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Determination of Factors Affecting Preschool Teacher Candidates' Attitudes towards Science Teaching*

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Abstract

The purpose of this study was to determine preschool teacher candidates' attitudes towards science teaching and to examine the reasons behind their attitudes in depth. In this study, mixed methods were used including quantitative and qualitative data. Quantitative data gained by attitudes towards science teaching scale, qualitative data gained by focus group interview with 10 preschool senior teacher candidates. Data were analyzed by content analysis methods. At the end of the analysis four themes were attained. These four themes are; science content knowledge, experience of science teaching, opinions of the science education course in their undergraduate program, knowledge of science teaching methods. Preshool teacher candidates' attitudes towards science teaching were obtained good level. However, comfort-discomfort sub-dimension was identified as having medium attitude score. In addition, as a result of focus group interview data, science content knowledge and positive science teaching experience have been found to be most effective positive attitudes towards science teaching. In light of results obtained from the study, educational suggestions for preschool teacher candidates' attitudes towards science teaching are made.

Key Words

Preschool Teacher Candidates, Science Teaching, Attitudes.

Early childhood education is an important process in pediatric development (Kol, 2012) of individuals as it prepares them for primary education by contributing to their physical, social, cognitive and emotional development (Ayvacı, 2010; Özbey & Alisinanoğlu, 2010). Especially during early childhood, children tend to explore the objects and events happening in their environment by touching, hearing, seeing, smelling and tasting and by asking questions out of curiosity. Children observe the events happening in the physical world and begin to build their own hypothesis. As a result, they achieve meaningful learning and develop their own ideas about how the equipments around them work. Thus, children begin to learn science by themselves and their process of science learning starts as their attitudes towards science begin to develop (Ünal & Akman, 2006; Karamustafaoğlu & Üstün, 2006; Özbey & Alisinanoğlu, 2010; Özdemir & Uzun, 2006). In short, children begin to learn the concepts of physical sciences and other scientific fields during early childhood. Most of the concepts aimed to be taught are presented by activites. For this reason, teachers' attitudes towards science, adequacy of their content knowledge and their ability to present it through activities are of vital importance at this point (Ayvacı, 2010; Özbey

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& Alisinanoğlu). An effective teaching of science during eary childhood is dependant on the preschool teacher candidates' attitudes towards science and the factors affecting the development of their attitudes.

Children's curiosity towards science should be supported by their teachers and each question they ask should be answered carefully because teachers' curiosity and passion for science can become a role model for children. Teachers should be able to motivate each child to participate in scientific activities and research. For this reason, preschool teachers should know children's cognitive development very well, organize activities considering individual differences, arouse students' curiosity for science, give them the opportunity to develop a skeptical attitude about a situation, listen to their creative ideas about science carefully and provide an effective learning environment (Günay Bilaloğlu, Aslan, & Aktaş Arnas, 2008; Karamustafaoğlu & Üstün, 2006; Ünal & Akman, 2006).

In order for students to learn science subjects in school curricula properly, those subjects should make sense for them and they should be encouraged to develop a positive attitude (Erdemir & Bakırcı, 2009) because students' attitudes towards a school subject have an important effect on their learning process (Altınok, 2004). In Science and Technology classes it is aimed at transferring scientific knowledge into their daily lives rather than just memorizing it. Other objectives are; enabling students to know what to do and how to react when they encounter a difficulty and teaching them the skills to think like a scientist (Demirbaş & Yağbasan, 2008). The main focus of science education is to enable students to perceive the knowledge they gain at school from a new point of view and to carry that knowledge to the other stages of their lives (Bilgin & Geban, 2004). At the same time, sufficient science education provides students with skills of critical thinking (Sert Çıbık, 2009).

Attitude means positive or negative learned and consistent behavior towards an object (Magno, 2003). Attitudes are not only behavioral tendencies or just an emotion but a combination of behavioral tendencies resulting from both thoughts and emotions (Kağıtçıbaşı, 1988, p. 84). The concept of attitude has three components as cognitive, affective and kinetic attitudes. These components are dependent on one another. They affect each other mutually, and most of the time there is a consistency among them (Aydın, 2002, p. 281). Although attitude is an indefinable affective factor, 'attitude towards science' can be defined as a belief system or set of values related to a scientific object, to the subject of science or to the influence of science on the society. Attitudes towards science are related to student participation and performance in a science class (Norby, 2003). Gardner defines attitude towards science as learned tendencies in evaluating objects, people, actions, and situations in a certain way or as statements about the field of science whereas Martinez supports the idea that students' attitudes to science classes and their academic success affects their attitudes towards science education (cited in Altınok, 2004).

