CHILD CARE TEACHERS' ATTITUDES, BELIEFS, AND KNOWLEDGE REGARDING SCIENCE AND THE IMPACT ON EARLY CHILDHOOD LEARNING OPPORTUNITITES

By

LUCILLE ANN FAULKNER-SCHNEIDER

Bachelor of Science

University of Oklahoma

Norman, Oklahoma

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Thesis Approved:

Dr. Deborah Norris
Thesis Advisor

Dr. Barbara Sorrels

Dr. Richard Bryant

Dr. A. Gordon Emslie
Dean of Graduate College

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This study was conducted to provide knowledge regarding child care providers' attitudes, knowledge and beliefs and how they impact classroom practices. Focusing on the interplay of knowledge, attitude, and belief on personal actions can improve training for child care providers therefore improving classroom practices and ultimately the lives of children. My late father Dr. Kenneth K. Faulkner, a scientist of the truest form, inspired the research. His use of the scientific process in all aspects of life was an example of the importance of exploration, study, hypothesizing and testing. "The questions are just as important as the answers."

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CHAPTER I.

INTRODUCTION

In the current climate there has been an increasing public interest in early childhood care and education. Several events and trends have culminated in an increasing concern with the growth, development and education of our nation's youngest citizens. Brain development information such as that put forth in Rima Shore's "Rethinking the Brain" (1997) has fortified the notion that the early years are critical times for learning. States have created public-private partnerships whose noted goals incorporate making certain that young children arrive at school healthy and ready to learn. (United Way, Success by Six, n. d.). The "No Child Left Behind" legislation, signed into law January 2002, included the Good Start Grow Smart Initiative that focused on enhancing programs to improve child outcomes through quality criteria (Good Start, Grow Smart: President Bush's Plan to Strengthen Early Learning, n.d.). Fueled by longitudinal studies such as the Perry Preschool and Abecedarian Projects (Mitchell, 2001) forty-two states are now funding public pre-kindergarten programs.

With all the attention on children's outcomes, program quality, and providing programs universally, little concern has been given to the content of early childhood education programs. With national concern towards literacy and numeracy (Good Start, Grow Smart: President Bush's Plan to Strengthen Early Learning, n.d.), other curriculum domains have received short shrift. Science is one of the content areas that has not always been considered one of the “basic” domains in early childhood program. Daily science activities are only offered to 30 % of children in elementary schools (Campbell,Voelkl, & Donahue, 2000).

Description of Problem

In examining the context of learning environments, Tonyan and Howes (2003) found the typical child care facility contained the following activities: creative, language arts, didactic (teacher directed), gross manipulatives, and non play (TV viewing, unoccupied, onlooker). Missing from this list is science/inquiry, exploration or sensory activities. When science activities are excluded from learning and play activity designation, they are excluded from research (Howes & Smith, 1995; Wishard, Shivers, Howes & Ritchie, 2003). Science activities often have a minor role in the classroom and this lack of a broad range of activities may result in lost opportunities for learning for children and in the realm of research.

Science is both a noun and a verb. It is a system of knowledge and the acquisition of skills needed to gain knowledge. Scientific skills are required to think. “…students describe objects and events, ask questions, acquire knowledge, construct explanations of natural phenomena, test those explanations in many direct ways and communicate their ideas to others” (National Committee on Science Education Standards and Assessment, 1996, p.2).   Engaging in science develops observation skills, interaction, collaboration, prediction, and more. These basic inquiry skills are used in learning to decode letters, words, and meaning as well as in classification, patterning, quantity recognition, and shape discrimination. Integrated throughout, these skills cannot be placed in one domain of learning. Science education is a part of cognitive development (Landry & Forman, 1999), just as “reading, writing, and arithmetic”. By supporting science learning, educators are supporting skills necessary for gaining knowledge (Conezio & French, 2002).

Characteristics of the teacher influence the interaction and engagement with children in the classroom. By examining attitudes, beliefs and knowledge of the teacher we can better understand what impacts the teacher’s behavior and in particular the teacher’s behavior as it relates to science activities.

According to The American Heritage Dictionary of the English Language (1980), attitude is a learned feeling or mental attitude about a subject (in this case science). Attitudes can be transferred to the children in the classroom. Beliefs refer to the information a person accepts to be true (The American Heritage Dictionary of the English Language, 1980). Knowledge is that which the teacher knows not only about the subject of science but also about how children learn about science and how science is taught (Kallery & Psillos, 2001). Behaviors are those actions taken that reflect knowledge (Harlen, 1997), attitudes and beliefs (Koballa & Crawley, 1985). Teachers’ beliefs appear to match their behavior in the classroom (Charlesworth, Hart, Burts, & Hernandez, 1991). Zeitler (1984) determined that preservice elementary teachers are perpetuating negative attitudes about science in themselves and therefore their students.

Looking at aspects of the early learning environment such as teacher knowledge, interaction, beliefs and practices it is imperative that we examine an important piece of the learning puzzle, the teacher. As mediator of the learning-teaching process, the role of the teacher's attitudes, beliefs and knowledge requires closer examination.

Focus

Studies have been conducted in various early learning settings including but not limited to child care settings, preschool settings and elementary school settings. In these early childhood settings, variables included the education of the teacher, the frequency and quality of teacher-child interaction, and the depth of materials. Few research projects have touched on teacher characteristics as they relate to teaching practices. In this study the focus was on the examination of child care teacher's attitudes, beliefs and knowledge regarding science and the impact these have on learning opportunities provided in the classroom.

Definitions

In this study **attitude** was described as a state of mind or mental attitude toward a fact or state (The American Heritage Dictionary of the English Language, 1980). Attitude is affected by knowledge and understanding and beliefs regarding the subject. It is also affected by a person's interest, perceived value of the subject and philosophy of learning.

Beliefs are habits of the mind in which trust or confidence is placed (The American Heritage Dictionary of the English Language, 1980). A belief can be the conviction of the truth of some statement. Beliefs are affected by knowledge and personal attitude.

Knowledge is the information and understanding of truth or fact (Merriam-Webster Online, retrieved January 7, 2005). Scientific knowledge falls into four categories (Oklahoma Early Learning Guidelines, 2004):

1) Science inquiry (investigate and experiment with objects to discover information),
2) Physical science activities (group objects by physical properties or sensory attributes)
3) Life science (plants and animals)
4) Earth science (concepts of the earth such as weather, seasons, environment, water, air, and soil)

Science materials and equipment are the natural and made-made items that children are encouraged to touch, manipulate and construct (Armga et al., 2002). Materials and equipment include but are not limited to collections of specimens, typical science exploration tools, animals and plants, sensory items, and other found items or machines. **Science area**, "exploration station" or discovery center is the space in the classroom or outdoors that provides room for children to explore and store science materials (Armga et al., 2002).

Science activities/experiences were defined as those activities/experiences offered children where they are given an opportunity to explore a variety of natural and manmade materials in order to make sense of the world. Lind (1998) noted three types of science activities/experiences that are provided in the classroom:

1) Naturalistic or spontaneous opportunities for science inquiry. Where children have access to science area, sensory table (for dry or wet activities) or displays of natural

objects (feathers, twigs, etc), collections of items (keys, stamps, etc.) and exploration tools (magnifying glass, a scale, etc.). In these situations the child controls the choices and actions.

2) Informal experiences. The child chooses the activity and action and the teacher intervenes to question, suggest, and involve the child in the activity
3) Structured science activities. The teacher chooses specific items for exploration, or experimentation. The teacher gives some direction to the child's activities.

Teacher-child interaction is the conversation and physical communication that takes place between the teacher and the learner (Owens, 1999). Interactions include modeling, assisting, questions, statements, shared observations, written and unwritten symbols, guidance and expansion of ideas.

For the purpose of this research, **child care teachers** were defined as those teachers who work in a child care setting. The word teacher was used interchangeably with child care teacher and preschool teacher to describe the participants of the study. It was important to define and operationalize theses terms to clarify the research topics.

CHAPTER II.

REVIEW OF THE LITERATURE

Exploring the literature regarding science began first by examining the theoretical framework that forms the foundation for the research. By investigating the acquisition of science concepts, the importance of personal interaction between children, the environment and teachers became apparent. After delving into Lev Vygotsky's theory of constructivism, literature regarding science education was described. More literature promoting science inquiry and the need for additional science programming was located than research studies that utilized scientific methods.

