Asst. Prof. Dr. Mehmet Kanak[1]
Cumhuriyet University, Sivas, Turkey
Asst. Prof. Dr. Serpil Pekdoğan[2]
Hitit University, Çorum, Turkey

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EXAMİNATİON OF SCİENCE AND MATHEMATİCS ACTİVİTİES İN PRE-SCHOOL EDUCATİON

Abstract: This research aims to reveal the importance of science and mathematics education, children's natural curiosity towards science, and teachers' deficiencies and opinions in this area. In this study, where the qualitative method is preferred, the special case method, which enables in-depth research within a specific subject, is used. The study group of the study constitutes 45 preschool teachers working in independent kindergartens affiliated to the Ministry of National Education. When the study group was determined, the maximum diversity type sampling method was used. In order to collect data in the research, a semi-structured interview form consisting of 3 open-ended questions was used. The results of the research showed that teachers find science and mathematics activities necessary and important but they generally abstain from practice because they are inadequate. It is clear that teachers are often inadequate in using materials and they prefer mostly traditional, structured materials. Some suggestions were made according to these results.

Key words: preschool education, science and math activity, child.

Introduction

Science draws the attention of children by its nature. Infants and young children are motivated to have biologically social interaction, learn to walk and talk and also motivated to learn about the world that surrounds them biologically. Science is a privileged subject for the preschool period due to the natural interest of children. Parents and teachers should provide children a rich experience settings and a conscious guidance in this critical process (French, 2004).

Early childhood educators state that they desire to see young children become young scientists and young mathematicians. Along with this, however, the reality of the classroom environment may cause limitations in the applications in the fields of mathematics and science and hinder the application of an innovative program that covers forms of thinking and behavior. Most of the early childhood period science and mathematics education curricula cover concepts such as numbers, operations, colors, forms, life-cycle and nutrition groups. When examining the scientific research methods, it is observed that fundamental concepts such as problem solving skills and understanding numbers in the preschool period are neglected (Bers & Portsmore, 2005). Besides, teachers are able to provide guidance

[1] mehmetkanak58@gmail.com
[2] serpil4423@hotmail.com

appropriate for children and a warm classroom climate and it is required for them to carry out activities for science and mathematics education programs that also cover special skills in the fields of literacy, arithmetic and scientific literacy. In previous large-scale studies, it was found that among children receiving quality science and mathematics education in the preschool education, the effect of this education on their cognitive skills is effective on their academic achievement in the future (Anders et al.,2012). It is indicated that mathematics skills taught in the early period leave a significant effect on writing skills, socio-emotional skills, and other developmental areas in the primary school (Claessens & Engel, 2013).

Numerous studies put forward the necessity for all educators to be aware of the importance of science and mathematics education in the early childhood period and to prepare learning settings appropriate for the development of children (Cakmak, 2012). The quality of the learning setting is affected by many variables. The quality of process of the interaction between the structural properties related to the learning processes (i.e. classroom size, staff quality level), and the beliefs and orientation of teachers, and the children is significant (Anders et al., 2012). For preschool children, goals should be provided developmentally suitable, but accessible. Besides being flexible enough to address to individual differences, most importantly, science and mathematics activities should have the quality that provides thinking and learning on behalf of children. Teachers should pay attention to the individual differences of children and avoid emotional abuse likely to arise from learning difficulties in that sense. They should try to protect the advantages of determining goals and take measures for preventing the problems (Sarama & Clements, 2009). Without using the appropriate methods and techniques for children, providing the suitable learning environments for children, and providing them guidance, it would not be the right approach to assess and grade the science and mathematics skills of children. In that sense, as a result of the way teachers behave to children, they might either be excited or scared to learn mathematics (Ginsburg & Golbeck, 2004). Three components of learning are essential for children. They should be invited to the learning environment, be given an opportunity for modelling and ensured to apply the skills. A child needs the encouragement of an adult for his/her participation into a work; by this way, the suitable learning ways are modelled. Children need application and time to fulfill these skills in real life. (Mongillo, 2017).

According to the data from a four-year study examining the competences of early childhood teachers in mathematics and science, it was revealed that the preschool teachers usually wanted to teach skills focused more on reading and other language skills. The result was obtained indicating that the teachers considered mathematics and /or science to be based on more difficult topics and they were unable to teach these subjects to children (Copley & Padron, 1998). There are some results indicating that girls and boys who are in the preschool period and the early years of primary school have different beliefs in their competencies in the field of science. Additionally, it is required for preschool children not to be supported by their teachers especially in this period when they have a special interest towards science literacy; and a significant portion of their learning process in their future educational grades should be allocated for the education of science and mathematics (Patrick, et al., 2009).