In the literature there are plenty of studies on teachers' and teacher candidates' attitudes towards science education in primary and secondary education. Some of the research in the literature is on self-efficacy in science teaching and comparison of attitudes toward science teaching (Çelikkaleli & Akbaş, 2007; Denizoğlu, 2008; Bayraktar, 2011; Sullivan, 2011), analysis of attitudes toward science teaching in terms of different variables (Altınok, 2004; Hançer, Uludağ, & Yılmaz, 2007; Kitts, 2009; Türkmen, 2008) and the effect of content knowledge on teacher attitudes towards science teaching (Johnston & Ahtee, 2006; Murphy & Smith, 2012; Weinburgh, 2007). There are also studies that review the literature on attitudes toward teaching science which came into prominence in the recent years (Nieswandt, 2005; Osborne, Simon, & Collins, 2003; Van Aalderen-Smeets, Walma van der Molen, & Asma, 2012). Although the teaching of science has an important role in early childhood education, the number of studies on the attitudes of preschool teachers and teacher candidates on science teaching is still scarce. In one of these studies a small but significant relation was found between preschool teachers' attitudes towards science teaching and the frequency of science activities done in the class but there was not a significant relation between the preschool teachers' level of education and years of experience and their attitudes to science teaching (Erden & Sönmez, 2011). In another study, it was found out that preschool teachers' limited content knowledge of science makes them to feel insufficient in science and nature activities (Kallery & Psillos, 2001). In addition, it has been determined that preschool teachers need in-service training on science and nature activities (Kıldan & Pektaş, 2009).

When the literature is reviewed, it can be concluded that the studies on preschool teachers' and teacher candidates' attitudes towards science teach-

ing mainly focus on the implementation of science activities in early childhood education, self-efficacy of teachers in science teaching, the analysis of attitudes towards science in terms of different variables and teachers' attitudes to science teaching. However, unlike other studies in the literature, this study analyzes preschool teacher candidates' attitudes towards science teaching and the factors affecting their attitudes.

Objectives of the Study

This study aims at analyzing the attidutes of preschool teacher candidates (senior students studying early childhood education) towards science teaching and the factors affecting their attitudes. The research questions are as follows:

1. What are the preschool teacher candidates' attitudes towards science teaching?
2. What are the factors affecting the preschool teacher candidates' attitudes towards science teaching?

Method

Research Design

Mixed methods research was used in this study. In mixed method, researchers seek to answer research questions by using both qualitative and quantitative data (Nagy & Biber, 2010, p. 3). Quantitative research focuses on relations among variables (Denzin & Lincoln, 1998, p. 8) and tries to answer the question 'how many'; while qualitative research focuses on process and seeks answers to questions 'why' and 'how'. Researchers who use mixed method collect qualitative data by standart tests, scales, true false tests or scoring scales. On the other hand, they use interviews, open-ended written questions, focus group interviews, dairies, documents, printed books or works of art to collect qualitative data (Brannen & Halcomb, 2009, p. 68). Sometimes mixed method is the best way to collect qualitative and quantitative data depending on the aim of the research (Muijs, 2004, p. 6). Using mixed methods research is a useful strategy that strengthens weaknesses of other methods and presents an extensive empirical record (Axinn & Pearce, 2006, p. 58-59).

In this study, enrichment study design which is one of the four different mixed method designs was used because it was aimed at collecting different but supplementary data on the same topic in order to understand research questions better. After collecting the data it was checked if the data were consistent or not. In enrichment study design the researcher compares statistical qualitative data with findings or supports quantitative data with qualitative data (Cresswell & Clark, 2007).

Qualitative studies are appropriate for many case studies including statistical hypothesis testing. The value of many case studies can be increased by using different data collecting tools, quantitative and qualitative methods together in the same study (Woodside, 2010, p. 11). Regarding the research questions, descriptive survey model of quantitative research and case study method of quantitative research were used in this study in order to obtain more valid and reliable data.