Theoretical Framework

Philosophical frameworks for contemporary science education have included both constructivism and sociocultural constructivism (Fleer & Robbins, 2002; Watters & Diezmann, 1998). Constructivism is the premise that each individual constructs his or her own knowledge and meaning (Fleer, 1993; Howe, 1996). Over time some developmentalists who studied constructivism and the work of Jean Piaget came to view Lev Vygotsky's sociocultural theory as a more comprehensive framework for cognitive development (Fleer, 1992a). The theory supports the active role of the teacher in the teaching-learning process (Fleer, 1993). Constructivists conclude that the child develops at his/her own pace through interaction with a rich environment. Learning occurs when children note the disparity of their ideas and what they observe (Fleer & Robbins, 2002). The teacher does not directly instruct, but leads children to draw conclusions through activities (Landry & Foreman, 1999). Vygotsky purported that the teacher/adult is the mediating factor in the learning equation. Individual development occurs within cultural/historical activities as a result of cooperation as individuals try to solve conflicts between perspectives (Fleer & Robbins, 2002).

Vygotsky theorized that social interaction plays a prominent role in the development of cognition and that the context or culture in which social interaction takes place shapes the patterns of thinking (Fleer, 1992b). The interaction between the child and another person is on an interpsychological or intermental plane. When the child internalizes the function or social structure it becomes intrapsychological or intramental (Goldhaber, 2000; Renshaw, 1992). Every function of a child's development begins as a social interaction (Howe, 1996; John-Steiner & Mahn, 1996; Vygotsky, 1986). When a new idea or observation is introduced or naturally occurs within a social context, children are better able to understand the learning activity and make use of the experience in other social contexts (Fleer, 1992b). Children participate in many social experiences that at first they do not understand (Fleer, 1992a). A child might not understand why it is necessary to wash hands before eating, but the adult works with the child to complete the chore, which eventually becomes culturally relevant and the purpose is understood. Each function in a child's social development emerges twice: first on the social level, between people, and then on the individual level, inside the child (Vygotsky, 1986; Wertsch & Rogoff, 1984).

Spontaneous and Scientific Concepts

In Vygotsky's book "Thought and Language" (1986), the acquisition of concepts was explored in great detail. Concepts cannot be assimilated in ready-made form but must undergo development. Vygotsky stated there were two types of concepts: 1) spontaneous concepts and 2) scientific concepts. The formation of a true concept is connected to understanding "word meaning". The path to understanding a concept is long and winding. Vygotsky (1986) stated that a concept is more than the sum of associative connections formed by memory and more than a "mental habit." A concept represents an act of generalization learned by the child.

Spontaneous concepts are those that are acquired in everyday life, outside of explicit instruction. Spontaneous concepts evolve, are instilled with personal meaning and are tied to existing experiences (Renshaw, 1992; Vygotsky, 1986). Children are not conscious of spontaneous concepts because their attention is centered on the object to which the concept refers, not the act of thought itself. Children cannot use spontaneous concepts to form abstractions (Vygotsky, 1986). Sometimes spontaneous concepts are thought to be those learned before a child enters school or outside the classroom setting. They are not a result of instruction (Panofsky, John-Steiner & Blackwell, 1990).

"Scientific concepts are systematic and general but are initially empty of personal meaning." (Renshaw, 1992, p. 6) Explicitly introduced by a teacher, "Scientific concepts evolve under conditions of systematic cooperation between the child and the teacher"

(Vygotsky, 1986, p.148). Scientific concepts benefit from cooperation and instruction of the teacher and child and develop before spontaneous concepts. Scientific concepts begin with analytic procedures (Panofsky, et al., 1990). Howe (1996) stated "Vygotsky used the term 'scientific concepts' in a broad sense, encompassing concepts in the social sciences, languages, and mathematics as well as the natural sciences, and associated scientific concepts with systematic, hierarchical knowledge…" (p. 37). Attainment of scientific concepts cannot occur instantaneously. A mediated connection must occur between concepts for understanding to develop.

When comparing spontaneous concepts to scientific concepts Vygotsky (1986) saw spontaneous as those that are "empirical, practical and situational", while scientific concepts were seen as "deliberate and conscious from the start". Vygotsky stated (1986) "…it is essential to first bring spontaneous concepts up to a certain level of development that would guarantee the scientific concepts are actually above the spontaneous ones (p. 194-195). The development of scientific concepts proceeds downward toward becoming concrete and spontaneous ones proceed upward to becoming abstract. In the child's mind, there is movement back and forth between the spontaneous concept and the scientific concepts until they come together in a system (Howe, 1996).

Zone of Proximal Development

Social interaction has been a primary component in Vygotsky's theoretical framework of learning and development. The importance of teacher-child interaction is maintained in Vygotsky's "zone of proximal development" or ZPD, (Vygotsky, 1986). The ZPD has been defined as the difference between the child's capacity to solve problems on his/her own, and the capacity to solve them with assistance. Wertsch and Rogoff (1984) stated the ZPD is "a region of sensitivity in which cognitive development advances." (p. 1) The assistance provided to advance development has sometimes been called "scaffolding". (Bruner, as cited in Fleer, 1992a) Scaffolding has been identified as a process that allows children to move from one level of thinking to the next (Fleer, 1992b). The support for learning is provided by the teacher, "…by offering the socially constructed symbol systems, models, and other tools that the child needs to create his own understanding" (Landry & Foreman, 1999, p.146). Social interaction among children themselves can also support learning. Success is based on active involvement of all participants in a dialogue that promotes the teaching-learning process.

Vygotsky's theory of social constructivism clearly indicates the importance of teacher involvement in learning. The teacher can assist in the acquisition of scientific concepts through planned experiences and interactions. Recognizing a child's ability to progress to more complex thinking through assistance of others is taking advantage of Vygotsky's concept of ZPD. This theory reiterates the impact the individual teacher's attitudes, beliefs and knowledge can have on the educational process.

Literature Review

The literature review covered topics important to early childhood science education. The research discussion began by exploring the notion of science and scientific thinking as well as the nature of children. The role of the teacher in science was then discussed along with the importance of environment and class time devoted to science activities. The review concludes with an examination of the research on the relationship of teacher attitude, beliefs and knowledge to the provision of a science program.

Although much has been written on the content of early childhood science from a practitioner's view, the role of the teacher, the nature of children involved in science, and the benefits of science education, little research has been done in the field of early childhood science education (Landry & Forman, 1999). In a review of research, Fleer and Robbins (2002) determined that most studies involved children completing surveys; therefore young children were less likely to be included. They also found few early childhood professionals with science backgrounds, therefore research was less likely to be conducted.

Science and Scientific Thinking

It was important at the beginning of the review of the literature on science in the early childhood setting that we focus on the definition of science. In the simplest terms science has been defined as the process of finding out how the world works (Chaille & Britain, 1997; Landry & Foreman, 1999; Nicholls, 1998). Owens (1999) added that science is "an active search for patterns in the relationships of things..." (p. 4). Howe and Jones (1998) went further in defining science and stated that science is not just the knowledge and understanding of the world, but science is also the way of arriving at that knowledge. With emphasis on the way one arrives at knowledge, Trumbull stated, "science is an active and social pursuit, in which ideas are tested, discussed and made public", (as quoted in Goldhaber, 1994, p 26).

For many the goal of science education has been to promote self-directed thinking and problem solving (Hadzigeorgiou, 2001; Stegelin, 2003; Watts, 1997). Another identified goal of science education has been to foster new generations of scientists by developing skills such as observing, classifying, making predictions, hypothesizing and making inferences. (Watts, 1997). Science is not only the knowledge that is acquired through the interactions with the environment, but also the process of inquiry, creativity, and discovery.

For children the acquisition of knowledge has not always been as important as the process that is undertaken. Scientific thinking is the utilization of the skills required to make sense of the world. These skills are essential building blocks for higher thinking (Pearlman & Pericak-Spector, 1995). Levitt (2001) stated that science learning is more about altering prior conceptions than about giving explanations of phenomena where none previously existed. Landry and Foreman (1999) plainly stated that scientific thinking is the application of curiosity and intelligence. The National Committee on Science Education Standards and Assessment (1996) called this scientific literacy; the knowledge and understanding of scientific concepts and processes required to ask, find, or determine answers to questions.

Nature of Children

Critical scientific thinking can develop during early childhood (Watters & Diezmann, 1998). Due to their innate sense of curiosity, children have been described as natural scientists (Nicholls, 1998; Pearlman, & Pericak-Spector, 1995; Pick, 2002; Ross, 2000; Smith, 2001; Watters & Diezmann, 1998). Diffily (2001) suggested that science is what young children do every day as they question, observe and engage in activities. Children experience the world with their senses (Armga, et al., 2002; Humphryes, 2000) and explore natural phenomena.

Although children are often seen as sponges for information, caution must be taken to keep activities as simple and concrete as possible (Pick, 2002). Elkind (2001) advised against presenting more formal kinds of science experiences at an early age. If science is only seen as imparting knowledge, children's curiosity and need for exploration are stifled. With nurturing and guidance from adults, children can develop through spontaneous exploration of natural experiences and events.

Hadzigeorgiou (2001) has seen early childhood as a time to facilitate certain positive attitudes, because attitude is what motivates the child's involvement in science activities. Science is more likely to incite feelings of wonder, amazement and surprise if the child is allowed to physically participate in activities. Since children change their minds as a result of a conversation or experience, learning should be looked at from a sociocultural perspective (Fleer & Robbins, 2002).