Problem of Research

The studies have revealed that all children, who received preschool education, are unable to find the chance to learn sufficiently in the field of mathematics and science. It is seen that teachers find the science and mathematics applications specific and they rarely provide the

learning environment for the science and mathematics activities for their students. In that sense, it can be asserted that early childhood educators are insufficient from time to time when it comes to provide chance for learning science (Piasta, et al., 2015). As a result, the purpose of this study was to indicate the significance of mathematics and science education, and to reveal children's lack of natural curiosity as well and deficiencies of teachers in that field. The following questions were asked in the study to examine the applications of science and mathematics activities by the preschool teachers in Turkey:

1- What is the significance of activities in science and mathematics?
2- What are things to take into consideration during preparation of activities for science and mathematics?
3- What are the support activity types you use for supporting science and mathematics activities?

Methodology of Research

Case study method allowing to investigate in depth within a subject whose limits were determined was used in this study (Cohen & Manion, 1994; Cepni, 2001). In a case study, the researcher investigates the subject in depth without having any prejudices on the topic investigated (Ekiz, 2009).

Sample of Research

The sample group of the study consisted of 45 preschool teachers working in the independent kindergartens affiliated with the Ministry of Education. While 10 of the teachers (22%) were male teachers, 35 (68%) were female teachers. The professional experiences of the preschool teachers varied between 5 and 15 years. The maximum variation sampling method was chosen among the purposeful research sampling methods to form the sample group. The maximum variation sampling method aims to form a relatively small sample and reflect the variation of individuals to be a party of a problem studied in the sample in the maximum degree (Yıldırım & Simsek, 2016).

Instrument and Procedures

In the study, a semi-structured interview form three open-ended questions was used in order to determine the socio-demographic characteristics of the teachers, the importance of science and mathematics activities, the cases they pay attention in preparing the activities, materials used in the science and mathematics activities, concepts they try to acquire, support activity types, and the problems they encounter in their practice. In the semi-structured interview technique, the researcher prepares the interview questions in advance; however, partial flexibility is provided to the persons being researched during the interview (Ekiz, 2009). Expert opinion was received in order to control the suitability of the prepared interview form to the case targeted, its comprehensibility and feasibility and the interview form was finalized following the specified modifications.

Data Analysis

The criteria of the internal validity were met by checking the results obtained during data collection, analysis, and interpretation in the study and providing the consistency; on the

other hand, the fact that the results of the study were consistent with the results of other studies and allowed generalization indicated that the criteria of external validity were met. As a result of implementation of the study by more than one researchers, compromise is provided in the data collection and sorting stages. Therefore, the internal reliability of the study was provided by increasing its acceptance rate whereas, the external reliability was provided by including detailed and open information on the analyses of the research (LeCompte & Goetz, 1982).

For data analysis, data analysis steps by Miles and Huberman (1994) were used. The data analysis is examined in three sections. Firstly, the data are processed and then they are converted into visuals, and the last step is the stage of interpreting and confirming. At the data processing stage, the data are analyzed and encoded. In this way, the data are summarized and important ones are selected. Later on, the data set that becomes more comprehensible and compatible with the research problems is converted into a visual state by exhibiting in graphics, tables, and figures in the second stage. On the other hand, the concepts, themes, and correlations that emerge in the last stage are interpreted, compared, and confirmed. Hence, it is possible to interpret the research results and provide the validity (Yıldırım & Simsek, 2016). The codings in the parentheses were formed by the researchers. T1 stands for the first teacher.

Results of Research

The results obtained from the questions asked to the teachers were presented in the form of tables in themes and frequency (f) values in the study.

The importance of science and mathematics activities in preschool education

Table 1 shows the views on the importance of science and mathematics activities in preschool education.

Table 1. The views of preschool teachers on importance of the science and mathematics activities

Themes	f
Scientific Process skill	**55**
Investigation	18
Observation	9
Research	6
Exploring	10
Cause-Effect Relationship	12
Learning	**142**
By doing and experiencing	30
Permanently learning	41
Scientific thinking	37
Imagination	14
Problem solving skills	20
Developmental	**23**
Cognitive development	23

When examining the views of preschool teachers on importance of science and mathematics activities in Table 1, it was found that these activities were important since they stated that they provided the children with permanent learning mostly in the learning process, they

helped them acquire investigation skills in the scientific process skills; on the other hand, in the developmental area, they are effective on cognitive development. Some of the teacher views are given below.

