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The Effects of Professional Development on Implementation of the 2010 Mississippi Science Framework on Teachers' Attitudes About Teaching Science in Elementary School

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THE EFFECTS OF PROFESSIONAL DEVELOPMENT ON IMPLEMENTATION OF THE 2010 MISSISSIPPI SCIENCE FRAMEWORK ON TEACHERS' ATTITUDES ABOUT TEACHING SCIENCE IN ELEMENTARY SCHOOL

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ABSTRACT

This study attempted to determine the effects of professional development on teachers' attitudes about teaching the 2010 Mississippi Science Framework in elementary school. Subjects were elementary teachers in grades three through eight. A sample size of 26 teachers was selected from two school districts; one was rural and the other was an urban school district. The selected participants were then randomly assigned to either the control or treatment group. Teachers in the treatment group met once a week for four weeks for at least 90 minutes per session that focused on improving knowledge and attitude toward science inquiry. The treatment group also participated in a teacher blog, classroom observations, as well as lesson plan feedback. The control group participated in the blog, classroom observations, as well as the lesson plan feedback but did not receive any face to face professional development sessions. Based on the philosophy of science inquiry, teachers were allowed to choose topics they were interested in to try in their classrooms. Teachers were also allowed to contact the researcher when any questions or troubles arose when preparing or teaching lessons.

Data from the Revised Science Attitude Survey (Bitner, 1994, Thompson and Shrigley, 1986) was collected before and after the study and analyzed using the statistical test Analysis of Covariance (ANCOVA) as well as the qualitative data (blogs, lesson plans, and classroom observations) to help support the primary source of data.

Based on the results of the statistical analysis of the data of this study for both types of data, it was concluded that professional development on inquiry did not result in fostering a more positive overall attitude toward teaching science.

DEDICATION

This dissertation is dedicated to my children and my husband

Tim, Mia, Drew, and Mason Carroll

who have given me constant support and encouragement while reaching my goals.

They have instilled in me the drive to keep going and expressed tireless patience while awaiting my completion.

Words cannot express how thankful and indebted I am to each of you.

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CHAPTER I

INTRODUCTION

In 1996, The National Research Council (NRC) published The *National Science Education Standards (NSES)* which were designed to guide the United States to become a scientifically literate society (Mangrubang, 2004). The *NSES* advocates for: the education of students who are able to experience the richness and excitement of knowing about and understanding the natural world; using of the appropriate scientific processes and principles in making personal decisions; engaging intelligently in public discourse and debate about matters of scientific and technological concern; and increasing the economic productivity through the use of knowledge, understanding, and skills that scientifically literate people employed in their careers. The *NSES (*NRC, 1996*)* currently serve as a guide for excellence in an effort to reform the nation in the field of science teaching.

The No Child Left Behind Act (NCLB) (Office of Public Planning and Innovation, 2003) requires that all teachers of any subject, including science, must hold at least a bachelor's degree from a four-year institution, have full state certification, and demonstrate competence in their subject area. Most institutions often only offer or require one science methods course during the fourth year of obtaining a teaching degree. Research has indicated the need for more training pre- and post-graduation from a teacher education program in the field of elementary science

(Murphy, Neil, and Beggs, 2007).

Byman, Krofkors, Toom, Maaranen, Jyrhama, and Kynaslahti (2009) indicated that inquiry oriented, research-based education, or professional development for teacher education means that the skills presented should be dynamic instead of lecture-based. In addition to the dynamic training styles, teacher candidates' roles need to be hands on.

Howes, Lim, and Campos (2008) stated that teaching scientific literacy in inquiry-based science teaching settings has recently become a larger focus in training teachers to teach science. Howes et al. also states that professional scientists use reading, writing, speaking, and listening as essential to their work, in comprehension and communicating results. This means that students and teachers should be practicing inquiry on a daily basis and becoming literate in science vocabulary. Students should be taught and allowed to speak and think like scientists. This type of science teaching ensures that students have a chance at becoming global competitors or informed citizens according to the *NSES*. The *NSES* (NRC, 1996) indicates that the importance of becoming more scientifically literate in the workplace is crucial to being a global competitor for jobs. An increasing number of jobs are demanding advanced scientific skills and require people to think at a much higher critical level than ever before. Individuals' working in today's society and jobs of the future are and will be required to understand science and problem-solve (Kahle, 2007).

Augustine (2007) in an essay for The National Academies – serving as an advisor to the nation on science, engineering, and medicine-stating that America's overall competitiveness, as assessed by the World Economic Forum in Geneva, "recently plummeted from first place to sixth place in a single year" (Augustine, 2007, p.3). A critical implication of this report is the possibility of leaving a younger generation in a weaker state than ever before in regard to invention and advancements in the field of science.

The mission of the Mississippi Department of Education (MDE) (2008) is to improve the achievement of students in science by addressing a national problem often identified as students who are unprepared to do many jobs globally. Also, another main problem is that many students need some scientific knowledge to make everyday decisions. The purpose of revising the 2001 Mississippi Science Framework was to improve science education in schools and to provide assurance that the students will be ready to compete globally for jobs. The intent of the science curriculum framework is to assist teachers in Mississippi in "producing citizens who are capable of making complex decisions, solving complex problems, and communicating fluently in a technological society" (MDE, 2008, p.8).

Two newly introduced issues that are being addressed in the 2010 Mississippi Science Curriculum Framework for elementary students are inquiry and science literacy (MDE, 2008). Barrow (2006) concludes that in the field of education there is a disagreement of the definition of the word "science inquiry" and "scientific literacy" as related to science.

Howes et al. (2008) defines "science inquiry" as the process of encouraging students to pose questions about the world around them. Science literacy is defined as the communicating or understanding of ideas related to science including component skills such as vocabulary, language structure, reading, and writing elicit to comprehending (Czerneda, 2006). However, science literacy does not mean teaching children to read about science. Science educators often define the term "science literacy" as speaking the language of science, not simply integrating the subject into reading. For this study, the researcher will use the following definition "possession of the kind of scientific knowledge that can be used to help solve practical problems" (Roberts, 2007, p.739). The intent of scientific literacy in this manner is defined to be able to communicate scientifically *in and outside* of the classroom setting. The *NSES* states that scientific literacy means that individuals would be able to ask, find, or reason through their personal curiosities (NRC, 1996). By replacing the former 2001 Mississippi Science Curriculum Framework with a more rigorous and inquiry-based 2010 Science Framework Mississippi educators "are provided with a systematic progression of content and process skills across grade levels.

Many researchers have indicated the need for more training and extensive follow-ups with educators as new curricula is developed and expected to be carried out to students. Basista et al., (2001) in a one year intense study, found that professional development for teachers of integrated math and science training increased content knowledge and achieved a sixty-one percent gain pre/post test in ability and confidence levels. Because the main focus was continuity of professional development the study was a workshop, four weeks of intensive training, follow-up throughout the year, as well as classroom support with observations. This study achieved the goals of increasing teacher content knowledge and pedagogy, increasing teacher efficacy, and also increasing the quality of lessons implemented in the classrooms.

According to the National Assessment of Educational Progress (NAEP, 2005) which is also known as the Nation's Report Card, on a test of understanding science, thirty-two percent of United States fourth grade students performed below the basic achievement cutoff level which is the lowest achievement level acknowledged by this testing series. By the time students were in the eighth grade, the basic achievement performance level increased to forty-one percent. One major purpose of science education reform is to create critical-thinking citizens who can do the jobs that improve our national economy and contribute toward personal economic benefit (NRC, 1996). To reemphasize the ranking of United States students to other students of the world

Augustine (2007) stated that, “There is little consolation in being the first among losers” (p.45). The United States Department of Education (USDE) estimates that sixty percent or more of the newly created jobs will be obtainable by only twenty percent of the students that graduate. This statement is so crucial to educators because the students that are being taught are the workforce of the future. All students must engage and develop their critical thinking skills to the best of their individual ability.

Many researchers have recommended that the key to improving student achievement is by improving teachers’ attitudes toward the subjects that they teach (Wilson, 2010). Colley (2006) indicates that some of the reasons teachers may have poor attitudes in regard to science may be attributed to the limited or absence of formal coursework or professional development on instructional approaches and content knowledge in the area of science.

Little emphasis is placed on the teaching of science inquiry or science literacy. A broad overview of what is expected to be taught specified by a national or state curriculum in regard to science is often the focus of science teaching. According to Mangrubang (2004) teaching candidates earning a degree in elementary education are intensively trained in formal classroom teaching, methodology, pedagogy, concepts, and theories. The students also experience field work and student teaching. Engaging students in school seems to be a recurring problem worldwide (Fraser, 2007; NRC, 1996). Levin (2010) states that students are more engaged when teachers and parents set high expectations for learning.

Problem Statement

The implementation of the 2010 Mississippi Science Framework is intended to enhance students’ scientific literacy, critical thinking, inquiry skills, and problem solving abilities. Due to a weakness in problem-solving abilities, Mississippi students are frequently unprepared to enter the job market (MDE, 2007). MDE attempted to solve this problem by the implementation of the 2010 science framework that includes more emphasis on inquiry and scientific literacy. By revising the 2001 science framework, Mississippi educators hope to improve student achievement in science. Stakeholders believe this will produce citizens who are making complex decisions, solving complex problems, and communicating fluently in a technological society (MDE, 2008).

The *National Science Education Standards (NSES)* (NRC, 1996) state that to meet the needs of a scientifically demanding workforce, teachers should have professional development opportunities to participate in a continuous process of how to teach students to understand scientific ideas. Teachers also should support students in their individual endeavors as scientifically literate citizens and as possible future scientists.

Statement of the Purpose

The purpose of this study is to determine the effects of professional development on implementation of the 2010 Mississippi Science Framework on teachers' attitudes about teaching science in elementary school.

Research Question

What effect does professional development in teaching science inquiry and literacy have on teachers' attitudes about teaching science in elementary school?

Hypothesis

There is no significant difference in mean teacher attitudes by group (treatment or control) when controlling for pretest scores.

Delimitations and Limitations of the Study

The researcher will delimit the study to elementary teachers who are employed in the rural or city school districts in Northeast Mississippi. The researcher will restrict this study to fifth through eighth grade teachers. The study will be delimited to a two month period from March to April 2011.