Role of the Teacher

"Science, like walking, talking, and breathing, doesn't require direct instruction, but it does take practice to perfect" (Ross, 2000, p. 6). The role of the teacher is one that orchestrates experiences for learning. The teacher determines what children are interested in and what they know (Elkind, 1998; Fleer, 1992b; Gilson & Cherry, 2004; Jones & Courtney, 2002; Smith, 2001). This allows the teacher to effectively organize the science experiences based on a shared understanding so that the children with assistance from the teacher achieve optimum learning. The child is at the center of the activity, not the teacher or the concepts (Landry & Foreman, 2001; Cho, Kim, & Choi, 2003). The term experiment should be used in a metaphorical way, “in the sense that one is asking a question of nature in a way that can be answered by observation.” (Elkind, 2001 p. 50). The teacher is not there to only explain scientific principles, but to set up a physical and social environment for children (Cho, et al. 2003). The interaction with materials, other children and adults guides children to make sense of the world.

Owens (1999) stated that talk is the interplay between experience and language. Without it children would be hindered in their ability to use precise words to explain ideas. Communication has a very important function in learning. The teacher assists children in enriching their language and vocabulary through discussions and conversations (Humphreys, 2000; Smith 2001). The teacher takes on a collaborative role of interviewer/teacher in assisting children with expressing their understanding (Fleer & Robbins, 2003; Rakow & Bell, 1998). The teacher asks open-ended questions and accepts a wide variety of answers. This allows her/him to understand the child’s thinking. Examples include: “How do you arrive at that idea?”, “Could you explain what you did?”, “What made you decide that?” and “How could you find the answer?” Teachers are there to help children reflect on what they are doing, the ideas they have and the explanations or conclusions they might invent (Armga et al.; 2002, Buzzelli, 1996; Fleer, 1992b; Nicholls, 1998; Pearlman & Pericak-Spector, 1995; Wilson, 1995). Children’s thinking is also stimulated by that of their peers (Fleer & Robbins, 2003; Nicholls, 1998).

Fleer's (1992b) research concluded the most successful interactions were those that generated learning outcomes for the children. Although the teachers studied categorized themselves as subscribing to an interactive approach to teaching science, two out of three focused their energy on procedures and management or cognitive focus without a purposeful direction. Using discourse analysis, it was determined that the successful teacher had more discussions that were "on-task" and provided opportunities for the expression and extension of children's thinking. The teacher should not be seen as the inexperienced fellow explorer, but they should be able to "assist, model and extend children at each stage of an interactive approach" (Fleer, 1992b, p. 394). Teachers should be encouraged to be mentors and guides, to expose children to the natural world (Humphryes, 2000; Wilson, 1995).

The teacher's role is somewhat indirect. They are the facilitator that sets the stage with materials and resources (Pearlman & Pericak-Spector, 1995; Rakow & Bell, 1998) and models curiosity and how to find answers to questions (Armga et al., 2002). They do not present science as "magic". They provide experiences that lead children to make discoveries.

Curriculum

It is the teacher's responsibility to create the science curriculum, an organized framework made up of all that is planned and conducted to result in learning. This includes methods and approaches used to assure children are acquiring and using the concepts. The classroom daily schedule, the environment, the learning materials, and the interaction between children and teacher are all part of the curriculum. It should not be prescribed and rigid but must be adaptable, open to the needs, interests, and capabilities of the children as individuals along with the characteristics of the children as a group (Chaille & Britain, 1997).

Lind (1998) suggested that children are engaged in three types of learning experiences: 1) inquiry experiences where the child controls the choices and actions, 2) informal experiences where the child chooses the activity and action, but the adult intervenes at some point, and 3) structured experiences where the adult chooses the experiences for the child and gives some direction to the child's actions. Children are involved in learning whether teachers are there to guide them or not. The difference in the inquiry experiences and the informal and structured is that there is a teacher present who assures that they are not only involved in "hands-on" but "minds-on" activities.

Environment

Science centers are often neglected with few specimens or items to explore. (Diffily, 2001). In order for children to construct meaning, a rich, problem solving environment must be provided (Landry & Foreman, 2001). The learning environment should be full of materials for children to explore, manage, manipulate, transform, and even destroy (Ross, 2000). Found items, along with simple machines, natural specimens, tools of technology and tools of exploration should be included in the science area (Diffily, 2001; Patton & Kokoski, 1996; Rakow & Bell, 1998; Rivkin, 1991). Animals and plants should also be integrated in the environment not only as participants of investigation but also so children can learn to care and respect other living things (Ross, 2000). Teachers are encouraged to not only to create an interesting science area in the classroom, but also to utilize natural outdoor surroundings (Humphryes, 2000). Teachers should focus on adult supervision and safety as they select materials that work properly and can be manipulated by a child (Armga et al., 2002; Ross, 2000).

There are numerous articles and books written for early childhood teachers with slight differences in the details of the contents of a productive environment. Areas designed specifically for science experiences have been named the "messing about" table, discovery area, investigation station, or just plain science center (Perry & Rivkin, 1992). All of these spaces are designed to facilitate learning and development.

The environment should be arranged so that children can interact with the materials, other children and the teacher. There should be enough room to spread out objects and include a number of observers and participants. Concepts are constructed through social interaction. The space should encourage interaction, invite "messy" activities, and not be located where activities could disturb others (Diffily, 2001). There should also be space for library/resources, student projects, inventions and constructions, running water, sinks and electricity (Patton & Kokoski, 1996). Welton (2000) has found that a classroom full of hands –on materials for science seemed better at controlling behavior than those classrooms structured for typical behavioral management.

Time

A minimum of 30 to 40 minutes of free play/exploration time is recommended for engaging in activities (Patton & Kokoski, 1996; National Association for the Education of Young Children, 1996). There should be extended amounts of time dedicated to "sciencing" (Perry & Rivkin, 1992; Wasserman, 1988). Sciencing is the motion activities: exploration, examination, inquiry, etc. Without dedicated time to the processes of investigation, hypothesizing, and inventing, science remains only facts for recitation without true understanding.

Attitude, Beliefs and Knowledge of Teacher

The opportunity for exploration alone does not lead to successful construction of concepts or the acquisition of exploration skills. A strong relationship must exist between the world of science and the child. The teacher must facilitate that relationship (Hadzigeorgiou, 2001). Few studies have looked at the impact of teacher's attributes as they relate to the teaching of science.

Cho et al. (2003) found that teacher attitudes toward science teaching have been an important component for effective science education. Teacher attitude has been affected by their own comfort level, knowledge, confidence, and personal beliefs of how children learn. Cho et al. (2003) developed a valid and reliable scale to measure degreed early childhood teachers' attitudes towards science teaching. The scale was designed to measure comfort-discomfort, desire for teaching science and the importance of teaching, teachers' concern/willingness about time needed for science, and familiarity with using science materials. The study was limited to revising the scale and determining a foundation for future scale validation research. Additional research is needed to focus on the correlations of the constructs to actual teaching practices

Beliefs individual teachers hold influence classroom interactions. The teacher may be ill at ease with the natural world or uninterested (Diffily, 2001; Kupetz & Twiest, 2000; Owens, 1999). The lack of interest and motivation are influencing factors. The teacher's learning philosophy may also hinder the role of science in the classroom. If the teacher does not see the importance of active engagement with materials and sees her/his role solely as passing along or imparting knowledge, the teacher will probably provide few effective science opportunities (Humphryes, 2000; Watters & Diezmann, 1998).

Levitt (2001) analyzed interviews and observations of elementary teachers to classify their beliefs about teaching science into three categories. Teacher's beliefs fell along a continuum from traditional to transitional to transformational. Those beliefs that were traditional were least consistent with those of the *National Science Education Standards* (1996). Regardless of belief categories, teachers believed in providing hands-on activities, allowing students to actively participate in science, questioning as a corner stone of science, and fashioning science programs to be meaningful to students (Levitt, 2001). Traditional and transitional teachers were more likely to be constrained by the availability of science materials than those in the transformational category. Although student engagement in activities was important to all teachers, only approximately half of the classrooms were arranged to promote cooperative or group learning. Levitt (2001) determined that the theories an elementary teacher holds about the nature of science and the teaching and learning of science determine to a great extent what science education will be provided for a child.

Some early childhood educators may be uncomfortable with their level of knowledge of science content and may therefore limit the role science plays in the classroom (Diffily, 2001; Owens, 1999; Patton & Kokoski, 1993; Watters & Diezman, 1998). Teachers may also shy away because they equate science with memorization of facts and completing experiments (Armga et al.; 2002; Diffily, 2001), or they may see science and scientists in a stereotypical fashion (Moseley & Norris, 1999).

