
The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2016

Volume 4, Pages 357-362

ICEMST 2016: International Conference on Education in Mathematics, Science & Technology

DETERMINATION OF VIEWS OF PRE-SCHOOL TEACHERS ON SCIENTIFIC PROCESS SKILLS AND LEVEL-OF-EFFORT ON BASIC SCIENTIFIC PROCESS SKILLS USE IN SCIENCE ACTIVITIES

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ABSTRACT: The aim of this study is to determine the views of preschool teachers on scientific process skills and basic scientific process skills they included in science activities. Study group included 32 preschool teachers determined with purposive sampling method. A semi-structured interview form developed by researchers to determine the views of preschool teachers on scientific process skills, and to determine basic scientific process skills they included in science activities, a science activity syllabus detailing the application process were used as data collection tools in the present study. Collected data were analyzed with content analysis method. Conducted analyses demonstrated that participating preschool teachers did not possess adequate theoretical knowledge on scientific process skills and were not completely proficient in basic scientific process skills. Teachers stated that science literate individuals would be trained as a result of development of scientific process skills. They reported that the predominantly utilized observation as the basic scientific process skill in science activities they conducted. Analysis of the application process identified that in observation, students were in the position of observation only.

Keywords: Pre-school science education, basic scientific process skills, science activities.

INTRODUCTION

Scientific process skills that are defined as the skills and thought processes used by the individual during the process of examining the nature and natural events and production of scientific knowledge (Özmen & Yiğit, 2005) are an integral part of science education. Kujawinski (1997) stated that scientific process skills are significant in the instruction of scientific content, furthermore, Germann, Aram and Burke (1996) expressed that the main objective of science education should be the acquisition of scientific process skills. Because, individuals could solve the problems they encounter in daily life using ways, methods and perspectives that scientist utilize only when they acquire scientific process skills (Bozdoğan, Taşdemir and Demirbaş, 2006).

American Association for the Advancement of Science (AAAS) considers scientific process skills within two categories of the basic and complimentary skills in Science – A Process Approach. Main skills were identified as “observation, prediction, measurement, classification, presentation and conclusion,” and high level skills were determined as “identification of the variables, controlling the variables, hypothesis formation, experimentation, expression of the results based on data, graphing, interpretation and modeling” (Cited by Can and Ş. Pekmez, 2010). Learning main process skills is a prerequisite for the development of integrated process skills. Children would not be able to acquire integrated process skills in the following educational levels unless they develop basic process skills during preschool stage (Ayvaci, 2010).

Teachers have a responsibility in students’ acquisition of scientific process skills, which are key for both their school and daily lives. The objective of the present study is to determine the views of preschool teachers who play a significant role in the achievement of basic process skills by the students, on scientific process skills, and their level-of-use of basic scientific process skills in scientific activities.

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- Selection and peer-review under responsibility of the Organizing Committee of the conference

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Objective of the Study

The objective of the present study is to determine the views of preschool teachers on scientific process skills, and the basic scientific process skills they used in science activities.

Research Questions

- 1- How do preschool teachers define scientific process skills?
- 2- Which basic scientific process skills preschool teachers identify?
- 3- What are the views of preschool teachers about the importance of scientific process skills in science education?
- 4- What are the views of preschool teachers on the development of scientific process skills?
- 5- What are the views of preschool teachers on the responsibility of teachers on the development of scientific process skills?
- 6- What are the levels of planning and application of basic scientific process skills used by preschool teachers in the science activities they conduct?

METHODOLOGY

Research Model

The present study is a qualitative descriptive study that aims to determine the views of preschool teachers on scientific process skills, and their level-of-use of basic scientific process skills.

Study Group

Study group included 32 preschool teachers selected with purposeful sampling method.

Data Collection Tools

A semi-structured interview form and science activity syllabus were used as data collection tools. To determine the views of preschool teachers on scientific process skills, a semi-structured interview form was designed. To establish content validity of the interview form, two science education specialists were consulted, and proposed changes were implemented in the form. In compliance with the ethics standards, codes such as OÖÖ1, OÖÖ2, ... OÖÖ32 were used to replace the actual names of participating preschool teachers. To determine the basic scientific process skills used in scientific activities, participating teachers were asked to prepare a scientific activity syllabus where the application process for scientific activities were detailed.