"Thanks to the science and mathematics activities, children learn to explore. They allow them to carry out research and investigation. They explore by themselves through experiencing and seeing. Also the science and mathematics activities are not limited only to the classroom environment but also they give the children a chance to go out to the nature and help them learn and recognize the living species and the nonliving things out there (T1)"

"They enable the children think scientifically and allow them for learning by doing and experiencing (T13)"

"Science and mathematics activities are critical for the cognitive development of children. Science activities increase the interest of children towards the nature and develop their problem solving skills (T40)"

"Science and mathematics activities are extremely important activities that develop the mental skills of children. They have a great importance in exploring children's skills (T22)"

"They are the activities that allow children to observe, research, analyze, explore and at the same time, have fun. The activities made become more permanent as they make abstract concepts concrete (T4)"

Things to take into consideration during preparation of the science and mathematics activities

Table 2 shows the views of the preschool teachers on things to take into consideration during preparation of the science and mathematics activities.

Table 2. *Things to take into consideration by the preschool teachers during preparation of the science and mathematics activities.*

Themes	**f**
Material	**90**
Safe	25
Robust	32
Interesting	18
Facilitating learning	15
Child	**82**
Suitable for age	40
Suitable for developmental level	42

The preschool teachers stated that the things to take into consideration during preparation of the science and mathematics activities were mostly the suitability of the activities to the age and developmental level of children. In terms of material, on the other hand, the teachers stated that they paid attention for materials to have characteristics of being robust, and then safe, interesting, and facilitating learning. Some of the views of the teachers are provided below.

"I take into account the children's developmental levels while preparing the activities and I select materials that facilitate learning (T12)".
"I pay attention to the material being used to have qualities that will not cause any danger, the activities to be at the level of children and to use safe and robust materials (T42)"

"I pay attention to whether or not the material is suitable for the age level of the children, and what it can contribute to for the children (T22)"

"I pay attention the materials to be interesting and facilitate learning and for the activities to be in accordance with the age and developmental levels of the children (T36)"

Materials used in the science and mathematics activities

Table 3 shows the results concerning the materials used by preschool teachers during preparation of the science and mathematics activities.

Table 3. *Materials used by the preschool teachers while preparing science and mathematics activities*

Themes	**f**
Materials	**496**
Dry and Live Plants	21
Animal Models	32
Magnifiers	40
Magnets	35
Aquarium	12
Clock	24
Thermometer	38
Weather and height graphics	42
Computer	45
Blocks	30
Numbers	37
Non-standard measurement units	40

When examining Table 3, it can be seen that the preschool teachers used mostly computers, and then weather and height graphics, magnifiers, non-standard measurement units (steps, hand span, etc.), thermometers, numbers, magnets, animal models, blocks, clock, dry and live plants and aquarium in their science and mathematics activities. The related statements by the teachers are stated below.

"As they are easy to access in science and mathematics activities, I use dry and live plants, blocks, thermometer, magnifier, and computer. I believe that these materials are in all classes (T41)"

"I prefer non-standard measurement units especially in mathematics activities. I really like doing measurements with materials like hand spans, steps or ropes (T9)."

"I use animal models, aquarium, and numbers more often (T26)".
"Magnets and magnifiers are among materials I most frequently use in the science activities (T12)".

"I use weather and height graphics, thermometer, magnifiers, animal models and non-standard measurement units, and the numbers. Since these are easy to access and cost effective, this ensures me to use them more (T31)".

Concepts that are tried to be acquired through the science and mathematics activities

Table 4 shows the results related to views of the teachers on concepts that are tried to be acquired through the science and mathematics activities.

Table 4. *Concepts that are tried to be acquired through the science and mathematics activities*

Themes	f
Concepts	**240**
Numbers	21
Hot-cold-warm	23
Night-day	15
Half-whole-quarter	18
Empty-full	22
Little-much	8
States of matter	32
Cause-effect relationship	12
Long-short	16
Light-heavy	23
Slippery-rough	6
Space-location	8
Senses	36
Other skills	**124**
Skills of daily living	40
Matching	11
Grouping	11
Categorizing	11
Ordering	11
Curiosity	16
Taking responsibility	9
Loving	7
Protecting	5
Respect	3

When examining Table 1, the preschool teachers stated that they tried most to have their students acquire senses and the hot-cold-warm concepts in the concepts category; whereas, they tried to acquire little-much and slippery-rough concepts the least. On the other hand, the skills tried to be acquired at most are the skills of daily living in the category of the other skills. Some of the teacher opinions are given below.