Garbett (2003) surveyed Australian teacher education students and found they had little confidence in their own knowledge of science and science teaching. For preservice teachers, science knowledge background was poor (Garbett, 2003; Zeitler, 1984;) and few enrolled in college science courses (Garbett, 2003). Zeitler (1984) determined the majority of preservice teachers thought the purpose of science was to teach science information (only 10 % listed problem solving as a purpose), therefore they felt poorly prepared to teach science.

Through testing and observation, Kallery and Psillos (2001) found Greek early childhood teachers were deficient in science content knowledge and understanding and the ability to turn complicated scientific questions into those children can investigate. After analyzing teachers' answers to questions requiring views and explanations of phenomena, less than 22% contained scientific information and more than half the answers were incorrect.

Harlen's 1997 study researched primary teachers in Scotland and determined confidence in teaching science was related to understanding of concepts in science. Teachers were less confident teaching science than teaching English and mathematics. When comparing fields of science study, teachers were more confident about biological topics and earth science than topics of energy/forces. When surveyed, teacher's lack of confidence in science teaching did not seem to increase the difficulty in coping with the demands of teaching science.

To examine teacher's science knowledge and understanding, Harlen (1997) conducted a test. An interviewer discussed explanations for events and phenomena with the teachers. The teachers were then separated into the top one-third and the bottom one-third according to the answers given. These groups were compared to those who indicated they had some science background and those with no science background (courses in school). The top third of the group was more likely to have some science background. Although some who had had an understanding of science did not have a science background. Those teachers in the bottom third had no science background. Years of teaching experience did not indicate differences in knowledge and understanding. Males in study were significantly more confident than females in developing children’s understanding of science.

According to Harlen (1997) teachers with some science background have some confidence about teaching science. Although teachers with no science background may have limited understanding of science, they do have confidence in teaching science. Harlen (1997) identified six strategies teachers use to compensate for low confidence in science teaching ability. These included: 1) Avoidance, 2) Keeping to topics where confidence is greater, 3) Stressing process rather than concepts, 4) Relying on the textbook or workbook, 5) Emphasizing direct teaching rather than discussion or questioning, and 6) Avoiding all but the simplest activities. The individual characteristics of teachers affect the role the teacher takes in the classroom. A teacher’s comfort and fondness for science can foster children’s interest in activities (Harlen, 1997; Rivkin, 1991).

Summary

In summary, much has been written about classroom science practices, curriculum suggestions, exceptional settings, and anecdotal observations of children engaged in "sciencing". With the current emphasis on children's outcomes, program quality, and providing programs universally, research on early childhood science has not been the focus of academics. In examining current literature pertaining to science education, the most important ingredient in the relationship of science process and understanding is the facilitator of learning, the teacher. Research on child care teacher attitudes, beliefs, and knowledge and their effect on provided science experiences is deficient The aim of this study was to provide information on the impact of child care teacher's characteristics on teaching activities. This information provides guidance in developing appropriate teacher preparation.

Hypotheses

In order to determine if child care teacher attitudes, beliefs, and knowledge affect classroom behavior and interaction it was be imperative to establish teacher's perceptions of their knowledge of science and science teaching, their beliefs about what is science and science teaching, and their attitude towards science and science teaching. Program size and class characteristics were also noted along with age, sex, race, and educational level of the teacher. While examining the individual aspects of the teacher, the types of science activities provided were also noted. This study examined the following hypotheses.

1. There is a positive association between positive teacher attitude toward science and the frequency of science activities provided in the classroom.
2. There is a positive association between the amount of teacher knowledge of science and the frequency of science activities provided in the classroom.

3. There is a positive association between teacher beliefs about science involvement and the frequency of science activities provided in the classroom.
4. There is a positive association between positive teacher attitude toward science teaching and the frequency of science activities provided in the classroom.
5. There is a positive association between the amount of teacher knowledge about teaching science and the frequency of science activities provided in the classroom.
6. There is a positive association between teacher beliefs about teaching science and the frequency of science activities provided in the classroom.

There are a few basic assumptions regarding the testing of the hypotheses that were established. First assumption is that the child care teacher would accurately report their beliefs, attitudes and knowledge of science. The next assumption was that teachers would accurately report the types of activities they provide. And lastly it is assumed that teachers would accurately report their personal characteristics and those of the classroom where they work.

CHAPTER III.

PROCEDURES AND METHODOLOGY

In order to study the science knowledge, beliefs, and attitudes of child care teachers and their science practices in the classroom participants for research were identified. The most available sample of preschool teachers came from licensed child care programs. Surveying ideas regarding the topics of interest provided data for the research project.

Sample

The sample was made up of teachers who work with preschool children (ages three-five years) in licensed programs in Oklahoma. At the time of the mailing, there were approximately 1,850 licensed child care centers in Oklahoma. Every facility received a survey and was encouraged to have preschool teachers fill out a copy and return it. A 41.7% return rate was achieved with 778 surveys utilized in the study.

The vast majority of participants working with children age three, four, and five-years were women, (98.7%). The most represented age-range of teachers was age 26-35 (28.8%) followed by teachers from 36-45 (24%). The least represented age range was 56 and older, 7.8% of respondents. The ethnicity of the majority of participants was white

(72.7%) with African American following at 28.8%, and Native American, Latino and other ethnicities making up 15.8% of the population. The bulk of participants have worked in early childhood programs more than four years; 53% have worked in the field of early more than seven years, with 20.6% in the field four to six years. Descriptive information about participants has been presented in Table 1.

The education levels of child care teachers were noted with the largest number of teachers (33.7%) having some college, while high school diploma (23.6%) and bachelors degree (22.3%) made up the next largest numbers of teachers. Child Development Associate Credentials and Child Care Professional Credentials were held by 29.9% of the participants. Education information about the participants has been presented in Table 2.

Of 778 surveys, 79.4% came from teachers in child care programs. Of the programs where teachers were employed 54.2% were rated Two-Star in the Reaching for the Stars program and 36.2% were in programs licensed for over 76 children. A higher percentage of participants were employed in Two and Three Star programs than are represented in the state (45% were Two and 6% were Three Star). The majority of participants (70.3%) worked with 4 year-old children, while 53.9% worked with 5 year-olds and 40.2% worked with 3 year-olds. It was possible for participants to have more than one age group in their classrooms. Most classrooms (60.2%) contained 1-15 children. Program characteristics where child care teachers are working is presented in Table 3.

Procedures

Attitude scales regarding science and science teaching were previously administered to preservice elementary teachers (Starwitz & Malone, 1986; Thompson &

Shrigley, 1986; Zeitler, 1984) and elementary teachers (Moore, 1973). These scales were successful at assessing science preparation for preservice teachers and differences in purpose for science instruction. Validity and reliability were achieved utilizing the "Revised Science Attitude Scale" (Thompson & Shrigley, 1986). Minor alterations were made to the scale by Cho et al. (2003) and used to measure early childhood teacher's attitude toward science teaching.

The revised science survey (See Appendix I) was sent to the Institutional Review Board (IRB) along with required application seeking approval to conduct the research (See Appendix II). Approval was received from the IRB and the survey instrument was mailed to 1,862 licensed Oklahoma child care facilities along with a letter explaining the research, providing directions, and requesting teachers who work with children ages three to five to fill out the survey. The survey was printed on colored paper to enhance the probability of return. A postage-free, return envelope was included with the survey and participants were asked to return the survey three weeks after it was mailed out. As an incentive, those teachers who returned the survey by the deadline were entered into a drawing for a chance to win one of three $25.00 gift certificates to Lakeshore Learning Materials. Names and addresses of respondents for the research were not requested since each survey was given a number that corresponded to a center on the mailing list. If more than one child care teacher responded from a center they were instructed to duplicate the survey and letter them a, b, c etc. This information was used to award the gift certificates.

The returned surveys were entered into the statistical package SPSS. Recorded responses to questions #11, #13, #27, #29, and #31 were reversed so that the higher numbered response was most preferred. Those surveys that were missing eight or more responses were eliminated from the analysis. For the missing responses from questions #10-#38, question means were substituted.

Instrument

The survey instrument was based on the Early Childhood Teacher's Attitudes toward Science Teaching Scale (Cho et al., 2003; Thompson & Shrigley, 1986). Questions regarding classroom science activities were added to the scale to reflect the purpose of the research and revisions were made to questions to achieve a lower readability (9.3 on Flesch-Kinkade). The survey obtained information such as sex, race, age, years of experience (Question #2), program where the individual worked (Question #6a, #6b) and classroom characteristics (Question #7, #8, and #9). Knowledge was measured by total number of high school and college courses, along with educational activities (Question #1, #3, #4, #5). It was a self report survey that contained sections that assessed the child care teachers' knowledge of science and how to teach science, attitudes about science including how to teach science, beliefs regarding appropriateness of science education in the early childhood classroom and how to teach science, interest in science, and the child care teachers' current science teaching practices. The instrument used a 4-point Likert scale. Participants were asked to respond to statements #10-#30 with the following: strongly disagree, disagree, agree and strongly agree. On statement #32-#38 participants indicated how often they provide science activities: not at all, occasionally, weekly, and daily.