Survey research is carried out in large groups and the opinions and attitudes of individuals in the group are collected in order to describe facts and events (Karakaya, 2009, p. 59). According to Büyüköztürk, Çakmak, Akgün, Karadeniz, and Demirel (2009, p. 16) survey research model aims at collecting data to determine certain features of a group. In this study case study method of quantitative research was used. Case studies generally focus on facts that represent personal groups or individuals and they analyze this fact by limiting it to its natural time and place and describe it in detail because it collects data from extensive and various sources (Hancock & Algozzine, 2006, p. 15-16). Case studies are the most common quantitative research method (Stake, 2005, p. 443) seeking answers to questions of how and why (Yin, 2003, p. 22). Data are obtained by observations, interviews and documents in case studies (Yin). In addition to this, data collection methods can vary. Individual interviews and group interviews can be carried out with the participants.

In this study "Focus Group Interview" was used to collect quantitative data. Focus group interviews provide a basis for one on one interview and questionnaires and it is important for determining the knowledge, experiences, feelings, perceptions and attitudes of participants (Çokluk, Yılmaz, & Oğuz, 2011). Focus group interviews are advantageous methods used to save time when the participants have similar characteristics (Creswell, 2007, p. 133).

Participants

The study was carried out at Çanakkale Onsekiz Mart University with 60 Early Childhood Education Department senior student teachers who study in two different groups. Two voluntary male

and eight voluntary female preschool teacher candidates participated in the focus group interview. The participants were exposed to a "science education" course for a semester before the focus group interview.

Data Collection Instruments

Quantitative research method was used to find out an answer to the first research question of the study while qualitative research methods were used for the second. The quantitative data were collected from 60 preschool teacher candidates by administering an attitude scale for preschool science teaching. The scale which was adapted to Turkish by Çakmak (2006) includes sub-dimensions of comfort-discomfort, preparation before teaching, experimental science teaching method and developmental readiness. Focus group interview was carried out with 10 teacher candidates for qualitative data for an hour.

Attitude Scale for Science Teaching (ASST) was developed by Thompson and Shrigley (1986) for primary school teachers. It was adapted to preschool teacher candidates by Cho, Kim and Choi (2003 cited in Çakmak, 2006). Çakmak (2006) adapted the scale to Turkish. It is a five point likert type scale and it consists of seventeen items divided into five sub-dimensions. The sub-dimentions are; comfort-discomfort (items 1-4), preparation before teaching (items 5-8), experimental science teaching method (items 9-12) and developmental readiness (items 13-17). In the adaptation process of the scale, Cronbach Alpha reliability was found as $\alpha = .81$. For the sub-dimentions it was found as $\alpha = .66$ for comfort-discomfort, $\alpha = .75$, for preparation before teaching, $\alpha = .52$ for experimental science teaching method and $\alpha = .46$ for developmental readiness. In this study, Cronbach Alpha reliability coefficient for the whole scale was found as $\alpha = .78$. For sub-dimensions it was found as $\alpha = .56$ for comfort-discomfort, $\alpha = .73$, for preparation before teaching, $\alpha = .62$ for experimental science teaching method and $\alpha = .66$ for developmental readiness.

Focus group interview is a kind of interview in small groups on a certain topic. A focus group interview generally consists of six to ten people and it lasts for one or two hours around a selected topic (Patton, 2002, p. 385). For this purpose, the focus group interview of this study lasted for almost an hour and it was recorded. Fourteen main questions were prepared for teacher candidates in order to find out their experiences on preschool science teaching and their opinions about it. Interview questions were prepared by taking the opinions of two academic members into consideration. The academic members teach science education to students of Early Childhood Education Department. After preparing the questions, a pilot study was carried out by two teacher candidates who were out of the experimental group. As a result of the pilot study the questions which were difficult to understand for teacher candidates were readjusted (Creswell, 2007, p. 133). Some of the questions asked during the focus group interviews are; "Do you have any experience of teaching science at preschools?", "Do you think you are sufficient enough to teach science to preschool children?" and "What are the shortcomings of preschool science teaching process that you have observed?" During the focus group interview it was aimed at receiving opinions of each teacher candidate. Therefore, new questions related to their answers or the answers given by the other participants were asked in order to deepen their opinions. Apart from this, some sub-questions were asked to obtain a thorough understanding of the teacher candidates' opinions. In accordance with the focus group interview teacher candidates' opinions about each question were tried to be received. During this process, teacher candidates agreed on each others' ideas and put forth opposite or different views. In this respect, it can be stated that the focus group interview was fruitful in terms of collecting appropriate data.