Data Analysis

Data collected in conducted interviews were analyzed using content analysis methodology. During the analysis of the data collected during conducted interviews, content analysis data for both researchers were coded separately and coherence between these two datasets was calculated using $[\text{Agreement} / (\text{Agreement} + \text{Disagreement}) \times 100]$ formula (Miles and Huberman, 1994). Consistency between the researchers who coded the data was calculated as .81. Science activity syllabi were described by coding the basic scientific process skills identified by the teachers during application and planning phases.

FINDINGS

Table 1: Definition of Scientific Process Skills by Preschool Teachers

Theme	Codes	Frequency
Definition of Scientific Process Skills by Preschool Teachers	Skills required to conduct a scientific research.	13
	Steps such as observation, prediction and classification.	9
	Skills required to solve a problem.	8
	High-level thinking.	1
	Skills that children acquire via science activities.	1

Table 1 demonstrates that 13 preschool teachers defined scientific process skills as skills required to conduct a scientific research. Teacher OÖÖ15 defined scientific process skills using the following words:

“[They are] the behavior, skills and performances that individual demonstrated in a conducted scientific study until the end of the study” (OÖÖ15).

Scientific process skills were defined as steps such as observation, prediction and classification by 9 teachers, as the skills required to solve a problem by 8 teachers, as high-level thinking by 1 teacher and as the skills that children acquire through science activities by 1 teacher.

Table2: Basic Scientific Process Skills Identified by Preschool Teachers

Theme	Codes	Frequency
Basic Scientific Process Skills Identified by Preschool Teachers	Observation	22
	Hypothesis Formation	8
	Classification/Categorization	6
	Analysis	5
	Synthesis	5
	Measurement	5
	Assessment	4
	Data Collection	4
	Data Recording	4
	Problem Solving	4
	Application	3
	Determining the Problem	3
	Research	3
	Prediction	2
	Experimentation	1
	Cause-Effect Relationship	1
	Survey	1
	Testing techniques	1
	Decision Making	1
	Curiosity	1
Defining	1	
Creativity	1	
Testing the Hypotheses	1	

Table 2 demonstrates that 22 teachers identified basic process skills with observation, 8 teachers with hypothesis formation and 6 teachers with classification.

Table 3: Significance of Scientific Process Skills in Preschool Science Education

Theme	Codes	Frequency
Significance of Scientific Process Skills in Preschool Science Education	It is significant in training science literate individuals.	11
	It is significant in achieving active participation of students in activities.	5
	It is significant in producing solutions for encountered problems.	4
	It is significant to achieve the goals of science activities.	4
	It is significant in preparing the students for the future.	2
	It is significant in enabling the students to come up with ideas.	2
	It is significant for the student in understanding the natural phenomena that occur around the student.	2
	It is significant since it is the basis for scientific activities.	1
	It is significant since experiments and observation are continuously conducted in science activities.	1

Table 3 demonstrates that 11 preschool teachers stated preschool scientific process skills were significant in training science literate individuals. Teacher OÖÖ17 used the following expression in defining scientific process skills:

“As a result of preschool science education, students’ scientific process skills would improve and science literate individuals would be trained” (OÖÖ17).

Preschool teachers identified that scientific process skills were significant in preschool science education since they promote active participation of students in activities (f=5), produce solutions for encountered problems (f=4), enable science activities to reach their goals (f=4), prepare students for the future (f=2), enable the students to come up with ideas (f=2) and understand the natural phenomena occurring around the students (f=2), form the basis of science activities (f=1).

Table 4: Views on Development of Scientific Process Skills

Theme	Codes	Frequency
Views on Development of Scientific Process Skills	With student-centered activities	19
	By teachers primarily acquiring these skills	7
	By creating the appropriate educational environment via necessary and adequate stimulants	3

Table 4 demonstrates that 19 preschool teachers expressed that scientific process skills could be developed using student-centered activities. Teacher OÖÖ8 stated the following on developing scientific process skills:

“Students could develop scientific process skills in adequate educational settings where they would participate directly in the activities and could express themselves freely under the guidance of teachers” (OÖÖ8).

Among the participating teachers, 7 stated that primarily the teachers should have these skills for the development of scientific process skills among students and 3 said that an adequate educational environment should be provided via the required and appropriate stimulants.

