Influence of Learning Science in Outdoor Settings on 5th Grade Students' Understanding of the Nature of Science

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Abstract. *The purpose of this study is to find out the effect of learning science in outdoor settings on 5th grade students understanding of the nature of science (NOS). The sample of the study consists of 5th grade students(n:50) in a primary school. The experimental group (n:27) was taught science in outdoor settings whereas the control group (n:23) was taught science in a classroom environment. VNOS-E (views of nature of science for primary students) questionnaire were employed to the students as pre and post test. Additionally, semi-structured interviews were conducted with 10 students from only the experimental group. According to the results the experimental group developed their understanding of the nature of science better than the control group.*

Keywords. Science learning in outdoor settings, Nature of science, Primary science

1. Introduction

Tal and Morag (2007) believed that students have limited opportunities to interact and share their knowledge with each other, on the other hand learning activities in museums, in zoos, in science and nature centers and in any other informal settings the interaction between individuals become active and effective. Having opportunities to be experienced science concepts outside classrooms develops students' scientific literacy and their social interaction (Bybee, 1993, 2001). That is why outdoor learning is suggested all around the world.John Dewey also supports the idea that instead of limiting science learning just in classroom environment science knowledge should be a part of our life. Knowledge can be learned only it is used in the real life (Bender, 2005; Bal, 1993).

Recent curriculum frameworks around the world have reflected science as more than a body of facts (Duschl et al., 2006; Ekiz, 2006; Ministry of National Education (MEB), 2005; Qualifications and Curriculum Authority, 2006; Western Australia Curriculum Council, 1998). It has been argued (Gott and Mashiter 1991) that solving problems in science requires, inter alia, an understanding of both the substantive ideas of science (e.g. force, chemical change, photosynthesis etc.) and ideas associated with the procedural understanding which let the students use scientific processes and construct their own knowledge. Certainly this is easier in a natural environment since students engage with real materials. MEB (2005:9) describes the learning science in outside the classroom as follows: "It helps students to ask questions, to observe natural environment, to develop creative thinking abilities, to investigate, to discover and making conclusions like a scientist". Actually, the emphasis is on using hands on activities and developing students' understanding of the "nature of science (NOS)".

The nature of science is referred as scientific epistemology, and describes science as a teaching method and states the values and beliefs of the nature of scientific knowledge (Lederman, 1992). Bell et al. (1998) expressed that the nature of science is epistemology of science and science as a way of knowing. At the same time McComas et al. (1998) describe the nature of science as an intersection of the history of

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science, sociology of science, psychology of science and philosophy of science. “What is science?”, “How does science work?”, “What is a scientific knowledge?” “How do scientists work?”, “What are the effects of social and cultural issues on science?” are the questions that needs to be answered with the nature of science.

Scientific literacy is also an aspect of the nature of science. It is obvious that without teaching about the nature of science students could understand science as a list of factual knowledge (Akerson, Morrison and McDuffie, 2006). Many research findings have shown that the way of science teaching affects students' understanding of the nature of science (Lucas and Roth, 1996; Shapira, 1989; Songer and Linn, 1991). It is suggested that the nature of science should be taught directly and reflectively (Abd-El-Khalick and Lederman, 2000). According to the indirect teaching approach students can learn automatically by joining research activities. Instead of this some researchers (Khishfe and Lederman, 2006; Kucuk (2006) Abd-El-Khalick and Lederman, 2000) have found out that using direct teaching methods was more effective.

In Turkey, lately this research subject was studied by the researches. It is found that direct teaching method is affective (Macaroglu-Akgul and Aksoy, 2002; Kucuk, 2006; Bagci-Kilic et al., 2007, Can and Sahin-Pekmez, 2008). Bagci-Kilic et al. (2007) worked with primary students in a science camp and found a great effect of the work on students' understanding of nature of science. Because of the outcomes of outdoor learning and teaching nature of science stated elsewhere in this paper and since Turkey has many possibilities to use nature, in this study it was aimed to find out the influence of learning science in natural environment on 5th grade students' understanding of nature of science. The activities used with students and findings of this research will show alternative ways to teachers.

2. Method

The data collected in 2008-2009 academic year (March-May). The sample of the study consists of 50 5th grade students in a primary school located in a small village which is surrounded by nature. One group of students were choosen as an experimental group (n:27) and another group of students were choosen as control group (n:23). The experimental group was treated with some teaching materials (19 working sheets used from the literature) in outdoor settings, on the other hand control group was taught science in classroom with more traditional methods. In the curriculum it is suggested to teach this module in outdoor settings. However, from our experiences and from some informal talk with the teachers in the school it is for sure that they never go out for teaching science. The teaching materials chosen for the experimental group were for developing the students' understanding of nature of science. They were all suitable for the research purposes (they were all checked by the academicians working in that area). When the research was carried out it was the time to teach the concept of Living Organisms. The students in the experimental group followed the working sheets; they were instructed for collecting data by making observations, and make poster presentations about their research. The study time took eight weeks. Before and after the learning process VNOS-E (views of nature of science for primary students) questionnaire (Lederman, and Ko, 2004) was employed to the students in both groups as pre and post questionnaire. Additionally, semi-structured interviews were conducted with 10 students only from the experimental group.

