PRESCHOOL TEACHERS' ATTITUDES TOWARD SCIENCE AND SCIENCE TEACHING

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ABSTRACT

PRESCHOOL TEACHERS' ATTITUDES TOWARD SCIENCE TEACHING AND ITS EFFECT ON FREQUENCY OF SCIENCE ACTIVITIES PROVIDED IN THE CLASSROOM

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This study aims to explore preschool teachers' attitudes toward science teaching and its impact on classroom practices through the frequency of science activities provided in the classroom. In addition, attitudes of preschool teachers' toward science were investigated in terms of affecting factors such as age, educational level, years of teaching experience, undergraduate course work on science, number of children in classroom, and the age group they work with.

The present research was conducted with 292 preschool teachers who work in public and private schools in different districts of Ankara during the second semester of 2006-2007 academic years. The data were collected by administering Early

Childhood Teachers' Attitudes toward Science Teaching Scale (ECTASTS). Analysis of the data indicated that there is a statistically significant relationship between preschool teachers' attitudes toward science and the frequency of science activities that they provide in the classroom. Also, all factors were found highly related with the teachers' attitudes toward science teaching and the frequency of science activities except for age and in-service training.

Keywords: Science Teaching, Attitudes toward Science Teaching, Preschool Teachers' Attitudes

ÖZ

OKUL ÖNCESİ ÖĞRETMENLERİNİN FEN EĞİTİMİNE YÖNELİK TUTUMLARI VE BUNUN SINIFTA UYGULANAN FEN ETKİNLİKLERİNİN SIKLIĞINA ETKİSİ

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Yüksek Lisans, Okul Öncesi Öğretmenliği Bölümü

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Bu çalışma, okul öncesi öğretmenlerinin fen öğretimine yönelik tutumları ve bu tutumların fen etkinliklerinin sınıf içinde uygulanma sıklığı ile ilişkisini belirlemeyi amaçlamaktadır. Ayrıca, okul öncesi öğretmenlerinin fen öğretimine yönelik tutumları yaş, eğitim düzeyi, deneyim süresi, lisans fen dersleri, sınıftaki çocuk sayısı ve eğitim verilen yaş grubu gibi faktörler açısından incelenmiştir.

Bu araştırma 2006-2007 eğitim-öğretim yılının ikinci döneminde Ankara'nın farklı bölgelerindeki devlet okulu ve özel okullarda çalışan 292 okul öncesi öğretmeni ile yürütülmüştür. Araştırmanın verileri Okul Öncesi Öğretmenlerinin Fen Eğitimine Yönelik Tutum Ölçeği ile toplanmıştır. Analiz sonuçları okul öncesi

öğretmenlerinin fen öğretimine yönelik tutumları ile fen etkinliklerinin uygulanma sıklığı arasında istatistiksel olarak anlamlı bir ilişki bulunduğunu göstermiştir. Ayrıca, yaş ve hizmet içi eğitim hariç tüm faktörler okul öncesi öğretmenlerinin fen öğretimine yönelik tutumları ve fen etkinliklerinin uygulanma sıklığı üzerinde etkili bulunmuştur.

Anahtar Kelimeler: Fen Öğretimi, Fen Öğretimine Yönelik Tutumlar, Okul Öncesi Öğretmenlerinin Tutumları

To My Mother

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This master study has provided me many contributions in my personal and professional life. Also, through this study I understand and appreciate the process of this degree.

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CHAPTER I

INTRODUCTION

1.1. Background of the Study

The knowledge about early childhood years has been significantly expanding so people become aware of the importance of early childhood education. Due to this awareness, not only working mothers but also the mothers who do not work send their children to schools or child care centers so that children can receive early childhood education. Before parents have only dealt with how their children are cared in schools or child care centers. However, today, parents have more knowledge about early childhood education and they deal with what their children learned and how they develop rather than how they are cared. As a result of this increase in knowledge, educational experiences gained during early years of life have gained critical importance for both parents and educators. The early experiences of children have important effects not only on their later school life but also throughout their whole life (Bredekamp & Copple, 1997). In fact, according to Yoon and Onchwari (2006), rich early experiences play an important role in the development of rich brains, and science is a subject that "provides great opportunities for the development of the brain." (p. 419). When children engage in science experiences using different scientific thinking skills, they use their brain's capacity at a maximum level for learning (Bredekamp & Copple, 1997). For these reasons, science is one of the

important concepts in early childhood education. Science experiences provide opportunities that develop receptive and expressive language skills (Conezio & French, 2002). These experiences not only provide opportunities for development but also introduce fundamental science concepts to children (Hadzigeorgiou, 2001).

For young children, science is not an academic school subject; actually it is a part of everyday life. Through science young children become aware of the world around them and gain science inquiry skills like wondering, questioning, exploring and investigating through a wide variety of science experiences that introduce fundamental science concepts (Tu, 2006). Therefore, science should be a part of early childhood curricula in order to make it more meaningful to young children. According to Eshach and Fried (2005), even very young children should be exposed to science due to several reasons. Firstly, children like observing nature and thinking about it. Also, when children are exposed to science, they develop positive attitudes toward science. In addition, early exposure to scientific phenomena results in better understanding of scientific concepts later in life. Another reason is that scientifically informed language used in the early years affects the development of scientific concepts. Furthermore, children can understand scientific concepts and make judgments scientifically. The last reason is that children develop scientific thinking through science.

Young children have an innate sense of curiosity and they are biologically prepared to learn about how the world works (Ross, 2000). Children begin to gain mathematical and scientific concepts in early childhood period. With their innate sense of curiosity, children explore their surroundings by observing, predicting, and

communicating. In the first years of life, these natural behaviors of children support their cognitive and language development and increase their interest in science later in life. For these reasons, providing a wide range of experiences are helpful in improving children's curiosity (Akman, Üstün, & Güler, 2003; French, 2004). By using children's curiosity, teachers can increase children's knowledge about scientific concepts and improve their scientific thinking skills (Aktaş-Arnas, 2002).

According to Science Start! Curriculum, children's learning about the everyday world can be enriched with adult guidance (French, 2004). Similarly, Jones and Courtney (2002) state that everyday experiences provided by teachers are the source of children's early science understanding. According to Cho, Kim and Choi (2003), a critical factor in science education for young children is the attitudes of teachers toward science. Teachers' attitudes toward science teaching have an effect on both teachers' understanding of science and their classroom practices. Children's long term attitudes toward science have been influenced by the attitudes of teachers whom children gain their first science experiences (Koballa & Crawley, 1985; Harlan & Rivkin, 2004). Today, children experience many things for the first time in preschools with the help of early childhood educators. Hence, it would not be incorrect to say that attitudes of early childhood educators toward science affect children's attitudes toward science via the way of science experiences that they provide throughout daily program. According to Conezio and French (2002), due to their negative science education experiences, many early childhood educators are hesitant and unwilling to teach science in their classrooms. For these reasons, describing the attitudes of early childhood teachers toward science is important in

terms of science experiences provided in the classroom and the formation of children's attitudes toward science. Therefore, this study focused on the attitudes of preschool teachers toward science and science teaching and the frequency of science activities that they provide in the classroom.

An important issue in describing teachers' attitudes is the affecting factors. Previous studies have shown that teachers attitudes are related to many factors, such as age (Aljabber, 2004; Dowdy, 2005), educational level (Hallam & Ireson, 2003), years of teaching experience (Chen & Chang, 2006; Sadık, 2006), course work and background on subject (Cassidy, Buell, Pugh-Hoese, & Russell, 1995; Cho, 1997), in-service training (Jarvis & Pell, 2004; Sadık, 2006), school type (Hallam & Ireson, 2003), school capacity or number of children (Cho, 1997; Lee & Loeb, 2000), and grade level or age group (Cho, 1997; Vartuli, 1999). These studies have investigated teacher attitudes toward ability grouping (Hallam & Ireson, 2003), gender role attitudes (Lasonen, 1991), computer use in the classroom (Sadık, 2006), developmentally appropriate practice (Vartuli, 1999) and science and science teaching (Cho, 1997).

Although the results of previous studies investigating the effect of age, educational level, teaching experience, undergraduate science course and science background are conflicting, these variables are worth exploring due to some reasons. For instance, younger teachers who have newly graduated and are aware of the importance of their attitudes on children are likely to hold more positive attitudes toward science. On the other hand, older teachers who have more years of teaching experience are more likely to have more positive attitudes toward science because

they might have faced with the difficulties related to their attitudes toward science over the years and might have changed these attitudes. Also, teachers with higher educational levels are expected to hold more positive attitudes because of their awareness about their attitudes and its impact on children. Furthermore, the teachers who have pleasant experiences in science courses and science related activities are likely to develop and hold positive attitudes toward science; whereas the teachers who have unpleasant experiences in these course and activities are likely to develop and hold negative attitudes toward science. The results of previous studies that have explored the impact of in-service training, type of school, number of children and age group that teachers work with are consistent with each other. These factors were found effective on teachers' attitudes in all research. In the present study, they are also expected to be related with teachers' attitudes toward science.

1.2. Purpose of the Study

The main purpose of this study is to investigate and describe the attitudes of preschool teachers toward science and the frequency of science activities provided by the teachers in the classroom and the relationship between these attitudes.

The second purpose of this study is to explore the underlying factors that influence teachers' attitudes toward science and science teaching and the frequency of science activities provided in the classroom. This study aims to analyze whether age and educational level of teachers, years of teaching experience, undergraduate course work on science and number of science activities teachers have completed, in-service training on science, types of schools, number of children in classroom, and

the age group they work with are related to early childhood educators' attitudes toward science and the frequency of science activities.

In this study, survey method was used to assess the attitudes of preschool teachers toward science. The attitudes of early childhood education teachers were investigated through Early Childhood Teachers' Attitudes toward Science Teaching Scale (ECTASTS) developed by (Cho, Kim & Choi, 2003) and revised by (Schneider, 2005).

1.3. Research Questions and Hypotheses

The research questions raised as follows:

1) Is there a relationship between preschool teachers' attitudes toward science and the frequency of science activities provided in the classroom?
2) Are teachers' ages related to their attitudes toward science and frequency of science activities?
3) Are teachers' educational levels related to their attitudes toward science and frequency of science activities?
4) Are teachers' years of teaching experience related to their attitudes toward science and frequency of science activities?
5) Do teachers who participated in undergraduate course work on science differ from the teachers who did not participate in undergraduate course work on science in terms of their attitudes toward science and the frequency of science activities provided in the classroom?
6) Are number of science related activities that teachers completed related to

their attitudes toward science and frequency of science activities?

7) Do teachers who participated in in-service training on science differ from the teachers who did not participate in in-service training on science in terms of their attitudes toward science and the frequency of science activities provided in the classroom?
8) Do teachers who work in private schools differ from the teachers who work in public schools in terms of their attitudes toward science and the frequency of science activities provided in the classroom?
9) Do teachers who work with fewer numbers of children differ from the teachers who work with more number of children in terms of their attitudes toward science and the frequency of science activities provided in the classroom?
10) Are children's age related to teachers' attitudes toward science and frequency of science activities?

The following hypotheses form the basis of this investigation:

Hypothesis 1: There will be a significant correlation between early childhood education teachers' attitudes toward science and the frequency of science activities provided in the classroom.

Hypothesis 2: There will be a significant difference in early childhood education teachers' attitudes toward science and frequency of science activities in terms of age of the teachers.

Hypothesis 3: There will be a significant difference in early childhood

education teachers' attitudes toward science and frequency of science activities with respect to the educational level of teachers.

Hypothesis 4: There will be a significant difference in early childhood education teachers' attitudes toward science and frequency of science activities in terms of years of teaching experience.

Hypothesis 5: There will be a significant difference in early childhood education teachers' attitudes toward science and frequency of science activities in terms of undergraduate course work on science.

Hypothesis 6: There will be a significant difference in early childhood education teachers' attitudes toward science and frequency of science activities with respect to the number of science activities they have completed themselves.

Hypothesis 7: There will be a significant difference in preschool teachers' attitudes toward science and frequency of science activities in terms of in-service training on science.

Hypothesis 8: There will be a significant difference in preschool teachers' attitudes toward science and frequency of science activities in terms of school type.

Hypothesis 9: There will be a significant difference in early childhood education teachers' attitudes toward science and frequency of science activities in terms of number of children in classroom.

Hypothesis 10: There will be a significant difference in early childhood education teachers' attitudes toward science and frequency of science activities in terms of the age group they work with.

1.4. Significance of the Study

Many studies showed that the early years and teachers have a considerable effect on children not only later in school life but also throughout their lives (Phillips, McCartney & Scarr, 1987; Vandell & Corrasanti, 1990; and Bredekamp & Copple, 1997; Wylie & Thompson, 2003). According to Koballa and Crawley (1985), attitudes toward science are learned predispositions. Therefore, they have significant effects on children's future behaviors. Also, teachers reflect their attitudes toward science while they are teaching by the way of their teaching style. Some other studies are about developing teacher attitude scales toward science, students' and teachers' attitudes toward science, modification of teachers' attitudes, teachers' attitudes toward science and its effect on teaching practices (Cho, et al., 2003; Pauson, 2005; Dowdy, 2005; Schneider, 2005). However, the present study investigates the attitudes of preschool teachers toward science and the effect of these attitudes on the frequency of science experiences provided in preschool classrooms.

In Turkey, there are some studies on science in early childhood and teacher attitudes. These studies generally focus on the planning and application of science activities, efficacy of teachers in science activities, teaching methods, thoughts about science, and the relationship between pre-service teacher attitudes toward science and their understanding of science (Bilaloğlu, Aslan, & Aktaş-Arnas, 2006; Ayvacı, Devecioğlu & Yiğit, 2002; Karaer & Kösterelioğlu, 2005; Hamurcu, 2006; Çakmak, 2006). However, analysis of the literature indicated that there were no studies about early childhood educators' attitudes toward science and the impact of these attitudes on the frequency of science activities provided in the classroom in Turkey.

Therefore, this study is important to fill the gap in this field. Also, the present study provides information about the effect of teaching experience, undergraduate course work related to science, number of science activities that teachers completed, number of children in the classroom and age group that teachers work with on preschool teachers' attitudes toward science and the frequency of activities provided in the classroom.

Preschool teachers play a significant role on young children. The negative attitudes of teachers toward science may affect the children's attitudes toward science negatively. When the effect of early years in children's life is considered, children can be influenced from their teachers' attitudes toward science and may show negative attitudes toward science not only in early childhood years but also later in school life. In addition, the findings of this research may be useful for teacher training programs and future research.

1.5. Definitions of Terms

Attitude: Attitude can be defined as learned predisposition in responding to a person or an object in a positive or negative manner (Fishbein & Ajzen, 1975).

Attitude toward Science: Attitude toward science can be defined as a general and enduring positive and negative feeling about science (Koballa & Crawley, 1985) and science teaching that influences the way science is taught or even whether it is taught or not (Watters & Ginns, 1995).

Science: Science is an activity that involves experimentation, creativity, and problem solving skills for young children to understand the world around us (Chaille

& Britain, 2003).

