism, self-efficacy, and perceptions of utility in shaping children's interests in scientific fields. Only 19 self-efficacy items specific to the domain of science from the TWBS were utilized in the present study. Response options ranged from 1 (*strongly disagree*) to 5 (*strongly agree*). These statements direct the teachers to think about their comprehension of science, effectiveness as a science teacher, and their feelings about other situations related to science within their classroom. Teachers' answers to these statements allow researchers, leaders of professional development workshops, and teachers to understand their beliefs and behaviors. The data from this sample shows the measure has a reliability alpha (Cronbach's) of 0.873. See Appendix B for a copy of the original TWBS scale and Appendix C for a copy of the modified TWBS that was utilized.

Weisgram and Bigler's identified 3 subscales: egalitarian views of science (high scores indicate you are more egalitarian); self-efficacy beliefs (high scores indicate you think you are good in science and others think you are good in science); and utilitarian beliefs (high scores indicate you believe that science is useful to society). Items 10, 11, 14, 16, 17, and 18 are on the egalitarian subscale; items 1, 3, 4, 6, 8, 12, and 19 are on the self-efficacy subscale; items 2, 5, 7, 9, 13, and 15 are on the utility subscale. Reverse coded items are 3, 6, 10, 11, 12, 16, 17, and 18.

Demographics Questionnaire

A demographics questionnaire was used in order to gather information about each participant's personal and teaching backgrounds. Questions regarding personal background included their age, gender, primary language, and ethnic classification. Questions regarding participants' teaching background included college/university attended, major, certifications held, when and how they were certified in Early Childhood Education, what grades they have taught, how many years they have taught in a pre-kindergarten through third grade classroom, and whether they are National Board Certified. The questionnaire also included questions about participants' current classrooms. These questions asked how many students are in the classroom, how many aides they have in the classroom, and what is the average teacher to child ratio. A copy of the demographics questionnaire can be found in Appendix B.

Plan of Analysis

The information gathered will be coded and be prepared to be analyzed using Statistical Package for the Social Sciences (SPSS). Two members of the research team will double check the data set for accuracy. Following the accuracy check, dependent t-tests and correlations will be utilized to determine the answers to the research questions.

CHAPTER IV

FINDINGS

The purpose of the professional development workshop was to support early childhood teachers' development for teaching science in their classrooms, as well as improving teacher self-efficacy. The purpose of the current study was to evaluate the impact of the program. Early childhood teachers from seven public school districts in the Northwest region of Oklahoma participated in a 30-hour professional development workshop at Oklahoma State University. Workshop participants were invited to be part of the current research study. Workshop participants completed the Weisgram and Bigler Scale (2006) pre and post training in order to determine their self-efficacy toward teaching science, completed pre and post concept maps about their knowledge of teaching science, and completed a demographic questionnaire. The teachers participated in developmentally appropriate, hands-on learning activities for teaching science in early childhood classrooms through read-alouds.

The current study was guided by three research questions. The questions consisted of 1) what were the gains, if any, of the teachers' knowledge about teaching science as measured before and after attending a 30-hour professional development workshop through concept maps? The hypothesis was that there would be an improvement in teachers' knowledge about teaching science from the beginning to the end of the workshop. 2) Is there a relationship between the teachers' efficacy about teaching science and the concept map scores? It was hypothesized that there would be a positive correlation between what teachers know about teaching science and their efficacy. 3) What is the relationship between the teachers' demographics and teachers' efficacy about teaching science? Specifically: how did the teachers attain early childhood certification (tested, add on with courses, major, not certified in ECE), their level of education (Bachelor's or Master's), how many years they have been teaching, and how many years they have been teaching in an early childhood classroom.

Participants

The participants for this research project are the PreK - 3rd grade teachers registered for the "Beyond Read Aloud: Integrating Science and Literacy While Meeting the Needs of Diverse Learners" training. All 29 participants in the training were selected to participate in the research component, knowing that it was not necessary to consent to the research to fully participate in the training. On the second post-assessment, a participant withdrew from the study due to a promotion working at the district level and not having her own classroom. This left us with a sample size of 28.

All participants were female and reported English as their primary language. Table 4 includes more demographic information of the participants.