In addition to this, they explained their ideas by agreeing or disagreeing on the opinions of other participants even though they did not have any idea when they were asked in the first place. Thus, it is assumed that a wider range of data was collected in terms of content and depth. Focus group interview was carried out under the moderatorship of the academic member who taught preschool science education course. The group interview was consisted of semi-structured questions. It was recorded and scripted down as thirty three pages long document to be analyzed and interpreted.

Data Analysis

The voice recordings of the focus group interview were scripted as a written document. Content analysis method was used to analyze it. The main aim of content analysis is to find out the concepts and relations which explain the collected data. For this purpose the collected data have to be conceptualized and organized logically according to

the concepts revealed and the themes that explain the data have to be determined (Cassel & Symon, 2004). The documented opinions of teacher candidates were coded and the themes were found out by two professional qualitative researchers. The researchers independently marked the codes as "Agreement" or "Disagreement" in order to be consistent. The formula suggested by Miles and Huberman (1994) was used to measure the reliability of the concordance correlation coefficient of the data analysis. When the researchers used the same code for teacher candidates' statements it was called "Agreement" and when they used different codes it was called "Disagreement". The concordance correlation coefficient between the first professional and the researcher was found as 0,85 while it was found as 0,89 between the second professional and the researcher. If the concordance percentage of the codes in the data set of two different researchers is 70%, it is accepted as reliable. The coefficients obtained from the study show that the coding is reliable. In addition, the participants' opinions were quoted directly in order to increase the internal reliability of the study. By direct quotations, it was aimed at conveying the participants' opinions more effectively to the reader. HyperRESEARCH 2.8.3. Program was used to analyze the qualitative data. Four themes were found out at the end of the analysis. These themes are; science content knowledge, experience of science teaching, opinions of the science education course in their undergraduate program, knowledge of science teaching methods.

Findings

Findings Regarding Preschool Teacher Candidates' Attitudes towards Teaching of Science

In order to interpret the data collected in the study "Sequence Range / Number of Groups to be established" (Tekin, 1993) formula was taken into account while measuring the range width of the scale. In this respect, the arithmetic means this study is based on are; I totally disagree for the score interval of 1,00-1,79, I disagree for the score interval of 1,80-2,59, I am undecided for the score interval of 2,60-3,39, I agree for the score interval of 3,40-4,19 and I totally agree for the score interval of 4,20-5,00.

The attitude scale of preschool teacher candidates for science teaching and the points they got from the sub-dimensions are shown in Table 1 below.

Table 1.
The Attitude Scale of Preschool Teacher Candidates for Science Teaching and the Distribution of the Points they Got from the Sub-dimensions

Sub-dimensions	N	Minimum	Maximum	$\bar{x}$	SD
Comfort-Discomfort	60	2,00	4.00	3,22	0,47
Preparation before Teaching	60	2,25	5	3,81	0,53
Experimental Science Teaching Method	60	2,00	4,00	3,42	0,47
Developmental Readiness	60	5,5	5,00	3,59	0,67
General	60	2,82	3,94	3,48	,28

The average of the points preschool teacher candidates got from the attitude scale for science teaching was found as 3,48. According to this finding it can be stated that preschool teacher candidates have a "posivite" attitude towards science teaching.

It can be indicated that teacher candidates have positive attitudes towards science teaching according to the findings obtained from sub-dimensions of preparation before teaching ($\overline{X}$ =3,81), experimental science teaching method ($\overline{X}$=3.42) and developmental readiness ($\overline{X}$=3.59). In comfort-discomfort sub-dimension ($\overline{X}$= 3.22) the teacher candidates have moderate attitudes.

Findings Regarding Preschool Teacher Candidates' Science Content Knowledge

Preschool teacher candidates stated that the failure of a science activity they do in the class results from the lack of their content knowledge. Because of their inadequate knowledge of science, they could not understand why the science activity of that class was a failure.

> *Student Teacher 3: "One day our friends from the group also came for the experiment of electrification. We were 15 people altogether working with 5 year olds. We couldn't do the electrification experiment. We couldn't do it no matter how hard we tried."*
>
> *Interviewer : "What did the children say? Did they ask you why it didn't work?*

Student Teacher 3: "Yes, they did. Then we started to do another experiment."