2.1 VNOS-E

VNOS-E (Views of Nature of Science Elementary Level) questionnaire was used in this research which was developed by Lederman and Ko (2004). It consists of seven open ended questions. The questionnaire was translated into Turkish from English. After that the questionnaire was compared with the Turkish version of VNOS-D (almost the same questionnaire with VNOS-E) which is adapted into Turkish by other researchers in their study (Kilic et al., 2007). Additionally it was applied to 82, 5th grade students in the same district. By doing this piloting the questions are reorganized according to students' understanding. Although some more questionnaires (Lederman and O'Malley, 1990, VNOS-A; Abd-El-Khalick, Bell, and Lederman, 1998, VNOS-B; Abd-El-Khalick and Lederman, 2000, VNOS-C; Lederman and Khishfe, 2002; VNOS-D) were developed, VNOS-E was chosen since it was developed for elementary level students.

The questions are asking about the definition of science, scientific knowledge, scientific method and scientists.

2.2 Interviewing

Lederman et al. (2002) suggested that after using VNOS interview technique should be used with all of the students or 15-20% of students who are employed the questionnaire. In order to have deeper understanding of the nature of science and to have their feelings about the learning activities 10 interview questions were prepared. Five questions were to learn their feelings about the activities; the other five questions were about the nature of science. 10 students in the experimental group were chosen by using stratified sampling method.

The questions, like in the VNOS-E, are asking about the definition of science, scientific knowledge, scientific method and scientists. Of course the interview questions were probing, for instance "what do you understand from the meaning of science?", "How would you describe science?", "What is the aim of science?", "What does science do?".

2.3 Students' Working Sheets

Nineteen working sheets, which had two purposes, were chosen. One of the purposes is to teach conceptual knowledge. In the first section of the working sheets there are some explanation and questions for engaging, motivating and also making students to realize their understanding of the subject. The second purpose is to make students to acquire the understanding of the nature of science. Students were encouraged to work like a scientist. The all names and the content of the 3 working sheets are given below.

Natural living areas: It introduces the living areas and living species. Students construct their own knowledge by observing and making classification in a zoo.

Variety of living things: Outside of the classroom they collect data scientifically about the variety of living things. They discuss if scientific knowledge is definite or not.

I am introducing with plants: Students examine different plants and find out the differences between them. They observe, collect data, and make conclusion.

The others are types of roots, the function of the plants body, my plants are growing, my magic cards, I am discovering animals, my leaf, interview with an animal, worm farm, life story, my tree, are mushrooms different from plants?, why is dough rising?, mold garden, why do not I see?, have you ever made yoghurt?, nourishment pyramid, my story.

4. Results

According to the pre- and post-test (VNOS-E) results the students in the experimental group developed their understanding of the nature of science in all aspects. About the meaning of science most of the students told that "it is to invent something" in the pre-test whereas according to the post test 70% of students said that "science is finding evidence by working as a scientist. At the beginning they all believed that scientific knowledge has no chance to change, after the instruction they all said that it is not definite. Pre-test results showed that 15 students said that scientific knowledge can be reached by making research, this number increased to 22 in the post-test. According to both pre- and post test they did not decide if scientific knowledge is subjective or not. They all saw a scientist a person who makes invention; most of the students did not talk about scientific method a scientist uses before the instruction. The results of the post tests showed that students' attitudes towards scientists increased and most of them believed that being a scientist is a very hard work. About the scientific method students' previous ideas were about collecting data this changed to the importance of the data collection, and the way of collecting data. The students reported that they were not sure if scientists use their imagination or creativity but after the activities they believed that scientists use their imagination and creativity in each stage of their work.

On the other hand, the responses of the students in the control group showed that they do not have adequate knowledge and understanding of nature of science before or after the instruction.

The interview findings supported the results of VNOS-E. Additionally, during the interview the students stated that the activities were very useful and enjoyable and they wished all science classes were like that.

5. Conclusion

As a summary, the results showed that the students in the experimental group developed their understanding of nature of science whereas the control group showed no difference in their understanding.

In the experimental group the number of the students who believed that scientific knowledge can change, increased. Some researches also found that result (Akerson and Abd-El Khalick, 2005; Akerson and Volrich, 2006). About scientists using imagination the similar findings were found by Akerson and Abd-El Khalick (2005). Their sample (4th grade) and this research sample (5th grade) believed that if scientists used their imagination what they found would not be real. (This was found before the instruction)

Learning science outside the classroom increased students' attitudes toward science and scientists. They all found the activities enjoyable this means that it would be easy to motivate students with outdoor activities. Since we believe that students need to have the understanding of NOS we definitely suggest to find ways of acquiring different methods. Learning outside is one of them. Most of the teachers prefer doing experimental work rather than going outside. The next work will definitely will be again working outside both control and experimental group by using different approaches to teach the nature of science.

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