Several conditions could exist in the study over which the researcher may have no control. One possible limitation is the unknown effects of school administration, other teachers, or outside professional development toward science teaching. Another limitation could be the investigator's lack of control over the teachers' previous attitudes which may have influenced their beliefs about science literacy, science inquiry, or both of these terms. The investigator will have no control over the environments or the context of the classroom to include lesson plans being implemented. The generalizability of the study can also be limited due to the location of the study.

Definition of Terms

The following terms used in this study are defined as follows:

Attitudes Toward Science: Attitudes toward science include having a feeling or an opinion about science that may cause a person to take some actions. These actions regarding attitudes towards science could be good, bad, harmful, beneficial, pleasant, unpleasant, important, or unimportant (Jones and Barmby, 2007).

Professional Development: Professional development can be defined in simple terms as facilitated learning opportunities (Buysse, Winton, and Rous, 2009). Professional development is facilitated teaching and learning experiences that are transactional and designed to support the acquisition of professional knowledge, skills, and dispositions as well as the application of this knowledge in practice.

Science Literacy: Science Literacy is the communicating or understanding of ideas related to science including component skills such as vocabulary, language structure, reading, and writing elicit to comprehending (Czerneda, 2006).

Science Inquiry: Science inquiry, in regard to students, means "doing what scientists do" (Howes, Lim, and Campos, 2008). Windschitl, (2002) also states that science inquiry is at any level, posing questions and testing hypotheses is an authentic activity through which they can generate their own knowledge and develop an understanding of the processes by which scientists make claims about the natural world.

2010 Mississippi Science Framework: The primary purpose of the *2010 Mississippi Science Framework* is to provide a basis for curriculum development for K-12 teachers. The framework provides an outline of what students should learn through competencies and objectives. The *2010 Mississippi Science Framework* replaces the *2001 Mississippi Science Framework*. The content of the framework is centered on the strands of **inquiry, physical science, life science, and Earth and space science.** Instruction in these areas is designed to expose students to experiences which reflect how science should be valued, to enhance students' confidence in their ability to apply scientific processes, and to help students learn to communicate and reason scientifically. The *2010 Mississippi Science Framework* provides teachers with the systematic progression across grade levels and is written to ensure the development of essential science concepts that students will utilize as they pursue a career or continue their education (MDE, 2008).

MCT2 (Mississippi Curriculum Test Edition 2): The Elementary and Middle Grades Science Assessments will be criterion-referenced assessments in grades 5 and 8 that allow Mississippi to be in full compliance with the requirements of the federal legislation No Child Left Behind. These assessments are fully customized criterion-referenced tests, and a committee of Mississippi teachers who have been selected by the MDE approved the items that appear on these tests. The tests will be aligned with the portions of the Mississippi Curriculum Science Framework 2001 specified by the teacher committee and will meet the requirements of NCLB. The results of these assessments will provide information that will be used for the purpose of improving student achievement; the results may also be used in Mississippi's school accountability system (MDE, 2008).

NAEP (National Assessment of Educational Progress): a national test and also known as the nation's report card that is given to students in grades four, eight, and twelve to measure subject matter achievement. The intent is to measure students' progress in areas such as reading, math, and science over a period of time.

Depth of Knowledge (DOK): measures the degree to which the knowledge elicited from students on assessments is as complex as what students are expected to know and do as stated in the state or national standards. DOK includes levels respectively as level one through four and each increases in rigor with one being the lowest level of thought (Webb, 2007).

Trends in International Mathematics and Science Study (TIMSS): an international assessment of science and mathematical knowledge of fourth and eight grade students from around the world. The assessment was designed to compare the achievement of students around the globe. The assessment is given every four years and was last administered in 2007.

Performance Assessment Links in Science (PALS): is an online standards based resource bank of science tasks that can be used in classrooms. The website is continuously maintained by educators who reference the National Science Education Standards (*NSES).*

<u>“Big Ideas”:</u> an overarching standard also identified by the *NSES* as the unifying concepts and processes standard. The “Big Ideas” of science is that all of what is learned in science is connected and carried throughout a student’s life (NRC, 1996).

Summary

Much of the research indicates that educators are struggling with science teaching especially in teaching science and problem-solving skills related to science inquiry and literacy. Some of these reasons are: lack of training pre and post college, poor content knowledge or pedagogy, and a lack of support and supplies (Augustine, 2007; Flannagan, 2009; Trumper, 2006). Lack of training and support can contribute to negative attitudes towards teaching and learning science concepts. To address teachers’ needs, the NRC (1996) suggests that teachers should receive ongoing professional development with follow-up training and feedback. Teachers should feel they are being supported and know exactly who and where to turn to for support in science education.

Organization of the Remainder of the Study

This study is organized into five chapters. The first includes the introduction, background, and broad overview of the experimental research. The second chapter consists of an in-depth review of the current literature, including both theory and actual research conducted in the area that is being studied. The third chapter explains the methodology of the study. This chapter includes the descriptions of the subjects, the variables, the data collection, the experimental treatments, qualitative components, and a description of the data analysis procedures. Chapter four presents the results of the study, and Chapter five discusses implications and conclusions of the study.

CHAPTER II

REVIEW OF LITERATURE

The purpose of this chapter is to present a review of the literature summarizing the problems in science education, the importance of teachers' attitudes toward teaching science, the effects of professional development in enriching teachers in their area of study, and on-going professional development on the promotion of science inquiry instruction in elementary school.

The Current State of Science Education and Problem Statement

According to Augustine (2007) the understanding of science is the "key to innovation and power in today's world" (p.38). The report published by the National Academy of Sciences (NAS, 2007) "Is America Falling Off the Flat Earth?", states two main objectives for the United States to address immediately: 1) "America must repair its failing K-12 educational system, particularly in mathematics and science, in part by providing more teachers qualified to teach those subjects," and 2) "the federal government must markedly increase its investment in basic research, that is, in the creation of new knowledge" (p.1).

The National Science Education Standards (*NSES*) (NRC, 1996) reports that professional development for teachers should be a continuous process that involve experiences that show "the importance of learning to *do* science as well as learn *about* science"(NRC, p.89). By doing inquiry themselves, teachers learn how to teach their students inquiry. According to the authors of the *NSES*, developing science inquiry skills among teachers is "making a commitment to inquiry-as something that all humans must do to improve their lives and those of others" (NRC, p.109). By making a commitment to inquiry, teachers use strategies to help develop students' higher-level thinking and problem-solving skills that are essential to forming a scientifically literate society.

Pine and Aschbacher (2006) report that, to help students become individuals who actively think and learn like scientists, they need an early foundation in learning how to ask the "why" questions about the natural world (*NSES)* (NRC, 1996). Pine and Aschbacher also stated that, by providing a solid foundation for students in science inquiry and scientific literacy, students "could increase their ability to use scientific reasoning in their every day lives" (p. 308). The ability to "ask questions, acquire reasoning and procedural skills of scientists, and understand the nature of science are uniquely powerful" in today's society (NRC, p. 13).

According to Trumper (2006) some of the specific problems that science education is faced with include the lack of conceptual understanding and growing student illiteracy which hampers the growth of our nation's capacity for scientific and technological innovation. Perhaps one of the more complex problems in science education is that, commonly in elementary school, "science teachers treat science class as if it is a time for preparing students for a quiz show" (NRC, p.12) Students often "fail to see how scientific knowledge will be useful to them in the future"(NRC, p.13).

The *NSES* provide standards of excellence to help teachers teach and support the educational and experiential development of scientifically literate students. The *NSES* do not encourage or recommend the use of rote memorization for any portion of a science curriculum. According to research findings from the *NSES*, "When teachers use memorizing as their main form of instruction, it is less likely that students will actively seek evidence for different explanations, think about why one set of evidence is stronger, or make good decisions about natural phenomena (*N*RC, p.118). The *NSES* indicates, through narrative teacher accounts, that science content and science process skills must be taught together in a continuum (NRC, p. 91).

The *NSES* recommend that science teachers provide increasing support for students to "explore scientific concepts as they feel comfortable with the steps necessary for doing science inquiry" (NRC, p. 92). But first, teachers must "sharpen their own pedagogical knowledge about science inquiry" before becoming a mentor to their students (NRC, p.104). Inquiry professional development can "stretch the teacher's knowledge, stimulate focused discussions with colleagues, and motivate the teacher to see more knowledge about science content and teaching approaches" (NRC, p. 108). Inquiry Instruction should be taught as a continuum of learning stages first modeled by the teacher so that students become increasing independent in learning the skills needed to answer scientific questions (NRC, p.109).

According to Piaget's Theory of Development, students neatly fit their own observations of the natural world into their pre-existing schema; they assimilate this information (NRC, 1996). When students learn more deeply and specifically about a topic they realize that there could be multiple solutions to the problem they are investigating. By using inquiry-based practices, students can become independent problem-solvers by a continual process of assimilation and accommodation of new knowledge and experience into their standing science schema (NRC, p.34).

The publication "A Nation at Risk" (1983) emphasizes and recommends a more elicit and hands-on approach to science education at all levels. John Slaughter, a former director of the National Science Foundation, warned the United States that there was "a growing chasm between a small scientific and technological elite and a citizenry ill-informed, indeed-informed, on issues with a scientific component" (United States Department of Education, 1983, p.5). The United States Department of Education (1983) also states that they were "worried that educators were solely focusing on reading and math- which left little room for teaching scientific skills and problem-solving" (p.7).

Following "A Nation at Risk," learned societies developed content standards and in 1996, the *NSES* recommended that instruction should be "learner-centered" in science classrooms (NRC p.121). The *NSES* includes guidelines to excellence for what students should know and be able to do, teacher professional development, and science assessment. One overarching content and professional development standard states that teachers and students are linked by "the actions of teachers who deeply influence the understandings of and relationships with their students" (NRC p.28). The teaching standard of "developing an inquiry-based program" must also be included in schools which recommend the following: developing year-long frameworks and short-term goals for students; selecting science content that is meaningful and interesting to the students; selecting appropriate assessment that nurtures and supports student learning; and working together as professionals across the grades and curriculum.