Interviewer: "But they knew the result; they must have seen it before and they probably know that it will lift the paper up…"

Student Teacher 3: "Yes, they had seen it before and asked us why we couldn't do it but we also didn't understand it"

Another teacher candidate also does not know why a science activity was not successful and this might also result from the lack of content knowledge.

Student Teacher 8: "We tried to do an experiment called parachute man but as it was done with a nylon bag it was difficult to do it properly. But later some of them tried and achieved to fly it so they were interested in the experiment but most of their parachutes didn't fly…"

Teacher candidates also stated that preschool teachers prefer to do art activities rather than science activities.

Student Teacher 4: "…doing an art activity takes an hour of class time, exhibitions, and expectations of the head teacher and so on. So, they prefer to do some art work instead of science activities."

They stated that preschool teachers' content knowledge of science is inadequate. Therefore, they avoid doing science activities.

Student Teacher 5: "In my experience, the teacher didn't do any science activities for the whole semester. There was a problem with the teacher, too. I just observed art activities."

Student Teacher 6: "Teachers give more importance to art activities than science activities. It makes sense for them to say kids did this kids did that. First of all, they find it easier to hang something on the wall……. teachers' knowledge, culture and qualifications are important"

Student Teacher 7: "I observed 5 year olds and that week the teacher was teaching buoyancy of water so she brought a bucket of water and stones, toys and things like that, she demonstrated the experiment. But I have doubts about its efficiency.

Teacher candidates expressed that the shortcomings of preschool science teaching processes are because of the lack of preschool teachers' content knowledge of science.

Interviewer: "What are the shortcomings of preschool science teaching process that you have observed?"

Student Teacher 4: "lack of content knowledge"

Interviewer: "What do you mean by lack of content knowledge? Do you mean that teachers don't know about science as you said before?

Student Teacher 6: "Most of them don't."

Preschool teacher candidates stated the reasons of unsuccessful activities in preschool science teaching as the lack of their own content knowledge. This resulted in the tendency to replace science activities with art activities. They expressed that the shortcomings of science teaching at preschools results from inadequate content knowledge of preschool teachers. This might be an important factor affecting their attitudes towards preschool science teaching.

Findings Regarding Preschool Teacher Candidates' Experiences of Science Teaching

Preschool teacher candidates stated that their experience of preschool science teaching is limited to demonstration experiments.

Student Teacher 2: "I did a demonstration experiment because if they did it individually they might have spilled the water. I did the dancing grapes. I filled one glass with water and the other with sparkling mineral water and then put the grapes in the glasses and asked them why the grapes floated on sparkling mineral water but not on the water and they answered. They explained why they didn't move in the water. They said the waves raised them up and down. I tried this with 6 year olds…"

Student Teacher 10: "….I conducted an experiement for the first time with preschool children; it attracted their attention and increased my self-confidence. If I had done another experiment, it would have been the same. I did the experiment that you conducted with us, the one that we did by putting paper on a glass and explained that it happens due to external and internal pressure but they found it difficult to understand, then I explained it once more and

they understood."

Student Teacher 8: "I demonstrated the experiment with candles. It's a very simple experiment; you light the candles and cover them and they blow out. I demonstrated the experiment and let all the students to try it and they were interested in it."

Teacher candidates concluded from their experiences of preschool science teaching that science teaching improves with experience.

Student Teacher 5: "…sometimes we think that we have difficulties or we can't do it. There are experienced and inexperienced teacher candidates. We go to schools to gain experience and as we go it gets better, the more we experience the better we get, all in all there are different students…"

Student Teacher 9: "the thing is we can't search for something because nothing comes to our minds but when we're in the class the children ask something and then we say hey why don't we search it today and as we search we improve ourselves ….Did I have to learn the theory? Yes I did. At first it seemed unnecessary. It could be better if they first teach the practice then the theory"

Preschool teacher candidates' science teaching experiences mainly consisted of demonstration experiments. This indicates the fact that teacher candidates' content knowledge of science is inadequate. In addition, teacher candidates think that their teaching will improve by experience. This indicates that they feel themselves inadequate and that they do not have self-confidence in teaching science.