Science Activities/Experiences: Science activities or experiences are opportunities for children to observe, explore, and investigate the natural or manmade materials in and outside of the classroom to make sense of the world around them. According to Lind (2000), these activities/experiences are grouped under three categories as naturalistic, informal and structured experiences.

1. Naturalistic experiences are child initiated activities that provide opportunities to observe, explore and discover how the world works throughout daily activities.
2. Informal learning experiences are not preplanned activities that are initiated by teachers to take advantage of teachable moments while children engage in naturalistic experiences.
3. Structured learning experiences are preplanned activities by teachers to work together with a child or groups of children.

Early Childhood Teacher/Early Childhood Educator/Preschool Teacher: Early childhood teacher refers to the teacher working with 3 to 6 year-old children in public and private schools. The term of early childhood teacher is used interchangeably with early childhood educator and preschool teacher in the present study.

1.6. Limitations of the Study

This study contains a few limitations due to the nature of the research method. Because of administrating a survey, a low return rate is an important limitation that may affect the study. This problem was handled by the nature of the questionnaire that was well prepared in terms of content and format so that it can be easily read and followed by the participants decreasing the risk of being exhausted. Also, considering the low return rate, questionnaires were sent to 400 teachers who worked at different preschools in different districts of Ankara. In order to reduce this problem, the questionnaires have been sent to the administrators and administrators ask teachers to fill the questionnaire forms. The researcher tried to reduce the Location threat by administering the survey out of the classroom and in similar settings. Another limitation is that the instruments were only distributed in one city, Ankara. This may limit the generalizability of the study. However, this limitation was reduced by delivering the instrument to both public and private preschools located in different districts of the city. The frequency of the science activities provided by preschool teachers was investigated by ECTASTS. That is, this knowledge is self-reported. The lack of classroom observations is another limitation of this study.

CHAPTER II

REVIEW OF THE LITERATURE

This chapter reviews the theoretical and empirical literature about science teaching in early childhood education and teachers' attitudes toward science and science teaching. Exploring the literature has revealed that teachers are important agents not only in the acquisition of science concepts, but also in the development of attitudes. The teachers' role becomes evident through exploration of the theories about concept development and attitude formation. Therefore, in the first part of the chapter, constructivism and Vygotsky's social theory of cognitive development related to science in early childhood education, importance of science education, goals of science education and role of teacher in science education are presented accordingly. The second part of the chapter reviews the concept of attitude, attitude formation and theories of attitudes explaining how attitudes are formed and changed. The third and last part of the chapter provides a review of the literature related to attitudes toward science and science teaching.

2.1. Constructivism in Science Education and Vygotsky's Social Cognitive Development Theory

The Constructivist approach to science education in early childhood focuses on the children's ways of thinking when they interact with the physical and natural world (Chaille and Britain, 2003). According to constructivism, while children are constructing knowledge internally by interacting with the world around them, they learn how the world works and make meaning of it. The Constructivist view implies that there must be experiences for children to build knowledge from these experiences (Harlan and Rivkin, 2004).

As a constructivist, Vygotsky believed that development depends on both natural and social forces. He believed that social forces are necessary for the development of higher mental functions in concept development. He gave more emphasis on the role of teaching and social interaction in the development of science concepts. Children become aware of their basic mental functions and are able to use them in their independent thinking and actions through social interaction with teachers (Howe and Jones, 1998).

According to Vygotsky, there are two kinds of information. These are everyday or spontaneous concepts and scientific concepts. Everyday concepts are the concepts that children develop on their own from experience. Unlike everyday concepts, scientific concepts are those that children learn in schools. The concepts in math and science are included in the category of scientific concepts. Vygotsky studied the development of scientific concepts in order to improve the instruction in schools. According to Vygotsky, children integrate their everyday concepts into

scientific concepts through the process of conceptual change with the help of teachers (Crain, 1992). Vygotsky believed that the people around children are important factors because children construct their knowledge by the help of others around them and move to higher levels of thought (Harlan and Rivkin, 2004; Seefeldt, Galper, 2007).

2.1.1. Zone of Proximal Development

Vygotsky described the zone of proximal development as the distance between the actual developmental level of the child and the potential developmental level that can be reached under adult guidance or more capable peers (Crain, 1992). He claims that children should participate in tasks that are just beyond the level of their current ability and can be performed with the guidance of teacher or more advanced peers. According to Vygotskian perspective, the role of teacher is to set tasks that are just beyond the children's current level and help children to reach higher levels of development (Howe and Jones, 1998).

2.2. Science in Early Childhood Education and Concept Development

Science is generally viewed by people as information about discoveries, technological achievements or some content knowledge that people memorize. However, from preschool to college years, science is seen as a way of thinking and acting rather than learning or memorizing a body of knowledge. Through the medium of science, children try to discover the nature of things and investigate how

the everyday world functions (Lind, 2000).

Young children are attracted by the fascinating natural world. They like exploring how things work, planting seeds, and studying animals. Hence, early childhood classrooms are appropriate places for young children to make science explorations and make sense of the world around them through everyday experiences provided by preschool teachers (Jones and Courtney, 2002).

Concept development begins as early as infancy. Babies explore the world with their five senses through looking, touching, smelling, hearing and tasting. They want to know all about their environment with their innate sense of curiosity. Then, when children learn to walk, they are free to explore and discover on their own. They begin to learn ideas of size, shape, weight, space, and time sequence through everyday experiences. Moreover, toddlers learn to sort things according to their properties through free exploration. As children enter preschool and kindergarten, although they use exploration as a first step in dealing with new situations, they begin to apply basic concepts for collecting and organizing data to answer a question by using science process skills (Lind, 2000).

While investigating the world around them to discover the content of science, children use science process skills. Science process skills can be classified under three subtitles as basic science process skills, intermediate science process skills, and advanced science process skills. According to Lind (2000), basic science process skills of observing, comparing, classifying, measuring, and communicating are more appropriate science skills for preschool and primary school children rather than intermediate process skills of inferring and predicting, and advanced process skills of

hypothesizing and defining and controlling variables.

Improving basic science process skills help children not only to cope with the events in daily life, but also help them in future science and mathematic studies (Lind, 2000).

2.3. Basic Science Process Skills

Basic science process skills are those that are most appropriate for preschool and primary school students and allow them to process new information through concrete experiences (Lind, 2000).

Observing

Observation is the most fundamental process in scientific thinking. It is the first step for gathering information to describe something or to solve a problem (Lind, 2000). While observing, children use one or more of the five senses to notice characteristics of objects and events. Moreover, children need to be provided with ample opportunities to observe the properties of objects such as size, shape, color and a texture (Howe and Jones, 1998). According to Harlen (1996), the means of observation in the early stages is to use more than one of the senses to make observations and identify the obvious characteristics of objects or events.

Comparing

Comparing is the next process that builds on the process of observing. After developing skills in observation, children begin to compare the similarities and

differences in the objects they have observed (Lind, 2000).

Classifying

After comparing the objects around them, children begin to sort objects according to their certain characteristics, hence, classifying develops. Younger children classify objects according to one property. However, when children grow older, the classifying process improves and they begin to sort objects according to two or more characteristics (Lind, 2000). Classifying not only includes using other people's classifying systems but also creating and using new systems (Howe and Jones, 1998).

Measuring

Measuring emerges when the skills of quantifying develops. Measuring includes numbers, distances, time volumes and temperature. Children make quantitative observations by comparing objects with one another or to a unit of measure. Measurement can involve standard or nonstandard units. Nonstandard units are often used in early childhood measurement (Howe and Jones, 1998; Lind, 2000).

Communicating

Communicating can be defined the skill to describe a phenomenon in early childhood. Children can communicate their ideas and descriptions through different ways such as pictures, dioramas and graphs. Through communication skills, children can describe the main points of objects or events, what they have observed, and what

they have discovered (Harlen, 1996; Lind, 2000).

2.4. Science Content Areas

Children use science process skills in order to process information from many areas. There are four main science areas in early childhood: Life Science, Health Science, Physical Science, and Earth, Space and Environmental Science (Lind, 2000).

Life Science

Life science includes the exploration of the senses, investigation of living things such as plants and animals and non-living things that can be any object in the environment, the characteristics of organisms, the life cycle of organisms, organisms and their environments, and classification of any organism or an object (Allen, 2002).

Health Science

Health science includes the study of the human body, exploration of body parts and the relationship between these parts, body systems, food and nutrition in early childhood (Lind, 2000).

Physical Science

Physical science includes the study of properties and description of objects and materials, energy, light, heat, movement and change in early years (Allen, 2002).

Physical science helps children to become aware of the sun, the stars, and the planets. Through physical science children have the opportunity to observe the changes in speed, the action of magnets and the pull of gravity (Howe and Jones, 1998).

Earth Science

Earth science includes the exploration and understanding of earth materials, objects in the sky, changes in the earth and sky (Lind, 2000), air and water, sand and soil, day and night, and the seasons (Allen, 2002).

2.5. Science Activities/Experiences for Young Children

Children acquire fundamental science concepts through active involvement with their environment and wide range of science experiences. There are three kinds of science experiences for children: naturalistic experiences, informal learning experiences, and structured learning experiences.

Naturalistic Experiences

Naturalistic experiences are child initiated activities that provide opportunities to observe explore and discover how the world works throughout daily activities. The role of the preschool teacher in naturalistic experiences is to provide an encouraging environment in which children can find many things to observe and investigate.

Informal Learning Experiences

Informal learning experiences are unplanned activities that are initiated by teachers to take the advantage of teachable moments while children are engaging in naturalistic experiences.

Structured Learning Experiences

Structured learning experiences are preplanned activities by teachers to work together with a child or groups of children (Lind, 2000). Open-ended, free choice science activities enable children to discover their own ways of inquiry. Children's cognitive and language development are supported through hands-on, personal science experiences. As a result of these experiences, children learn to form mental representations of complex phenomena, process complex language, and to communicate their learning to other people (French, 2004).

2.6. Importance of Science Teaching

Children begin to learn mathematics and science concepts in the early childhood years. This is due to their innate sense of curiosity and eagerness to learn about everything in their surroundings. While children actively explore their environment, they use their senses to observe, to classify and to make predictions. In the early years of life, opportunities for science experiences increase children's interest in science. Ample experiences through senses help children to be better observers (Akman, Üstün, & Güler, 2003). In addition to these merits, children gain many skills that enable them to solve problems that they may encounter in daily life

through the science learning process (Akman, 2003). In early childhood science learning, children gain a strong basis in science and learn to think scientifically by investigating, observing and exploring. After children gain their first experiences in science, their interest in science continue throughout their life according to their level of development (Aktaş-Arnas, 2002). In all, science supports children's learning and development (French, 2004).

There can be many reasons for science education in the preschool years. The most important of these reasons are the benefits of science education for children.

The Benefits of Science Noted by Head Start Teachers are:

1. Science responds to children's need to learn about the world around them.
2. Children's everyday experience is the foundation for science.
3. Open-ended science activities involve children in a wide range of developmental levels.
4. Hands-on science activities let teachers observe and respond to children's individual strengths and needs.
5. The scientific approach of trial and error welcomes error and interprets it as valuable information, not as failure.
6. Science strongly supports language and literacy.
7. The problem solving skills of science can be easily generalized to social situations.
8. Science demonstrations help children become comfortable in large group conversations.

9. Science connects easily to other areas, including center-based play, math, artistic expression, and social studies. (Conezio and French, 2002, p.16).

2.7. Goals of Science Teaching

The major goal of the science curriculum is to develop a knowledge base about the world. Another goal is to support intellectual development by fostering receptive and expressive language and self regulation skills. These skills are needed in identifying and analyzing a problem and reaching a solution. When children are provided meaningful activities, they also have the opportunity to practice and develop their social skills (Conezio and French, 2002). According to Turkmen and Bonnstetter (1999), the main purpose of science education is to develop positive attitude towards science and scientist.

According to Howe and Jones (1998), there are several goals in science teaching, some of them are listed below. Children participating in science activities are:

1. Able to develop and maintain curiosity about the world around them.
2. Able to observe and explore their environment and organize those experiences.
3. Able to develop the technical and intellectual skills needed to carry out further study on science.
4. Able to build an experimental basis for understanding of important concepts in science.

5. Able to relate what they learn in school to their own lives.
6. Able to enjoy science and develop positive attitudes.
7. Able to ask questions about objects and events in the environment.
8. Able to plan and conduct a simple investigation.
9. Able to use simple equipment and tools to gather data.
10. Able to use data to make reasonable explanations.
11. Able to communicate investigations and explanations.

Taking into account all these goals in science education, the main goal of science education is to educate scientifically literate people.

Scientific literacy is defined by Science for All Americans as;

> (1) the awareness that science is a human enterprise with strengths and limitations,
>
> (2) understanding the key concepts and principles of science,
>
> (3) a familiarity with the natural world and recognition of its diversity and unity,
>
> (4) the ability to use the knowledge for individual and social purposes. (Howe and Jones, 1998, p. 11).

Scientific literacy implies that scientific understanding should be part of everyone's education. Scientific literacy means being able to look at something in a scientific way by thinking whether it makes sense with the related events. In addition, scientific literacy can be defined as "functioning with confidence in relation to the scientific aspects of the world around." Scientific literacy can be achieved with

the acquisition of scientific knowledge, skills, values and attitudes (Harlen, 1996, p. 7).

National Standards for Science Education for Kindergarten to Fourth Grade Teaching (as cited in Ovens, 1999, p.8) suggest that

> science education should have a different kind of goal: science literacy. Science literacy involves being able to use science processes and content knowledge to enjoy, understand and act upon situations encountered in real life as well as those encountered through science study. Science process skills of observation, counting, measuring, comparing and classifying may be learned and practiced in the course of daily activity in developmentally appropriate early childhood settings.

2.8. Role of Teacher in Science Teaching

Harlan and Rivkin (2004) define four teaching roles for teachers in science teaching : Facilitator, catalyst, consultant and model.

The first role of the teacher in science teaching is a facilitator. As a facilitator, the teacher provides a learning environment in which children have an extensive range of opportunities to observe, explore and discover the nature of materials and objects. The teacher plans activities, collects necessary materials, and performs experiments with children. Furthermore, the teacher as facilitator can tolerate the messiness around the class caused by children's works in science experiences. She is also willing to take new risks through new experiences in science and she has the

ability to learn from mistakes.

The second role of teacher in science teaching is catalyst. The teacher helps children to be aware of their intellectual power and helps them to see themselves as thinkers and problem solvers. In addition, a teacher as a catalyst establishes a positive and encouraging environment in which she feels the excitement of discovery as children do.

Teacher plays a role of consultant in science teaching. As a consultant, teacher carefully observes children, listens to their conversations, and answers their questions, while they engage in scientific exploration. Also, the teacher can give some information as learning cues and ask questions to focus children's attention to the relevant parts of a problem. Then, each child is given time to reflect his/her ideas about a problem or solutions of a problem.

The last role of the teacher in science teaching is model. Curiosity, appreciation, persistence, and creativity are the characteristics of successful learners and these traits are learned best by a model. Teachers help children to gain these traits by sharing both their personal experiences and thought process with their students.