The state of Mississippi Science Curriculum Frameworks followed the *NSES* recommendations and put an emphasis on inquiry in 2008. Mississippi replaced the MCT1 with MCT2 because of the greater adherence to the NAEP assessment which has a greater emphasis on higher-order thinking and problem-solving. Mississippi wanted to create science programs and assessments that were taught and tested at a higher DOK level. Mississippi piloted the inquiry inclusive framework for two years prior to implementing the framework one-hundred percent in the 2010-2011 school years. According to *NSES*, the reason for a more inquiry based curricula is to "exploit the natural curiosity of children, so that they maintain their motivation for learning not only during their school years but throughout life" (NRC, p.13). United States students are often not considered global competition when it comes to jobs that require critical thinking skills because of past poor quality science instruction (Augustine, 2007, *NSES*, 1996). Students must be able to think, speak, and act like scientists in an outside of the classroom to show science mastery (NRC, p. 1).

As reported by the Trends in International Mathematics and Science Study (TIMSS) (2007) results showed a decline in U.S. fourth grade students' scores in science between the years 1995 and 2007 as compared to other countries. Augustine (2007) states a need for an increased positive response to science education to United States decision-makers and educational leaders. He claimed that, by the time a child is in the fourth grade, s/he has already arrived at the conclusion of whether or not s/he is going to pursue science as a possible career. According to Augustine, the biggest challenge for science educators is establishing a drive within students to continue to be life-long learners of science.

According to the *NSES (1996)* and Augustine (2007) students and teachers must make a life-long commitment to seeking new knowledge about the natural world. Teaching Standard C: Becoming Lifelong "Inquirers" reminds teachers and students to view learner's growth as a continuous process, which increases knowledge through active participating in scientific investigations, and a means to improve their value to the community by seeing the "big" ideas of science.

Science education reform continues to build with the support of President Barack Obama. Through the, "Educate to Innovate" campaign, he initiated a nationwide effort to help United States students increase their achievement in science and math over the next ten years. The Science, Technology, Engineering, and Math (STEM) education national initiative that has received a budget of over $260 million dollars which includes: technology courses to help students increase their ability in innovative design and discovery, involvement of many current and former scientists who are willing to work directly with students and educators, and a yearly science fair at the White House.

According to Appleton (2007) for the number of science inquiry learners to increase in the student population, science will be put back into the hands of the learners. However, Appleton emphasizes that, when students are performing inquiry-based tasks, teachers must "scaffold or carefully structure lessons to maximize learning scientific concepts and the development of independent inquiry-based skills" (Appleton, 2007 p.511) A highly-qualified science teacher will make sure that instruction is "focused in on helping students clarify scientific misconceptions and take ownership for their own learning" (Appleton, 2007 p.514). The science classroom is an "environment that promotes innovation, design, and the drive to continue to make inquiries in the field of science throughout a learner's life."(Howes et al., 2008, p.195).

According to Pine and Aschbacher (2006) the current state of science education will continue to remain under scrutiny. Pine and Aschbacher state that, because literacy and mathematics are the more demanding priority in the United States, science is forced to be at the end of the priorities list of many educators. Science education is constantly disregarded because of the pressure to raise the achievement bar in reading and math to meet the requirements of the No Child Left Behind Act of 2001. Because of federal legislation's focus on literacy and math, little effort is given to science education professional development. According to Howes et al. (2008) "little or no science mentoring or induction is taking place for new or veteran teachers in school systems" (p.192). According to Keys and Bryan (2001) "science reformers are hoping to place teacher knowledge, actions, and meanings for inquiry-based science professional development at the center of the reform process" (p.190). Pine and Aschbacher recommend the following to ask legislative officials to recognize that science needs immediate attention in schools:" insist that literacy and math are not the only matters that count in schools; recognize that good inquiry-based science teaching provides powerful literacy-learning experiences; and show support for professional development of science teachers" (p.313). According to the *NSES*, science inquiry teaching can support the efforts of other subject area reform such as "developing cognitive abilities, such as critical thinking and reasoning, as well as learning science (non-fiction) content" (NRC, p.18).

Defining Inquiry

According to the *NSES*, scientific inquiry is defined as "multi-faceted activities that involve making observations, posing questions, examining books and other sources of information to see what is already known in light of experimental evidence, using tools to gather, analyze and interpret data, produce answers, explanations, and predictions" (NRC, p.13). The *NSES* also state that "inquiry requires identification of assumptions, use of critical and logical thinking, and consideration of alternative explanations" (NRC, p.14). According to the *NSES*, science inquiry "reflects how scientists come to understand the natural world, and it is at the heart of how students learn" (NRC, p. 23).

Even though the *NSES* define inquiry, Barrow (2006) states that there is a

According to Barrow, one definition commonly used is "a skill-set to be developed by students" (p.190). Windschitl (2002) defines inquiry as "generating knowledge and developing an understanding of the processes by which scientists make claims about the natural world" (p.114). However, the National Research Council (1996) states that in "defining terms in any subject there is bound to be disagreement" (p.140). A more basic explanation of inquiry is defined as "doing what scientists do" (NRC, p. 21). The *NSES* Teaching Standard B (NRC, 1996) describes the characteristics of acceptable science inquiry curricula. An appropriate inquiry curriculum focuses on "scientific literacy and includes the knowledge and skills required to be future scientists" (Howes et al., 2008 p.190).

Critique of Science Inquiry Teaching

According to Akkus, Gunel, and Hand (2007) "many state and federal governments have mandated in such documents as the *NSES* that inquiry strategies be the central focus of science teaching" (p.1745). According to the *NSES*, through "scientific inquiry students can gain new data to change their ideas or deepen their understanding of important scientific principles" (NRC, p.117). However, the *NSES* also maintains that, "students do not come to understand inquiry simply by learning words such as hypothesis or inference or by memorizing procedures" (NRC, p.14). Students learn science by "doing what scientists do" (NRC, pg.21). Perhaps the most critical element of inquiry comes in the form of teacher uncertainty. Trumbull, Scarano, and Bonney (2006) state "involving students in learning about and doing inquiry introduces much more uncertainty and unpredictability into the classroom than doing tightly structured exercises" (p.1718). Many teachers are often unsure how to access lessons that promote science inquiry. The *NSES* state that, "in the classroom, a question robust and fruitful enough to drive an inquiry generates a 'need to know' in students, stimulating questions of 'how and why' a phenomenon occurs" (NRC, p.24). But the process of inquiry does not necessarily begin with the students. According to the *NSES*, "the initial question may originate from the learner, the teacher, the instructional materials, the web, some other source, or combination of sources" (NRC, p.24).

Another major criticism of inquiry-based instruction is the deficit of many teachers' content knowledge. Trumbull et al., (2006) states that "dealing with students' questions requires solid content knowledge" (p.1719). Trumbull, et al. argues that it depends on the teachers beliefs about the nature of science of whether or not they will embrace the ideas of science inquiry. According to Trumbull, et al. some teachers believe that "science discovers truths about the world and only experts can discover these truths" (p.1719).

The Importance of Teacher Training in Inquiry Based Teaching

According to Colley (2006) teachers are having trouble teaching and understanding science inquiry because little attention is being given to science in professional development efforts. Colley also stated "science educators are having difficulty distinguishing between inquiry- and discovery based instruction because of prior beliefs about science teaching" (p.26). According to Byman et al., (2009) "schools need research-based science teacher professional development opportunities in place to help better train teachers to teach science" (p.79). According to the *NSES* Teaching Standard F: "teachers should fully participate in planning and implementing professional growth and development strategies for themselves and their colleagues" (NRC, p.23). According to Byman et al., "when science teaching is research based, teachers teach what they study or their teaching draws from well-articulated knowledge of fresh ideas and research" (p.81). According to the *NSES*, developing an understanding of inquiry and the interaction that must happen between students and the natural world is considered "vital" to creating scientifically literate citizens. Teachers also have to experience this interaction of inquiry practices (NRC, p.23).

Guskey et al., (2009) stated there is a "complex relationship between teacher training and improvements in instruction in the classroom" (p.496). Guskey also emphasized that there are three elements that should be considered when beginning any new professional development efforts regardless of subject matter: 1) "all educators have a responsibility for critically assessing and evaluate the effectiveness of their current teaching style"; 2) "make sure the efforts produce trustworthy, verifiable, replicable, and comparative data"; 3) "always begin the efforts on a small scale for deeper understanding" (p.498). Furthermore, Guskey states that "educators at all levels need job-embedded assistance as they struggle to adapt to new instructional practices" (p.498). As supported by the *NSES*, professional development of "teachers of science should be on-going with support" (NRC, p.23).

Mangrubang (2004) states that inquiry-based teacher training should include improvement of pedagogical practices and attempt to clear up any scientific misconceptions that might occur in the sessions. The *NSES* supports professional development efforts by making "science for everyone" even those with limited background experience. Mangrubang states that, by taking the "big ideas" of science and personalizing teacher training, teachers are more likely to pass the "big ideas" off to their students (p.290).

Inquiry Based Curriculum Enables Teachers to Develop Future Problem-Solvers

Pine and Aschbacher (2006) states that teachers who view the primary purpose of science education as: "preparing tomorrow's workforce; as helping individuals lead personally fulfilling and responsible lives; or ensuring that we will have the collective wisdom and inclination to use science and technology to solve the myriad problems facing the world; have allowed inquiry and critical thinking skills to be invaluable to the world" (p.308). Augustine (2007) agrees that teachers must focus more on preparing students to think critically and problem solve. By learning and becoming "comfortable with science as a student, learners can become comfortable with using science and scientific thinking skills in their daily lives" (Pine and Aschbacher, 2006 p.308).

With support of the *NSES*, teachers are encouraged to embrace science curricula with inquiry embedded into their daily instruction. According the *NSES*, an inquiry-based curriculum embraces the idea that students will ask questions and attempt to find answers about the natural world. Despite powerful supporters, it was not until Russia Sputnik I, the first man-made satellite, that educators and policy-makers really started focusing more on science education. After the events of Sputnik I, the United States knew it needed to make advances in science and technology. However, the new focus still only centered on the best and brightest students. The problem with the new focused curricula was the lack of support and training that teachers received during this time period. According the *NSES*, these historical events led to the Physics Curriculum of 1960 and many more curricula that defied the understandings of teachers with limited background knowledge in science education efforts (p.16). Even after the events of Sputnik and the 1983 "A Nation at Risk" report and the 1990 report "Science for All Americans", science education reform efforts found that most science teachers "were still using didactic methods" (p.17).