Findings Regarding Preschool Teacher Candidates' Opinions of the Science Education Course in their Undergraduate Program

Preschool teacher candidates stated that preschool science education courses should be more practical than theoretical.

Student Teacher 2: "…we have theoretical classes all the time and there's nothing related to practice. To be honest the education we get at university doesn't involve any practice and if I didn't do it myself now, I would never be able to do it when I graduate"

Student Teacher 3: "I think practice can be done. There should be practical classes in laboratories. There are no separate laboratories"

Student Teacher 9: "Well, in foreign countries we see children have separate laboratories, they wear their overalls and bonnets, they study like scientists and feel like them, we don't have that opportunity…"

Student Teacher 4: "…or there could be reports. We could conduct an experiment as Büşra said. But before we present it we could conduct it and take down notes. We could also videotape it to see if there were any difficulties faced. The presenter can show us the experiment conducted from the video record and show the main experiment. Questions might be asked to our classmates after pausing the record when a child asks a question and we could discuss how that question can be answered. Then the actual answer can be listened."

Preschool teacher candidates think that they can teach preschool science classes by doing some research about it and without taking science education classes at university. They believe that science education courses are not useful.

Student Teacher 5: "Even someone who hasn't taken any classes on science teaching can conduct science experiments just by doing some research on their own."

Student Teacher 4: "This can be learned only by practice…"

Student Teacher 6: "When we talk about efficiency for example you can teach us the basics, it is just 4 hours a week, we can't say ok we learned everything and we are ready. But if you teach us the basic things and if we learn them, it is our responsibility to improve our knowledge and skills…"

Teacher candidates expressed that the course should not be just for one semester but continue in the second semester, too. They also stated that 2 hours theory and 2 hours practice should not be on the same day one after the other.

Student Teacher 2: "I think the course can be divided into two semesters but not as four hours. It can be two hours a week because four hours is too long and tiring. We can confuse all the experiments we learn. I complained about the length and intensity of the course at the beginning of the term."

Preschool teacher candidates support the idea that the science education course they take at university for one semester should be more practical. They do not feel themselves adequate in science teaching because they think the science education course is too theoretical. In addition, they believe that science can be taught at preschools without taking a science education course at university. They do not think the course is beneficial. This might affect their attitudes towards teaching of science. They also stated that the course should be divided into two semesters instead of 4 hours a week in one semester.

Findings Regarding Preschool Teacher Candidates' Knowledge of Science Teaching Methods

Preschool teacher candidates stated that drama and story telling methods can be used frequently in science teaching.

> *Student Teacher 6: "Cloud brothers bumped into each other by accident while they were trying to walk across and the clouds they were carrying at that time fell down in the form of rain. We can teach rain by telling this story. We don't have to conduct experiments in science and maths classes.*
>
> *Student Teacher 7: "Yes, dramatization and impersonation are two frequently used and the best methods in our field. For example, you can teach the growth of a seed by telling a story."*

Teacher candidates stated that they also use question and answer teaching method in science teaching.

> *Student Teacher 3: "Before conducting the experiment we can ask questions to children to learn their preliminary knowledge."*
>
> *Student Teacher 6: "Open ended questions arouse children's curiosity."*
>
> *Student Teacher 4: "First we give preliminary information. For example, I first asked types of matter like solid, liquid and gas and they gave examples. I listened to every student's answer. Then I started the experiment and after that I used question and answer method again. The kids retold what happened during the experiment…"*

Teacher candidates expressed that they preferred demonstration experiments due to crowded classes.

> *Student Teacher 4: "on the other hand their parents don't care and the kids take them as models and they also don't care. At this point the teacher takes the responsibility but what can the teacher do with twenty students in one classroom? We can't expect her to be interested in the kids individually. But it can be like this; the teacher demonstrates and asks questions and answers the students' questions."*

However, it was determined that the teacher candidates are confused about the concepts related to the teaching methods.

> *Student Teacher 5: "learning together, learning by doing, learning by demonstrating"*
>
> *Student Teacher 2:"I observed 4 year olds for a month. I don't think children at that age can understand by demonstration method. I can only be an example for them. The teacher mixed the colours and just told the process, so it's not difficult to demonstrate to children. There are twenty five children you can simply make them do an overall then give them transparent glasses they can enjoy more if they mix the colours themselves. I mean, it's not always necessary to use demonstrations they can also learn by doing."*
>
> *Student Teacher 5: "actually both the teacher and the children do the activity, later as it is a long term process we observe it, I mean we make use of observations, too."*
>
> *Student Teacher 6: "we use presentation technique, the kids do, they observe, it is one of the best examples"*

In addition, teacher candidates think that preschool science activities are done spontaneously.