Cho et al. (2003) scale was utilized in the science survey. Within the survey, a priori scales were constructed with attitude toward science (Questions #10, #14, #22, #23,

#24, #25) and toward science teaching (#11, #15 #16, #17, #18, #19, #21, #26), beliefs about science (#20, #21, #25, #26, #27, #29, #31), and beliefs about science teaching (#19, #28, #30). Knowledge of science (#1, #3, #4, #5, #13,) was measured along with knowledge about science teaching (#12, #20), the provision of science activities and delivery method identified in Lind's 1998 paper (#32, #33, #34) and the content of science activities found in the chapter on science in Oklahoma Early Learning Guidelines Science (2004)(#35, #36, #37, #38).

Data Analysis

In order to test the hypotheses, the data recorded from the surveys had to be transferred into data that could be compared. The number of completed high school science courses, the number of completed college science courses, and the number of science resource activities completed by the respondents were transformed into Z scores. The Z scores were added together to come up with a measurement for science knowledge (M = .0064).

The survey items that represented the frequency of science delivery methods were added together and a mean response was calculated (M = 3.07). A similar calculation was completed on the survey items that represented the frequency of science content (M = 2.9). The scale for these frequency means included 1=not at all, 2=occasionally, 3= weekly and 4= daily. Items used for these subscales are listed in Table 4.

After examining frequencies to responses from the surveys, each of the previously identified questions (# 10-#31) were grouped according to hypotheses they were designed to test and then were tested for reliability. The Cronbach alpha coefficient was used to determine the internal consistency based on the average inter-item correlation. When questions were grouped according to indication of belief, attitude and knowledge variables, the results of tests did not show acceptable minimum Cronbach's alphas of .70 or higher.

Utilizing Cho et al. (2003) factor analysis research on survey questions, reliability tests were conducted on those questions which were related and were deemed to be indicators of science attitude and beliefs. An attitude toward science and science teaching subscale (*a* = .77) was used and included question #10, #15, #18, #19, and #22. A beliefs about science and science teaching subscale (*a* =. 80) was used and included #12, #14, #16, #17, #23, #24, #25, #26, #30, and #31. Questions #11, #13, #20, #21, and #29 were deleted due to lack of usefulness in determining reliability. Subscale content information can be found in Table 4.

Summary

Original items utilized for the creation of the subscales within the science survey did not turn out to be reliable indicators of science beliefs and attitudes. By reexamining the survey and looking at Cho et al. (2005) research, new subscales were created that better reflected the research plan. Collapsing beliefs about science and science teaching into one subscale and attitudes about science and science teaching into another subscale allowed research results to be examined.

CHAPTER IV.

RESULTS

The results of the research project were separated into two sections. The first section of the results highlighted information gathered from frequency response data showing preschool teachers' attitudes, beliefs, and practices in the provision of science activities. The second section focused on the specific hypotheses identified in the review of the literature.

Frequency Data

When examining all responses to the surveys, the majority of respondents indicated that they felt young children can learn science even though they may be unable to read (81.7%), that it is appropriate to introduce science to children at an early age (76.9%), that young children are curious about scientific concepts and events or observations (75.9%), and that they are comfortable using classroom materials for science (75.6%). Details regarding the frequency of responses to the survey can be found in Table 5.

Responses to the survey indicated preschool teachers have a basic understanding about how children learn science and they are comfortable doing science activities. Of the respondents 52.6% "agreed somewhat" and 30 .9% "strongly agreed" with the statement they were familiar with the processes and ways that young children learn science. The respondents in general felt comfortable doing science activities in the early childhood classroom (35.5% “agreed somewhat” with the statement and 59.4% “strongly agreed”).

Survey responses indicated preschool teachers were not fearful of science information or their abilities to teach science. When combining survey responses of “Disagree Somewhat” and “Strongly Disagree”, a combined 69.2% indicated they were not fearful of teaching science to young children and 58.5% were not afraid children may ask a scientific question they cannot answer.

Preschool teachers indicated in their responses to the science survey they were willing to plan science activities and did not mind the messiness of the activity or the time it may take to prepare for the activity. Combining “Agree Somewhat” responses with “Strongly Agree” resulted in 97.2% of respondents indicating they were somewhat ready to spend time setting up science activities, 96.9% were ready to learn and use scientific knowledge and skills for planning science, and 95.9 % did not mind the messiness created when doing science.

When reviewing the survey results reporting the frequency of science activities offered, 38.5% of preschool teachers reported that they offered structured science activities weekly. When reviewing survey questions regarding the type of science activity offered daily, the majority, 53.1% reported offering inquiry and discovery, while 44.3% reported they took advantage of teachable moments by asking questions and encouraging exploration, and only 23.6% reported they provided structured science activities.

Preschool teachers reported at a minimum offering science activities occasionally. When examining the reported content of science activities offered daily, 39.4% of preschool teachers reported they provided activities where objects are grouped by physical properties, 35.6% reported they provided earth science activities, 33.8% reported that they set up the classroom for science inquiry and discovery, and 21.7% reported they provided life science activities. Combining the frequency of daily and weekly, 73.3% of respondents provided activities where objects are grouped by physical properties and 62.4% set up classroom for science inquiry and discovery.

Although science knowledge varied, the overall results of the science survey showed preschool teachers had positive attitudes and beliefs about science. Preschool teachers offered science activities with a variety of content and methods of delivery.

Findings of Hypotheses

After examining the results of the survey response analysis, it was determined that beliefs about science and science teaching could be collapsed and attitudes about science and science teaching could be collapsed in order to test the hypotheses. The information obtained from the analysis was helpful in looking at possible influences in classroom activity. Correlations were significant and can be found in Table 6.

Hypotheses one and four were collapsed to determine whether there was an association between positive teacher attitude toward science and science teaching and the frequency of science activities provided in the classroom. Pearson's correlational analysis was performed utilizing science/science teaching attitude, method of delivery, and science content subscales. For the purpose of analysis, the science activities were separated into delivery method (r = .38) and content of activity (r = .35). It was concluded that the more positive the teacher attitude about science/science teaching, the more frequent different types of science activities were provided in the classroom. Details of the science activity subscales are reported in Table 4.

Hypotheses two and five were collapsed to determine whether there was an association between the knowledge of science and science teaching and the frequency of science activities provided in the classroom. Using the scores for knowledge of science/science teaching, method of delivery, and science content, Pearson's Correlation analyses were completed. The correlation between knowledge of science/science teaching and method of delivery was .25. The correlation between knowledge of science/science teaching and content of science activity was .25. The results indicated the more teacher knowledge of science/science teaching, the more frequent different types of science activities were provided.

Hypotheses three and six were collapsed to determine whether there was an association between teachers' beliefs about science and science teaching and frequency of science activities provided in the classroom. Employing scores for beliefs about science/science teaching activities, method of delivery and science content Pearson's correlational analyses were performed. The analyses resulted in .42 for beliefs about science/science teaching and method of delivery and .42 for beliefs about science/science teaching and content of science activity. It was determined that the more positive the teacher's beliefs about science/science teaching, the more frequent different types of science and science activities were provided.

The strongest correlation in this research was the positive correlation between beliefs about science/science teaching and the content of the science activity ($r = .42$). The weakest association was the positive correlation between knowledge of science/science teaching and the delivery method of science ($r = .25$). The statistical data supported the research hypotheses.

CHAPTER V.

DISCUSSION

In this study preschool teachers reported positive views of science and science teaching, and science activities. Research supported the following hypotheses: 1) There is a positive association between positive teacher attitude towards science and science teaching and the frequency of science activities provided in the classroom, 2) There is a positive association between the amount of teacher knowledge of science and science teaching and the frequency of science activities provided in the classroom, and 3) There is a positive association between teacher beliefs about science and science teaching and the frequency of science activities provided in the classroom.

Summary

The majority of teachers surveyed indicated feeling positive about their abilities to provide science. They reported they enjoyed science resources, they were ready to learn and use scientific knowledge and skills for planning science, and were willing to get involved in science activities. They also indicated willingness to spend time setting up the science area for exploration, and reported they did not mind the messiness created when doing hands-on science.

Science activities were reported to be offered daily by the majority of the responding preschool teachers. Although there were subtle differences in the reporting of science activity frequency with regards to delivery method of science and content of science activity, few of the respondents indicated that they did not provide any science activities. There was a wide variance in the amount of science education reported by preschool teachers. The amount of science education did not appear to influence classroom practices. These results could be because of the preschool teachers' need to provide the most socially desirable, developmentally appropriate answers to the survey.