Teachers' Attitudes toward the Teaching of Science

According to the *NSES*, "teachers beliefs and values about students, teaching, and the purposes of education can impose obstacles to inquiry-oriented approaches" to teaching (NRC, p.139). More specifically the *NSES* list the following as factors that negatively influence teachers attitudes toward teaching science: "limited teaching abilities; prior commitments to textbooks; assessment; forced to work as groups; new teacher mentoring; in-adequate in-service education; political influence including parents; lack of resources, and resistance from school leaders" (NRC, p.140).

According to the *NSES*, "teachers attitudes are a powerful influence" on not only students, but colleagues as well (p.140). Ediger (2002) states "attitudes toward teaching students science are vital" (p.25). Teachers serve as guides and good models for conducting and answering science questions about the natural world. For teachers to form positive attitudes about science teaching, they must be surrounded with support to continue their growth as a science education (*NSES*) (NRC, 1996).

In 2002, Ediger's study using the California Test of Personality to measure teachers' attitudes and its effects of student achievement in public schools revealed that student achievement was "significantly higher at the .05 level in personal adjustment" to new science subject matter when the teacher taught with a positive attitude (p.25). When students are taught by confident teachers they feel confident in posing and asking questions in science class (Ediger, 2002).

Taylor et al., (2008) indicated a decline in teachers' attitudes in science teaching because of the pressure from school leaders to do well on state and national tests. According to Taylor et al., the study reported that teachers felt students were being over-tested and this affected their attitudes about participating in science class. Taylor also found that teachers felt pressured to teach testing strategies rather than content. According to Taylor et al., (2008) "teachers already knew they were not going to be able to teach the lessons to the degree intended" due to testing pressures (p.1063).

According to Taylor et al., (2008) when the same teachers were asked what the goals of science should be, they indicated there "should be an increase in critical thinking skills rather than testing strategies" (p.1064). Overall, the study found that the excessive use of testing in science has decreased teachers and students attitudes toward science.

Teacher Background Knowledge and Support for Science Teaching

According to Goodnough and Nolan (2008) teachers play a "pivotal role" in helping students develop scientific understandings, abilities, and dispositions (p. 215). However, one of the many challenges of being a science educator is the variety of content knowledge needed to foster and guide inquiry learners at confident levels (Howes et al., 2008).

Results from a survey administered by Goodnough and Nolan (2008) revealed that teachers often feel "ill-equipped and unprepared to carry out problem and inquiry-based curriculum in science teaching" (p.216). Plourde and Alawiye (2003) stated that there is concern that many elementary science educators are unprepared for teaching science. Assumptions about teacher preparation are reemphasized by survey data from the National Science Foundation (NSF, 2000) between the years 1993 and 2000. The NSF study involved 6,000 teachers in the United States who taught in grades one through six in self-contained classrooms. The study found that the average United States classroom only spends 27 minutes per day on science instruction and the majority of that time is spent only reading about science. Goodnough et al. (2008) stated five reasons why science teaching differs among teachers: orientation of teaching content, knowledge of the curriculum, usage of pre/post-assessment, and knowledge of instructional strategies.

In a study conducted by Taylor et al., (2008) interviews with scientists, who worked with teachers on improving content knowledge, clearing-up misconceptions, and improving inquiry based practices. The scientists noted that most of the teachers lacked a sufficient understanding of science content and "did not have enough background knowledge to teacher their own students" (p.1064). The researchers also concluded that even with providing teachers with "enough" preparation for science teaching the teacher has some responsibility to growing as a professional. Taylor, et al. stated, "there is little time to prepare beginning teachers, and finding balance between content and pedagogy is a narrow if nonexistent point" (p.1070).

Taylor et al., (2008) indicated two factors that could help in the efforts of better preparing science teachers. The first suggestion was that professional development leaders could model specifically planned ways the processes of science should be taught in the classroom. The second suggestion was that teachers could use the outside expertise of community-based professionals such as scientists in the classroom more often. Taylor, et al. stated that "the center of science reform should be to help better educate teachers to teach their subject area" (p.1065).

Forming Positive Attitudes toward Teaching Science

Wilson (2006) describes positive attitudes of teachers as "a relationship in which students perceive the teacher as available and welcoming" (p. 91). Evidence of positive attitudes includes a mixture of verbal and non-verbal gestures that support a positive learning environment. Wilson also stated that "students' perceptions of their teachers' attitudes toward them resulted in positive correlations with student motivation, academic achievement, and evaluations of their teachers" (p.91). According to Ediger (2002) "administrators should consider teacher attitudes toward science teaching as one of the critical components of hiring an individual" (p.28). Ediger also states that positive attitudes of the teacher affected students' willingness to learn new skills. Ediger also noted that "students of more positive and competent teachers achieved significantly higher than those students who had less positive teachers in science class" (p.27).

According to Flannagan (2009) developing a positive attitude toward science teaching means the teacher is "attending to the needs of students and allowing them to feel success and failure in science class" (p.30). According to the *NSES*, "teachers' beliefs about science are related to their attitudes about science teaching" (NRC, p.139). Flannagan states "to further develop as a science teacher and reduce anxiety about teaching science teachers need time, encouragement, guidance, and support" (p.31). Flannagan also states "without support of school leaders and other teachers, teachers could give up or lose interest in becoming a better teacher" (p.32).

Professional Developments on Inquiry, Science Assessment, and Student Achievement

According to the *NSES* a "long-term, comprehensive, inquiry-based professional development is an absolute requirement for success" in science teaching (NRC, p.113). The *NSES* also states that science is an ever-changing field and constantly calls for on-going learning to occur among professionals. Teachers must also be given multiple opportunities to enhance their understanding of how multi-diverse students learn best in science class (Penuel et al. 2008). The *NSES* recommend that science educators share their experiences with their colleagues and their students about science. Teachers, parents, and policy-makers often question "why they should support inquiry-based curricula and professional development" (NRC, p.115). The reason for this questioning is that many people don't understand why students can just learn like their parents did as a child (*NSES*, 1996).

Harlow (2007) collected data on how professional development courses, based on critical thinking teaching strategies, impact the way teachers teach their students. According to Harlow (2007) it was not surprising to find that these teachers struggled in science-specific areas due to weak pedagogical content knowledge (PCK). According to Guskey et al., (2009) professional development practices can provide additional classroom strategies and pedagogical content knowledge which could increase student achievement. Types of professional development implementations with positive correlations to student learning are teacher workshops with active-learning experiences and training with outside experts such as scientists (Flannagan, 2009).

Castle, Arends, and Rockwood (2008) investigated the effects of professional development on teachers who taught students who took standardized tests. The researchers compared the professional development school's achievement scores to a school who did not provide on-going specific targeted professional development achievement scores. By mandating professional development in this particular school over the span of six years the following was achieved: "the faculty shared a common vision for student learning, by the implementation of data-driven instructional practices student achievement increased specifically in low socio-economic students, instructional practices now were able to focus more on inquiry learning by being trained to hand specific situations, and teachers felt they had a voice now in the professional development they received" (Castle et al., p.4). Castle et al. stated that the greatest impact on student achievement came from the "long-term partnerships that are focused on student learning, professional development, and inquiry to impact student learning (Castle et al., p.2)."

In 2005, NAEP reported that 32% of United States fourth graders performed below basic achievement cut-off levels- this being the lowest one can possibly perform on the assessment. In the eighth grade, 41% performed below basic achievement cutoff levels. By twelfth grade, 46% performed below basic achievement cutoff levels. The outlook for potential scientists to compete globally for jobs seem increasingly grim with the data from the NAEP. According to Augustine (2007) increasingly tight budgets can negatively effect student achievement and the attitudes of the science teachers. Augustine reported that Asia, a leading scientific competitor, educates 20% of the world's students with only 2% of the world's educational resources. The report also stated that the United States spends more money per student than any other country but achievement scores in science continue to decrease. Augustine indicated that the "real problem is not that the money is being spent; it is on what the money is being spent" (p.33) A major conclusion of this report is that, along with increasing parental involvement, the best way to improve the United States science educational system is to provide opportunities for science teachers to become highly-qualified through professional development opportunities in science and continued advanced education science courses, workshops, and other types of professional development.

According to the Elementary and Secondary Act (ESEA), a highly-qualified a teacher must have a bachelor's degree, be fully certified as defined by the state department of education, and demonstrates subject area competence in any core subject taught (United States Department of Education, 2002). According to Augustine (2007) 93% of fifth through eight grade students in the United States are being taught by science teachers who possess no real certification in that particular area of science. "Many entire school districts do not have a single teacher with an academic degree in science." (p. 35) When author of this report "gave students between the age of 11 and 15 a Raytheon survey with questions such as, "what would you rather do, take out the trash, eat your vegetables, go to the dentist, or learn math and science", and 84% answered take out the trash" (p. 35). The attitude stems from teachers who do not possess the appropriate certification in the subject area lack confidence and comfort with teaching the concepts to students and can negatively impact students. According to Augustine, teachers often end up leaving the profession to work in offices or other jobs within five years of teaching. Among this group, science teachers are among the first to resign. Augustine stated that potentially good science teachers leave the education field due to lack of" prestige, increasing discipline, decreased parental support, and demanding and unrealistic workloads, and pay." (p. 36)

Summary

Science inquiry and literacy instruction is a major part of science education reform. A growing body of research supports the need for in-depth investigation involving regular and follow-up professional development in science inquiry and literacy instruction for teachers (Howes et al., (2008), Augustine (2007). From novice teachers to veteran teachers, inquiry and scientific literacy can play an important part in the ever-changing science curriculum. Supporting positive change in all science teachers' attitudes towards science could benefit students and teachers alike. By forming a community among educators who teach science, educational leaders can ensure that teachers acquire greater job satisfaction. With greater job satisfaction, educators may be less likely to leave the school system and with improved pedagogical content knowledge student achievement could increase. With the appropriate instruction teachers and students will be able to adapt to new technologies and will know that science is a continuous process that requires further developing problem-solving and critical thinking skills throughout life.