"I teach concepts and skills related to loving living and nonliving species, protecting them, respecting the rights of others, establishing cause-effect relationship, being respectful, matching, grouping and their sensory organs (touching-tasting-smelling) (T1)".

"I give more space to skills such as opposite concepts and love, taking responsibility and respect (T21)".

"I teach skills related to taking responsibilities, establishing cause-effect relationships, matching, grouping, categorizing, ordering, and sensory organs (T45)".

Support activity types applied together with the science and mathematics activities

Table 5 shows the results concerning the types of support activities applied by the preschool teachers together with the science and mathematics activities.

Table 5. *Support activity types applied together with the science and mathematics activities*

Themes	**f**
Types of Activities	**253**
Drama	36
Art	40
Turkish	41
Field trip	20
Games	38
Music	36
Preparing for literacy	40
Project	2

When examining the types of support activities applied by the teachers together with the science and mathematics activities, it can be seen that the activities of Turkish, art and preparing for literacy activities were used, which were followed by games, music, drama, field trips, and project works, respectively. Some of the opinions of the teachers related to this subject are given below.

"As integrated skills, I apply them together with activities of art and preparing for literacy. Also, I think that stories and songs also draw the attention of children in the music and Turkish activities (T7)"

"I use the activity of field trips more. I consider that children learn more permanently thanks to this (T18)"

"I apply the activities of games, songs, and preparation activities for literacy together since children learn easier through games and music. Also, art activities help, as well (T34)"

Problems encountered during the application of science and mathematics activities

Table 6 shows the results concerning the problems encountered by preschool teachers during the application of the science and mathematics activities.

Table 6. *Problems experienced during the application of the science and mathematics activities*

Themes	**f**
Material	45
Classes being crowded	23
Total	**68**

All of the teachers stated that they had difficulties in finding materials for science and mathematics activities, and the classes were crowded. The opinions related to this were as follows:

"I have difficulties in finding materials. I think there are not enough materials and tools in the schools (T22)"

"Some materials are missing and this has a negative effect on the education process (T42)"

"Firstly, it becomes difficult for me to carry out the activities in a child centered manner because the class is crowded. Also, we had material shortage. More effective education can be provided by reducing the class numbers and eliminating for the material shortages (T6)"

Conslusion and Discussion

Children are born with curiosity and they want to know everything that surrounds them. The role of the adult person in this process is to provide an environment with rich stimuli drawing attention of the child. The adult person must observe the activities of the child, note how that progresses and respond with a glance, a greeting, a smile or a praising word for encouraging the child (Lind, 1999). The traditional learning approach makes the children passive, and eradicates their curiosity and interest in the system that forces memorization. It is not the duty for a child to memorize what is presented just like it is not the duty for a teacher to design a small series of learning experiences and watch them (Gelman & Brenneman, 2004). At this point, the importance of application of science and mathematics activities reveals. In this study, preschool teachers stated that their practices for the science and mathematics activities were effective mostly on the acquisition of scientific process skills by the children, scientific learning and their cognitive development. While it is pleasing to see that these results show how aware the teachers are on importance of science and mathematics activities, it is also thought-provoking that they paid attention to mostly the robustness of the materials while preparing their activities. The selection of the materials in accordance with the children's age and developmental level is another topic addressed by teachers. Although the robustness of the materials is important for science and mathematics education, the primary point to emphasize is drawing attention of children and facilitating learning as a priority. This is because children in the preschool period are in the pre-procedure stage and their abstract thinking has not yet developed fully. Concrete experiences provide more concrete learning for the children and allow them to structure their experiences.

Another result of the study is the materials used by the preschool teachers in science and mathematics activities. It was observed that the teachers used mostly computers, and then equipment such as weather and height graphics, magnifiers, non-standard measurement units (steps, hand spans, etc.), thermometers, numbers, magnets, animal models, blocks, clock, dry and living plants and aquariums. These types of materials are preferred more as they are easy accessible and affordable. The said materials of course have an effect in the learning process of children. However, it is foreseen among the targets of national science standards that the children begin researches at early ages and execute science on their own in order for all children to learn science and to find a chance to be scientifically literate. Such structured materials restrict the creativity of children and lead them to focus on one point of the science and mathematics activities only, instead of leading them to think sophisticatedly. Instead of these materials, it is considered that the use of unstructured ones that are created out of their own effort would provide more permanent learning. In the studies by Ayvacı, Devecioglu, and Yigit (2002), and Karamustafaoglu and Kandaz (2006), the result was obtained indicating that preschool teachers used similar materials. Despite the fact that many years have passed, it is thought-provoking that the teachers still carry on using the same materials, which can be accepted as an indicator of continuance of the traditional methods.