The participants reported providing life sciences activities occasionally, while offering discovery, physical property exploration and earth science activities daily. These results could be because of the preschool teachers' possible fears of involvement with animals and insects and feeling more comfortable with activities that require children to group items by shape, color, function, etc.

Structured science activities reportedly were offered weekly by more than one-third of preschool teachers. A large number of preschool teachers reported providing inquiry and unstructured informal activities most frequently. From this information it can be concluded that additional education is needed on how to engage children in science activities, and the importance of teacher interaction. The use of open-ended questions, arrangement of environment, and progression of skill acquisition could assist teachers in planning and implementing meaningful science activities. Another area of training indicated by research findings might be in the utilization of accessible earth and life science materials in the science area. Teachers may not fully understand how materials could be used and where children could practice exploration and inquiry.

Three respondents to the survey included hand written notes regarding science activities in the classroom with the completed form. In summary science was indicated to be the "hardest", most challenging center in the classroom for teachers. The preschool teachers said science is difficult to plan for differing age groups in the same classroom, "There are fifteen children and only one of me, so I am not able to give that center as much attention as I would like." Two of the respondents would like to attend workshops or training on science.

Research in the field of early childhood science has been limited. In reviewing the literature regarding science attitude beliefs and knowledge, there are few studies for comparison. Although research has been done with preservice teachers, degreed preschool and elementary teachers surrounding this topic, this is the only recent research that has focused on preschool child care teachers and the only study completed with a sample that represented wide variety of educational levels, experience, and science education.

This study provided additional information regarding the Cho et al. (2003) science attitude scale. The revised scale appeared to replicate the previous factor analysis when utilized in this study. The subscales created to test the hypotheses did not indicate reliability.

The results of this study indicated that like the Levitt (2001) study with elementary school teachers, the majority of preschool teachers indicated they believed in providing hands-on activities and believed children should actively participate in science. Additional results regarding knowledge of science and science activities provided are in the same vein as Harlen's (1997) study that found Scottish teachers have confidence in teaching science even though they may have little background or science education. Results could be due to training and education emphasis on the terms “developmentally appropriate” and “best practices” or the need to provide the “educationally correct” response to a survey. These terms may be identified as desirable without complete understanding of their meaning.

Few survey respondents indicated they were uncomfortable with their level of knowledge of science. Knowledge level did not appear to influence beliefs and attitudes about science and science teaching as was suggested in previous literature (Diffily, 2001; Owens, 1999; Patton & Kokoski, 1993; Watters & Diezman, 1998) These results could be due to the use of a self-report survey rather than an observation that would more clearly indicate activities in the classroom.

The participants in the research were not representative of the population of Oklahoma child care teachers since the majority (70.4%) were employed at Two and Three Star programs. At the time of the survey only 51% of licensed child care centers in Oklahoma were Two and Three Star programs. Training requirements for Two and Three Star child care staff could have influenced the educational levels and knowledge of science of the preschool teachers employed at the programs.

Research Implications

The recent research adds to the body of knowledge regarding the impact of science knowledge, attitude, and beliefs of instructors on behaviors in the classroom. The study also provides information regarding weaknesses in methods of instruction for child care providers particularly in the science content area.

The infrequency that teacher-structured science activities were provided indicates the lack of understanding of the importance of the role of the teacher in science learning-teaching. Infrequency of activities could also be due to the low amount of science materials available in child care classrooms. The variance of educational levels of the participants and low number of degreed teachers could be an indicator of the lack of familiarity with the impact of social activity and sociocultural constructivism. The importance of the evolution of scientific knowledge (Vygotsky,1986) hinges on teaches identifying themselves as mediators.

The research indicated preschool teachers' overwhelming positive beliefs and attitudes regarding science in the early childhood classroom and showed an association between these positive beliefs and attitudes and the science activities provided. It did not indicate whether positive beliefs and attitudes caused science activities to be provided. It did not show that knowledge of science caused positive beliefs and attitude nor did it indicate why science activities were provided.

Limitations

The research study limitations include the possibility that the information provided in the survey responses was not accurate. During data input, it was observed that perhaps not all respondents read the survey since responses did not always coincide. A more reliable means of gathering accurate information regarding classroom activities and child care teacher attitudes, beliefs and knowledge could result in better information. A simple test to determine science knowledge could be utilized along with the beliefs and attitude portion of the survey. Classroom observation could yield more details regarding classroom activities and learning environment. An environmental rating scale could be used to determine classroom content related to science. Observations could be completed by trained observers to remove the chance for inconsistency. The use of other measurement tools could provide more complete, accurate data.

The science survey tool could be improved to add more examples of science activities that vary in teacher involvement. For example: Would you teach science by: reading to children about electricity?, putting out batteries, wires, and light bulbs at the science table?, or guiding children step by step through exploring batteries, light bulbs wires, etc.? A pretest of the Cho et al. (2003) attitude scale could have been done prior to giving it to the sample. This might have helped revise the research project theses early on.

Recommendations

The research in early childhood science programs is almost non-existent. Future research regarding science knowledge, beliefs, attitudes and activities should be encouraged and utilize a research design that provides more accurate information than the current study was able to provide. Additional research is needed specifically in the area of teacher-interactions in the classroom and impact on classroom activities, environment and atmosphere. A study comparing observations of child care teachers with little science knowledge to those with the most science knowledge could offer more information on how knowledge impacts practice.

In addition, emphasis is needed on the benefits of science education not only in acquiring literacy and numercy skills but also in the development of children’s abilities to become critical thinkers. This would encourage the provision of more science activities and the integration of science into all topics of study. When more early childhood teachers understand that science is both a noun and a verb then perhaps more experiences involving exploration and inquiry will be provided, and children will have the opportunity to reach their learning potential. The field should continue to support not only “hands-on” science, but “minds-on” science too.

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Appendix I

Science Survey for Teachers of Three, Four and Five-Year Olds

Please mark the box that best describes you.

☐ **Male** ☐ **Female**

☐ **Under age 25** ☐ **Age26-35** ☐ **Age 36-45** ☐ **Age 46-55** ☐ **Age 56 and older**

☐ **White** ☐ **African-American** ☐**Native American** ☐**Latino** ☐**other________**

1.Please mark your educational level.

☐ **High school**
☐ **Child Development Associate (CDA)**
☐ **Some College**
☐ **Associates Degree**
☐ **Bachelors Degree**
☐ **Masters Degree**
☐ **Doctorate**

2.Please mark the length of time you have worked in early childhood programs.

☐ **Less than 1 year** ☐ **1-3 years** ☐ **4-6 years** ☐ **7 or more years**

3. Please mark all the **science** education activities <u>you</u> have completed.

☐ **Science courses in high school**
☐ **Formal college course work on science**
☐ **In-service training on science**
☐ **Conference workshops on science**
☐ **Read resource books about science**
☐ **Read newsletters and/or articles on science**

4. Please write the number of science courses you had in:

_____High school **_____College**

5.Please mark all the **science** education activities <u>you enjoy</u>.

☐ **Science courses in high school**
☐ **Formal college coursework on science**
☐ **In-service training on science**
☐ **Conference workshops on science**
☐ **Read resource books about science**
☐ **Read newsletters and/or articles on science**

6. Please place an <u>X</u> next to the type of program where you work <u>and</u> the Star Level.

☐ **Child Care Center** ☐ **Head Start** ☐ **Public School**

☐ **One Star** ☐ **One Star +** ☐ **Two Star** ☐ **Three Star**

7. Please mark the licensed capacity of the program where you work.

☐**0-25 children** ☐ **26-50 children** ☐**51-75 children** ☐ **over 76 children**

8. Please mark the number of children in your classroom.

☐**0-15** ☐**16-30**

9. Please mark the age group(s) in your classroom.

☐ **3-year olds** ☐ **4-year olds** ☐ **5-year olds**

Read the following statements and please circle the number that corresponds to the words that show your agreement with the statement.

		Strongly Disagree 1	**Disagree Somewhat 2**	**Agree Somewhat 3**	**Strongly agree 4**
10.	I feel comfortable doing science activities***** in my early childhood classroom.	**1**	**2**	**3**	**4**
11.	I fear that I am unable to teach science to young children adequately.	**1**	**2**	**3**	**4**
12.	I feel comfortable with the level of scientific knowledge that I need to have to teach young children.	**1**	**2**	**3**	**4**
13.	I am afraid that children may ask me a question about scientific laws and events that I cannot answer.	**1**	**2**	**3**	**4**
14.	I hope to excite children about science in my classroom.	**1**	**2**	**3**	**4**
15.	I am willing to get involved in children's scientific inquires.	**1**	**2**	**3**	**4**
16.	I enjoy reading resource books to obtain ideas about science activities for young children.	**1**	**2**	**3**	**4**
17.	I am willing to spend time setting up materials★ for scientific exploration.	**1**	**2**	**3**	**4**

*****Science activities/experiences are those offered children where they can explore a variety of natural and man-made items. The activities include science inquiry (investigate and experiment with objects), physical science activities (group items by size, shape, use), life science (plants and animals), and earth science (weather, seasons, environment, water, air, and soil).
★Science materials and equipment are the natural and man-made items that children are encouraged to touch, move, and construct. Materials and equipment could include collections of items (insects, rocks,

leaves), typical science exploration tools (magnifying glass, scale), animals and plants, sensory items (feathers, sponges, sand), and other found items or machines (egg beater, pulley, clock).

