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APPLICATION OF ACTIVITIES INTENDED TO PERCEIVE NATURE OF SCIENCE FOR 5TH AND 6TH GRADE STUDENTS

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ABSTRACT: The purpose of this study is to introduce two different activities in which students can understand nature of science fundamentally and to discuss the results of applied activities. The study is applied with the 5th and 6th grade students. 32 students in the 5th grade, 27 students in the 6th grade, 59 students in total have been participated in the study. There are 14 female students and 18 male students in the 5th grade, 14 female students and 13 male students in the 6th grade. In this study, there are two activities called “Scientific Knowledge” and “Direct and Indirect Observation” which are intended to perceive nature of science and to comprehend the importance of observation with the difference of objectives in science curriculum. While the students are thinking about nature of science with the activity called Scientific Knowledge, they realize that science has a dynamic structure based on application and science may change as knowledge changes. Students have taken an opportunity to improve observation and scientific inquiry abilities and also defend their own arguments with the activity of Direct and Indirect Observation. This study has been the first step for our students to study scientifically enabling to think scientifically, to reach scientific knowledge and realize its importance.

Key words: Nature of science, scientific knowledge, direct observation, indirect observation

INTRODUCTION

Starting from the idea ‘No matter how different students are, each of them should be scientifically literate.’ the curriculum of 2004 Science and Technology was prepared. When the subject scopes, contents and target behaviour of the curriculum were studied, not only was it the understanding based on observation but it was also expected from students to carry out studies in which they effectively participated.

Nature of Science

According to the widely accepted description, the nature of science reflects epistemological and social structure of science and it also expresses scientific knowledge, values and beliefs of the formation of scientific knowledge. (Lederman,1992). In the recent years, researches introducing nature of science with different practices have been done. For instance, Wong and others (2008) gathered nine scientists who studied on SARS virus and prospective teachers in order to ask them to share the period of fighting off the virus they suffered and the characteristics of science were discussed in this context. Schwartz, Lederman & Crawford (2004) designed an application which thirteen prospective teachers could interact with scientists five hours in a week for ten weeks and identify the different characteristics of science in this way. Here are the main characteristics of the nature of science that are the research subjects about teacher and students. (Akerson&Abd-El-Khalick,2005);

- Scientific knowledge is reliable however it changes over time.
- There is not only one scientific method. There are several versions of the scientific method.
- Imagination and creativity play an important role in constructing scientific knowledge.
- Although there is a relation between theories and laws, two of them are different from each other.
- Although there is a relation between observations and inferences, both of them are different from each other.
- Scientific knowledge is subjective and based on theories.

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- Scientific knowledge is affected by the socio-cultural environment where it is constructed

In this study, the activities named ‘Scientific Knowledge’ and ‘Direct-Indirect Observation’ related with the main characters of the nature of science were conducted.

Scientific Knowledge

From primary education, it is necessary for students to pay attention to the following points to develop the understanding of scientific knowledge (Akerson and others,2006):

- Scientific knowledge is reliable.
- Scientific knowledge is not fixed.
- There is no one single method to attain scientific knowledge.
- Creativity plays an important role in developing scientific knowledge.
- There is a relation between scientific theories and laws.
- Socio-cultural environments play an important role in developing scientific knowledge.
- Even though science deals with objective knowledge, it has a subjective factor in the development of scientific knowledge.

Çuçen (2001) specified the main characteristics of scientific knowledge as;

- people research it by using their mind
- it handles a subject area
- it uses a method (experiment and observation)
- it is systematic and regular
- it is consistent and regular
- it is verifiable and controllable
- scientific knowledge is objective

While students are thinking about nature of science with the activity called ‘Scientific Knowledge’ that finds out the main characteristics mentioned above, students are expected to realize that science has a dynamic structure and science may change as knowledge changes.

Direct and Indirect Observation

We typically think of observations as having been seen ‘with our own eyes,’ but an observation can be made directly by seeing, feeling, hearing, and smelling. We can also extend and refine our basic senses with tools during direct observation. There are many phenomena that humans cannot sense by direct observation (such as inside of the atom and objects that seen by X-ray devices). Through these tools, we can make observations much more precisely than those our basic senses are equipped to handle. Students have taken an opportunity to improve observation and scientific inquiry abilities and also defend their own arguments with the activity of Direct and Indirect Observation.