Conceptual skills have a special place in children's developing investigation and observation skills in learning environments, and learning scientific thinking by creating sound scientific foundations. Children should actively work in acquiring the basic concepts and learning principle process skills. Concepts are the basic constituents of the information children will acquire; it helps people to organize and categorize the information. It is possible to see children's ability to use concepts by observing them in their various developmental stages and daily activities (Aktas Arnas, 2002). From this viewpoint, when examining the opinions of the preschool teachers on the concepts acquired by the children in the science and mathematics activities in the study, it was observed that many concepts such as the senses, states of matter, being light or heavy were taught and also concepts related to daily life skills and social skills were used as means. Similar results were concluded in the study by Cınar (2013). The important point is that concepts are used as means for supporting developmental areas of children instead of being an aim in the teaching of science and mathematics. This is because teaching concepts in the preschool period is not an aim. However, an important result of the present study was that teachers gave importance to the teaching of daily life skills and were aware of these skills.

It is regarded as a basis in preschool education that children learn through doing and experiencing. Considering that the job of children is to play games, all the activities being based on game increase the motivation of children and providing more permanent learning. When several of the activities such as drama, art, field trip, Turkish, music, preparation works for literacy are presented together, they constitute integrated skills, which keep the attention of the children at a high rate and support to learn sophisticatedly. When examining the types the teachers applied as support activities in science and mathematics activities, it was observed that Turkish, art, preparation for literacy, games, drama, music, field trip and project works were used. In the study by Ayvacı, Devecioglu and Yigit (2002), it was concluded that drama and game methods were used by the teachers. At this point, the real problem was that teachers had a low knowledge level on project works, and low application frequency. Project works can be described as the solution of a problem of the children concerning a topic determined within the interest of children in a process where they structure again and the teacher serves as the guide. Preschool teachers must absolutely involve project works in their educational activities since it is essential for project works to address all developmental areas of children and they develop investigation, exploring, problem solving, creative thinking skills of children. In-service trainings should be provided by experts to preschool teachers concerning project works.

Even though pedagogical quality is in the foreground compared to the quality of preschool education, the usage pattern of the education environment supporting this system, the materials in the education environment and the number of children in the classroom also have a significant effect on the quality. When considering the importance of concrete experiences, especially in preschool period, active use of the senses bring the need of materials into the forefront. In the study, the teachers stated lack of materials and high number of children in the classrooms regarding the problems they encountered in applying the science and mathematics activities. Similar results were obtained in the study by Karamustafaoglu and Kandaz (2006). Such problems have still continued today and affected the quality of education adversely. Education environments should be designed in such a way that children shall comfortably act and the number of children in the classrooms should be in accordance with the physical conditions in order for preschool teachers to have job satisfaction.

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Biographical notes:

Asst. Prof. Dr. Mehmet KANAK completed his bachelor's degree on preschool education at the Cumhuriyet University 2007 , and master degree on preschool education at the İnönönü Unuversity 2011 and PhD degree on child development and education at the Gazi University 2015. The authors' work areas are child neglect and abuse, children's rights, technology dependency and development. After two years of teaching experience of the authors in the ministry of education as a lecturer at the Hitit university in 2009, he began his academic studies. He started to work as a lecturer at Cumhuriyet University in 2013 and has been working as an assistant professor at the same university since 2015. He has studies in child abuse and neglect, preschool education, child development and teacher training.

Asst. Prof. Dr. Serpil PEKDOGAN in 2009 graduated from Inonu University Faculty of Education, Department of Preschool Education. In 2011, she completed graduate education at the Inonu University Institute of Educational Sciences Department of Preschool Education, and in 2015, she received Ph.D. at Gazi University Department Institute of Educational Sciences, Department of Preschool Education. Between 2009-2011, worked as a preschool teacher at Ministry of Education. Between 2011-2012, she worked as a research assistant at Kilis 7 Aralık University Faculty of Education. Between 2012-2015, she worked as an lecturer at Amasya University Faculty of Education. Between 2015-2017 she worked as an assistant professor at Amasya University Faculty of Eduction. Starting from 2017, she serves as an assistant professor at Hitit University, Faculty of Health Sciences Department of Child Development. She has studies in children decision making skills, children socail skills, child abuse and neglect, preschool education and teacher training.