Table 4
Participants' Demographic Information

	Number of Participants
Age	
25 or under	3
26 to 40	12
41 to 55	8
56 or older	6
Race	
Black	1
Multiethnic	1
White	29
Level of Education	
Bachelor's degree	24
Master's degree	5
Process of Attaining Certification	
Unrelated Degree & ECE Exam	1
Additional Courses for ECE Add-On	2
Elementary or Special Education Degree	12
Early Childhood Degree	12
Missing	2

Results

The first research question for this study was what were the gains, if any, of the teachers' knowledge about teaching science as measured before and after attending a 30-hour professional development workshop through concept maps? The hypothesis was that there would be an improvement in teachers' knowledge about teaching science from the beginning to the end of the workshop. Concept maps were scored using the methodology described by Hough, O'Rode, Terman, & Weissglass (2007). The depth (measure of depth of a person's knowledge) and width (measure of the breadth of a person's knowledge) scores are added together to create a hierarchic structure score (HSS). This score represents the complexity of understanding. Therefore, the higher the HSS, the more complex the understanding of participants regarding the teaching of science. Two independent coders analyzed the concept maps. Inter-rater reliabilities were calculated. Cronbach's alphas for the coding resulted in an inter-rater reliability of .99 (pretest concept map) and .98 (posttest concept map).

Changes in the concept map score totals, as well as the changes in the pre and post Hierarchical Structure Scores (HSS), were analyzed. Differences in HSS scores can be found in Table 5. In order to analyze change in teachers' knowledge about teaching science pre and post training, dependent t-tests were utilized to examine total number of concepts and HSS scores. Results for total concepts indicate a significant increase in teachers' knowledge [t (26) = 4.27, $p < .001$] from before training (M = 17.52, SD = 6.46) to after training (M = 23.89, SD = 8.65). Results for HSS scores indicate a significant increase in teachers' knowledge about teaching science [t(15) = 4.48, p < .001] from before training (M = 12.25, SD = 4.16) to after training (M = 18.31, SD = 8.07). In other words, teachers had more complexity in their concept maps on Day 4 of the training than on Day 1.

Table 5
Participant Hierarchical Structure Scores (HSS) Changes Analysis

	Score Difference
Average pre assessment	13.5
Average post assessment	16.36
Number of participants with HSS gains	17
Average gain	6.6
Number of participants with HSS losses	8
Average loss	4.5

Note: Three participants had no change between pre and post HSS scores.

The second question was is there a relationship between the teachers' efficacy about teaching science and the concept map scores? It was hypothesized that there would be a positive correlation between what teachers know about teaching science and their efficacy.

The change between pre and post total concept map scores and the change between pre and post teachers' science efficacy as measured by the Weisgram and Bigler scale (TWBS) was examined through a Pearson's correlation (see Table 6). The results indicate that there was a significant association between the two variables ($r = 0.63$, $n = 23$, $p < .001$). Therefore, those teachers who had an increase in self-efficacy also demonstrated an increase in knowledge about teaching science through the pre and post concept maps.

The final research question was what is the relationship between the teachers' demographics and teachers' efficacy about teaching science? Specifically: how did the teachers attain early childhood certification (tested, add on with courses, major, not certified in ECE), their level of education (Bachelor's or Master's), how many years they have been teaching, and how many years they have been teaching in an early childhood classroom.

Two of the research team members coded the qualitative data explaining how participants became certified into one of the following categories: 4 was a degree in Early Childhood Education, 3 was a degree in Elementary Education, 2 was taking courses and getting the add-on certification, and 1 was and unrelated degree and taking the Early Childhood Certification Exam. The coders agreed 100% on the classification. Table 4 summarizes the number of teachers under each category.

Participants completed a modified version of an instrument developed by Weisgram and Bigler (2006) to examine the roles of altruistic values, egalitarianism, self-efficacy, and perceptions of utility in shaping children's interests in scientific fields. Several Pearson's correlations were calculated (see Table 6) to examine the relationship among demographic variables and the TWBS score gains. A one-tailed test was used because literature suggests demographic variables (e.g., the years spent teaching in an early childhood classroom) are related to teacher efficacy.

Results indicated there was a significant association between science efficacy and number of years participants had taught in PreK-3rd grade ($r = 0.37$, $n = 24$, $p = .037$). Thus, teachers' efficacy in regards to science is related to the number of years they have spent teaching in an early childhood classroom. There was not a significant relationship between the other demographic variables (i.e., how the teachers were certified in ECE, how long they have been teaching, and their level of education) and teachers' efficacy regarding teaching science.