> *Student Teacher 2: "Even if we don't do anything the children leads us, if we forget to say something they immediately ask a question and we remember what to do, it happens spontaneously, I'm not concerned about what they will ask next."*

Teacher candidates stated that science-math corners at schools are important but they think that in state schools those corners are not considered important because of small classrooms.

> *Interviewer: "Were there science-math corners at the schools you worked or trained?"*
>
> *Student Teacher 2: "Yes, there was."*

Student Teacher 5: "No, there wasn't."

Student Teacher 6: "devlet okullarında yok gibi ama özel okul kuruluşlarında var çok faydalı olmasa da yeterli olması da bizde vardı" "there aren't science corners in state schools but there are in private schools but not adequate.

Student Teacher 3: "there are no globes or human skeleton models"

Interviewer: "So do you mean there are materials from mountains?

Student Teacher 3: "Yes, exactly, the animal figures"

Student Teacher 9: "The classrooms are small, preschools are problematic as it a newly developing field of research"

Student Teacher 8: "They do the art activity at the corner of the classroom; they don't have enough space in the classroom"

Student Teacher 4: "The field of early childhood education is very problematic, it has started to develop recently so the children play in the middle, it is difficult to prepare a corner"

Teacher candidates think that preschool science teaching methods should be practical and the science-math activities should follow a passive activity.

Interviewer: "How do you think the science education should be given at preschools?

Student Teacher 1: "It should be practical"

Interviewer:"What else? I mean, how could it be effective?

Student Teacher 3: "The children should be active in the class."

Student Teacher 6: "And if stories are told, as I mentioned before it would be better."

Student Teacher 4: "Timing is important. For example if you do a science-nature activity when the children are sleepy, it can't be effective. Those activities should be at the right time in their daily program."

Interviewer: "What time for example?

Student Teacher 4: "It depends on the experiment, for example if it's an experiment that they have to take an active role it can follow a passive activity or vice versa."

Preschool teacher candidates expressed that they generally use drama and story-telling techniques as well as question and answer method in teaching science. It was found out that they confuse the observation technique with observating children. In addition, they think that science and math corners are important in science teaching but they stated that in state school those corners do not exist due to lack of space. They support the idea that science activities should follow a passive activity. Preschool teacher candidates use only a few science teaching methods which are mostly teacher centered and they have misconceptions about those teaching methods. These facts might have a negative an impact on their self-confidence in science teaching and therefore on their attitudes towards science teaching itself.

Conclusion and Discussion

The aim of the study is to analyze preschool teacher candidates' attitudes towards science teaching and the factors affecting these attitudes. It was found out that preschool teacher candidates who participated in this study have positive attitudes to science teaching. However, their attitudes are moderate in terms of comfort-discomfort sub-dimension of the study. The questions under this sub-dimension consist of items related to teacher candidates' self-confidence in doing science activities, their efficacy in content knowledge of science and their willingness to encourage students to participate in science activities. The fact that their attitudes are moderate in this sub-dimension can be explained by their insufficient content knowledge of science as it was also found out in the focus group interview. It is also indicated in the literature that teacher candidates' content knowledge and their attitudes towards science are interrelated with each other (Nilsson & Van Driel, 2010). In addition, it was found out in another study that there is a positive relation between preschool teacher candidates' attitudes towards science and their knowledge of science concepts (Çakmak, 2006). Teacher candidates' insufficient content knowledge of science might be explained by the fact that they are accepted to early childhood education programme by their scores in Turkish and maths they get from the university entrance examination. Teacher candidates have positive attitudes towards teaching of science because they take a science education course during their university education. Teacher candidates also have positive attitudes in terms of the sub-dimensions of preparation before teaching, experimental science

teaching and developmental readiness. Preparation before teaching sub-dimension consists of questions related to teacher candidates' willingness to use resources of teaching preschool science classes while there are questions measuring their willingness to use materials in science teaching under experimental science teaching sub-dimension. In addition to them, developmental readiness subdimension measures their willingness to teach science to preschoolers. Parallel to these results, teacher candidates stated that there should be science education and science corners at preschools. They also believe that science can be taught by searching science resources without taking science education courses.