CHAPTER III
METHODOLOGY

Design of the study

This section described the population, sample, and participants of the study. In addition, it included information about the selection of the respondents, the selection of the survey instrument, professional development modules, and the data analysis. This study was designed as a mixed-methods study. For the quantitative portion of the study the researcher employed survey research. The quantitative portion was experimental with random participant assignment and included a control and treatment group. For the qualitative portion of the study the researcher used an on-line discussion session, classroom observations, and evaluated teachers' lesson plans. The researcher was also an instrument in this particular study; not only did she develop the professional development modules, but she also served as an expert trainer for the duration of the study. The survey research was designed as a pre- and post-attitudinal survey that examined the effects of professional development for teachers participating in a four week professional development module program. The survey, blog, and observations were utilized in both the control and treatment group. The only addition the treatment group received was the professional development modules.

Population, Sample, and Participants

The target population for this study was teachers who teach science in the Southeast United States. All of the samples were teachers who teach grades three through eight in Mississippi during the 2010-2011 school years. Teachers were selected by using an email, mailed letter selection, by word of mouth through other teachers, or informational meeting process. Teachers had various background experiences such as highly qualified licensure, alternate-route teacher certifications, anxiety of teaching science, excited about teaching science, and neutral attitudes towards teaching science. Participants were selected using purposeful sampling and then placed into the treatment or control group by random assignments. The researcher chose this method of sampling for both the quantitative and qualitative portions of this research to "achieve an in-depth understanding of selected individuals" (Gall, Gall, and Borg, 2007 p.178). The sample was divided equally and assigned a random number to determine whether any particular teacher will be a part of the treatment or control group. At least thirty participants was selected for both the treatment and control groups to participate in both pre and post attitude surveys, fifteen will receive professional development, and fifteen will not receive any formal training from the researcher (n=30).

Instruments

To measure teachers' attitudes about teaching their students and engaging them in science inquiry and developing scientific literacy, the researcher, used a survey instrument to address the hypotheses of this study. The survey consisted of a 32-item questionnaire- 10 items at the beginning of the survey addressed qualitative aspects such as age, number of years teaching experience, and type of pre-service training. The survey was the Revised Science Attitude Scale that was built upon the ideas, attitudes, and beliefs of the *National Science Education Standards*

(*NSES*) and the constructivist theory (Bitner, 1994; Thompson and Shrigley, 1986) (Appendix A). In constructivism, the idea is not to just focus on how the person learns. The focus should be to consider how the person learns best, what beliefs they already have about inquiry learning, and are they willing to change or learn from new experiences. Learning and growth happens when learners are engaged, interested, and challenged with the work that is being asked of them (NRC, 1996). The researcher was also an instrument in this study. The researcher has been teaching in the science classroom for the past five years. She also possesses a highly-qualified license in science and works for the department of curriculum in a Southeastern school district. The job allowed her to study science education as well as participate in many professional development opportunities. She had lessons from her own classroom published as examples for effective science teaching. The researcher has also been a presenter at the National Science Teachers Conference for teachers pursuing more effective science teaching in elementary classrooms.

The thirty-two question Likert scale survey consisted of statements such as, "comfortable teaching inquiry," and "too much effort to teach inquiry." The participants of this study responded to items using a five-point Likert scale ranging from strongly agrees, agrees, neutral, disagrees, and strongly disagrees. Each response was assigned the numerical values 5, 4, 3, 2, and 1, respectively. The survey instrument was analyzed for content validity at .46 to .70 and reliability was determined at .89 (Bitner, 1994; Thompson and Shrigley, 1986). For the online discussion, the researcher used the website www.webs.com to create a blog session for the treatment and control group. The blog was a private session so that only the participants and researcher can access the discussions. Participants were asked to have discussions online at least once per week and to respond to other participants as a form of community building and a way of working out problems that arise while teaching science lessons. However, participants were not forced to use the online discussion. The researcher then used the online discussion sessions as a form of transcripts and coded the discussion as a form of secondary data to support or disagree with the findings from the attitudinal survey. For the observations and lesson plans, the researcher used a rubric that will align with the professional development modules (Appendix B). The researcher scheduled weekly observations and requested copies of the lesson plans ahead of time and gave feedback so that the teachers could make adjustments to their lessons if needed. The researcher took field notes and reviewed the lesson plans to address problems and successes that occurred from the professional development training. The researcher also took field notes, reviewed lessons, and online discussion sessions of the control group.

The professional development modules consisted of four modules, some of which that were developed by the researcher (Appendix C). Others were developed by using online sites that provide research-based professional development training and lessons. Overall, the modules were designed with a panel of experts and adjusted as any issues arise during the training or classroom observations. The online lessons and modules came from Performance Assessment Links in Science (2010). PALS (2010) are an online, standards based, continually updated resource bank of science performance assessment tasks indexed to the *NSES*. By incorporating the NSES the following standards were primarily focused on by the researcher: science teaching, science content, and professional development for teachers of science. The modules were also designed in align with the Mississippi Curriculum Framework and by using the site learner.org as an additional resource of support.

Procedure

Prior to any training, approval for (Appendix D) this study was obtained from the dissertation committee and the university Institutional Review Board (IRB). A notice of informed consent explaining the purpose of the study was given to each participant with the survey. Participants that did not respond were contacted a second way such as phone or email. The data from the surveys are stored in a locked cabinet.

Research Question

What effect does professional development in teaching science inquiry and scientific literacy have on teachers' attitudes about teaching science?

Hypothesis

There is no significant difference in mean teacher attitudes by group (treatment or control) when controlling for pretest scores.

Statistical Test and Data Analysis

For the hypothesis, the dependent variable was the post-test, the independent variable was the group type (control or treatment), and the covariate was the pre-test. The data was collected and entered into the Statistical Package for the Social Sciences (SPSS) and analyzed using an analysis of covariance (ANCOVA). This test was used to analyze the data because it is appropriate when the data set is represented by one independent variable and one dependent variable (Gall, et al., 2007). Using ANCOVA also controlled for differences that already existed between groups. The hypothesis was tested at the $\alpha = .05$ significance. If the p value is greater than the level of significance, the researcher will fail to reject the hypothesis being tested.

For the qualitative portions of the study, the researcher used Creswell's (2009) concurrent embedded strategy. This strategy allowed the researcher to use and collect both quantitative/qualitative data independently of each other. The researchers used the online discussion and observations after they had been coded by the researcher as a secondary source of data to provide a supporting role for the primary source (quantitative) of data. Online discussions were used to find themes among participants and correlated to the survey results. The researcher was able to triangulate the data by using experts, the transcripts from the blogs, and the notes from the observations to compare the qualitative data to the quantitative data. The remainder of this study is constructed of two additional chapters. In chapter four, the results of the statistical analysis were explained. Also, the qualitative themes are presented and compared to the qualitative results. Chapter five concludes with the findings and recommendations for further research.

CHAPTER IV

RESULTS

Summary

The purpose of this mixed-methods quasi-experimental research study was to analyze the effect of professional development on implementation of the 2010 Mississippi Science Framework on teachers' attitudes about teaching science in grades 3-8. The results of the study are presented in the form of demographic information and data analysis for the hypothesis. The qualitative results include data from the teacher blog, observations, and teachers' lesson plans. An analysis of covariance (ANCOVA) statistical test used an alpha level of .05. Creswell's (2009) concurrent embedded strategy was used to simultaneously collect qualitative data (i.e., blog, observations, and lesson plans) to support the processes and experiences of the participants in both the control and treatment groupsParticipants for this study were selected from 51 third through eighth grade classrooms from one rural and one urban school district. Participants were randomly assigned to both control and treatment group. The treatment group and control group participated in four professional development modules (Appendix C). The treatment group received face to face professional development which will be referred to as type A professional development. The control group received the same materials to do independently by email which will be referred to as type B professional development. Of the twenty-six participants (n=26) in this study thirteen were assigned to the treatment group (n=13) and thirteen were assigned to the control group (n=13) All teachers who participated in the study gave written

consent to participate in the study. Participants were given an informational letter and a letter of consent to sign before participating in any of the professional development modules.

Both control and treatment groups lasted four weeks – they started during the first few weeks of March 2011 and ended the last weeks of April 2011. The hypothesis stated there is no significant difference in mean teacher attitudes by group (treatment or control) when controlling for pretest scores. The instrument administered to gather data was the pre- and post- Revised Science Attitude Scale (RSAS) (Bitner, 1994; Thompson and Shrigley, 1986). For the qualitative data collection three types of data collection methods were used, www.wikispaces.com for the teacher blog and the STIR rubric (Beerer and Bodzin, 2003) for classroom observations and analyzing teacher lesson plans. The result of the hypothesis is listed below.

Results

Hypothesis One: There was no significant difference in mean teacher attitudes by group (treatment or control) when controlling for pretest scores. The independent variable was professional development group type (Type A or Type B). The dependent variable was the post survey. The covariant was the pre survey.

The Revised Science Attitude Scale (RSAS) consisted of thirty-two items, eleven of which are discussed in the qualitative section. The quantitative section measures teachers' attitudes on science inquiry and general science teaching comfort level. The statements required teachers to strongly agree to strongly disagree with specific statements on a Likert Scale. Only the quantitative scores were combined to create one raw score for the pre and post attitude survey. Strongly agree was labeled as "1" and strongly disagree was labeled as "5". To control for group differences, an ANCOVA statistical test was administered

As shown in Table 1, data analysis generated an F= 3.127, p=.090. The value was greater than .05; therefore teachers who had Type A professional development did not show significant differences on the RSAS than teachers who had Type B professional development, when controlling for the pre-survey. Hence, the null hypothesis failed to be rejected. Before analyzing this table of data, the researcher had to make sure that the assumption that is a linear relationship between the dependent variable and the covariate was met. The data analysis generated an F=9.093, p=.006. The value was less than .05; therefore there is a significant relationship between the covariate and the dependent variable.