Table 6

Correlations Among Variables of Interest

Variable	1	2	3	4	5	6
1. Science Knowledge[a]						
2. Science Efficacy[b]	.634**					
3. Attainment of ECE Certification[c]	-.257	-.254				
4. Years in PreK-3[d]	.336	.371*	-.235			
5. Years Teaching[e]	.356*	.256	-.400*	.811**		
6. Education Level[f]	-.224	-.120	-.138	.377*	.299	
Mean	6.71	5.32	3.29	10.74	12.14	.14
Standard Deviation	7.69	7.71	.78	9.48	10.24	.356

n = 26 for Science Knowledge; *n* = 25 for Science Efficacy; *n* = 27 for Variables 3-4; *n* = 28 for Variables 5-6.
*$p < .05$, **$p < .01$
Note: [a]Science knowledge measured by change in concept map scores.
[b]Science efficacy measured by change in efficacy scores.
[c]Attainment of ECE certification ranged from 1 (alternative certification) to 4 (degree in ECE).
[d]Years in PreK-3 ranged from 2-33.
[e]Years teaching ranged from 1 to 33.
[f]Education level ranged from 1 (Bachelor's) to 2 (Master's).

In summary, teachers' knowledge about teaching science increased throughout the training. A significant relationship was found between teacher knowledge about teaching science and their efficacy. There was not a relationship between how teachers were certified in ECE, the number of years they have been teaching, or their education level and their science-teaching efficacy. There was a significant relationship found between how many years teachers had taught in early childhood classrooms and their science-teaching efficacy.

CHAPTER V

CONCLUSIONS

Professional development workshops explaining and showing strategies for teaching and/or integrating science into other subjects are beneficial for teachers and students. According to Lumpe, Czerniak, Haney and Beltyukova (2012) the benefits for teachers who participated in professional development workshops are improved confidence, new strategies and tools for teaching science, and a support system of other teachers, among others. Findings indicate the training provided was effective in increasing teachers' knowledge of teaching science. Teachers who had an increase in science teaching knowledge were also found to feel more efficacious about teaching science after completing the training and an academic year of implementing science lessons in their classrooms. It was also found that the longer teachers taught in PreK-3rd grade classrooms, they had a higher efficacy in regards to teaching science.

Professional development workshops enable teachers to be continuous learners and expand their science teaching strategies. The present study's findings support previous research by demonstrating that professional development workshops are beneficial for the increase of teachers' knowledge about teaching science.

Although two of the research questions and part of the last research question were supported through the findings, the final research question regarding the relationship between demographic variables such as the number of years teaching, their level of education, and how they became certified had no significant impact on the participants' science teaching efficacy.

This indicates, in this sample, that these demographics of participants are not influential on teachers' efficacy, but professional development workshops do enable teachers to gain more knowledge about teaching, as well as increase their efficacy about teaching science.

Despite the strengths, the current study does have its limitations. A limitation of this study is the inability to make it generalizable to a larger population. This is partly due to the small sample size. The sample size was also not representative of different settings such as rural, suburban and urban. The sample included one urban teacher, twelve from a small suburban district and sixteen from very rural school districts. A more balanced sample may yield different results. Another limitation was the sample was one of convenience from among teachers who signed up to attend a summer workshop. Thus, these teachers were eager to learn. Their attitudes may have influenced the results. Had the sample come from a mandated professional development workshop for districts or the state, the results may have been different.

Future research should consider the integration of other content areas, such as social studies and math, with language arts to determine whether the same positive outcomes can be established. As long as our policies and laws emphasize language arts and math, teachers will have to address other content areas through an integrated curriculum. Professional development seems to be a successful means of empowering teachers to address multiple subject areas.

The professional development workshop in the study was funded by the Improving Teacher Quality State Grant. The grant is meant to assist schools and districts in the improvement of teacher quality so that all teachers are highly qualified. This study appeared to be effective in meeting this objective by improving teacher quality through improved self-efficacy and knowledge in teaching science. Professional development workshops are a good investment of government money and should be continued in supporting teachers' desires to increase the quality of their teaching.

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APPENDICES

Appendix A

The 30 hour professional development summer workshops engaged teachers in hands-on lesson planning activities. The workshops showed teachers how utilizing appropriate materials one can support their efforts to differentiate instruction for their diverse students and individualize the learning experiences. The materials and strategies presented in the workshops illustrate the ways in which children can learn vocabulary, or express their understanding through pictures, attempt to read the story, write their own story or utilize other media to represent their understanding. The integrated curriculum model demonstrated is a vehicle for teaching English Language Arts and Literacy in Science in a way that respects each students' developmental state, be it in reading and /or writing skills, and acquisition of vocabulary, as well as draws on the funds of knowledge of every child.