Preschool teacher candidates gave examples from their positive and negative experiences of science teaching during the focus group interview. Their negative experiences result from their insufficient content knowledge of science. They also stated that their self-confidence is low in science teaching. However, they believe that this can be improved by experience. According to the literature primary school teachers with inadequate content knowledge avoid teaching science (Abell, Appleton, & Hanuscin, 2010, p. 71). Lack of teaching experience causes teachers to be uncertain about their knowledge. For this reason, their content knowledge is mainly based on books (Tilgner, 1990). Therefore, content knowledge is an essential type of knowledge for teachers (Koehler & Mishra, 2008, p. 13). In another study, it was fould out that there is a strong relation between primary school teachers' attitudes towards science teaching and their self-confidence in teaching science (Jarett, 1999). In this regard, teacher candidates stated that science education course they take during their undergraduate education should be more practice based. They also suggested increasing class hours and the length of science education in the programme. Furthermore, it was determined in another study that the frequency of doing science activities affects preschool teachers' attitudes towards science teaching (Sönmez, 2007).

Preschool teacher candidates expressed that they usually use drama, story-telling and question and answer methods in teaching of science. The fact that teacher candidates do not use various methods in science teaching and that the methods they use are teacher-centered affect their attitudes towards science teaching. In a similar study carried out at a primary school with second graders, it was found out that the learning strategies students use are affected by their attitudes towards science classes (Ilgaz, 2006). In addition, it was determined that teacher candidates have misconceptions about some teaching methods. Moreover, they support the idea that science and maths corners are important at preschools even though they do not exist in state schools due to lack of space.

In conclusion, it was found out that teacher candidates' attitudes towards science teaching is affected by their content knowledge of science, their science teaching practices and by their positive teaching experiences. It can be implied that preschool teacher candidates' attitudes are affected by their level of content knowledge. Their lack of content knowledge might have a negative impact on their classroom practices and therefore on the attitudes of preschool children's towards science. It is also stated in the literature that preschool teachers' content knowledge of science is inadequate (Kallery, 2004; Kallery & Psillos, 2001). In similar studies it has been found out that there is a positive relation between preschool teacher canditates' attitudes towards science and their knowledge level of science concepts (Çakmak, 2006), and the frequency of science activities they perform in the class (Erden & Sönmez, 2011). In addition, there are some studies which found out that content knowledge of science plays an important role on the attitudes towards science teaching (Johnston & Ahtee, 2006; Murphy & Smith, 2012; Weinburgh, 2007).

Another important result of the study is that all the teacher candidates think that the things they learned in the preschool science education course can be improved by experience. Teacher candidates believe that they will gain experience as they teach and as a result develop their teaching skills. Similarly, some studies showed that teachers' attitudes towards science teaching was positively influenced by in-service training courses on science (Asma, Walma van der Molen, & van Aalderen-Smeets, 2011; Carleton, Fitch, & Krockover, 2008; Hartshorne, 2008). In addition to this, it has been determined that preschool teachers need in-service training on science and nature activities (Kıldan & Pektaş, 2009).

Suggestions

The suggestions based on the results are listed below;

1. It was found out that preschool teacher candidates have moderate attitudes regarding the comfort-discomfort sub-dimension of the at-

titude scale for preschool science teaching. For this reason, their teaching environment should be organized well enough to make them feel comfortable while doing science activities and they should be encouraged by their lecturers.

2. During interviews preschool teacher candidates stated that they do not have adequate content knowledge. During two hours theoretical part of the science education course brief information on the subject should be given and during the other two hours student teachers should be given the opportunity to practice what they have learned.

3. It was determined that science teaching practices and their positive experiences of science teaching have an impact on teacher candidates' attitudes towards science teaching. The time devoted to the science teaching practices in early childhood education programme should be increased and it should be focused more within the scope of school experience.

4. Experimental studies should be conducted in order to find out the ways to improve teacher candidates' attitudes towards science teaching.

5. Qualitative studies based on observation, interview and document analysis research methods should be carried out in order to determine the factors affecting preschool students', teachers' and teacher candidates' attitudes towards science teaching.

6. Comparative research should be done analyzing preschool teachers' and teacher candidates' attitudes towards science teaching.

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