2.9. Attitudes

Attitude is a broad term and many definitions of attitudes are given in the literature. For instance, attitudes are defined as individual mental processes that determine "the actual and potential responses" of an individual in a social context (Fishbein, 1967, p. 6). Allport and Petty, Priester, & Wegener (as cited in Bohner &

Wanke, 2002, p. 5) defined attitudes as "enduring concepts which are stored in memory and can be retrieved accordingly". For Bogardus (1973) attitude is a tendency to act toward something in the environment with a positive or negative manner. According to Fishbein (1967) attitude is a state of mind of an individual toward a value. Attitude is defined as "an enduring pattern of evaluative responses towards a person, object, or issue" in a Dictionary of Psychology (Colman, 2006, p. 63). Finally, attitude can be defined as a learned predisposition in responding toward a person or an object with a positive or negative manner (Fishbein & Ajzen, 1975) as it has been used in the present study.

Attitude is defined by many theorists from different aspects. However, there are some certain characteristics that are stressed in different definitions. The characteristics identified are that attitude:

1) is a mental set or disposition,
2) is a readiness to respond,
3) has a physiological basis,
4) is permanent,
5) has a nature, and
6) has an evaluative character.

Attitudes are important and useful concepts because of several reasons. Some of these reasons, which stress the importance of attitudes, reported by Oskamp (1977) are :

1) Many different behaviors can be the summary of a single attitude. For instance, the behavior of spending time with family, comforting them, and

doing things for them can be the summary of one's love of his/her family.

2) An attitude may be cause of one's behavior toward a person or an object.
3) A single attitude can be the cause of different behaviors so attitude can be used in the explanation of a person's behavior.
4) Attitudes are worth studying even though they are not related to a person's behavior since attitudes reflect the way a person perceives the world around him.
5) Attitudes may explain the unconscious determinants of a behavior.
6) Formation of attitudes can be affected from both hereditary and environmental factors. Therefore, attitudes play a connecting role in the controversy between heredity and environment that influence behavior.

Another common view about attitudes is that they have three components; cognitive component, affective (emotional) component and behavioral component.

1) Cognitive component includes the ideas and beliefs of a person about the attitude object.
2) Affective (emotional) component includes the feelings and emotions of a person toward the attitude object.
3) Behavioral component includes the action tendencies and responses of a person toward the attitude object (Albarracin, Jonhson, Zanna, 2005).

2.10. Attitude Formation

Attitude formation can be described as an "initial change from having no attitude toward a given object to having some attitude toward it, positive, negative, or in-between" (Oskamp, 1977, p.120). There are two main factors that affect the formation of attitudes. These are genetic and environmental factors (Bohner and Wanke, 2002).

Genetic and Physiological Factors

Genetic factors play a role in the development of predispositions for the formation of particular attitudes. For instance, one's level of aggressiveness can be helpful in determining one's attitudes of hostility toward other people. Age, illness and the effect of some drugs are the physiological factors that influence attitude formation. Old age is found to affect new attitudes On the other hand, certain illnesses are related to particular attitude states. For example, increased optimistic attitudes were observed in people with tuberculosis. It is also known that some drugs have calming and anxiety reducing effects (Oskamp, 1977).

Direct Personal Experience

Direct personal experience with the attitude object is the most fundamental way that affects attitude formation. For instance, a baby who is given a fruit which has a sweet and delicious taste for the first time is apt to like it. After this experience, a baby acquires an attitude toward that fruit and this attitude can be strengthened through further experience. Similarly, children who are provided engaging science

learning experiences as early as they enter the preschool is likely to form positive attitudes toward science (Oskamp, 1977). According to Zanna, Olson, and Fazio (1980), attitudes that are based on direct experience predict behaviors better than the attitudes that are formed in other ways. Since direct experience provides more information about the attitude object for the person. That is, having more information about the attitude object results in more attitude about the object.

2.11. Theories of Attitude

Attitude theories are concerned with the basic nature of attitudes, how attitudes are formed, and how they can be changed. According to resources there have been several theories that try to explain the formation of attitudes. These theories can be examined under four titles as Learning Theory, Balance Theory, Cognitive Dissonance Theory, and Self-Perception Theory.

Learning Theory

Learning theory is based on the idea that acquisition of attitudes and attitude change results from the learning process. That is, attitudes are formed by the way of classical conditioning, operant conditioning and modeling (Oskamp, 1977). Doob (1947) defines attitude as an unobservable response toward an object that occurs before an overt response. He claims that a person first acquires an attitude toward a given stimulus and then he learns to give a response to the attitude that has just acquired. According to classical conditioning model, attitudes develop as conditioned responses to an attitude object. If an object is paired repeatedly with anything that

produces a favorable or unfavorable response, the object begins to produce the same favorable or unfavorable response (Petty and Cacioppo, 1996). Operant conditioning model gives much stress to reinforcement in explaining attitude change because reinforcement is seen as the main principle in all learning theories. In attitude formation, a reinforcer can be a verbal or nonverbal signs of approval or disapproval and it can be a reward or a punishment (Oskamp, 1977). In modeling or observational learning, people learn which responses are rewarded and which are not by observing other people's behaviors. That is, the behavior of the model influences the attitude and behavior (Bohner & Wanke, 2002).

Balance Theory

Balance theory was developed by Fritz Heider. Heider's theory deals with the way that how people perceive other people, objects, and ideas in their environment (Oskamp, 1977). According to Heider (1946), attitudes toward persons affect causal unit formations and causal unit formations affect the person. Heider also states that "An attitude towards an event can alter the attitudes towards the person who caused the event, and, if the attitudes towards a person and event are similar, the event is easily ascribed to the person." He concluded that a balance state occurs when "the attitudes towards the parts of a causal unit are similar" (Heider, 1946, p. 107). Balance theory includes three elements and these elements are the perceiver, P; another person, O; and an impersonal entity, X that can be some object, idea or event. There can be two types of relationship between elements. The first type of relationship is a sentiment relationship that can be either positive or negative. The

second type is a unit relationship. Like the sentiment relationship, it can be either positive or negative. In balance theory, there can be eight possible patterns. Whether the pattern is balanced or unbalanced are determined by the characteristics of the relationships. In a balanced state, no cognitive stress is found in the perceiver's view of the system and the relationships are in a harmony. That is, if all three elements are positive or all of them are negative, balance state exists. Therefore, the system is stable and it resists change. On the other hand, in an unbalanced state, the system is not stable and it produces tension. That is, all three elements do not share the same dynamic character. As a result, the perceiver is forced to change his attitudes in order to maintain a state of balance (Albarracin, et all., 2005; Insko, 1967; Oskamp, 1977).

Cognitive Dissonance Theory

Leon Festinger's theory deals with relationships between cognitive elements. According to Cognitive Dissonance Theory an individual has cognitive elements about himself, his behaviors in past, his beliefs and attitudes, and his environment (Oshikawa, 1968). Three kinds of relationship that can exist between two cognitive elements are dissonant, consonant and irrelevant (Fishbein and Ajzen, 1975). If one cognitive element is followed from another, they are consonant. Conversely, if one cognitive element is not followed from another, they are dissonant. Thus, dissonance can be caused by logical inconsistency. When elements are dissonant, a psychological tension arouses and this state is referred to as cognitive dissonance. An individual in the state of cognitive dissonance is forced to change the dissonant cognitive element in order to reduce the dissonance (Oshikawa, 1968). According to

Festinger (1957), decision making, forced compliance, voluntary and involuntary exposure to dissonant information, and disagreement with other persons are the four basic situations that cause cognitive dissonance. Cognitive dissonance may be eliminated or reduced through increasing an individual's evaluation about the chosen alternative or decreasing an individual's evaluation about the unchosen alternatives.

Self-Perception Theory

Self-Perception Theory was proposed by Bem as an alternative to Cognitive Dissonance Theory. Bem proposes that the way that a person makes judgments about his internal process such as beliefs or attitudes is the same way that he makes judgments about other people's beliefs or attitudes on the basis of observable behavior (Woodyard, 1973). A person's attitude statements is seen as inferences from his observations about her own behavior and "its accompanying stimulus variables". According to Bem, children learn to draw these kinds of inferences. Although parents seem to act as if they like the things that their children like and avoid the things that their children dislike, children are still made to do the things that they dislike. In other words, children are taught by parents that attitudes can be inferred from behaviors (Petty and Cacioppo, 1996). According to Bem's theory, attitude change occurs in reaction to self-observed behaviors that are combined with observed external cues showing whether or not the behavior is likely to be valid. Bem's theory differs from other theories in that it depends on the principle that attitude change results from behavior change (Oskamp, 1977).

2.12. Related Research Studies

Related research studies provide the review of previous studies about students' attitudes toward science, pre-service teachers' attitudes toward science, and science in early childhood education and teachers' attitudes toward science and science teaching.

Research Related to Students' Attitudes toward Science and Science Teaching

Morrel and Lederman (as cited in Papanastasiou, 2002) stated that students' attitudes toward science are shaped by many variables such as the teacher's learning environment, self concept, peers and parental influence.

Yeşilyurt, Kurt, and Temur (2005) mentioned that the primary school students showed positive attitude towards the science laboratory. The research conducted by Altınok (2004) investigates the fifth grade elementary school students' attitudes toward the science course and influence of gender and achievement on their attitudes. The study was conducted with 1042 fifth graders at elementary schools. The attitude of students towards science course was found to be positive. In general, gender does not have a significant effect on the students' attitudes toward science course, whereas achievement has a significant affect on their attitudes. However, the findings have revealed that achievement is not a remarkable factor for girls to desire to continue further studies in the field of science and girls were found less eager than boys to continue further studies in the field of science.

In their study with 321 students attending 6th, 7th, and 8th grades Yaman and Öner (2006) found that the interest of girls to the science course is higher than the

boys. In addition, the level of the students attending to the schools in the city center was found higher than the ones in the out skirts. The study also revealed that 6th grade students among the other grades showed the most positive attitude toward science course. However, in terms of attitude toward science, 7th graders' attitude was observed to be the most negative. The researchers also claimed that teachers play an important role in developing more positive attitudes towards science in students.

Şen and Koca-Özgün (2005) reported that secondary school students had generally positive attitudes towards mathematics and science classes. Admiration towards the teacher and understanding of the subject were found to be the two main reasons for developing positive attitudes towards mathematics and science courses.

The research carried out by Durmaz and Özyıldırım (2005) explored the attitudes of elementary school students toward science and science courses. The influence of schools and the socio-economic levels of these schools, sex, their fathers' and mothers' educational levels were also investigated. The results indicated statistically significant differences between students' attitudes regarding their schools and fathers' educational levels. However, mothers' educational levels and sex had found no significant effect on students' attitudes toward science and science courses.

Paulson (2005) explored the effect of elementary science methods course on student attitudes toward science and science teaching through an action research. Thompson and Shrigley's Revised Science Attitude Scale was used to measure attitudes at the beginning and end of the course. The findings indicated that elementary science methods course caused more positive attitudes and feelings of

competence and confidence toward science and science teaching.

Baykul (as cited in Turkmen and Bonnstetter, 1999) found that Turkish students' attitudes toward science and mathematics courses decreased from grade 5 through grade 11. Students complain that the science courses were not useful, the science and mathematic courses were extremely difficult and their math and science teaches had very negative attitudes.

Bozdoğan and Yalçın (2005) investigated the attitudes of 337 students from grade 6, 7 and 8 towards the subject of physics. The research reported two important results. The first result is that the attitude of the students in the physics experiments in the science courses in the basic education schools started to decrease along with the increase of the class level. The second result showed that there was a difference in student attitude in respect to the different types of training-education and the varying number of students assigned to each teacher (Bozdoğan & Yalçın, 2005)

Koca-Özgün and Şen (2006) stated four major reasons for students' negative attitudes towards mathematics and science are the teacher, the teaching methods used in mathematics and science classrooms, common beliefs and attitudes among the members of the society related to mathematics and science, and not being able to relate the content of these courses to the real life. They explored secondary school students' negative attitudes towards mathematics and science classes and relationships among gender, grade level and negative attitudes. The results showed that while female students developed more negative attitudes towards physics classes, male students developed more negative attitudes towards biology classes. The difficulties faced in understanding the subject, difficult content, and the teacher

is the main reasons for developing negative attitudes.

Demirci (2004) investigated the students' attitudes toward physics. 176 first and second year undergraduate students attending first introductory physics course constitute the sample of the study. Results of the study revealed that there was a significant difference between male and female students' attitude toward physics. Male students were found to have more positive attitude toward physics than female students. In addition to this, the students enrolling in physics and space programs showed more positive attitude than others. On the other hand, the students in Biology, Environmental Science, and Oceanography departments showed more negative attitude than the other academic departments.

In another study, Yılmaz (2006) explored the relationship between students' attitudes toward mechanics and related variables. The results of the study revealed that female students' mean scores from university entrance exam, high school averages, and university cumulative grades and also the introductory physics course grades were higher than the males. On the other hand, their attitudes toward mechanics were lower than the male students. Significant difference was found between the scores of junior and senior pre-service science teachers. Especially, attitudes of female students increased gradually up to the end of the 4th year. Furthermore, the students who mention physics as their favorite lesson indicated significantly higher scores.

Research about Pre-service Teachers' Attitudes toward Science

In the study by Christiansen (1971) the training, attitudes, and competence of the pre-service elementary teachers in science education were investigated. The results of the study revealed that pre-service elementary teachers who had more positive attitudes toward science content courses gained higher achievement scores and indicated more positive attitudes toward teaching elementary science. Furthermore, pre-service teachers displaying more positive attitudes toward the methods course showed more positive attitudes toward science teaching.

A study conducted with 750 pre-service elementary teachers' reported that pre-service elementary teachers had moderate sense of self-efficacy beliefs regarding science teaching. Besides this, pre-service elementary teachers showed a low level of science knowledge, but generally positive attitude toward science teaching (Sarıkaya, 2004). Similarly, the result of another study showed that pre-service Turkish science teachers have positive attitudes toward science and science teaching (Turkmen and Bonnstetter, 1999).

Chin (2005) expressed that scientific literacy and attitudes toward science play a significant role in human daily lives and he investigated whether first-year pre-service teachers in elementary education and science education programs in Taiwan have a satisfactory level of scientific literacy. The results indicated that while elementary pre-service teachers were moderately positive attitudes toward science, science education majors hold more positive attitudes toward science. Also, gender was found no significant effect on pre-service teachers' attitudes toward science. Previous experience in science showed more positive attitudes toward science.

The study by Buldu (2005) examined the attitudes of pre-service elementary teachers toward science in the U.S. and Turkey. It also investigated the effect of variables such as gender and the grade that pre-service teachers wanted to teach. 1144 pre-service elementary teachers constitute the sample of the study. Findings showed that both U.S. and Turkish pre-service elementary teachers had positive attitudes toward science. On the other hand, U.S. pre-service elementary teachers had more confidence in science and they found science more useful than Turkish pre-service teachers. While pre-service elementary teachers in U.S. do not show significant differences in terms of gender, there were significant differences between the Turkish pre-service teachers in terms of gender.