Content Outline for Professional Development Workshop

OBJECTIVES

- **Effective read aloud is a deliberate, structured and pre-planned.**
- **The context of read aloud can introduce, engage, encourage science learning**
- **Science is learned best by a combination of naturalistic, informal, and structured experiences.**
- **Become familiar with strategies to enhance comprehension (Zimmerman & Hutchins, 2003)**

Day 1

Initial surveys and pre concept maps were completed.

Solids, Liquids, and Gas: Bartholomew and the Oobleck by Dr. Seuss was used to demonstrate an effective read-aloud and how it can be used to integrate science concepts.

Day 2

Wind: Gilberto and the Wind by Marie Hall Ets was used to illustrate how read-alouds can be used to encourage high-level thinking while practicing visualization skills. It Looked Like Spilt Milk by Charles G. Shaw was used to demonstrate how words can be used to describe a picture to others while they create an image in their own mind.

Day 3

Making Connections: Pop! A Book about Bubbles by Kimberly Brubaker Bradley and The Bubble Gum Kid by Stu Smith were used to illustrate how making connections between prior knowledge/experiences and a story helps children remember what was read.

Day 4

Review of the week.

Follow up surveys and post concept maps were completed.

For a detailed description of the script utilized during the professional development workshop, contact Julia Atiles by email at julia.atiles@okstate.edu.

Appendix B

TWBS

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

How much do you agree with each sentence?	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. I am sure that my students can learn science	1	2	3	4	5
2. Knowing science will help my students get a job.	1	2	3	4	5
3. I don't think my students could do advanced science.	1	2	3	4	5
4. I think my students could be good at science.	1	2	3	4	5
5. I would trust a woman just as much as I would trust a man to solve important science problems.	1	2	3	4	5
6. I believe science contributes to the good of society.	1	2	3	4	5
7. Boys are not naturally better than girls at science.	1	2	3	4	5
8. Science is hard for my students.	1	2	3	4	5
9. It's hard to believe a girl could be a genius in science.	1	2	3	4	5
10. I study or I have studied science because I know how useful it is.	1	2	3	4	5

11. When a woman has to solve a science problem, she should ask a man for help.	1	2	3	4	5
12. Women don't make as much effort to succeed as men.	1	2	3	4	5
13. Women quit their jobs because they want to have kids, but men do not.	1	2	3	4	5
14. My students can get good grades in science.	1	2	3	4	5
15. Women can do just as well as men in science.	1	2	3	4	5
16. I think my students could be good in science	1	2	3	4	5
17. I would have more faith in the answer for a science problem solved by a man than by a woman.	1	2	3	4	5
18. Science does not help society much.	1	2	3	4	5
	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
19. Teachers think that boys are better at science than girls.	1	2	3	4	5
20. My child is not the type to do well in science.	1	2	3	4	5
21. Taking science is a waste of time	1	2	3	4	5
22. I think my students could handle more difficult science.	1	2	3	4	5
23. Women are not as good at performing science jobs as men.	1	2	3	4	5

24. Girls are as good as boys in science.	1	2	3	4	5
25. I use science in many ways as an adult	1	2	3	4	5
26. I know my students can do well in science.	1	2	3	4	5
27. Women certainly are smart enough to do well in science.	1	2	3	4	5
28. Doing well in science is not important for my students' future.	1	2	3	4	5
29. Women don't enjoy doing scientific jobs as much as me	1	2	3	4	5
30. Science is not important in my life.	1	2	3	4	5
31. Women don't make as much effort to succeed as me	1	2	3	4	5
32. My students are no good at science.	1	2	3	4	5
33. I think my students could be good in science.	1	2	3	4	5

Appendix C

Modified TWBS

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

How much do you agree with each sentence?	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. I am sure that my students can learn science	1	2	3	4	5
2. Knowing science will help my students get a job.	1	2	3	4	5
3. I don't think my students could do advanced science.	1	2	3	4	5
4. I think my students could be good at science.	1	2	3	4	5
5. I believe science contributes to the good of society.	1	2	3	4	5
6. Science is hard for my students.	1	2	3	4	5
7. I study or I have studied science because I know how useful it is.	1	2	3	4	5
8. My students can get good grades in science.	1	2	3	4	5
9. I think my students could be good in science	1	2	3	4	5
10. Science does not help society much.	1	2	3	4	5