		Strongly Disagree 1	**Disagree Somewhat 2**	**Agree Somewhat 3**	**Strongly agree 4**
18.	I am ready to learn and use scientific knowledge and scientific skills for planning hands-on science.	**1**	**2**	**3**	**4**
19.	I like to discuss ideas and issues of science teaching with other teachers.	**1**	**2**	**3**	**4**
20.	I am familiar with raising open-ended questions to encouraging children's scientific exploration.	**1**	**2**	**3**	**4**
21	Preparation for science teaching generally takes more time than other subject areas.	**1**	**2**	**3**	**4**
22.	I am not afraid of science experiments in the classroom	**1**	**2**	**3**	**4**
23.	I enjoy collecting materials and objects to use in my science teaching.	**1**	**2**	**3**	**4**
24.	I am interested in handling certain animals and insects to teach science.	**1**	**2**	**3**	**4**
25.	I am comfortable using any classroom materials (e.g., blocks, toys, boxes, so forth) for science activities	**1**	**2**	**3**	**4**
26.	I do not mind the messiness created when doing hands-on science in my classroom.♦	**1**	**2**	**3**	**4**
27.	I do not believe it is appropriate to introduce science to children at an early age.	**1**	**2**	**3**	**4**
28.	I am comfortable with determining the science activities that are developmentally appropriate for young children.	**1**	**2**	**3**	**4**
29.	I don't feel that young children are curious about scientific concepts and events or observations.	**1**	**2**	**3**	**4**
30.	I am familiar with the processes and ways that young children learn science.	**1**	**2**	**3**	**4**

♦The science area, "exploration station" or discovery center is the space in the classroom or outdoors that provides room for children to explore and store science materials.

		Strongly Disagree 1	**Disagree Somewhat 2**	**Agree Somewhat 3**	**Strongly agree 4**
31.	I feel that young children cannot learn science until they are able to read.	**1**	**2**	**3**	**4**

Read the following statements and circle the number that best shows how often you provide science activities.

		Not at all 1	**Occasionally 2**	**Weekly 3**	**Daily 4**
32.	I make opportunities available for science inquiry and discovery in my classroom. Children have access to science area, sensory table (for dry or wet activities) or displays of natural objects (feathers, twigs, etc), collections of items (keys, stamps, etc.) and exploration tools (magnifying glass, a scale, etc.). In these situations the child controls the choices and actions.	**1**	**2**	**3**	**4**
33.	I take advantage of teachable moments by asking science related questions and encouraging exploration of a science concept. For example: child playing with blocks could be asked questions about balance, size, or gravity.	**1**	**2**	**3**	**4**
34.	I make opportunities available for children to be involved in structured science activities: I choose specific items for exploration or experimentation. I give some direction to the children's activities.	**1**	**2**	**3**	**4**
35.	I set up my classroom for science inquiry and discovery (children investigate and experiment with objects to discover information).	**1**	**2**	**3**	**4**
36.	I give children a chance to do science activities where they group objects by physical properties (size, weight) or sensory attributes (color, shape).	**1**	**2**	**3**	**4**
37.	I provide children with life science activities, so they have experiences with plants and animals.	**1**	**2**	**3**	**4**
38.	I offer science activities, which include concepts of the earth such as weather, the seasons, outdoor environment, water, air, and soil.	**1**	**2**	**3**	**4**

APPENDIX II

OKLAHOMA DEPARTMENT OF HUMAN SERVICES
Sequoyah Memorial Office Building
2400 N. Lincoln Blvd.
P.O. Box 25352
Oklahoma City, OK 73125-0352
(405) 521-3646. www.okdhs.org
February 7, 2005

OKLAHOMA OKDHS EXCELLENCE
OKLAHOMA DEPARTMENT OF HUMAN SERVICES

Dear Child Care Director:

This letter is to ask for your **preschool teacher's** participation in a research project for the Division of Child Care. The project is looking at child care teacher's attitudes, knowledge, beliefs and practices pertaining to science.

In order to participate, the child care teacher must work with three, four, or five year old children. Participation in the project is **voluntary**. Those who do participate by returning the completed survey will be eligible for a drawing for one of three **$25.00** gift certificates from Lakeshore Learning Activities. In order to be eligible for the drawing surveys must be postmarked by **March 8, 2005.**

Please copy the survey for every teacher that participates in the research and place a letter next to the number on the survey (101a, 101b). The identifying number will only be used for the drawing. The surveys should be returned in the enclosed return envelope.

Please answer all questions honestly and to the best of your ability. The information from the surveys will be used as a group. The identities of the respondents will not be revealed. The results of this study will provide insight regarding child care teachers' science backgrounds, thoughts about science and the science activities provided. It will also be used to make recommendations for child care teacher training and preparation. Thank you in advance for your participation in this valuable study. If you have any questions you may contact Lu Ann Faulkner-Schneider at 405-521-2075 or 1-800-347-2276.

Sincerely,
Nancy L. vonBargen
Nancy L. vonBargen
Director of Child Care Services
LuAnn Faulkner-Schneider
Lu Ann Faulkner-Schneider
Program Field Representative

For information on subjects' rights, contact Dr. Sue Jacobs, IRB Chair, 415 Whitehurst Hall, 405-744-1676.

OSU
Institutional Review Board
Approved 2/8/05
Expires 2/7/06
Initials ERM

Information to Participants

Project Title: Child Care Teachers' Attitudes, Beliefs, and Knowledge Regarding Science and the Impact on Early Childhood Learning Opportunities

Investigators: Lu Ann Faulkner-Schneider.

Purpose: The project involves researching child care teacher's attitudes, beliefs, and knowledge of science and science teaching and the science activities teachers provide. This research will provide a picture of teachers' current attitudes, beliefs, knowledge and practices regarding science and will help direct the content of future of child care teacher preparation and training.

Procedures: The project will involve the completion of the survey. The first part of the survey will ask for demographic information such as your age, gender, race or ethnicity, your education, the age level you work with, and your program's licensing capacity. The next section of the survey asks you to respond to statements about attitudes beliefs and knowledge regarding science, science teaching and practices. It will take no longer than an hour to complete the survey. You will then put the completed survey in an addressed and stamped envelope that accompanied the survey and mail it back to the Department of Human Services, Division of Child Care.

Risks of Participation: There are no know risks associated with this project which are greater than those ordinarily encountered in daily life.

Benefits: The benefits are that you will be providing information for valuable research into science activities in child care.

Confidentiality: All information about you will be kept confidential and will not be released. Each survey will be numbered in order to identify winning programs in drawing. After drawing is completed, all forms with numbers will be destroyed. The principal investigator and the faculty advisor are the only people who will have access to the data. The data will be reported in the aggregate.

Compensation: The child care teachers who return the surveys will be included in a drawing for three $25 gift certificates from Lakeshore Learning Activities.

Contacts: If you have questions regarding the research, please contact Lu Ann Faulkner-Schneider at 405-521-2075 or 800-347-2276 or Dr. Deborah Norris at 405-744-7084. For information on subjects' rights, contact Dr. Sue Jacobs, IRB Chair, 415 Whitehurst Hall, 405-744-1676.

Participant Rights: I understand that my participation is voluntary, that there is no penalty for refusal to participate, and that I am free to withdraw my consent and participation in this project at any time, without penalty.

OSU
Institutional Review Board
Approved 2/8/05
Expires 2/7/06
Initials Em

APPENDIX III

Oklahoma State University Institutional Review Board

Date:	Tuesday, February 08, 2005
IRB Application No	HE0532
Proposal Title:	Child Care Teachers' Attitudes, Beliefs, and Knowledge Regarding Science and the Impact on Early Childhood Learning Opportunities
Reviewed and Processed as:	Exempt

Status Recommended by Reviewer(s): Approved   Protocol Expires: 2/7/2006

Principal Investigator(s

Lucille Ann Faulkner-Schn 1200 Hampton Court Edmond, OK 73034	Deborah J. Norris 226C HES Stillwater, OK 74078

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

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

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

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

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact Beth McTernan in 415 Whitehurst (phone: 405-744-5700, emct@okstate.edu).