Turkmen (2002) explored the attitudes of 102 female and 89 male students in an elementary education program toward science and science teaching by using Science Teaching Attitude Scale-II. The results showed that elementary education major students' attitudes toward science and science teaching were positive. Students who take more science courses than other students who attend required science courses during their high school years indicated higher attitudes than the others.

In another study, conducted by Tekkaya, Çakıroğlu, and Özkan (2002) pre-service science teachers' understanding of science concepts, their attitudes toward science teaching and their beliefs of their efficacy in science teaching were explored. 85 pre-service science teachers participated in the study. The results showed that pre-service science teachers generally hold positive attitudes towards science teaching, and towards three different domains of science, namely, biology, physics, and chemistry.

Research about Science in Early Childhood Education and Teachers' Attitudes toward Science

Pearlman and Pericak-Spector (1995) expressed that children are natural scientists and they have an innate sense of curiosity that can be developed with the support of parents and teachers. Children's investigations are important because of the processes that are used to find the answers rather than the answers that they can come up with and these processes play an important role in the foundation for later science and mathematics achievement. Children develop science process skills such as observing, comparing, classifying, inferring, predicting, hypothesizing, experimenting and recording data while they are investigating their environment. When children gain the qualities like curiosity, creativity and persistence, they also acquire positive attitudes toward science. Being in touch with the natural world is important for children because they need to understand natural processes and experience the feeling of contact with nature.

In another study, parents' and teachers' interest in science and their attitudes toward science, comfort level teaching and talking about science, use of hands-on science activities and teaching methods, perceived support for science reform in school systems, and overall assessments of the current and future status of science education were investigated. The findings revealed that even though parents and teachers view science as a very important subject for children in grades K-5, teachers do not feel highly qualified to teach science. Moreover, most of the teachers feel that schools should increase the current emphasis on science education, and most

of them feel that a hands-on approach in science instruction should be increased (Research Communications, 1995).

Ovens (1999) pointed out that some early childhood educators feel uncomfortable with the level of their knowledge of the physical sciences. Therefore, many of them see this as the reason of the limited science activities in their classrooms. In the study of Ayvacı, Devecioğlu and Yiğit (2002), teachers reported that it is useful to direct children to make observation before and after science activities. In this qualitative study, while 7 teachers found themselves sufficient in the application of science and nature activities, 5 teachers identified themselves as insufficient in providing the necessary materials and in the application of the science activities. Furthermore, 3 teachers expressed that they are insufficient in the ending process of the science activities and experiments. It is also stated that because of teachers' insufficient attitude toward science, they do not apply or spend enough time for science activities. It is thought that the lack of courses related to developing materials in science and nature in undergraduate education are the causes of teachers' insufficiency in developing materials. Lucas and Dooley (2006) reported that much more effort should be made to foster desirable attitudes toward science and science teaching among future primary school teachers.

The study conducted by Bilaloğlu, Aslan and Aktaş-Arnas (2006) found that among five teachers only one who had a teaching experience of less than 5 years applied a science activity in one observation out of three. The subjects that teachers used in science were plants, natural events, and animals. The results indicated that although only one teacher applied a formal science activity, all of them ignored the

opportunities of informal science activities.

Palmer (2001) expressed that elementary education majors often do not like science and they lack confidence in their ability to teach it. It is seen as an important problem since students who have these attitudes are likely to avoid teaching science, when they become teachers or even if they do so, they teach it poorly. The results revealed that after attending a one semester elementary education course, the students' confidence change from negative to positive. It can be seen that teacher confidence and enthusiasm affect their attitudes positively.

In the study conducted by Karaer and Kösterelioğlu (2005) the determination methods that are used in teaching science concepts by the preschool teachers in Amasya and Sinop were investigated. The results of the study showed that the teachers' level of knowledge about science and nature is limited with the pre-service training. Most of the teachers in Amasya and Sinop also see themselves as insufficient in undertaking science and nature activities.

In the study by Schwirian (1969), the variables of age and number of hours in science were found to be associated with more positive science attitudes. The younger elementary teachers and those who had spent much time in science showed more positive attitudes toward science.

In another study, the relationship between teachers' attitudes towards science and their background in science was examined. The results revealed that there was no significant difference between teachers who prepared at two-year and four-year institutions in terms of attitude toward science. It was also found that the more science courses that a practicing teacher took at a two-year college resulted in a

more favorable impression of science by the teacher. Apart from this, teachers who had a higher science GPA while in college showed more positive attitudes toward science than teachers who had a lower science GPA. (Dowdy, 2005).

The study carried out by Cho (1997), explored early childhood teachers' attitudes toward science teaching and the variables that may have affected these attitudes. Although findings showed that early childhood teachers' attitudes toward science teaching was positive, many teachers feel uncomfortable with teaching science for young children. Teaching level, ratio of child to teacher, attendance of science method courses, number of participation in in-service science workshops, and personal science interest were the variables that were found associated with attitudes of early childhood teachers toward science teaching.

CHAPTER III

METHOD

This chapter presents the overall design of the study, participants, data collection procedures, and data analysis of the research.

3.1. Design of the Study

The overall design of this research is survey. According to Fraenkel and Wallen (2003) survey is used in order to collect information about abilities, opinions, attitudes, beliefs, and knowledge of a large group of people. In surveys, mostly carefully selected samples are studied and inferences are drawn from what is found about the sample to describe the population.

The purpose of this research is to determine the attitudes of preschool teachers working in public and private schools toward science in early childhood education, examine the factors such as educational level of teachers, teaching experience, number of children in classroom and number of completed science activities that affect their attitudes, and the relationship between the preschool teachers' attitudes toward science and the frequency of activities provided by the early childhood teachers.

The research questions stated as follows:

1) Is there a relationship between preschool teachers' attitudes toward science and the frequency of science activities provided in the classroom?
2) Are teachers' ages related to their attitudes toward science and frequency of science activities?
3) Are teachers' educational levels related to their attitudes toward science and frequency of science activities?
4) Are teachers' years of teaching experience related to their attitudes toward science and frequency of science activities?
5) Do teachers who participated in undergraduate course work on science differ from the teachers who did not participate in undergraduate course work on science in terms of their attitudes toward science and the frequency of science activities provided in the classroom?
6) Are number of science related activities that teachers completed related to their attitudes toward science and frequency of science activities?
7) Do teachers who participated in in-service training on science differ from the teachers who did not participate in in-service training on science in terms of their attitudes toward science and the frequency of science activities provided in the classroom?
8) Do teachers who work in private schools differ from the teachers who work in public schools in terms of their attitudes toward science and the frequency of science activities provided in the classroom?
9) Do teachers who work with fewer numbers of children differ from the

teachers who work with more number of children in terms of their attitudes toward science and the frequency of science activities provided in the classroom?

10) Are children's age related to teachers' attitudes toward science and frequency of science activities?

3.2. Participants

The preschool teachers who work in public and private schools in Ankara constituted the sample of the study. The list of public and private schools in Ankara was obtained from the Ministry of National Education. According to this list, there were 665 public and 104 private schools located in different districts of Ankara. 400 teachers working in public and private schools were chosen from the list randomly and permission was taken from the Ministry of National Education to send the surveys to preschool teachers who work in the listed schools. 400 instruments were distributed, 292 of them were returned and return rate was 73%.

3.3. Instrument

The Science Attitude Scale was developed in 1986 by Thompson and Shrigley for pre-service elementary teachers (Thompson and Shrigley, 1986). This scale was modified by Cho et. al in 2003 for early childhood teachers and was called Early Childhood Teachers' Attitudes toward Science Teaching Scale (ECTASTS). (Cho et. all, 2003). Finally, Schneider (2005) added a second part to the scale

consisting of 7 items related to classroom science activities. In Turkey, ECTASTS was used by Çakmak (2006) in a study for investigating the relationship between the attitudes of prospective preschool teachers toward science and science teaching and their understanding level of science concepts. There were 22 items in the original scale of Early Childhood Teachers Attitudes toward Science Teaching except for the second part related to the frequency of science activities including 7 items. According to the results of factor analysis done by Çakmak (2006), 5 items were excluded from the scale and the new scale was composed of 17 items. The second part of the scale that is related to the frequency of science activities provided in the classroom was translated into Turkish by three experts. According to the results of factor analysis 7 items were included in the instrument as in the original scale. Early Childhood Teachers' Attitudes toward Science Teaching Scale consisted of 24 items. The instrument used a 4-point Likert scale. Each item in the first part of the scale was evaluated with "strongly disagree" (1), "disagree" (2), "agree somewhat" (3), and "strongly agree" (4). The items in the second part of the scale were evaluated as "not at all" (1), "occasionally" (2), "weekly" (3), and "daily" (4). The first part of the scale is composed of 4 subscales: 1.Comfort – Discomfort (Q1 – Q6), 2. Classroom Preparation (Q7 – Q12), 3. Managing Hand-on Science Activities (Q13 – Q17), and 4. Developmental Appropriateness (Q18 – Q22). The second part of the scale consists of 2 subscales: 1. Science Delivery Method (Q23 – Q25) and Science Concept (Q26 – Q29). The scale includes 16 positive and 4 negative statements. Negative worded items were scored reverse. The score of 4 for each item represents the highest attitude and the highest score that a participant can get is 96.

3.3.1. Validity and Reliability of the Scale

In the previous study by Çakmak, validity of the scale was tested in terms of content and construct validity. The content validity of the scale was evaluated by two experts in the field of early childhood education and science education. After minor alterations were made, Early Childhood Teachers' Attitudes toward Science Teaching Scale was delivered to 52 four year students attending undergraduate program of Early Childhood Education in Abant İzzet Baysal University and 48 four year students attending undergraduate program of Early Childhood Education in Çukurova University. Validity and reliability of the instrument were evaluated from the data obtained from 100 prospective early childhood teachers. The second part of the scale related to the frequency of science activities provided in the classroom translated into Turkish by three experts, translations were compared and minor alterations were made. In addition to this, the scale was tested in terms of content validity by the professionals. Then, the instruments were copied and delivered to 100 early childhood teachers in order to test the construct validity and the reliability of the second part of the Early Childhood Teachers Attitudes toward Science Teaching Scale. However, only 44 of the instrument returned. According to Tabachnick and Fidell (2001), there should be at least 300 cases for factor analysis. Therefore, this pilot study was used to evaluate whether the items were readable and understandable and how much time was needed to fill out the instrument for preschool teachers. With the expert opinion, the pilot study had been added to the main study and the forward statistical analyses for construct validity and reliability were performed from this data.

3.3.1.1. Factor Analysis (Construct Validity) of the Scale

According to the results of factor analysis, 5 items that have low factor loadings in their factor were excluded from the scale by Çakmak. These items were shown in Table 3.1.

Table 3.1: Deleted Items with Low Factor Loading

Item Number	Factor Loading
2. I fear that I am unable to teach science to young children adequately.	.35
4. I am afraid that children may ask me a question about scientific laws and events that I cannot answer.	.30
9. I am ready to learn and use scientific knowledge and scientific skills for planning hands-on science.	.39
12. Preparation for science teaching generally takes more time than other subject areas.	.22
17. I do not mind the messiness created when doing hands-on science in my classroom.	.45

In the present study, the second part of the scale was evaluated from the data obtained from 44 early childhood education teachers. According to Tabachnick and Fidell (2001), there should be at least 300 cases for factor analysis. Therefore, data from the pilot study was added to the data from the main study and the validity and reliability analyses of the second part of the scale dealing with the frequency of science activities provided in the classroom were performed according to this data. The results of fit statistics and factor analysis were presented in Table 3.2 and 3.3.

Table 3.2: Fit Statistics of the Second Part of the Scale

Fit statistics	First-Order CFA	Second-Order CFA
χ^2	49.00**	49.00**
(χ^2/sd)	3.76	4.08
GFI	0.96	0.96
AGFI	0.91	0.90
RMS	0.02	0.02
St.RMS	0.04	0.04
RMSEA	0.09	0.09

Due to different strengths and weaknesses of each confirmatory factor analysis index in assessing the goodness of fit between a theoretical model and actual data, multiple criteria was used to evaluate the goodness of fit of the model: Chi-Square Goodness (χ^2), χ^2/df, Goodness of Fit Index (GFI), the Adjusted GFI (AGFI), Root Mean Square Residual (RMS/RMR), Root Mean Square Error of Approximation (RMSEA) (Cole, 1987; Jöreskog and Sorbom, 1993; Marsh and Hocevar, 1988). According to Jöreskog and Sorbom & Marsh and Hocevar (1993, 1988) the ratio is to be χ^2/df below 5; GFI, AGFI above 0.90; RMR and RMSEA below 0.05. Furthermore, the following values are acceptable criteria to fit model: GFI>0.85, AGFI>0.80 and RMS and RMSEA <0.10 (Anderson & Gerbing, 1984; Cole, 1987; Marsh, Balla & McDonald, 1988).

According to the results of Table 3.2, finding values for first and second order CFA [(χ^2) = 49.00/49.00 and χ^2/df= 3.76/4.08<5; GFI= 0.96/0.96>0.85; AGFI=

0.91/0.90>0.80; RMS= 0.02/0.02<0.10; RMSEA= 0.09/0.09<0.10] fit the criteria of the goodness of fit of the model so it can be concluded that the original 2 factors model of the scale is valid in Turkish culture. By the way of second order CFA, unidimensionality of the scale was tested and the results proved that all statements clustered on a single dimension and the scale can also be used as 1 factor.

Table 3.3: The Results of Factor Analysis of the Second Part of the Scale

Factor	Item Number	Factor Loading
Science Delivery Method	23. 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.) and exploration tools (magnifying glass, a scale, etc.) In these situations the child controls the choices and actions.	.47
	24. 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.	.47
	25. I make opportunities available for children to be involved in structured science activities: I choose specific items for exploration or experimentation. I give some directions to the children's activities.	.54
Science Concepts	26. I set up my classroom for science inquiry and discovery (children investigate and experiment with objects to discover information).	.61

Table 3.3: (continued)

Factor	Item Number	Factor Loading
Science Concepts	27. I give children a chance to do science activities where they group objects by physical properties (size, weight) or sensory attributes (color, shape).	.50
	28. I provide children with life science activities, so they have experiences with plants and animals.	.37
	29. I offer science activities, which include concepts of the earth such as weather, the seasons, outdoor environment, water, air, and soil.	.48

According to the results shown in Table 3.3, factor loadings for Science Delivery Method range from .47 to .54 and factor loadings of Science Concepts range from .37 to .61. Although item 28 (.37) has lower factor loading than .40, it is acceptable in social sciences. Also, lower factor loadings can be caused by few items under one factor. Factor loadings for Science Delivery Method and Science Concepts indicate that all items under these two factors measure the same property.

3.3.1.2. Reliability of the Scale

Item total correlations and cronbach alpha values obtained in the pilot study by Çakmak indicated that this scale is reliable. Item total correlations and cronbach alpha values for the second part of the scale were shown in Table 3.8 and 3.9.