11. My students are not the type to do well in science.	1	2	3	4	5
12. Taking science is a waste of time	1	2	3	4	5
13. I think my students could handle more difficult science.	1	2	3	4	5
14. I use science in many ways as an adult	1	2	3	4	5
15. I know my students can do well in science.	1	2	3	4	5
16. Doing well in science is not important for my students' future.	1	2	3	4	5
17. Science is not important in my life.	1	2	3	4	5
18. My students are no good at science.	1	2	3	4	5
19. I think my students could be good in science.	1	2	3	4	5

Demographic Questionnaire

1. What is your age?

   a. ____ 25 or under
   b. ____ 26-40
   c. ____ 41-55
   d. ____ 56 or older

2. What is your gender?

   a. ____ Female
   b. ____ Male

3. What is your primary language?

   a. ____ English
   b. ____ Spanish
   c. ____ Other - Specify____

4. What is the highest level of education you have completed?

   a. ____ Bachelor's degree
   b. ____ Master's degree (M.S. or MAT or M.Ed.)
   c. ____ Educational specialist degree (Ed.S,)
   d. ____ Doctoral degree (Ph.D. or E. Ed.)
   e. ____ Professional degree (MD, JD,
   f. ____ Other - Specify____________________________

5. How would you classify yourself?

   a. ____ African American
   b. ____ Asian
   c. ____ Caucasian/White
   d. ____ Hispanic/Latino
   e. ____ Native American - Tribe:_______________________
   f. ____ Multiethnic - Describe:_________________________
   g. ____ Other - Describe:_________________________
   h. ____ Would rather not say

6. Total years of teaching experience at the elementary level: ______________________

7. What grades have you taught? ____

8. What is the average teacher to child ratio in your classroom? _____________________

9. How many aides do you have in your classroom? ______________________________

10. Do you currently have a National Board Certification? ___ Yes ___ No

11. What certification or qualifications do you have?

a. ____ Early Childhood Education (Four-year-olds and Younger to Grade 3)
b. ____ Elementary Education (Grades 1-8)
c. ____ Other-Describe____

12. How many students do you have in your class?

13. What college or university did you receive your degree from?

14. What was your degree in?

15. When and how did you become certified in Early Childhood education?

16. How many years have you taught in a Pre K-3 classroom?

17. In your years of teaching in your current district, how many years have you had a child on an IEP in your class?

Please check all applicable IDEA-IEP categories of these current or previous students in your class.

______ Autism
______ Deaf-blindness
______ Deafness
______ Developmental delay
______ Hearing impairment
______ Intellectual Disability/Mental retardation
______ Multiple disabilities
______ Orthopedic impairment
______ Traumatic brain injury
______ Visual impairment, including blindness
______ Other health impairment (i.e., having limited strength, vitality, or alertness that affects a child's educational performance)
______ Emotional disturbance
______ Specific learning disability
______ Speech or language impairment

18. Have you ever had a student with an intellectual and/or developmental disability (e.g., autism, cerebral palsy, down syndrome) mainstreamed in your class?

19. Does your school have a self-contained special education classroom? If so do your students interact or interface with students in that class on a daily or weekly basis?

Appendix D

Oklahoma State University Institutional Review Board

Date:	Tuesday, May 17, 2011
IRB Application No	HE1126
Proposal Title:	Beyond Read Aloud: Integrating Science and Literacy While Meeting the Needs of Diverse Learners
Reviewed and Processed as:	Exempt

Status Recommended by Reviewer(s): Approved Protocol Expires: 5/16/2012

Principal Investigator(s):

Julia T. Atiles
342 HES
Stillwater, OK 74078

Jennifer L. Jones
321 HES
Stillwater, OK 74078

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

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

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

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

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

Sincerely,

Shelia M. Kennison

Shelia Kennison, Chair
Institutional Review Board

From: Atiles, Julia [julia.atiles@okstate.edu]
Sent: Thursday, January 19, 2012 4:42 PM
To: IRB
Cc: Clark, Sarah-OSU Stillwater
Subject: RE: Student involved

Thank you Beth. Indeed Sarah has completed IRB training. She will be using my data (already collected) for her thesis. I will be working with her in the protection of the participants/human subjects. Thanks! Julia

---

From: IRB
Sent: Thursday, January 19, 2012 4:28 PM
To: Atiles, Julia
Subject: RE: Student involved

Dr. Atiles:

You do not need to add Sarah as a PI to the IRB application unless she will be using the data for her thesis or dissertation. If that is the case, I would even encourage her to submit her own IRB application. Otherwise, since you do mention in the currently approved application that you will have research assistants involved in data analysis, then no modification is necessary.