Table 1

Analysis of Treatment and Control Groups Revised Science Attitude Scale Post-Survey Using ANCOVA

Source	df	Mean Square	F	Sig.
Intercept	1	68649.846	3172.399	.000
Presurvey	1	196.769	9.093	.006
Group type	1	67.672	3.127	.090
Error	23	21.640		
Total	26			

When reviewing the data further specifically the ANCOVA was analyzed to see if there were any differences in groups by pre or post attitude survey. The ANCOVA test revealed a significant difference in pre-survey attitude scale scores between groups.

Table 2

Analysis of Treatment and Control Groups Revised Science Attitude Scale Pre-Survey Using ANOVA

	df	Mean Square	F	Sig.
Between Groups	1	199.385	5.831	.024
Within Groups	24	34.192		
Total	25			

Table 2 shows the data analysis on pre-survey scores generated an F= 5.831, p=.024. The value was less than .05; therefore, there were significant differences in group type prior to training. However, once trained either by Type A or Type B the differences were not significant.

In conclusion, after all data was collected and analyzed with ANCOVA, there were mean differences between groups on the pre-attitude survey but those differences diminished after the training was conducted. Analysis with ANCOVA showed that there was no significant difference between treatment and control groups post attitude survey, when controlling for pre-test scores. The following section discusses the qualitative portion of the results.

Qualitative Data Analysis

Even though the survey was well established for validity and reliability, the instrument may not have addressed the entire research question or address specific science instruction related issues that may arise in classroom teaching environments. The research question for the qualitative portion was- What effect does professional development in teaching science inquiry and literacy have on teachers attitudes' about teaching science in elementary school? Also, participants may not have expressed their entire feelings or elaborated as much because of the restricted form of the survey. These weaknesses are overcome with the addition of qualitative analysis: ten specific open-ended questions, teacher blogs, classroom observations, and submission of lesson plans.

Open-ended questions

The first question was asked for participant ID number for the researcher's purposes. Beginning with the second question the answers will be answered in chart form.

Question 2:

Age of Participants:

Treatment Group:	Control Group:
25 years of age to 59 years of age	28 years of age to 65 years of age

Question 3:

Gender

Treatment Group:	Control Group:
Female (11) 84.6% ; Male (2) 15.4%	Female (13) 100%

Question 4:

Number of years teaching experience

Treatment Group:	Control Group:

1 year to 38 ¾ years	1 year to 22 years

Question 5:

Degrees or certifications held by participants

Treatment Group:	Control Group:
All participants held bachelor of arts or science degrees with emphasis in elementary education; Masters in Curriculum & Instruction (Reading); Bachelor of Biochemistry	All participants held bachelor of arts or science degrees with emphasis in elementary education; one participant has a bachelors and masters in special education; one masters in educational leadership, and one teacher that has a bachelors in elementary music education

Question 6

What types of professional development or training sessions have you previously attended?

Treatment Group	Control Group
None National Science Teachers Association Gulf Coast Research Lab Sea Scholars Science Energy Education Workshop	None National Science Teachers Association Conference Chemistry for Elementary Teachers (local) Jackson State University Training ATOMS

RIDES	Science Textbook Training

Question 7

What grade do you currently teach?

Treatment Group	Control Group
3rd grade through 8th grade	3rd through 8th grade

Question 8

How many science professional development opportunities have you attended?

Treatment Group	Control Group
0 to 20	0 to 10

Question 9

Describe your teacher preparation.

Treatment Group	Control Group
12 Regular Class A or AA license 1 alternate route	12 Regular Class A or AA license 1 alternate route

Question 10

How long after college did you start teaching?

Treatment Group	Control Group

11- immediately 1- 3 years before finding a teaching job 1- 11 years stay at home mom before teaching in public school	11- immediately 1- taught medical technology for 20 years before teaching in public school 1- 15 year stay at home mom before teaching in public school

Question 11

How many science content or method courses did you take in college?

Treatment Group	Control Group
Ranged from 1 to 20+	Ranged from 1 to 13

The first eleven questions helped determine if the groups were equivalent to some degree in experience and training type. In order to be able to get an inside look at how each participant came to teaching these questions were necessary to know prior to training. Most participants had little to no experience in inquiry science training.

Teacher Blogs

The teacher blogs were conducted at the same time as the survey research data was being collected and the training was being done. Before and after the training participants were asked to blog about the positive and negative aspects of teaching science inquiry from the Mississippi Science 2010 Framework in their respective grade level. In order to encourage them or make blogging easier for those who have not blogged before a question was posted to the blog. However, participants were not required to blog if they did not want to do so. The initial question on the blog was "What is the most stressful thing about teaching inquiry?" The treatment group answered with the most responses by stating "to get students to become critical thinkers." Some other answers were "difficult to assess" and "it's hard for me to wait long enough for their response and not give them the answer." The control group did not answer this question at all. The next topic in the blog was "How do you feel about teaching inquiry?" The treatment group answered "not in control", "I have to learn not to give them the answer and allow them time to think things through", and "I watch in awe as the light bulb comes on and their passion about science turn on." The control group also did not answer this question. The last part of the teacher blog was a free-style blog, where teachers could post anything they wanted. The treatment group responded with "there is so much to cover and lower grades tend to put science on the back-burner", "we are tested too much in other subject areas to focus on science", and "after training, I plan to implement science inquiry at least one day a week in our school science lab." The control group responded to the free-style blog by stating "they love the hands-on learning aspect of inquiry and how it relates to many things students do at home like measuring" and "I would love to do inquiry, but I just don't have the time it takes to do it."

Since the researcher did not feel that it would be beneficial to force participants to blog she felt that the treatment group was more engaged in blogging because they had made that connection with other science teachers and formed a sense of community. The control group lacked community. They did not discuss as deeply through blogging because they did not have that connection to others in their field. By allowing participants to blog about their experiences of inquiry there is some degree of insight into what they are going through while trying to teach a new curriculum with the pressures of state testing and for students to become more critical thinkers.

Lesson Plans and Classroom Instruction Assessed with STIR

Before going to observe classrooms the researcher requested a copy of each participant's lesson plan prior to an observation. Each participant had access to the STIR rubric prior to submitting a lesson plan to the researcher. The researcher did twenty-six observations and provided follow-up information and guidance as needed or when requested. Out of the twenty six observations the lesson plans and classroom teaching was labeled as teacher- centered, learner-centered, or emergent learner-centered.

Breakdown of Lesson Plan and Observation Type

Learner-Centered	Emergent Learner-Centered	Teacher–Centered
3	4	19

Learner Centered Lesson Plans and Observations

Three of the participants according to the STIR rubric had learner-centered lesson plans and observations. All three participants are in the control group and teach in grade five or eight which should be noted that these two grades take the state Mississippi Curriculum Test 2 in Science exclusively. The lesson plans consisted of students building junk-yard cars using a step-by-step inquiry process that directly correlates with the Mississippi eighth grade science framework. Students were asked to bring materials from home (mostly trash) to construct a car to race on one day and then asked to re-design the car based on new knowledge and research on another day. All of the elements of inquiry were included and the teacher did very little talking. The students were engaged and active the entire lesson. The next learner-centered lesson was done by a fifth grade teacher. The teacher allowed students to pick a researcher to research at the request of the students. Students were then taking the research a step further by trying to develop or conduct experiments based off their favorite researcher in science. Since the students were in-control of this lesson and they were following the majority of the steps to inquiry. I deemed this lesson as very beneficial to students as assessed by STIR. The last student-centered lesson was also done by a fifth grade teacher. This teacher was having students do a lesson called "The Great Egg Drop." Students were to come up with their own hypothesis about the best solution for egg-packaging without breaking the egg. They were then to research and write a report that considered gravity, air resistance, acceleration, potential energy, momentum, speed, friction, and force. The science lesson did not end here- the same week the teacher had the students develop news cast on their findings for the entire school and had it broadcasted from an outside location. The researcher then followed-up with each teacher about their lessons. The researcher found that each teacher had done these lessons in the past school year and had received prior science inquiry training before participating in this study.

Emergent-Learner Centered Observations

Four of the participants according to the STIR rubric had emergent learner-centered lesson plans and observations. The researcher termed these observations and lessons as emergent because with a few minor adjustments a very well-rounded inquiry lesson could be achieved. All of these participants were in the treatment group and teach in grades three through eight. The first observation and lesson was in a third grade classroom. The topic of the lesson was landforms and their effect on earth's surface. The teacher had a very hands-on lesson going, students were very engaged. But, he gave them the essential questions to answer and he did most of the discussing. So, the researcher discussed ways the teacher could change the lesson up so that the students were doing more learning. The teacher adjusted the lesson so that students were measuring in the metric system, let the students come up with an experiment and some of the research questions, and then let them present what they found instead of just ending the lesson as a whole group discussion. The second lesson was done by a fourth grade teacher. She was having the students' research scientists on their own but the lesson overall lacked criteria. They were not extending the lesson in any way or including all steps to inquiry. So we debriefed and went over some things she could add to the lesson such as an experiment of some type that was related to the scientists. The researcher gave her own example of the fifth grade teacher's lesson plan on this and she was very happy to make adjustments and have those resources on hand to better this lesson. The third lesson the researcher observed was by a fifth grade teacher. Students were creating food webs of the animals of their choice and playing a game called "Oh Deer." The game allowed students to become the prey/predator to do a live simulation of a food web. The students then extended this lesson even further by doing research reports on animals and their prey. This teacher integrated a lot of technology and showed students plenty of examples of food webs. However, we did discuss how she could provide a more structured inquiry approach so that students know exactly what they are supposed to be learning. The researcher had concerns that students weren't sure what they were learning and maybe thought the game was for fun only. The fourth lesson the researcher observed was by a fourth grade teacher. In this classroom students were to build a model of something of their choice and indentify how their design of whatever they selected could benefit society. They also had to have at least three critics to provide feedback as well as create a brochure for the model. The students had to present the idea to the class and work to improve the model in any way they could. The researcher deemed this lesson as emergent because of the unmeasurable objectives. The teacher was allowing students to do ball-park measurements and not conduct any research to see what is out there already. We both discussed these things and decided that metric measurement and prior research would be wonderful additions to this lesson to really increase inquiry.