Table 3.8: The Results of Item-Total Correlation and Alpha Scores Analysis of Science Delivery Method

Factor / Item Number	Corrected Item-Total Correlation	Cronbach Alpha
Science Delivery Method		.68
23. 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.) and exploration tools (magnifying glass, a scale, etc.) In these situations the child controls the choices and actions.	.46	
24. 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.	.49	
25. I make opportunities available for children to be involved in structured science activities: I choose specific items for exploration or experimentation. I give some directions to the children's activities.	.54	

Table 3.8 represented that corrected item-total correlations ranges from .46 to .54 and the cronbach alpha coefficient is .68 for Science Delivery Method. We can say that there is a significant relationship between the items of this scale. That is, the items measure the same property that the subscale does.

Table 3.9: The Results of Item-Total Correlation and Alpha Scores Analysis of Science Concepts

Factor / Item Number	Corrected Item-Total Correlation	Cronbach Alpha
Science Concepts		.75
26. I set up my classroom for science inquiry and discovery (children investigate and experiment with objects to discover information).	.56	
27. I give children a chance to do science activities where they group objects by physical properties (size, weight) or sensory attributes (color, shape).	.52	
28. I provide children with life science activities, so they have experiences with plants and animals.	.51	
29. I offer science activities, which include concepts of the earth such as weather, the seasons, outdoor environment, water, air, and soil.	.61	

According to Table 3.9, a corrected item-total correlations range from .51 to .61 and the cronbach alpha coefficient is .72 for Science Concepts. It means that there is a significant relationship between the items of this scale. Therefore, both the items and the subscale measure the same property. The total cronbach alpha value for the second part of the scale is .84.

3.4. Data Analysis

The data obtained from 292 early childhood teachers was analyzed by using SPSS 11.5. Data analyses procedure consists of two main parts. In the first part, descriptive statistics were used and the frequencies of the data gathered from the participants' responses to demographic questions including age, educational level, graduated program, teaching experience, type of school they work in, age group in classroom, completed science activities and enjoyed science activities were given respectively. In the second part of the data analysis, hypotheses were tested. Pearson Correlation Coefficient (r) is calculated to find out whether a relationship existed between the early childhood teachers attitudes toward science teaching and the frequency of science activities provided in the early childhood classroom at the level of α=.05 and α=.01. t-tests were performed at the level of .05 to compare the means of teachers' attitudes in terms of the type of school they work, number of children in classroom, undergraduate course work on science and in-service training. One-way analysis of variance was used to compare the attitudes of teachers in terms of age level of teachers, educational level, teaching experience, number of science activities that teachers completed, and the age level of children in classroom at .05 significance level. Scheffe Post-Hoc test was performed to find out which groups differ from others.

CHAPTER IV

RESULTS

This chapter presents the results of the study under two sections. In the first section, demographic characteristics of the participants and their background related to science are presented. The second section focuses on the attitudes of early childhood teachers toward science teaching, the relationship between the early childhood teachers attitudes toward science teaching and the frequency of science activities provided in the early childhood classroom, comparison of the means of teachers' attitudes in terms of the type of school they work, number of children in classroom, age, educational level, teaching experience, number of science activities that teacher participate and the age level of children they work.

4.1. Characteristics of the Participants

Table 4.1: Dispersion of Participants According to Demographic Characteristics

Variable	**Subgroups**	**F**	**%**
Age	Under age 25	80	27,4
	Age 26-35	105	36,0
	Age 36-45	81	27,7
	Age 46-55	26	8,9
	Total	292	100,0

Table 4.1: (continued)

Variable	Subgroups	F	%
Educational Level	High School	65	22,3
	University (2 years)	65	22,3
	University (4 years)	148	50,7
	Masters Degree	14	4,8
	Total	292	100,0
Grad. Program	Child Dev. and Education	156	53,4
	Early Childhood Education	80	27,4
	Preschool Teaching	35	12,0
	Other	21	7,2
	Total	292	100,0
Teaching Exp.	Less than 1 year	24	8,2
	1-3 years	56	19,2
	4-6 years	47	16,1
	7 or more years	165	56,5
	Total	292	100,0
Type of School	Public	168	57,5
	Private	124	42,5
	Total	292	100,0
Capacity of School	0-25 children	26	8,9
	26-50 children	77	26,4
	51-75 children	54	18,5
	76 children and over	135	46,2
	Total	292	100,0
Number of Children	0-15 children	103	35,3
	16-30 children	189	64,7

Table 4.1: (continued)

Variable	Subgroups	F	%
	Total	292	100,0
Age Group in Class	3 years old	28	9,6
	4 years old	40	13,7
	5 years old	84	28,8
	6 years old	140	47,9
	Total	292	100,0

Table 4.1 represents the demographic characteristics of the respondents. The 36% of the participants was 26-35 years old, it was followed by the teachers from 36-45 years old (27.7%), then the teachers under age 25 (27.4%) came and the age range from 46-55 (8.9%) constituted the least represented group. 50.07% of the respondents held a 4 years university degree, 22.3% of the teachers had high school degree, 22.3% of them held a 2 years university degree, and 4.8% of the teachers had masters degree. Half of the participants (53.4%) graduated from Child Development and Education, 27.4 percent of the teachers graduated from Early Childhood Education, 12% of them graduated from Preschool Teaching, and the remaining 7.2 percent graduated from other fields. A large group of participants 56.5% had 7 or more years of teaching experience, 19.2% worked 1-3 years, 16.1% of the teachers had 4-6 years of teaching experience and the 8.2% of the teachers had less than 1 year of teaching experience. The teachers who work in public schools constituted the 57.5 percent of the respondents, while 42.5 percent worked in private schools. 46.2% of the teachers worked in schools with the capacity of 76 children and over, 26.4% of

the participants worked in schools with the capacity of 26-50 children, 18.5% of the teachers worked in schools with the capacity of 51-75 children and the remaining 8.9% worked in schools with the capacity of 0-25 children. Most of the teachers (64.7%) had classrooms with 16-30 children and 35.3% had classrooms with 0-15 children. The distribution of age levels taught by teachers was 47.9% 6 years old, 28.8% 5 years old, 13.7% 4 years old, and 9.6% 3 years old.

Table 4.2: Dispersion of Participants According to Completed Science Activities

Variable	**Subgroups**	**F**	**%**
Completed Science Activities	Science courses in high school	256	87,7
	Undergraduate course work on science	171	58,6
	In-service training on science	28	9,6
	Conference and workshops on science	29	9,9
	Reading resource books about science	163	55,8
	Reading newsletter and articles on science	139	47,6

The results of Table 4.2 shows that 87.7% (N=256) of early childhood teachers participated in science courses in high school, 58.6% (N=171) completed undergraduate course work on science, 9.6% (N=28) took part in in-service training related to science, 9.9% (N=29) of the respondents attended in conference and workshops on science, 55.8% (N=163) of them read resource books on science, and 47.6% (N=139) read newsletter and articles on science. According to these results, it can be said that in-service training (9.6%) and workshops and conference (9.9%) were the activities that early childhood teachers attend at least.

Table 4.3: Dispersion of Participants According to Enjoyed Science Activities

Variable	Subgroups	F	%
Enjoyed Science Activities	Science courses in high school	106	36,3
	Undergraduate course work on science	102	34,9
	In-service training on science	32	11,0
	Conference and workshops on science	52	17,8
	Reading resource books about science	137	46,9
	Reading newsletter and articles on science	127	43,5

According to the results of Table 4.3, 36.3% (N=106) of early childhood teachers enjoyed science courses in high school, 34.9% (N=102) liked undergraduate course work on science, 11% (N=32) of them stated that they like in-service training, 17.8% (N=52) enjoyed conference and workshops on science, 46.9% mentioned that they like reading resource books about science, and 43.5% of the participants enjoyed reading newsletter and articles on science.

Table 4.4: Dispersion of Participants According to the Number of Completed Science Activities

Variable	Subgroups	F	%
Completed Science Activities	1 activity	69	23,6
	2 activities	61	20,9
	3 activities	74	25,3
	4 activities	69	23,6
	5 activities	19	6,5
	Total	292	100,0

According to the Table 4.4, 23.6% (N=69) of the respondents participated in 1 science activity (e.g., taking undergraduate course on science or attending in-service training), 20.9% (N=61) of the early childhood teachers completed 2 science activities, 25.3% (N=74) took part in 3 science activities, 23.6% (N=69) of the participants participated in 4 science activities, and 6.5% (N=19) of them completed 5 science activities.

4.2. Hypothesis Testing

In this part of the study, the hypotheses were tested at the significance level of .05 and .01 by using different statistical analysis.

Hypothesis 1: There will be a significant correlation between early childhood education teachers' attitudes toward science and the frequency of science activities provided in the classroom.

Table 4.5: Relationship between Early Childhood Education Teachers' Attitudes toward Science and the Science Activities They Apply in the Classroom

								(n=292)
		C-D.	**C. P.**	**M. H.S.**	**D.A.**	**T 1**	**S. C.**	**S. D.M.**
C-D.	r							
C. P.	r	.605**						
M. H.S.	r	.525**	.633**					
D.A.	r	.425**	.337**	.297**				
T 1	r	.823**	.804**	.754**	.715**			
S. C.	r	.120*	.202**	.173**	.080	.179**		
S. D.M.	r	.196**	.207**	.181**	.113	.220**	.287**	
T 2	r	.192**	.254**	.219**	.118*	.245**	.847**	.752**

**p<.01 *p<.05

The results of Table 4.5 showed that there was a significant correlation between the total score of early childhood education teachers' attitudes toward science and the total score of the frequency of science activities provided in the classroom ($r = .24$, $p<.01$). Although the total correlation coefficient was relatively low, all correlation coefficients were significant and positive. Therefore, it can be concluded that when the attitudes of preschool teachers toward science increase, the frequency of the science activities provided for children increase.

Hypothesis 2: There will be a difference in early childhood education teachers' attitudes toward science and frequency of science activities in terms of age of the teachers.

One-way analysis of variance was used to investigate the effect of the age on preschool teachers' attitudes toward science and frequency of science activities. According to the results, age had no significant effect on early childhood education teachers' attitudes toward science and the frequency of science activities provided by the teachers.

Hypothesis 3: There will be a significant difference in early childhood education teachers' attitudes toward science and frequency of science activities with respect to the educational level of teachers.

In order to investigate whether educational level of teachers had an effect on preschool teachers' attitudes toward science and frequency of science activities, one-way analysis of variance was carried out. The findings of the one-way ANOVA were displayed in Table 4.6 and 4.7.

Table 4.6: Results of ANOVA Scores of Early Childhood Education Teachers' Attitudes toward Science According to Their Educational Levels

Factor	Educational Level	N	M	SD	df	F	Sig.
Comfort-Discomfort	High School	65	19,76	3,02	3, 288	,922	,431
	University (2 years)	65	19,60	2,99			
	University (4 years)	148	19,15	2,73			
	Masters Degree	14	19,78	2,15			
Classroom Preparation	High School	65	17,78	2,38	3, 288	,487	,692
	University (2 years)	65	17,49	2,73			
	University (4 years)	148	17,33	2,47			
	Masters Degree	14	17,35	2,40			
Managing Hands-on Science	High School	65	17,49	2,12	3, 288	1,058	,367
	University (2 years)	65	17,16	2,65			
	University (4 years)	148	17,02	2,35			
	Masters Degree	14	17,92	1,43			
Developmental Appropriateness	High School	65	13,12	2,37	3, 288	1,255	,290
	University (2 years)	65	12,67	2,17			
	University (4 years)	148	13,52	4,10			
	Masters Degree	14	14,00	1,51			
Total 1	High School	65	68,16	7,90	3, 288	,503	,680
	University (2 years)	65	66,93	8,62			
	University (4 years)	148	67,04	8,88			
	Masters Degree	14	69,07	6,42			

The results revealed that educational level had no significant effect on Comfort-Discomfort [F(3, 288)= .922, p>.05], Classroom Preparation [F(3, 288)=

.487, p>.05], Managing Hands-on Science [F(3, 288)= 1.058, p>.05], Developmental Appropriateness [F(3, 288)= 1.255, p>.05] and Total 1 [F(3, 288)= .503, p>.05]. As a result, it can be concluded that educational level had no significant effect on preschool teachers' attitudes toward science.

Table 4.7: Results of ANOVA Scores of the Frequency of Activities in Terms of Their Educational Levels

Factor	Educational Level	N	M	SD	df	F	Sig.
Science Concepts	High School	65	10,33	2,10	3, 288	1,566	,198
	University (2 years)	65	11,33	6,32			
	University (4 years)	148	10,27	2,13			
	Masters Degree	14	10,00	2,41			
Science Delivery Method	High School	65	7,96	1,62	3, 288	3,803	,011
	University (2 years)	65	7,69	1,89			
	University (4 years)	148	7,89	1,79			
	Masters Degree	14	10,42	10,40			
Total 2	High School	65	18,30	3,45	3, 288	1,121	,341
	University (2 years)	65	19,03	7,36			
	University (4 years)	148	18,16	3,65			
	Masters Degree	14	20,42	10,44			

When the effect of educational level on the frequency of science activities provided in the classroom was examined, it was seen that educational level had no significant effect on Science Concepts according to calculated F value F(3, 288)= 1.566, p>.05 and on Total 2 with the value of F(3, 288)= 1.121, p>.05, whereas it

was found that educational level had a significant effect on Science Delivery Method $F(3, 288)= 3.803$, $p<.05$. In order to find out the differences between groups Scheffe Post Hoc test was performed. The results of Scheffe test showed that the mean of Science Delivery Method of early childhood education teachers with masters' degree was significantly different from the teachers with high school, 2 years university and 4 years university degree. As a result, it can be stated that when the level of education increases, the mean score of the frequency of science activities increases.

Hypothesis 4: There will be a significant difference in early childhood education teachers' attitudes toward science and frequency of science activities in terms of years of teaching experience.

This hypothesis was tested by one-way analysis of variance to investigate the effect of teaching experience on early childhood education teachers' attitudes toward science and frequency of science activities. The results of one-way ANOVA were presented in Table 4.8 and 4.9.

Table 4.8: Results of ANOVA Scores of Early Childhood Education Teachers' Attitudes toward Science in Terms of Teaching Experience

Factor	**Teaching Experience**	**N**	**M**	**SD**	**df**	**F**	**Sig.**
Comfort-Discomfort	Less than 1 year	24	20,20	2,50	3, 288	1,145	,331
	1-3 years	56	19,60	2,46			
	4-6 years	47	19,61	3,03			
	7 or more years	165	19,18	2,93			

Table 4.8: (continued)

Factor	Teaching Experience	N	M	SD	df	F	Sig.
Classroom Preparation	Less than 1 year	24	17,75	1,93	3, 288	1,279	,282
	1-3 years	56	17,87	1,75			
	4-6 years	47	17,72	2,23			
	7 or more years	165	17,22	2,83			
Managing Hands-on Science	Less than 1 year	24	17,70	1,80	3, 288	,571	,634
	1-3 years	56	17,33	1,80			
	4-6 years	47	17,21	2,36			
	7 or more years	165	17,08	2,56			
Developmental Appropriateness	Less than 1 year	24	15,66	8,62	3, 288	5,117	,002
	1-3 years	56	13,32	1,83			
	4-6 years	47	13,34	2,64			
	7 or more years	165	12,88	2,25			
Total 1	Less than 1 year	24	71,33	12,09	3, 288	2,748	,043
	1-3 years	56	68,14	5,38			
	4-6 years	47	67,89	7,97			
	7 or more years	165	66,38	8,74			

According to the results, years of teaching experience had no significant effect on Comfort-Discomfort [F(3, 288)= 1.145, p>.05], Classroom Preparation [F(3, 288)= 1.279, p>.05], and Managing Hands-on Science [F(3, 288)= .571, p>.05]. However, teaching experience had a meaningful effect on Developmental Appropriateness [F(3, 288)= 5.117, p<.05] and Total 1 [F(3, 288)= 2.748, p<.05]. Scheffe Post-Hoc analysis was carried out to find out which groups differ from each

other. According to the results of Scheffe test, mean attitude score of teachers having a teaching experience less than 1 year was significantly different from the teachers having more years of teaching experience in Developmental Appropriateness and Total 1. That is, preschool teachers less than 1 year experience hold more positive attitudes toward science on Developmental Appropriateness than the teachers having more years of teaching experience. In addition, it can be said that when the years of teaching experience increases, the science attitude of preschool teachers on Developmental Appropriateness and Total 1 decreases.