Table 5: Teachers’ Responsibilities for the Development of Scientific Process Skills

Theme	Codes	Frequency
Teachers’ Responsibilities for the Development of Scientific Process Skills	They should organize student-centered activities.	7
	They should ask open ended questions that would promote thinking and arouse interest.	7
	They should provide appropriate educational settings where students could ask questions and exchange ideas freely.	6
	They should guide the students.	6
	They should be fluent in theoretical knowledge on scientific process skills.	5
	They should allow students to conduct experiments.	1

Table 5 demonstrates that 7 preschool teachers stated that student-centered activities were among the responsibilities of teachers in the development of scientific process skills. Teacher OÖÖ9 stated the following concerning the responsibilities of teachers in the development of scientific process skills:

“Students should be active in the application process of the activity. Teachers should occupy the role of a guide in this process. Teachers are required to create adequate educational settings where students could develop their skills” (OÖÖ9).

Preschool teachers identified the responsibilities of teachers in the development of scientific process skills as asking open ended questions to promote thinking and arouse interest (f=7), providing appropriate educational settings where students could ask questions and discuss their ideas freely (f=6), providing guidance for students (f=6), achieving theoretical knowledge related to scientific process skills (f=5) and allowing students to conduct experiments (f=1).

Science activity syllabi were examined in detail to determine basic scientific process skills that preschool teachers included in the science activities and basic process skills aimed in the planning and implementation processes were identified.

Table 6: Levels-of-Use of Basic Scientific Process Skills in the Processes of Planning and Application of Science Activities

Basic Scientific Process Skills	BSPS in Course Syllabus		BSPS in application process	
	F	%	f	%
Observation	35	51,47	35	66,03
Prediction	21	30,89	12	22,64
Comparison	6	8,82	4	7,55
Classification(Categorization)	5	7,35	2	3,78
Measurement/Calculation	1	1,47	0	0

Table 6 demonstrates the findings on the levels-of-use of basic scientific process skills in the planning and application processes of science activities by participating preschool teachers.

Participating preschool teachers stated that they would use observation, prediction, comparison, classification and measurement basic scientific process skills in the planning stage of science activities. However, an analysis of the application phase of these activities showed that they were not able to utilize basic scientific process skills as planned.

RESULTS and DISCUSSION

The aim of the current study was to determine the views of preschool teachers on scientific process skills, and the basic scientific process skills they used in science activities.

Participating teachers defined scientific process skills as the skills that should be possessed to conduct research. However, scientific process skills are applicable to various fields, not only in scientific studies (Padilla, Okey and Garrard 1984; Padilla, 1990). Responses given by teachers about the definition of scientific process skills demonstrated that they had knowledge about these skills, albeit insufficient. These findings were parallel to the results of certain studies in literature (Yıldırım, Atila, Özmen and Sözbilir, 2013; Celep and Bacanak, 2013; Karşlı, Şahin and Ayas, 2009).

It was identified that participating teachers did not fully know what were the sub dimensions of basic scientific process skills. Celep and Bacanak (2013) determined in a study they conducted that teachers were not able to express the sub-dimensions of basic scientific process skills.

Participating teachers expressed that development of scientific process skills in preschool science education is important in training science literate individuals. There are also other studies in literature which demonstrated that scientific process skills in science education were significant in training individuals with science literate characteristics (Celep and Bacanak, 2013; Yıldırım, Atila, Özmen and Sözbilir, 2013).

Preschool teachers participating in this study expressed that scientific process skills could be developed with student-centered activities. They have stated the responsibilities of teachers in the development of scientific process skills as organizing student-centered activities and asking open ended questions to students to promote thinking and arouse interest. In studies conducted by Yıldırım, Atila, Özmen and Sözbilir (2013), Türkmen and Kandemir (2011), and Celep ve Bacanak (2013), it was indicated that scientific process skills could be developed through student-centered activities.

In the content analysis conducted to determine the basic scientific process skills used by participating preschool teachers in science activities, it was identified that teachers preferred the scientific process skills of observation and prediction the most in their plans, however, the skills identified in the plans were not realized in the application process. It was identified in the activity plan analysis that teachers perceived observation, one of the basic scientific process skills, as enabling the students to watch the activity. In a study by Kefi, Çeliköz and Erişen (2013) conducted with 35 teachers, it was found that only 5 teachers supported students to observe, while the others wanted the students just to watch the activities instead of active observation in planned science activities. Öztürk Yılmaztekin and Tantekin Erden (2011) arrived at similar findings in the study they conducted.

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