Teacher-Centered Lesson Plans and Observations

Nineteen of the participants according to the STIR rubric had teacher-centered lesson plans and observations. The teachers under this category were both from the control and treatment group. They all taught third through eighth grade. The researcher broke this section down into two smaller groups. The groups were teachers who were actually teaching science but were driving the learning and teachers who were teaching reading using science materials. Six participants were really teaching science but needed to focus on the learners more. These lessons consisted of skeletal system which included making a system out of macaroni noodles (three teachers used the same plan). Then, three other teachers also used the same plan to make edible plant and animal cells out of candy and sugar cookies. The researcher discussed the ideas from the STIR rubric and what the Mississippi Science Framework said about teaching science inquiry. The teachers were fully aware of what the framework stated but were insistent on doing a more "crafty" version of science because parents expected to see these types of things in schools. They also stated this is all they had time to do and the kids have fun doing it. They did state they were going to try to work harder at getting in a "real" science lesson. But, they were not interested in continuing on with anymore training. The other thirteen participants taught science in reading class. None of the lessons involved the students to do any science at all. The students were answering work sheets and literary questions that met language arts objectives instead of science objectives. When the researcher met with these teachers about integrating a more hands-on approach they ensured me they did not have time to teach science hands-on. They all stated that administration said the focus should be reading and they should teach science through reading.

Qualitative results found teachers to have primarily the same attitude as before beginning the study. Those who were using a hands-on approach were going to continue, some were going to work on improving, and others were going to keep on doing what they needed to do in language arts class due to the pressures of testing and administration.

Summary

In this chapter, the quantitative results of the survey and the qualitative results of the survey, blog, observations, and lesson plans are discussed in conjunction with the research questions and hypothesis. Data from the secondary source (all qualitative data) is examined for the purposes of explaining and expanding the quantitative data.

Overall, teachers have a positive attitude towards teaching science in elementary school. They are aware of the importance of the inquiry-based Mississippi Science Framework. However, they are also pressured by administration and state testing to have a primary focus on reading and mathematics. Some are taking time to teach science the way research (NRC, 2007) says science should be taught while others are choosing to teach science through reading and worksheets. Teachers either have positive attitudes about science teaching or negative attitude about not having enough time to teach science in their classroom. So, the idea became in this study if I can't do it the "right" way I refuse to teach science at all other than through reading. Factors influencing their attitudes include lack of ability to ask good questions, lack of comfort with content, pressures from testing and administration, and in some cases no desire to teach science.

In the following chapter, the findings are discussed in terms of contributions of the study and its implications for better understanding of how everyone can better understand the needs of science teachers.

CHAPTER V

SUMMARY AND IMPLICATIONS

This chapter presents a summary of the findings about teachers' attitudes in teaching the 2010 Mississippi Science Framework in elementary school while undergoing a type of professional development (Type A or Type B). In addition, contributions and implications of the study, and suggestions for future studies are discussed. Since this study employed a mixed method, the quantitative data (surveys) were considered the predominant data source in answering the hypothesis while the qualitative data (blogs, observations, and lesson plans) served as the secondary data sources providing a supporting role in explaining and expanding the questionnaire results and research question. Therefore, in summarizing the findings of the study, some of the specific quotes from the blogs and specific examples from the lesson plans and observations are selectively discussed to extend and elaborate the survey results.

Summary of Findings and Discussion

The purpose of this study was to determine the effects of elementary teachers' attitudes on teaching the 2010 Mississippi Science Framework while undergoing a specific type of professional development (Type A vs. Type B). The researcher's major concerns were how teachers were coping and adjusting to the new curriculum and also how their attitude changed if any while undergoing professional development related to the Mississippi Science Framework.

A quasi-experimental, mixed methods, pre/post survey, control design used in this study was repeated for both the control group which received no additional support from the researcher or any other type of professional development training and the treatment group which participated in a face to face professional development setting. All elementary teachers completed an initial pre-survey which was the RSAS (Bitner, 1994; Thompson and Shrigley, 1986) in March 2011. Twenty-six teachers were selected from a large group of urban and rural elementary schools. Teachers were then randomly assigned to either the control or treatment group. Sample size for both the treatment and control group was 13 in each. Human subject approval was obtained by the researcher from the University of Mississippi's Institutional Review Board and from subjects participating in the study. Treatment for subjects in the treatment group consisted of four weekly staff development sessions in a researcher led hands-on workshop format during the spring of 2011. The researcher administered the RSAS (Bitner, 1994; Thompson and Shrigley, 1986) to the twenty-six subjects in both the treatment and control group before and after the professional development sessions during the spring of 2011.

Data from the RSAS (Bitner, 1994; Thompson and Shrigley, 1986) was analyzed by using the statistical test Analysis of Covariance (ANCOVA) to determine if there were any significant differences in groups' attitudes by training type when controlling for the covariate which was the pre-survey. In addition to analyzing the pre and post survey data; the researcher was also collecting qualitative data as a secondary source to support the primary data (quantitative). The researcher asked subjects to blog, allow her to observe and provide necessary feedback to improve science inquiry instruction, as well as provide feedback alongside a rubric on lesson plans (STIR) during the research data collection period of March to April 2011.

Conclusions

Based on the results of the statistical analysis of the data, it was concluded that teachers who received professional development on inquiry based on the Mississippi Science Framework did not self-report significant differences in attitudes toward science or science teaching than those who received professional development through independent or email settings. There were a number of variables that could have contributed to this analysis such as the amount of pre-service training and post-service training in science content or science instruction as well as whether or not they were deemed highly qualified in science or not. However, there were significant differences in attitudes originally when the treatment and control group was compared in the pre-survey stage. This finding is consistent with the qualitative data that the researcher collected. Before the treatment group received professional development the majority of participants had a poor understanding of how inquiry should be taught to elementary students. However, after four weeks of training, observation, and coaching type feedback participants became more comfortable with teaching inquiry in their classroom. However, attitudes in participants did not change much. Participants stated from the blog and survey that planning for inquiry "takes too much time." Participants also would like to teach more science but "priority is given to reading and math" and they all felt "pressured by administration to teach toward MCT2." The researcher also notes that many of the participants enjoyed receiving feedback and also appreciated the consistent support that seemed like a coaching type professional development situation. However, in the end participants still did not feel like they were allowed adequate enough time in their classrooms to teach inquiry at the Depth of Knowledge Level required by the state curriculum.

The researcher also stands firm that many of the teachers in this study still only have a very basic understanding of inquiry. Most of them felt inquiry could be integrated throughout a "textbook" lesson and meet the state curriculum requirements. While teachers became more aware of how science inquiry should be taught they were not willing to change the ways of the current instructional practiced due to possibly a poor attitude, lack of comfort with science, or pressures of others to teach science through reading. This conclusion can be supported by referring back to the research review in Chapter II (Trumper 2006; Appleton 2007; NRC 2006).

The results of this study did not provide statistically significant evidence for the need for professional development in teachers who are trying to teach a new curriculum. Data collected and analyzed both qualitative and quantitative supported the conclusion that teachers must be their own advocates when the desire to improve instruction and in learning to teach a new curriculum. This also means that professional development type does not improve teachers' attitudes on such a task in teaching a new curriculum or to foster more realistic beliefs about teaching science inquiry.

Recommendations

The evidence presented in this study suggests many possibilities for further research. The recommendations which are most directly related to this study are as follows:

1. Future studies should explore the relationships between science teachers' attitudes toward their actual teaching practices. For example, take the actual survey the participant completed and actually compare the participants' answers to what is actually going on in the classroom.
2. Future studies should explore the actual understanding of scientific inquiry and scientific literacy. Many participants in this study still confuse inquiry with the scientific method.

Furthermore also as if it were sufficient enough to just read about science to promote scientific literacy.

3. This study should be replicated and used with a larger sample size; then group teachers who are in middle school settings separately from teachers who are below grade five.

While no significant differences were found in teachers' attitudes upon implementation of the Mississippi Science Framework while undergoing a specific mode of professional development type, the literature indicates the need for the following possible research:

1. The strategies and methods were offered to a very small group of teachers in which the majority was not held accountable for science content by the state. So, school districts could hold teachers responsible for science content by the grade level by employing a cumulative assessment at the end of each year (Plourde and Alawiye, 2003).

2. The strategies and methods featured in the professional development, which was offered to a small group of teachers, should be incorporated into on-going professional development for teachers who feel that science inquiry is a weakness or those who generally want to improve science instruction practices. To extend this recommendation, teachers who are comfortable with science teaching could be paired with teachers who are not comfortable as a type of coach or support that is on-going (Goodnough and Nolan 2008).

3. In further studies, school administration should be included in the professional development implementation so they understand the complex understanding of inquiry instruction that is effective and also how inquiry supports critical thinking. By including administrators hopefully they will allow for more science teaching time and also they will become advocates and supporters of more time for science education (Augustine, 2007).

4. Also in further studies, one could look at how much is perception of lack of support from administration compared to what the reality of the support of administration in science is teaching. A question that could be answered by examining the support of administration in science teaching is: “Are most principals against inquiry due to the factors involved?”

5. Another possible study could be a science academic coaching model and how having an academic coach on campus to access effects teachers’ attitudes toward teaching science.

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List of Appendices

Appendix A:

Revised Science Attitude Survey

Please answer the following in a narrative format.

1. Please list your participant number assigned to you by the researcher

2. Age

3. Gender

4. Number of years teaching experience in science

5. What degrees or certifications to your currently hold?

6. What types of professional development or training sessions have you attended that was inquiry or science based?

7. What grade(s) do your currently teach?

8. How many science professional development opportunities have you attended?

9. Describe your teacher preparation. (Alternate route, regular class a license, etc.)

10. How long after college did you start teaching?

11. How many science content and methods courses did you take in college?

The following statements should be responded to as: Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree.