Table 4.9: Results of ANOVA Scores of the Frequency of Activities in Terms of Teaching Experience

Factor	**Teaching Experience**	**N**	**M**	**SD**	**df**	**F**	**Sig.**
Science Concepts	Less than 1 year	24	11,12	2,17	3, 288	,671	,571
	1-3 years	56	10,21	1,89			
	4-6 years	47	10,08	2,20			
	7 or more years	165	10,64	4,34			
Science Delivery Method	Less than 1 year	24	8,00	1,74	3, 288	1,340	,262
	1-3 years	56	8,66	5,35			
	4-6 years	47	7,91	1,89			
	7 or more years	165	7,78	1,79			
Total 2	Less than 1 year	24	19,12	3,56	3, 288	,374	,772
	1-3 years	56	18,87	5,81			
	4-6 years	47	18,00	3,90			
	7 or more years	165	18,42	5,42			

The findings revealed that teaching experience had no effect on Science Concepts [F(3, 288)= .671, p>.05], Science Delivery Method [F(3, 288)= 1.340, p>.05] and Total 2 [F(3, 288)= .374, p>.05].

Hypothesis 5: There will be a significant difference in early childhood education teachers' attitudes toward science in terms of undergraduate course work on science.

In order to test hypothesis 5, a t-test was performed at .05 level of significance and the results were presented in Table 4.10 and 4.11.

Table 4.10: Results of T-Test Scores of Early Childhood Education Teachers' Attitudes toward Science in Terms of Undergraduate Course Work on Science

Factor	**Undergraduate Course Work on Science**	**N**	**M**	**SD**	**df**	**t**	**P**
Comfort-Discomfort	Undergraduate course work	171	19,46	2,67	290	,333	,739
	Other activities	121	19,35	3,06			
Classroom Preparation	Undergraduate course work	171	17,64	2,31	290	1,433	,153
	Other activities	121	17,22	2,74			
Managing Hands-on Science	Undergraduate course work	171	17,35	2,28	290	1,260	,209
	Other activities	121	17,00	2,42			
Developmental Appropriateness	Undergraduate course	171	13,63	3,84	290	2,221	,027
	Other activities	121	12,76	2,32			

Table 4.10: (continued)

Factor	Undergraduate Course Work on Science	N	M	SD	df	t	P
Total 1	Undergraduate course work	171	68,09	8,37	290	1,751	,081
	Other activities	121	66,33	8,58			

It can be drawn from the Table 4.10 that there was no significant difference between teachers who completed a course work on science in undergraduate and who did not complete a course work on science in undergraduate with respect to Comfort-Discomfort [t(290)= .33, p>.05], Classroom Preparation [t(290)= 1.43, p>.05], Managing Hands-on Science [t(290)= 1.26, p>.05] and Total 1 [t(290)= 1.75, p>.05. On the other hand, results showed that there was a significant difference in Developmental Appropriateness [t(290)= 2.22, p<.05]. This finding revealed that the teachers who participated in a course work on science in undergraduate study had more positive attitudes toward science on Developmental Appropriateness than the teachers who did not participate in a course work on science in undergraduate study.

Table 4.11: Results of T-Test Scores of the Frequency of Science Activities in Terms of Course Work on Science in Undergraduate

Factor	Undergraduate Course Work on Science	N	M	SD	df	t	P
Science Concepts	Undergraduate course work	171	10,56	2,30	290	,326	,745
	Other activities	121	10,42	4,78			
Science Delivery Method	Undergraduate course work	171	8,27	3,42	290	2,041	,042
	Other activities	121	7,58	1,68			
Total 2	Undergraduate course work	171	18,84	4,68	290	1,352	,177
	Other activities	121	18,01	5,72			

As seen from the Table 4.11, there was no significant difference between teachers who completed a course work on science in undergraduate study and who did not complete a course work on science in Science Concept [t(290)= 3.26, p>.05] and Total 2 [t(290)= 1.32, p>.05]. However, results showed that there was a difference in Science Delivery Method (t(290)=2.04, p<.05) with respect to undergraduate course work on science. The conclusion can be drawn that the teachers who participated in a course work on science in undergraduate study had more positive attitudes toward science on Science Delivery Method than the teachers who did not participate in a course work on science in undergraduate study.

Hypothesis 6: There will be a significant difference in early childhood education teachers' attitudes toward science and frequency of science activities with

respect to the number of science activities they have completed.

To test this hypothesis one-way ANOVA was performed and the effect of the number of completed science activities on preschool teachers' attitudes toward science and frequency of science activities was investigated. The results of one-way ANOVA were presented in Table 4.12, 4.13, 4.14 and 4.15.

Table 4.12: Results of ANOVA Scores of Early Childhood Education Teachers' Attitudes toward Science In Terms of the Number of Completed Science Activities

Factor	Number of Activities	N	M	SD	df	F	Sig.
Comfort-Discomfort	1 Activity	69	18,89	3,14	4, 287	3,162	,014
	2 Activities	61	19,04	2,44			
	3 Activities	74	19,35	2,93			
	4 Activities	69	19,86	2,46			
	5 Activities	19	21,15	3,05			
Classroom Preparation	1 Activity	69	16,81	2,86	4, 287	3,490	,008
	2 Activities	61	17,21	2,32			
	3 Activities	74	17,40	2,22			
	4 Activities	69	18,24	2,16			
	5 Activities	19	18,15	3,18			
Managing Hands-on Science	1 Activity	69	16,36	2,46	4, 287	4,341	,002
	2 Activities	61	17,19	1,81			
	3 Activities	74	17,17	2,28			
	4 Activities	69	17,91	2,20			
	5 Activities	19	17,84	3,23			

Table 4.12: (continued)

Factor	Number of Activities	N	M	SD	df	F	Sig.
Developmental Appropriateness	1 Activity	69	12,34	2,35	4, 287	3,913	,004
	2 Activities	61	12,65	2,09			
	3 Activities	74	13,50	1,79			
	4 Activities	69	14,21	5,52			
	5 Activities	19	14,26	2,37			
Total 1	1 Activity	69	64,42	8,54	4, 287	5,835	,000
	2 Activities	61	66,11	6,67			
	3 Activities	74	67,43	6,99			
	4 Activities	69	70,24	9,45			
	5 Activities	19	71,42	10,84			

The results revealed that the number of science activities completed by early childhood teachers had a significant effect on Comfort-Discomfort [F(4, 287)= .3.162, p<.05], Classroom Preparation [F(4, 287)= 3.490, p<.05], Managing Hands-on Science [F(4, 287)= 4.341, p<.05], Developmental Appropriateness [F(4, 287)= 3.913, p<.05] and Total 1 [F(4, 287)= 5.835, p<.05].

Scheffe Post-Hoc test was used in order to define the differences between groups and significant differences were found between groups.

Table 4.13: Comparisons between Early Childhood Education Teachers' Attitudes toward Science and the Number of Completed Science Related Activities

Factor	**Scheffe Test** **Significant Difference (α=.05)**
Comfort-Discomfort	1 Activity – 5 Activities
Classroom Preparation	1Activity – 4 Activities
Managing Hands-on Science	1Activity – 4 Activities
Developmental Appropriateness	1Activity – 4 Activities
Total 1	1Activity – 4 Activities 1 Activity – 5 Activities

Comfort-Discomfort: Table 4.13 displayed that there was a significant difference between the science attitudes of teachers who completed 1 activity and the teachers who completed 5 activities.

Classroom Preparation: A significant difference was found between the science attitudes of teachers who participated in 1 activity and the ones who participated in 4 activities.

Managing Hands-on Science: There was a significant difference between the science attitudes of teachers who participated in 1 activity and the teachers who participated in 4 activities.

Developmental Appropriateness: A significant difference was seen between the science attitudes of teachers who completed 1 activity and 4 activities.

Total 1: There were meaningful differences between the science attitudes of teachers who participated in 1 activity and 4 activities and teachers who participated

in 1 activity and 5 activities.

It can be stated that the teachers who completed 4 and 5 science activities had more positive attitudes toward science than the ones who participated in 1 activity. In addition, it can be concluded that when the number of completed science activities increases, the attitude of preschool teachers toward science increases.

Table 4.14: Results of ANOVA Scores of the Frequency of Activities In Terms of the Number of Completed Science Activities

Factor	Number of Activities	N	M	SD	df	F	Sig.
Science Concepts	1 Activity	69	9,31	1,92	4, 287	3,699	,006
	2 Activities	61	10,96	6,37			
	3 Activities	74	10,59	2,12			
	4 Activities	69	10,69	2,34			
	5 Activities	19	12,36	2,08			
Science Delivery Method	1 Activity	69	7,20	1,57	4, 287	4,489	,002
	2 Activities	61	7,42	1,75			
	3 Activities	74	8,09	1,60			
	4 Activities	69	8,82	4,90			
	5 Activities	19	9,21	1,71			
Total 2	1 Activity	69	16,52	3,26	4, 287	5,248	,000
	2 Activities	61	18,39	7,27			
	3 Activities	74	18,68	3,44			
	4 Activities	69	19,52	5,68			
	5 Activities	19	21,57	3,50			

As seen from Table 4.14, the number of science activities completed by preschool teachers had a significant effect on Science Concepts [F(4, 287)= 3.699, p<.05], Science Delivery Method (F(4, 287)= 4.489, p<.05) and Total 2 (F(4, 287)= 5.248, p<.05).

Scheffe Post Hoc test was applied in order to find out the differences between groups and significant differences were found between groups.

Table 4.15: Multiple Comparisons between the Frequency of Activities and the Number of Completed Science Related Activities

Factor	**Scheffe Test** **Significant Difference (α=.05)**
Science Concepts	1 Activity – 5 Activities
Science Delivery Method	1Activity – 4 Activities
Total 2	1Activity – 4 Activities 1 Activity – 5 Activities

Science Concepts: There was a significant difference between the frequency of science activities provided by teachers who attended in 1 activity and 5 activities.

Science Delivery Method: A significant difference was found between the frequency of science activities provided by teachers completing 1 activity and 4 activities.

Total 2: Significant differences were found between the frequency of science activities provided by teachers who participated in 1 activity and 4 activities and teachers who completed 1 activity and 5 activities.

It can be concluded that the teachers completing 4 and 5 science activities had more positive attitudes toward science than the ones who completed 1 activity.

Hypothesis 7: There will be a significant difference in preschool teachers' attitudes toward science in terms of in-service training on science.

T-test was performed to test the hypothesis 5 with the significance level of .05. The results showed that there was no significant difference between teachers who participated in in-service training on science and who did not participate in in-service training.

Hypothesis 8: There will be a significant difference between the attitudes of preschool teachers who worked in public and private schools toward science.

To test this hypothesis a t-test was performed at .05 significance level and the means of teachers who worked in public and private schools were compared. The results were displayed in Table 4.16 and Table 4.17

Table 4.16: Comparison of T-Test Scores of Early Childhood Education Teachers' Attitudes toward Science in Terms of School Type

Factor	Type of School	N	M	SD	df	t	P
Comfort-Discomfort	Public	168	19,00	2,79	290	2,994	,003
	Private	124	19,99	2,80			
Classroom Preparation	Public	168	17,25	2,64	290	1,725	,086
	Private	124	17,76	2,28			
Managing Hands-on Science	Public	168	16,94	2,56	290	2,211	,028
	Private	124	17,55	1,96			

Table 4.16: (continued)

Factor	Type of School	N	M	SD	df	t	P
Developmental Appropriateness	Public	168	12,88	2,31	290	2,349	,019
	Private	124	13,79	4,28			
Total 1	Public	168	66,08	8,25	290	3,055	,002
	Private	124	69,11	8,53			

The results of the t-test revealed that there were significant differences in the attitudes of early childhood teachers working in public and private schools except for Classroom Preparation. The t value was found for Comfort-Discomfort $t(290)= 2.99$, $p<.05$, for Managing Hands-on Science $t(290)= 2.21$, $p<.05$, for Developmental Appropriateness $t(290)= 2.34$, $p<.05$ and for Total 1 $t(290)= 3.05$, $p<.05$. These results provided support for the hypothesis that there was a significant difference in the attitudes of early childhood teachers who worked in public and private schools and it can be concluded that preschool teachers working in private schools had more positive attitudes toward science in terms of Comfort-Discomfort, Managing Hands-on Science and Developmental Appropriateness than the preschool teachers working in public schools. However, no significant difference was found for Classroom Preparation $t(290)= 1.72$, $p>.05$.

Table 4.17: Comparison of T-Test Scores of the Frequency of Science Activities Provided by Public and Private School Teachers

Factor	Type of School	N	M	SD	df	t	P
Science Concepts	Public	168	10,38	4,28	290	,692	,490
	Private	124	10,67	2,16			
Science Delivery Method	Public	168	7,70	1,83	290	1,971	,050
	Private	124	8,37	3,80			
Total 2	Public	168	18,09	5,41	290	1,568	,118
	Private	124	19,04	4,73			

When the results of Table 4.17 was examined in terms of the science activities provided in the classroom, the t values for Science Concept [t(290)= .692, p>.05], for Science Delivery Method [t(290)= 1.97, p<.05], and for Total 2 [t(290)= 1.56, p>.05] showed that there was no significant difference between public school and private school teachers with respect to the frequency of science activities provided in classroom except for Science Delivery Method. Thus, it can be stated that preschool teachers working in private schools hold more positive attitudes toward science in terms of Science Delivery Method.

Hypothesis 9: There will be a significant difference in early childhood education teachers' attitudes toward science in terms of number of children in classroom.

Hypothesis 9 was tested with a t-test at .05 significance level and the means of teachers who worked in classrooms with 0-15 children and 16-30 children. The results were reported in Table 4.18 and Table 4.19.