Sincerely,

Sue C Jacobs

Sue C. Jacobs, Chair
Institutional Review Board

Table 1

Characteristics of Child Care Teachers

Characteristic	n	%
Age (years)		
Under 25	156	20.2
Age 26-35	222	28.8
Age 36-45	185	24.0
Age 46-55	149	19.3
Age 56 and older	60	7.8
No answer	6	
	778	
Gender		
Male	10	1.3
Female	765	98.7
No answer	3	
	778	
Ethnicity		
White	560	72.7
African-American	89	11.6
Native American	84	10.9
Latino	18	2.3
Other	19	2.5
No answer	8	
	778	

Table 1 (continued)

Time in Early Childhood Programs		
Less than a year	55	7.1
1-3 years	149	19.2
4-6 years	160	20.6
7 or more years	411	53
No answer	3	
	778	

Table 2

Educational Characteristics of Sample

Characteristic	n	%
Level of Education		
High School	183	23.6
Some College	262	33.7
Associate Degree	123	15.9
Bachelors Degree	173	22.3
Masters Degree	32	4.1
Doctorate Degree	2	.3
No answer	2	
	778	
Child Development Associate or Child Care Professional Credential		
With Credential	232	29.9
Without Credential	543	69.8
No answer	3	
	778	

Table 3

Program Characteristics

Characteristic	n	%	% State (2/2002)
Star Rating			
One Star	135	17.4	38
One Star +	95	12.2	11
Two Star	422	54.2	45
Three Star	126	16.2	6
	778		
Licensed Capacity of Children			
0-25	104	13.4	
26-50	248	31.9	
51-75	144	18.5	
76 and higher	282	36.2	
	778		
Ages of children			
Three year olds	465	59.8	
Four year olds	546	70.3	
Five year olds	418	53.9	
Classroom Size			
0-15 children	468	60.2	
16-30 children	308	39.6	
No answer	1		
	778		

Table 4

Science Survey Subscales

Attitude Towards Science and Science Teaching

10. I feel comfortable doing science activities in my early childhood classroom.

15.I am willing to get involved in children's scientific inquiries.

18. I am ready to learn and use scientific knowledge and scientific skills for planning hands-on science.

19. I like to discuss ideas and issues of science teaching with other teachers.

22. I am not afraid of science experiments in the classroom.

Beliefs Towards Science and Science Teaching

12. I feel comfortable with the level of scientific knowledge that I need to have to teach young children.

14. I hope to excite children about science in my classroom.

16. I enjoy reading resource books to obtain ideas about science activities for young children.

17. I am willing to spend time setting up materials for scientific exploration.

23. I enjoy collecting materials and objects to use in my science teaching.

24. I am interested in handling certain animals and insects to teach science activities.

25. I am comfortable using any classroom materials for science activities.

26. I do not mind the messiness created when doing hands-on science in my classroom.

30. I am familiar with the processes and ways that young children learn science.

31. I feel that young children cannot learn science until they are able to read.

Table 4 (continued)

Science Survey Subscales

Science Delivery Method

32. I make opportunities available for science inquiry and discovery in my classroom. Children have access to science area, sensory table or displays of natural objects, collections of items and exploration tools. In these situations the child controls the choices and actions.

33. I take advantage of teachable moments by asking science related questions and encouraging exploration of a science concept.

34. I make opportunities available for children to be involved in structured science activities: I choose specific items for exploration or experimentation. I give some direction to the children's activities.

Science Concept

35. I set up my classroom for science inquiry and discovery .

36. I give children a chance to do science activities where they group objects by physical properties or sensory attributes.

37. I provide children with life science activities, so they have experiences with plants and animals.

38. I offer science activities with include concepts of the earth such as weather, the seasons, outdoor environment, water, air and soil.

Table 5

Frequency of Survey Question Responses

Question	Strongly Disagree	Disagree Somewhat	Agree Somewhat	Strongly Agree
10. Comfortable doing science.	1.8%	3.4%	35.5%	59.4%
11. Fear unable to teach science.	42.2%	27%	26%	4.8%
12. Comfortable with knowledge.	2.2%	14.3%	49.8%	33.7%
13. Afraid can't answer questions	30.8%	27.7%	35.5%	6.%
14. Excite children about science	.9% .	9%	26.5%	71.6%
15. Willingly involved in science	.6%	1.4%	25.2%	72.8%
16. Enjoy science resources	1.5%	5.4%	32%	61.1%
17. Spend time setting up science	.6%	2.2%	28.6%	68.6%
18. Ready to learn and use skills	.9%	2.2%	34.4%	62.5%
19. Discuss science with teachers	2.7%	11.2%	44.5%	41.6%
20. Familiar with open questions	1.5%	7.9%	35.8%	54.8%
21. Prep takes more time	6.2%	21.2%	54%	18.6%
22. Not of afraid of experiments	2.6%	6.7%	32%	58.7%
23. Enjoy collecting materials	.6%	6.5%	40.2%	52.7%
24. Interest in animals and insects	7.3%	17.7%	40.9%	34.1%
25. Comfortable with materials	.3%	1.4%	22.8%	75.6%
26. Do not mind messiness	.9%	3.2%	26.2%	69.7%
27. Not appropriate for youngsters	76.9%	10.3%	5.4%	7.3%

Table 5 (continued)

Frequency of Survey Question Responses

Question	Strongly Disagree	Disagree Somewhat	Agree Somewhat	Strongly Agree
28. Comfortable with activities	1.2%	7.9%	41.1%	49.9%
29. Youngsters are not curious	75.9%	14%	6.8%	3.2%
30. Familiar with science learning	1.9%	14.6%	52.6%	30.9%
31. Can not read or learn science	82.7%	13.9%	2.0%	1.4%

Question	Not at All	Occasionally	Weekly	Daily
32. Inquiry and discovery	1.8%	21.5%	23.6%	53.1%
33. Ask discovery questions	2.7%	28.3%	24.6%	44.3%
34. Structured science	4.8%	33.1%	38.5%	23.6%
35. Set up for discovery	6.2%	31.3%	28.6%	33.8%
36. Physical properties	3.2%	23.5%	33.9%	39.4%
37. Life sciences	8.2%	46.3%	23.8%	21.7%
38. Earth sciences	2.7%	31.4%	30.2%	35.6%

Table 6

Associations for Science Attitudes, Beliefs, Knowledge and Science Activities

	Delivery Method	Content of Activity
	n=778	
Variables		
Attitude	.379*	.353*
Beliefs	.418*	.422*
Knowledge	.246*	.252*

* = p<.01

VITA

Lucille Ann Faulkner-Schneider

Candidate for the degree of

Master of Science

Thesis: CHILD CARE TEACHER'S ATTITUDES, BELIEFS, AND KNOWLEDGE REGARDING SCIENCE AND THE IMPACT ON EARLY CHILDHOOD LEARNING OPPORTUNITITES

Major Field: Early Childhood Education

Biographical:

Personal Data: Born in Oklahoma City, Oklahoma on January 29, 1957.

Education: Graduated from Edmond Memorial High School, Edmond, Oklahoma in May 1975; received Bachelor of Science degree in Early Childhood Education and Elementary Education from University of Oklahoma, Norman, Oklahoma in December 1980. Completed coursework in human development at the University of Oklahoma from 1980 to 1984 and the University of Central Oklahoma the fall semester of 1994. Completed the requirements for the Master of Science degree with a major in Early Childhood Education at Oklahoma State University in May, 2005.

Experience: Taught preschool at Oklahoma City Community College Lab School and Oklahoma City Public Schools from 1981-1988; employed as a child care licensing representative for the Oklahoma Department of Human Services from 1988-1992: as an Administrative Officer and Program Field Representative in the Division of Child Care from 1992 to the present.

Professional Memberships: National Child Care Resource and Referral Association, National Association for the Education of Young Children, and National Afterschool Association.

Name: Lucille Ann Faulkner-Schneider Date of Degree: May, 2005

Institution: Oklahoma State University Location: Stillwater, Oklahoma

Title of Study: CHILD CARE TEACHERS' ATTITUDES, BELIEFS, AND KNOWLEDGE REGARDING SCIENCE AND THE IMPACT ON EARLY CHILDHOOD LEARNING OPPORTUNITITES

Pages in Study: 66 Candidate for the Degree of Master of Science

Major Field: Early Childhood Education

Scope and Method of Study: The purpose of this study was to examine the relationship between child care teachers' attitudes, beliefs, and knowledge about science and determine associations with teacher provided classroom activities. Participants in the study responded to a survey that sought demographic information, requested responses to science beliefs and attitude statements (Strongly agree to strongly disagree), and sought frequency of science opportunities provided in the classroom(Not all to Daily). Subscales were created from the surveys to test correlation of beliefs, attitude, knowledge, delivery mode of science, and content of science activities.

Findings and conclusions: The more positive teachers' attitude about science and science teaching, the more frequent different types of science activities were provided in the classroom. Results also indicated the more knowledge teachers have of science and science teaching, the more frequent different types of science activities were provided. The more positive the teachers' beliefs about science and science teaching, the more frequent different types of science and science activities were provided.

ADVISOR'S APPROVAL:________________________________