As a PI for the research, you are responsible for ensuring that the research assistants have been adequately trained in the protection of human subjects in research.

Thanks for checking,

Beth McTernan
IRB Manager

From: Atiles, Julia
Sent: Thursday, January 19, 2012 12:42 PM
To: IRB
Subject: Student involved

I am writing regarding the project:

IRB Application No: HE-11-26

Proposal Title: Beyond Read Aloud: Integrating Science and Literacy While Meeting the Needs of Diverse Learners

Sarah Clark, a master student, will be working with part of the data set. Is there a form or a need to add her to the IRB in order for her to be able to do some data analysis?

Thank you!

Julia T. Atiles, PhD
Associate Professor Early Childhood Education
Human Development & Family Science
Oklahoma State University
342 Human Sciences
Stillwater, OK 74078-6122

VITA

Sarah Clark

Candidate for the Degree of

Master of Science

Thesis: EARLY CHILDHOOD TEACHERS' SELF-EFFICACY TOWARD TEACHING SCIENCE: OUTCOMES OF PROFESSIONAL DEVELOPMENT

Major Field: Human Development and Family Science – Early Childhood Education

Biographical:

Education:

Completed the requirements for the Master of Science in Human Development and Family Science – Early Childhood Education at Oklahoma State University, Stillwater, Oklahoma in July, 2012.

Completed the requirements for the Bachelor of Science in Human Development and Family Science – Early Childhood Education at Oklahoma State University, Stillwater, Oklahoma in May, 2011.

Experience:

ECE Primary Student Teaching Spring 2011
Liberty Elementary School Ponca City, OK

- Assisted in classroom set-up.
- Observed and assisted cooperating teacher.
- Wrote and implemented lesson plans
- Attended parent teacher conferences
- Created and implemented a three-week integrated unit about oceans for a first grade class.
- Assessed students' learning using Oklahoma PASS Skills and district standards.

ECE Pre-K/K Student Teaching Fall 2010
OSU Child Development Laboratory/RISE Stillwater, OK

- Assisted in classroom set-up.
- Attended Open House to meet children and parents.
- Observed and assisted cooperating teacher.
- Created and implemented a two-week integrated unit about Oklahoma for four to six year olds.
- Assessed students' learning using Oklahoma PASS Skills.

Name: Sarah Clark Date of Degree: July, 2012

Institution: Oklahoma State University Location: Stillwater, Oklahoma

Title of Study: EARLY CHILDHOOD TEACHERS' SELF-EFFICACY TOWARD TEACHING SCIENCE: OUTCOMES OF PROFESSIONAL DEVELOPMENT

Pages in Study: 44 Candidate for the Degree of Master of Science

Major Field: Human Development and Family Science

Scope and Method of Study:

The teaching of science in the early childhood classrooms has slowly been decreasing. As the years have passed, the subject of science has been put on the backburner while mathematics and language arts have taken center stage in the educational system. Early childhood teachers need to find ways to integrate science with other subjects in order to ensure children are receiving a well-rounded and full education. The purpose of this study was to determine the effectiveness of professional development on teachers' efficacy in teaching science. Volunteer teachers completed the Weisgram and Bigler scale (TWBS) pre and post training, in order to determine their self-efficacy toward teaching science, they also completed pre- and post- concept maps about their knowledge of teaching science, and a demographic questionnaire.

Findings and Conclusions:

Findings indicate the training provided was effective in increasing teachers' knowledge of teaching science. Teachers who had an increase in science teaching knowledge were also found to feel more efficacious about teaching science after completing the training and an academic year of implementing science lessons in their classrooms. There was not a relationship between teacher demographics and their science-teaching efficacy. This means that the demographics of participants in this study were not influential on teachers' efficacy, but professional development workshops enabled teachers to gain more knowledge about teaching as well as increase their efficacy about teaching science.

ADVISER'S APPROVAL: Dr. Julia T. Atiles