Table 4.18: Comparison of T-Test Scores of Early Childhood Education Teachers' Attitudes toward Science in Terms of Number of Children in Classroom

Factor	Number of Children	N	M	SD	df	t	P
Comfort-Discomfort	0-15	103	19,76	2,75	290	1,541	,124
	16-30	189	19,23	2,86			
Classroom Preparation	0-15	103	17,67	2,35	290	1,042	,298
	16-30	189	17,35	2,58			
Managing Hands-on Science	0-15	103	17,64	1,81	290	2,359	,019
	16-30	189	16,96	2,56			
Developmental Appropriateness	0-15	103	13,25	2,08	290	,069	,945
	16-30	189	13,28	3,83			
Total 1	0-15	103	68,33	6,75	290	1,443	,150
	16-30	189	66,84	9,28			

According to the results of Comfort-Discomfort [t(290)= 1.54, p>.05], Classroom Preparation [t(290)= 1.04, p>.05], Developmental Appropriateness [t(290)= .06, p>.05] and Total 1 [t(290)= 1.44, p>.05] there was no significant difference in early childhood teachers' attitudes in terms of number of children in classroom except for Managing Hands-on Science. The t value was found t(290)= 2.35, p<.05 for Managing Hands-on Science. According to this result, it can be stated that teachers who work with fewer number of children (0-15 children) hold more positive attitudes on Managing Hands-on Science than the teachers who work with more number of children (16-30 children).

Table 4.19: Comparison of T-Test Scores of the Frequency of Science Activities in Terms of Number of Children in Classroom

Factor	Number of Children	N	M	SD	df	t	P
Science Concepts	0-15	103	10,62	2,36	290	,395	,693
	16-30	189	10,44	4,04			
Science Delivery Method	0-15	103	8,23	4,14	290	1,076	,283
	16-30	189	7,85	1,80			
Total 2	0-15	103	18,85	5,14	290	,868	,386
	16-30	189	18,30	5,15			

The results revealed that there was no significant difference between the teachers working with 0-15 children and the teachers working with 16-30 children in terms of the frequency of science activities provided in classroom on Science Concepts [t(290)= .39, p>.05], Science Delivery Method [t(290)= 1.07, p>.05] and Total 2 [t(290)= .86, p>.05].

Hypothesis 10: There will be a difference in early childhood education teachers' attitudes toward science and frequency of science activities in terms of the age group they work.

One way analysis of variance was carried out in order to investigate whether the age group that early childhood teachers worked had an effect on the attitudes of early childhood education teachers and the frequency of science activities provided in the classroom. The results were displayed in Table 4.20 and 4.21.

Table 4.20: Results of ANOVA Scores of Early Childhood Education Teachers' Attitudes toward Science In Terms of the Age Group They Work

Factor	Age Group of Children	N	M	SD	df	F	Sig.
Comfort-Discomfort	3 years	28	19,00	2,94	3, 288	,861	,462
	4 years	40	19,90	2,47			
	5 years	84	19,60	2,87			
	6 years	140	19,25	2,88			
Classroom Preparation	3 years	28	17,10	2,21	3, 288	,489	,690
	4 years	40	17,45	2,52			
	5 years	84	17,71	2,56			
	6 years	140	17,40	2,53			
Managing Hands-on Science	3 years	28	17,57	1,59	3, 288	,991	,398
	4 years	40	17,40	1,80			
	5 years	84	17,39	2,23			
	6 years	140	16,96	2,64			
Developmental Appropriateness	3 years	28	13,21	1,81	3, 288	3,092	,027
	4 years	40	14,65	6,79			
	5 years	84	13,32	2,30			
	6 years	140	12,85	2,37			
Total 1	3 years	28	66,89	5,37	3, 288	1,476	,221
	4 years	40	66,40	10,13			
	5 years	84	68,03	8,08			
	6 years	140	66,48	8,67			

The results indicated that the age group that teachers worked with had no effect on Comfort-Discomfort [F(3, 288)= .861, p>.05], Classroom Preparation [F(3,

288)= .489, p>.05], Managing Hands-on Science [F(3, 288)= .991, p>.05] and Total 1 [F(3, 288)= 1.476, p>.05]. However, the age group that teachers worked with had a significant effect on Developmental Appropriateness [F(3, 288)= 3.092, p<.05].

In order to find out the differences between groups, Scheffe Post Hoc test was performed and a significant difference was found between the science attitudes of teachers who work with 4 years old children and 6 years old children. It can be stated that teachers working with 4 years old children hold more positive attitudes toward science on Developmental Appropriateness than the teachers working with 6 years old children.

Table 4.21: Results of ANOVA Scores of the Frequency of Activities In Terms of the Age Group They Work

Factor	Age Group of Children	N	M	SD	df	F	Sig.
Science Concepts	3 years	28	10,00	2,19	3, 288	,617	,605
	4 years	40	10,12	1,93			
	5 years	84	10,42	1,98			
	6 years	140	10,77	4,66			
Science Delivery Method	3 years	28	7,67	1,98	3, 288	1,317	,269
	4 years	40	8,65	6,32			
	5 years	84	8,19	1,56			
	6 years	140	7,74	1,83			
Total 2	3 years	28	17,67	4,06	3, 288	,289	,833
	4 years	40	18,77	6,63			
	5 years	84	18,61	3,19			
	6 years	140	18,51	5,79			

The findings revealed that the age group that teachers worked with had no significant effect on Science Concepts [F(3, 288)= .617, p>.05], Science Delivery Method [F(3, 288)= 1.317, p>.05] and Total 2 [F(3, 288)= .289, p>.05].

CHAPTER V

DISCUSSION, IMPLICATIONS AND SUMMARY

This chapter consists of three parts. In the first part, the findings of the study related to the literature are discussed. The second part provides suggestions for further research and implications. The third part presents the overall summary of the study.

5.1. Discussion of the Findings

The first research question of the study investigated that whether there is a relationship between preschool teachers' attitudes toward science and the frequency of science activities provided in the classroom The results indicated that there was a significant correlation between the total attitude score of preschool teachers toward science and the total score of the frequency of science activities provided in the classroom. It can be drawn from the findings that attitudes of teachers are significantly related with the frequency of science activities that they provided in the classroom.

This result is consistent with many studies about teachers' attitudes and classroom practices. Pigge and Marso (as cited in Turkmen, 2007) stated that the teachers who have positive attitudes toward a field of teaching or a course reflect

their attitudes in their teaching. Furthermore, Mitchener and Anderson and Zoller, Dunn, Wild and Beckett (as cited in Pedersen and Totten, 2001) claimed that the way that the curriculum is implemented is affected by the teachers' beliefs.

The second research question explored that whether age of teachers are related to their attitudes toward science and frequency of science activities. However, the findings revealed that age of the preschool teachers are not related to their attitudes toward science and the frequency of science activities provided in the classroom.

The result of the current study was supported by a number of studies that investigate the impact of age on the attitudes of teachers. Dowdy (2005), Gressard and Loly (1985), and Hallam and Ireson (2003) reported that age had no significant effect on teachers' attitudes.

In the present study, majority of the teachers are in the age range between 26 and 35 and most of the teachers (59%) in this age range are working public schools. These factors might undermine the effect of age on teachers' attitudes toward science.

Impact of educational level of teachers on early childhood education teachers' attitudes toward science and the frequency of science activities was explored by third research question. The results showed that educational level has no significant effect on early childhood educators' attitudes toward science in terms of Comfort-Discomfort, Classroom Preparation, Managing Hands-on Science, Developmental Appropriateness, and Total 1.

This finding of this study is consistent with many studies carried out by Dowdy (2005), Manyfield-Shepard (1993), and Shireen-Desouza (1993). These

researchers have found no relation between educational level and teachers' attitudes. Nevertheless, the small number of teachers with a master's degree (14 out of 292) might be the reason of the insignificance of educational level on teachers' attitudes.

Furthermore, educational level has been found to have no significant effect on the frequency of science activities in terms of Science Concepts and on Total 2 except for Science Delivery Method. Further analysis revealed that preschool teachers with masters' degree were significantly different from the teachers with high school, a 2-year university and 4-year university degree. In other words, it can be concluded that when the level of education increases, the mean score of the frequency of science activities increases. This result may be because these teachers received education in how teach science (science delivery method) during their graduate studies or due to having conduct research about science and more knowledge about science delivery method in graduate study.

It was investigated that whether teachers' years of teaching experience are related to their attitudes toward science and frequency of science activities in by fourth research question. According to the results, while years of teaching experience had no meaningful effect on Comfort-Discomfort, Classroom Preparation, and Managing Hands-on Science, it had a significant effect on Developmental Appropriateness and Total 1. Scheffe Post-Hoc analysis was carried out to find out which groups differ from each other. The results of further statistical analysis displayed that teachers having less than 1 year of teaching experience hold more positive attitudes toward science on Developmental Appropriateness and total scores of early childhood educators' attitudes toward science than the teachers having more

years of teaching experience.

This result is interesting since teachers with more years of teaching experience were expected to display more positive attitudes. However, this finding was supported by many studies. Kallery (2004) was found that the teachers with more years of teaching experience had limited knowledge about science. Another study which was done by Bilaloğlu, Aslan, and Aktaş-Arnas (2006) revealed that teachers who had fewer years of teaching experience applied more science activities than the teachers who had more years of teaching experience.

Also, this result may be caused by new teachers' knowledge and awareness about developmental appropriateness in early childhood education. We can assume that newly graduated teachers who have less than one year of experience are more knowledgeable than teachers with more years of teaching experience. In addition, teachers who have less than one year of experience might be more enthusiastic than teachers who have more years of teaching experience.

By research question 5, whether teachers who participated in undergraduate course work on science differ from the teachers who did not participate in undergraduate course work on science was explored in terms of their attitudes toward science and the frequency of science activities provided in the classroom. The findings indicated that there was no significant difference between teachers who completed course work on science as an undergraduate and who did not complete any course work on science as an undergraduate with respect to Comfort-Discomfort, Classroom Preparation, Managing Hands-on Science, and Total 1. However, results also showed that there was a significant difference in teachers' attitudes toward

science in terms of Developmental Appropriateness. In other words, this finding revealed that the teachers who participated in course work on science during their undergraduate studies had more positive attitudes toward science on Developmental Appropriateness than the teachers who had not. Similarly, while no significant difference was found between teachers who completed course work on science as an undergraduate and who did not complete course work on science in Science Concept and Total 2, significant difference was found in Science Delivery Method. That is, it can be drawn from the findings that the teachers who participated in course work on science in undergraduate study hold more positive attitudes toward science on Science Delivery Method than the teachers who did not participate in course work on science in their undergraduate studies.

This result is consistent with the findings of much research that investigates the effect of science courses. For instance, Strawitz and Malone (1986) found that the attitudes of prospective teachers who have attended a science method course and field experience as a component of the course toward science and science teaching were significantly improved. The study by Westerback (1979) revealed that pre-service elementary teachers' attitudes toward science were found to be more positive during the courses of Science 5 and Science 6. Also, the scores that were obtained at the end of the two undergraduate courses showed that the pre-service elementary teachers' attitudes toward science continued to change in a positive direction. In another study, Paulson (2005) investigated the effect of an elementary science methods course on student attitudes toward science and science teaching. The findings indicated that the elementary science methods course resulted in more

positive attitudes and feelings of competence and confidence toward science and science teaching. Turkmen (2002) also found similar results. Pre-service teachers who take more science courses than other students who attended required science courses during their high school years indicated higher attitudes than the others.

The sixth research question of the study examined that whether number of science related activities that teachers completed are related to their attitudes toward science and frequency of science activities. The results showed that the teachers who completed 4 and 5 science activities hold more positive attitudes toward science than the ones who participated in 1 activity. Also, it was found that the teachers who participated in 4 and 5 science activities applied more science activities than the ones who participated in 1 activity.

This result was supported by the research findings by Chin (2005) and Cho (1997). Chin has found that pre-service teachers who previously attend science related activities had significantly higher attitude scores than the other pre-service teachers who did not take part in science related activities. Similar findings were drawn from the study by Cho (1997). The findings of his study revealed that early childhood teachers who participated in more public science events, bought or read more science books or magazines displayed more positive attitudes toward science teaching than the others.

This finding is not surprising since teachers who have previously engaged in science related activities may gain positive attitudes toward science as a result of their experiences in science or they have preferred to take part in science related activities due to their positive attitudes toward science. Thus, the number of science

activities that teachers have attended and positive attitudes toward science seems to be highly related with each other.

Influence of in-service training on preschool teachers' attitudes toward science and the frequency of science activities provided by the teachers was explored by research question 7. The results revealed that in-service training had no significant effect on early childhood educators' attitudes toward science.

This finding of the present study can be related with the findings of the research about primary teachers' attitudes and effect of a two year science in-service program by Jarvis and Pell (2004). They found that most teachers became more confident about teaching science outside the age group that they usually taught after a two year science in-service program except for the teachers who were working with lower age groups. The teachers who teach young children were found to be uncertain about their attitudes.

Furthermore, the duration of the in-service training that teachers attended was not known. The duration of in-service training may be too short or insufficient for preschool teachers. Therefore, it might not influence teachers' attitudes. This view is supported by Chen & Chang (2006). They reported that 48.3 % of the teachers participated in in-service training for one day or less, 32.7 % of them attended 2 - 5 days, and 19 % of them participated for more than a week. The results of the study indicated that only the teachers who attended in-service training for more than a week showed positive attitudes.

Another reason of this finding may be the percentage of teachers who participated in in-service training. Only 9.6% of the teachers participated in in-

service training on science. This small percentage might be the cause of the insignificance of in-service training.

It was investigated that whether teachers who work in private schools differ from the teachers who work in public schools in terms of their attitudes toward science and the frequency of science activities provided in the classroom by research question 8. The results indicated that preschool teachers who work in private schools hold more positive attitudes toward science than the teachers who work in public schools. In addition to this, while no significant difference was found between public and private school teachers in Science Concept and Total 2, the teachers working in private schools showed a significance difference in Science Delivery Method in terms of the frequency of science activities. That is, private school teachers provide more science activities than the public school teachers.

This result is consisted with the results of many studies. For example, Gwimbi and Monk (2003) and Hallam and Ireson (2003) found that teachers' attitudes are influenced by the school type where they work.

Although both public and private schools depends on the Ministry of National Education, schools have flexibility in the implementation of the curriculum. Also, private schools have more facilities than the public schools. These might be the causes of the difference in the attitudes of teachers who work in public and private schools.

Research question 9 explored whether teachers who work with fewer numbers of children differ from the teachers who work with more number of children in terms of their attitudes toward science and the frequency of science activities

provided in the classroom. The results displayed that preschool teachers who work with less children (0-15 children) hold more positive attitudes on Managing Hands-on Science than the teachers who work with more children (16-30 children). However, the number of children was not associated with the frequency of science activities provided in the classroom.

The results were related to the findings of other research by Lee and Loeb (2000) and Cho (1997). The findings of research by Lee indicated that teachers who work in small schools hold more positive attitude than the teachers who work in medium-sized and large schools. Cho found that teachers who teach smaller number of children had more positive attitudes toward science teaching than the teachers who teach to large number of children.

This result might also be caused by the difficulty in managing hands-on science activities with a lot of children. In early childhood settings, separating time for hands-on science experiences can be difficult for the teachers who work with a large number of children, whereas hands-on science activities can be applied easily with a small number of children. Therefore, it can be stated that the number of children and attitudes toward science in terms of Managing Hands-on Science is highly associated.