METHOD

In this study, in addition to objectives of the science curriculum, there are two activities that form a basis of science to perceive nature of science and understand the importance of observation.

Participants

The participants of the study are a total of 59 fifth and sixth grade students - 14 female students, 18 male students from 5th grade, 14 female students, 13 male students from 6th grade -

Data Collection

The data of the study were collected by carrying out activities called ‘Scientific Knowledge’ and ‘Direct and Indirect Observation’ and evaluating worksheets given to students.

Data Analysis

The items of the study are formed by using responses of students about

- Similarities between science and the activity of scientific knowledge
- Changeability of science and scientific knowledge

- Needs of students for qualified direct observation
- Relation of not showing objects in the box with science during the activity of indirect observation.

The percentage distributions of these items were calculated according to grade levels and genders of the participants.

Students were asked to guess which objects there are in the box through indirectly observation. When students were asked how they came to the conclusion, **‘the sounds coming from the box’**, **‘the weight of the box’** and **‘the movements in the box’** items were formed according to students’ responses.

FINDINGS

As a result of the study done by using the scale developed by Özmusul (2012), Çoban and Ergin(2008), the views of students towards the understanding of scientific knowledge in the dimension ‘scientific knowledge may change’ are at medium level. On the other hand, according to the activities carried out, 72,88% of the participants indicated that scientific knowledge may change. 71,88% of 5th grade students and 74,04% of 6th grade students believed that scientific knowledge may change.

It is provided that students correlate technology and technological advancements with the changeability of scientific knowledge. According to the examples given by students, it is understood that students correlate 52,54% of the improvement of telephone technology and 44,07% of treatments of illnesses with the activity applied in the study. The rates of the examples for the development of telephone technology, which is in the first place, from 5th and 6th grade students proving the changeability of science and scientific knowledge are near to each other. While fifth grade students give 12,06% more examples for treatments of illnesses, which is in the second place, sixth grade students give 12,84% more examples for transportation technology, which is in the third place.

35,59% of all participants and 46,88% of the 5th grade students indicated that it is necessary to use other sense organs in addition eye for qualified direct observation in the first place. Moreover, 25,93% of the 6th grade students indicated that it is necessary to look in to the box from a different perspective in the first place. 34,38% of 5th grade students and 22,22% of 6th grade students respectively needed more observation time and using other sense organs in the second place.

During the activity named direct observation, 46,43% of female students paid attention to cosmetics and 45,16% of male students interested in toy car in the first place.

28,13% of 5th grade students answered as ‘Science needs effort’ and 40,74% of 6th grade students answered as ‘Intuitions are used with sense organs in science’ to correlate not showing objects in the box with science during the activity of indirect observation.

CONCLUSION and RECOMMENDATION

‘Scientific knowledge is reliable however it changes over time’ item which is one of the main characteristics of nature of science determined by Akerson&Abd-El-Khalick(2005) and **‘Scientific knowledge is not fixed’** item which is necessary to improve an understanding about scientific knowledge in primary school years determined by Akerson and others,(2006) emphasized on changeability of science. In this study, it is also determined that students reached the changeability of science dimension by giving related examples in the activities. Students gave examples especially about technological developments. According to Prensky (2001), the reason is that this generation is living in an environment surrounded with technological equipments.

Participants of the study noticed that all sense organs and supportive devices are needed for qualified direct observation.

Two years old children relate certain tasks and stuffs with male or female such as they consider cooking and vacuum cleaner with female and automobile and repair kit with male. (Ruble & Martin,1998;Signorella,Bigler & Liben,1993; Bee, H., Boyd, D., (2009).). During direct observation activity, students interested in materials related to their gender. At the end of the activity, the idea was explained that social-cultural environment and experience can determine the scientific study subject but cannot influence scientific method.

Students have taken an opportunity to improve observation and scientific inquiry abilities and also defend their own arguments

In case of carrying out this study with students from different social cultural environment, it would be possible to reach 'Socio-cultural environments play an important role in developing scientific knowledge' item mentioned as nature of science dimensions by Akerson&Abd-El-Khalick, (2005).

This study has been the first step for our students to study scientifically enabling to think scientifically, to reach scientific knowledge and realize its importance.

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