12. Comfortable teaching science

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
O	O	O	O	O

13.Teaching science in elementary is important

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
O	O	O	O	O

14. Fear that unable to teach inquiry

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
O	O	O	O	O

15. Inquiry lessons are time consuming

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
O	O	O	O	O

16. Enjoy the lab

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
O	O	O	O	O

17. Difficult to understand science

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
O	O	O	O	O

18. Comfortable with science content

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
O	O	O	O	O

19. Interested in working on inquiry-instruction

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
O	O	O	O	O

20. Not afraid to demonstrate inquiry

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
O	O	O	O	O

21. Reluctant to teach science

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
O	O	O	O	O

22. Enjoy helping students' with science equipment

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
O	O	O	O	O

23. Willing to spend time to plan inquiry

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
O	O	O	O	O

24. Shortage of knowledge to answer students' questions

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
O	O	O	O	O

25. Science is basic skills to learn

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
O	O	O	O	O

26. Enjoy manipulating science equipment

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
O	O	O	O	O

27. Fear of unexpected event happening during the lab

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
O	O	O	O	O

28. Science is my preferred subject to teach

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
O	O	O	O	O

29. Expect students' excitement with inquiry instruction

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
O	O	O	O	O

30. Too much effort to teach inquiry

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
O	O	O	O	O

31. Children are not curious about scientific matters

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
O	O	O	O	O

32. Plan to integrate science into other areas

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
O	O	O	O	O

Appendix B:

Science Teacher Inquiry Rubric (STIR)

Directions: Reflect on the science lesson that you taught today. In your reflection, consider each of the following categories and the six statements on the left, written in bold. After looking at each bold statement, assess today's science instruction based on the categories delineated for statement. Place one "X' in the corresponding cell for each bold-faced statement. If there is no evidence of one of the statements in today's lesson, place a slash through the bold-faced statement. When you are finished, you should have 6 total responses.

Learner Centered **Teacher Centered**

Learners are engaged by scientifically oriented questions					
Teacher provides an opportunity for learners to engage with a scientifically oriented question.	Learner is prompted to formulate own questions or hypothesis to be tested. ☐	Teacher suggests topic areas or provides samples to help learners formulate own questions or hypothesis. ☐	Teacher offers learners lists of questions or hypotheses from which to select. ☐	Teacher provides learners with specific stated (or implied) questions or hypotheses to be investigated. ☐	No evidence observed. ☐
Learners give priority to evidence, which allows them to develop and evaluate explanations that address scientifically oriented questions.					
Teacher engages learners in planning investigations to gather evidence in response to questions.	Learners develop procedures and protocols to independently plan and conduct a full investigation.	Teacher encourages learners to plan and conduct a full investigation, providing support and scaffolding with making decisions.	Teacher provides guidelines for learners to plan and conduct part of an investigation. Some choices are made by the learners.	Teacher provides the procedures and protocols for the students to conduct the investigation.	No evidence observed.
Teacher helps learners give priority to evidence which allows them to draw	Learners determine what constitutes evidence and develop procedures and	Teacher directs learners to collect certain data, or only provides portion of	Teacher provides data and asks learners to analyze.	Teacher provides data and gives specific direction on how data	No evidence observed.

conclusions and/or develop and evaluate explanations that address scientifically oriented questions.	protocols for gathering and analyzing relevant data (as appropriate).	needed data. Often provides protocols for data collection.		is to be analyzed.	

Appendix C:

Professional Development Modules

Module 1 "I do"	We will watch the video "What is Inquiry and Why do we do it?" from www.learner.org a free professional development site. Review of the Steps to Inquiry focusing on the Mississippi Science Framework Competency 1 (Done by the researcher) Very brief power point presentation. (This keeps the steps to inquiry present in the room) Researcher will model an Inquiry Lesson that will involve all participants and share her articles written on actual inquiry experiences of her own. Participants will be shown the rubric for the lesson plan and observations and will discuss my articles in accordance to the rubric. (Articles are attached) The module will come from the PALS website and is titled: Acids and Bases: Alien I, II, and III This lesson is leveled at beginner, ready, and advanced inquiry students. This lesson will be linked to the job of a pathologist. PALS web address: www.pals.sri.com (click on performance tasks for 5-8) At the end of this module- I will ask participants to email, fax, or hand-deliver a copy of their lesson plans for the following week. I will then also schedule times to observe their classrooms. (See rubric attached for assessment of lesson and lesson plan) Groups will also be given a copy of the lesson they will be expected to perform in groups for the following module.

	This lesson is titled: "Who Sank the Boat?" and is from the website: http://www.science-house.org/learn/inquiry/boat.html
Module 2 "We do"	Participants will model their assigned lesson for the researcher and other participants. Some will serve as "students" and some will serve as "teachers" on a volunteer basis. At this module, we will also begin brainstorming a long-range inquiry lesson for the participants' classroom students to do. The participants can use lessons from a multitude of resources given by the researcher. The researcher will address any questions or concerns from the blog, observations, and lesson plans. We will also discuss inviting scientists to class to help support inquiry lessons.
Module 3 "The Art of Educating" "Being your own Advocate"	This module will consist of sharing resources such as PALS NSTA (specifically articles from Science and Children and Science Scope) www.learner.org (free professional development modules) Mississippi Science Framework (to include teaching strategies and practice MCT2 tests) **The above should all be review at this point- but I just want to reemphasize the resources that are readily available.** We will also complete a professional development module from learner.org on Inquiry The following topics will be addressed via

	video: Focus the Inquiry "Designing the Exploration" We will also discuss any changes or discoveries about inquiry since beginning this process.
Module 4 "You do"	Participants will model how they could brainstorm with students on how to come up with an original inquiry lesson. In order to successfully complete the task they will have to make a plan for all the steps involved in inquiry and how those tasks can be achieved. The participants will also be required to make a timeline for completing these tasks. Then, we will review the long-range lesson plans on inquiry for their own students. We will provide feedback on lesson plans and ideas as a whole group- "a community of science teachers." At this point these participants will be asked to complete their post-survey. **Along this whole process observation, review of lessons plans and feedback on the blog will be occurring. Some modules may be adjusted slightly to meet the needs of participants.**

Appendix D

MODEL CONSENT FORM

Consent to Participate in an Experimental Study
Title: The Effects of Professional Development on Implementation of the 2010 Mississippi Science Framework on Teachers' Attitudes about Teaching Science in Elementary School

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Description
We want to know whether a person's mode of professional development (independent or in a group that meets weekly) improves teachers' attitudes about science inquiry instruction on the 2010 Mississippi Science Curriculum Framework. In order to answer our question, we are asking you to take a pre and post attitude survey. In between the surveys you will either be selected to participate in a professional development group or asked to teach science inquiry independently as you are currently doing. You will also be asked to provide the researcher with copies of your science lesson plans, be observed by the researcher in your own science class, and participate in an online blog to discuss issues about teaching science regardless of what group you are selected for. This study will last for four weeks. Any questions you have regarding this study can and will be answered by the researcher.

Risks and Benefits
You may feel uncomfortable because you may not understand teaching inquiry as much as you thought you did. We do not think that there are any other risks. A lot of teachers enjoy meeting and working with other science teachers because you can often gain new ideas or make

connections by observing/working with others. You may also improve your instruction and improve your attitude about the Mississippi's new science curriculum; but this is not guaranteed.

Cost and Payments
Participants will be in a drawing for $100.00 at the end of the four-week session provided they fully participate in all parts of the study.

Confidentiality
We will not put your name on any of your surveys. The only information that will be on your surveys will be your gender (whether you are male or female) and your age, the grade you teach, and what certifications you hold. Therefore, we do not believe that you can be identified from any of your surveys. The researcher will assign you a participant number and you will use this number on lesson plans, blogs, and any other materials handed in during the study.

Right to Withdraw
You do not have to take part in this study. If you start the study and decide that you do not want to finish, all you have to do is to tell Kimberly Carroll or Dr. Chessin in person, by letter, or by telephone at the Department of Curriculum and Instruction, 301 Guyton Hall, The University of Mississippi, University MS 38677, or 915-5878. Whether or not you choose to participate or to withdraw will not affect your standing with the Department of Curriculum and Instruction, or with the University, and it will not cause you to lose any benefits to which you are entitled. Inducements, if any, will be prorated based on [the amount of time you spent in the study.]

The researchers may terminate your participation in the study without regard to your consent and for any reason, such as protecting your safety and protecting the integrity of the research data. If the researcher terminates your participation, any inducements to participate will be prorated based on the amount of time you spent in the study.

IRB Approval
This study has been reviewed by The University of Mississippi's Institutional Review Board (IRB). The IRB has determined that this study fulfills the human research subject protections obligations required by state and federal law and University policies. If you have any questions, concerns, or reports regarding your rights as a participant of research, please contact the IRB at (662) 915-7482.

Statement of Consent
I have read the above information. I have been given a copy of this form. I have had an opportunity to ask questions, and I have received answers. I consent to participate in the study.

Signature of Participant Date

Signature of Parent/Guardian Date
[Remove if no minors are involved.]

Signature of Investigator Date

NOTE TO PARTICIPANTS: DO NOT SIGN THIS FORM
IF THE IRB APPROVAL STAMP ON THE FIRST PAGE HAS EXPIRED.

VITA

Kimberly Lanette Carroll was born on March 16, 1982 in Tupelo, Mississippi. She graduated from Mantachie High School in Mantachie, Mississippi in 2000. Ms. Carroll received a Bachelor of Arts Degree in Elementary Education from the University of Mississippi in University, Mississippi in 2006. Ms. Carroll married Tim Carroll on April 17, 1999. She worked in Lee County Schools as a fifth grade teacher while working on her Masters of Art Degree in Curriculum and Instruction. She completed her Masters of Art Degree in 2007. Ms. Carroll took one year off to spend with her children and husband before applying to the doctorate program in 2008.

Ms. Carroll continued to teach fifth grade and eventually moved into academic coaching and the curriculum advisor position in the Lee County school district while completing her Doctorate of Education at the University of Mississippi. While at the University of Mississippi, Ms. Carroll became a member of the National Science Teachers Association (NSTA) in which she was a presenter for and also published two articles in Science and Children for NSTA. She was also awarded the National Writing Award for Excellence from the Association of Educational Publishers in 2010 for one of the articles published in Science and Children. In addition to pursuing her doctorate degree, Ms. Carroll also is an instructor for Itawamba Community College where she teachers English to at-risk students. Ms. Carroll has also written several grants that support science education and labs in the elementary school.

In addition to her studies, Ms. Carroll, also was a bone marrow donor for her brother at University hospital, where each sibling contributed to scientific research for leukemia patients.
She also is highly involved in philanthropy. She is consistently involved with the St. Jude Heroes program in Memphis, Tennessee as well as the Alzheimer' Association in Jackson, Mississippi.