By research question 10, whether children's age are related to teachers' attitudes toward science and frequency of science activities was investigated. The results showed that the age group that teachers worked with had a significant effect on teachers' attitudes in terms of Developmental Appropriateness. Further statistical analysis revealed that teachers working with 4 year-old children hold more positive

attitudes toward science in terms of Developmental Appropriateness than the teachers working with 6 year-old children.

The result of the present study is supported by Vartuli (1999) who explored teachers' beliefs through grade levels. She found that when the grade level increased, developmentally appropriate beliefs and practices decreased. This finding of the present study may be related with the results of the research conducted by Shireen-Desouza and Czerniak (2003). They have found significant differences among the attitudes of secondary, junior/middle, and elementary science teachers. The results of Scheffe post hoc analysis among three groups revealed that elementary science teachers had higher attitudes than the attitudes of the secondary and junior/middle school science teachers. Furthermore, this finding may result from the differences in school type. 85% of the 4-year old children's teachers are working in private schools. The difference in the attitudes of 4 year-old children's teachers might be caused by the facilities that were provided by public and private schools.

5.2. Implications and Suggestions for Future Research

The present study provides a body of knowledge regarding the impacts of science background, undergraduate course work in science, and the number of children that teachers teach. The study also provides information about the relationship between teachers' attitudes toward science and the frequency of science related activities.

Another implication of this study is that teacher education programs should be reevaluated in light of the effect of undergraduate courses on science. The current study and previous studies have revealed the impact of undergraduate courses on teachers' attitudes (Paulson, 2005; Strawitz & Malone, 1986; and Türkmen, 2007).

This study also presents the relationship between teachers' attitudes toward science and the number of science related activities that teachers participated in. As mentioned, when the number of science activities teachers attended increased, teachers showed higher levels of attitudes toward science. Therefore, teachers should be provided science related activities both during pre-service and in-service training.

Another contribution of this study might be improving teachers' own understanding and awareness about the importance of science education and the impact of their attitudes on children and children's attitudes to improve the quality of science teaching and students' attitudes toward science.

Beyond these, in Turkey, there are no national standards in science education not only for early childhood education but also for upper grade levels. In order to grow students and teachers who have positive attitudes toward science and they are scientifically literate, first national standards for science education should be established.

The current study presents the preschool teachers' attitudes toward science and science teaching, its relationship with the frequency of science activities in the classroom and the effect of variables such as, teaching experience, undergraduate science course work, and number of children through a survey method. However, the underlying reasons of early childhood educators' attitudes toward science are as

important as attitude itself. Therefore, a further study might go into more detail and try to discover underlying reasons of attitudes thoroughly by using qualitative techniques such as observation and interview. Also, this study may provoke further studies about teachers' attitudes toward science and its impact on their classroom practices.

5.3. Summary

Teachers' attitudes toward science are a key factor in terms of teachers' understanding in science and their classroom practices. Also, children's long term attitudes toward science have been influenced by the attitudes of teachers whom children gain their first science experiences from (Koballa and Crawley, 1985; Harlan and Rivkin, 2004). Therefore, this study was carried out to investigate preschool teachers' attitudes toward science and its impact on classroom practices.

Previous studies in the literature have shown that teachers' attitudes may be related to many factors such as age, educational level, and years of teaching experience, course work and background on subject, in-service training, school type, school capacity or number of children, and grade level or age group (Dowdy, 2005; Hallam & Ireson, 2003; Sadık, 2006; Cho, 1997; and Jarvis & Pell, 2004). For this reason, the present study was conducted to analyze the impacts of age, educational level, years of teaching experience, course work and background on subject, in-service training, school type, school capacity or number of children, and age group on early childhood educators' attitudes toward science.

The following research questions were raised to explore the preschool teachers' attitudes toward science:

1) Is there a relationship between preschool teachers' attitudes toward science and the frequency of science activities provided in the classroom?
2) Are teachers' ages related to their attitudes toward science and frequency of science activities?
3) Are teachers' educational levels related to their attitudes toward science and frequency of science activities?
4) Are teachers' years of teaching experience related to their attitudes toward science and frequency of science activities?
5) Do teachers who participated in undergraduate course work on science differ from the teachers who did not participate in undergraduate course work on science in terms of their attitudes toward science and the frequency of science activities provided in the classroom?
6) Are number of science related activities that teachers completed related to their attitudes toward science and frequency of science activities?
7) Do teachers who participated in in-service training on science differ from the teachers who did not participate in in-service training on science in terms of their attitudes toward science and the frequency of science activities provided in the classroom?
8) Do teachers who work in private schools differ from the teachers who work in public schools in terms of their attitudes toward science and the frequency of science activities provided in the classroom?

9) Do teachers who work with fewer numbers of children differ from the teachers who work with more number of children in terms of their attitudes toward science and the frequency of science activities provided in the classroom?
10) Are children's age related to teachers' attitudes toward science and frequency of science activities?

Early Childhood Teachers' Attitudes toward Science Teaching Scale by (ECTASTS) developed by Cho et. all (2003) and revised by Schneider (2005) who added a part related to the frequency of science activities provided in the classroom was used in the study. The instrument was administered to 292 preschool teachers who work in public and private schools in different districts of Ankara. The results showed that there is a significant relationship between teachers' attitudes toward science and the frequency of science activities that teachers provide. In addition, analysis of the data has revealed that while age had no significant effect on teachers' attitudes; educational level, years of teaching experience, undergraduate science course, number of related science activities, school type, number of children, and age group of children had significant effect on teachers' attitudes toward science.

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APPENDICES

APPENDIX A

ÜÇ - ALTI YAŞ GRUBU ÖĞRETMENLERİNE YÖNELİK FEN ÖĞRETİMİ TUTUM ÖLÇEĞİ

1. Cinsiyetinizi belirtiniz.
   a) Kadın b) Erkek

2. Yaşınızı belirtiniz.
   a) 25 yaş altı
   b) 26-35 yaş arası
   c) 36-45 yaş arası
   d) 46-55 yaş arası
   e) 56 yaş ve üzeri

3. Eğitim düzeyinizi belirtiniz.
   a) Lise mezunu
   b) 2 yıllık üniversite mezunu
   c) 4 yıllık üniversite mezunu
   d) Yüksek lisans mezunu
   e) Doktora mezunu

4. Mezun olduğunuz bölümü belirtiniz.
   a) Çocuk Gelişimi ve Eğitimi
   b) Okul Öncesi Eğitimi
   c) Anasınıfı Öğretmenliği
   d) Diğer (Belirtiniz.) _____

5. Kaç yıldır okul öncesi öğretmeni olarak çalışıyorsunuz?
   a) 1 yıldan az
   b) 1-3 yıl
   c) 4-6 yıl
   d) 7 yıl ve üzeri

6. Katıldığınız tüm fen eğitimi etkinliklerini işaretleyiniz.
   a) Lisedeki fen bilgisi dersleri
   b) Üniversitedeki fen bilgisi ile ilgili ders çalışmaları
   c) Fen bilgisi ile ilgili hizmetiçi eğitimi
   d) Fen bilgisi ile ilgili konferans ve atölye çalışmaları

e) Fen bilgisi ile ilgili kaynak kitaplar okumak
f) Fen bilgisi ile ilgili dergi ve/veya makaleler okumak

7. Almış olduğunuz fen derslerinin sayısını yazınız.
_____ Lise _____ Üniversite

8. Hoşlandığınız fen eğitimi etkinliklerini işaretleyiniz.
a) Lisedeki fen bilgisi dersleri
b) Üniversitedeki fen bilgisi ile ilgili ders çalışmaları
c) Fen bilgisi ile ilgili hizmetiçi eğitimi
d) Fen bilgisi ile ilgili konferans ve atölye çalışmaları
e) Fen bilgisi ile ilgili kaynak kitaplar okumak
f) Fen bilgisi ile ilgili dergi ve/veya makaleler okumak

9. Hangi tür okulda çalıştığınızı belirtiniz.
a) Devlet Okulu
b) Özel Okul

10. Çalıştığınız yerin resmi kapasitesini belirtiniz.
a) 0-25 çocuk
b) 26-50 çocuk
c) 51-75 çocuk
d) 76 çocuk ve üzeri

11. Sınıfınızdaki çocuk sayısını işaretleyiniz.
a) 0-15
b) 16-30

12. Sınıfınızdaki yaş grubunu işaretleyiniz.
a) 3 yaş
b) 4 yaş
c) 5 yaş
d) 6 yaş

Lütfen aşağıdaki ifadeleri okuyun ve ifadeye ne kadar katıldığınızı gösteren sayıyı işaretleyiniz.

		Kesinlikle katılmıyorum	**Katılmıyorum**	**Biraz katılıyorum**	**Kesinlikle katılıyorum**
1.	Okul öncesi sınıfımda fen etkinlikleri * yaparken kendimi rahat hissederim.	1	2	3	4
2.	Küçük çocuklara feni yeteri kadar öğretemeyeceğimden korkarım.	1	2	3	4

3.	Fen dersini küçük çocuklara öğretmek için gerekli bilimsel bilgi düzeyine sahip olduğum konusunda kendimi rahat hissederim.	1	2	3	4
4.	Çocukların bana bilimsel yasalar ve olaylar hakkında cevap veremeyeceğim sorular sormalarından korkarım.	1	2	3	4
5.	Sınıfımdaki çocukları fen hakkında heyecanlandırmayı umuyorum.	1	2	3	4
6.	Çocukların bilimsel sorgulamalarının içerisinde yer almaya istekliyim.	1	2	3	4
7.	Küçük çocuklara yönelik fen etkinlikleri hakkında fikir almak için kaynak kitaplar okumaktan hoşlanırım.	1	2	3	4
8.	Bilimsel araştırmalara materyal ★ hazırlamak için zaman harcamaya istekliyim.	1	2	3	4
9.	Uygulamalı fen etkinlikleri planlamak için bilimsel bilgi ve becerileri öğrenmeye ve kullanmaya hazırım.	1	2	3	4
10.	Fen öğretimi ile ilgili fikir ve konuları diğer öğretmenlerle tartışmaktan hoşlanırım.	1	2	3	4
11.	Çocukların bilimsel araştırmalarını cesaretlendirmek için açık uçlu sorular sormaya alışkınımdır.	1	2	3	4
12.	Fen öğretimi için hazırlanmak genellikle diğer konulara hazırlanmaktan daha fazla zaman alır.	1	2	3	4
13.	Sınıfta fen deneyleri yapmaktan korkmam.	1	2	3	4
14.	Fen öğretiminde kullanmak için materyal ve nesneleri toplamaktan hoşlanırım.	1	2	3	4
15.	Fen öğretmek için çeşitli hayvan ve böcekleri kullanmakla ilgilenirim.	1	2	3	4
16.	Fen etkinlikleri için sınıf materyallerini (bloklar, oyuncaklar, kutular, vb.) kullanırken rahatımdır.	1	2	3	4
17.	Sınıfımda♦ uygulamalı fen etkinlikleri yaparken oluşan dağınıklıktan rahatsız olmam.	1	2	3	4

18.	Çocukları fenle erken yaşta tanıştırmanın uygun olduğuna inanmıyorum.	1	2	3	4
19.	Küçük çocukların gelişimlerine uygun fen etkinliklerini belirlemede rahatımdır.	1	2	3	4
20.	Küçük çocukların bilimsel kavramlar, olaylar ya da gözlemler hakkında meraklı olduklarını düşünmüyorum.	1	2	3	4
21.	Küçük çocukların fen öğrenme sürecini ve yollarını iyi bilirim.	1	2	3	4
22.	Küçük çocukların okumayı öğrenene kadar fen öğrenemeyeceklerini düşünüyorum.	1	2	3	4

*Fen etkinlikleri/deneyleri çocuklara çeşitli doğal ve insan ürünü araçları keşfetmelerini sağlayan ortamlardır. Bu etkinlikler bilimsel sorgulamayı (araştırma ve nesnelerle deney), fiziksel fen etkinliklerini (nesneleri boyut, şekil ve kullanımlarına göre gruplama), biyolojiyi (bitkiler ve hayvanlar) ve dünyanın yapısını, yaşını, vb. inceleyen bilimleri (hava koşulları, mevsimler, çevre, su, hava ve toprak) içerir.

★Fen materyalleri ve aletleri çocukları dokunmak, hareket ettirmek ve inşa etmek için cesaretlendiren doğal ve insan yapımı ürünlerdir. Materyal ve araçlar nesnelerin koleksiyonunu (böcekler, taşlar, yapraklar), tipik fen araştırma aletlerini (büyüteç, terazi), hayvanlar ve bitkileri, duyusal nesneleri (tüyler, süngerler, kum) ve diğer bulunan nesneleri ya da makineleri (yumurta çırpıcı, makara, saat) içerebilirler.

♦Fen alanı, "araştırma istasyonu" ya da keşif köşesi sınıf içinde ya da dışarıda çocuklara araştırmalarını ve fen materyallerini saklamalarını sağlayan bir yerdir.

Lütfen aşağıdaki ifadeleri okuyun ve hangi sıklıkta fen etkinlikleri yaptığınızı en uygun gösteren sayıyı işaretleyiniz.

		Hiç bir zaman	**Arasıra**	**Haftada bir**	**Günde bir**
23.	Sınıfımda bilimsel sorgulama ve keşifler için fırsatlar sağlarım. Çocuklar fen köşesine, duyu masasına (ıslak ve kuru etkinlikler için) ya da doğal nesnelerin sergilenmesine (tüyler, ince dallar,vb.) nesnelerin koleksiyonuna (anahtar, pul,vb.) ve deney aletlerine (büyüteç, terazi, vb.)ulaşabilir ve bu durumlarda tercihlerini ve eylemlerini kendileri belirleyebilirler.	1	2	3	4

24.	Bilimle ilgili sorular sorarak ve bilimsel kavramların araştırılmasını cesaretlendirerek öğretilebilir anları değerlendiririm. (Örneğin; bloklarla oynayan bir çocuğa denge, boyut ve yerçekimi ile ilgili sorular sormak.)	1	2	3	4
25.	Çocukların yapılandırılmış fen etkinliklerine katılabilmeleri için fırsatlar yaratırım: Keşif ve deney için belirli aletler seçerim. Çocukların etkinlikleri için çeşitli yönergeler veririm.	1	2	3	4
26.	Bilimsel sorgulama ve keşif için sınıfımı hazırlarım (çocuklar bilgiyi keşfetmek için araştırırlar ve nesnelerle deney yaparlar.	1	2	3	4
27.	Çocuklara nesneleri fiziksel özelliklerine göre (boyut, ağırlık) ya da duyusal niteliklerine göre (renk, şekil) sınıflandırabilecekleri fen etkinlikleri yapmaları için şans veririm.	1	2	3	4
28.	Çocuklara bitki ve hayvanlarla deneyimleri olması için biyoloji etkinlikleri sağlarım.	1	2	3	4
29.	Çocuklara hava koşulları, mevsimler, dış çevre, su, hava ve toprak gibi dünya ile ilgili kavramlar içeren fen etkinlikleri sunarım.	1	2	3	4