Pre-Service Teachers' Attitudes Towards Lab Applications in Science Teaching

Bayram AKARSU
School of Education
Erciyes University
Kayseri, Turkey

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Abstract
The purpose of this study is to investigate: (1) in-service science teachers’ and elementary students’ attitudes towards laboratory activities in science teaching; (2) teachers’ self-evaluations of their science teaching strategies. Our research questions follow “What do in-service science teachers and students believe in science education lab experiments in elementary school settings? What are science teaching approaches and techniques utilized by the teachers? How do students and teachers’ attitudes towards science correlate with each other?” In order to fulfill above research questions, 196 pre-service science teachers were randomly selected in two separate universities school in Central and West of Turkey. Participants were enrolled in 2-4. years in their teacher preparation programs during the study. Data collection process took place in the first semester of 2015. Data were collected via the questionnaire “Students Attitude Survey towards Laboratory Activities to explore attitudes of teachers towards laboratory applications in science. Findings of the study showed that teachers believe that they are insecure in science laboratory and applications but they think that they have necessary teaching skills to teach science. Other results indicate that teachers are very fond of learning science in laboratory and it makes the concepts more reasonable. They also think that doing experiment in lab is fun.

Keywords: Science teaching, lab applications, in-service science teachers, hands-on learning

Introduction
Cecil Shugart at Louisiana University scientifically initiated first science Saturday school idea in 1971 (Shugart, 1976). The idea was rapidly speeded as the number drastically increased in the following years and currently many universities around the world presently offer similar scientific activities. Such programs were started as panels and seminars and later they started including virtual scientific materials in order to attract kids’ interests towards science such as balloons representations of electric charges or demos of acid and base mixtures. In the following years, although course sequences were the same as the formal education system, their orders were revised due to observed increase in students’ understandings and interests (Akerson, 2009). Mainstream of such programs continue demonstration of scientific events. In this regard, it supports to enhance their interests and wonders as well as brief conceptual understandings and descriptions. For example, ‘physics of toys” has been embedded as a part of science programs. Students, in this demo, acknowledge physics of toys in addition to concepts discussed in the process. Cartesian diver and bouncing balls of Newton could be considered as other demo examples. In addition, physics of sound, physics of music and physics of sports are considered to teach science. In chemistry, change in the speed of liquids in terms of surface area is another science example for observation.

The idea of science teaching with visual aid materials and cognitive techniques is supported by many scientists (Feynman, 1969). For this reason, weekend and summer school science programs are organized for every level of student especially in elementary grades. To increase such programs in our country is very important. In this science world, students need to be engaged in science activities that heavily utilize hands-on laboratory experiments, which employs inquiry skills.
In conclusion, informal science activities organized at education institutions should continue this attempt because it is very important to utilize laboratory hands-on activities for students to learn science concepts better. Scientific process skills and activities require experimentation and hands-on activities (Kuhn, 1998). In order to achieve this goal, science teacher should be trained in the same sense that they would be able to improve themselves with science concepts, demos and experimentation skills. Pre-service science teachers should keep in mind that their future students must learn science concepts in their first time in life and discovering its inferences. Jean Piaget suggested that the more a person uses its senses in learning process, the more it results in understanding science. In his whole life, Piaget supported the idea of utilizing hands-on activities, concrete materials and research-based learning environments. Later, Jerome Bruner contributed scientific learning process with a different approach that supports discovering new science subjects as students learn. This approach similarly requires concrete materials, inquiry and laboratory experimentation skills. Roots of discovery learning go back to learning theory base on critical thinking, trials and laboratory experiments. Studies on hands-on learning activities were started in 1980s. It is divided into two main parts: demonstration in the classroom and laboratory experiments. It consists of major disciplines of science such as physics, chemistry, and biology and even applied science areas. For example, environmental sciences (Haury, 1994), instructional technology (Korwin et al., 1990) and computer-aided instruction (CAI) (Gardner, 1992) are three important areas of applied science. Relationships between science and art are also considered as another area of research areas (Tolley, 1993).

Other studies (Glasson, 1988: Huber and Moore, 2010) investigated relationship between hands-on science experiments and popular instructional approaches. Recents studies mainly focused on students’ reasoning skills and practical science applications (Coelho, 1998); teachers’ demonstration and laboratory skills (Bilgin, 2006) and inquiry, text reading (Wallace, 2010). Whatever the reason is as long as other disciplines or instructional approaches and science are combined and integrated, researchers indicated that students won’t be able to achieve fundamental scientific process skills related science activities.

Scientific activities mostly aim to assess scientific development. However, such activities require investigations of participants’ scientific approaches and attitudes towards science. Aforementioned research ideas were studied in earlier investigations (Akerson & Donnelly, 2009; Akarsu, 2012) and those studies explained how such science programs affect science teachers but they mostly focused on how students and teachers are affected by those activities.

The purpose of this study was to examine elementary students’ and science teachers’ attitudes towards laboratory experiments in science teaching and teachers’ attitudes towards teaching strategies such as 5E and hands-on techniques. Such ideas have been studied by the researchers (Lunetta, 1998; Tobin, 1990) to setback various benefits form students and teachers understandings of non-traditional science teaching approaches. This study is guided by three research questions:

1-What do pre-service science teachers believe in science education lab experiments?
2-What do pre-service science teachers think about laboratory applications in science teaching?

We were guided by the research questions stated above to study students’ and teachers’ attitudes towards laboratory usage in science teaching in elementary level classrooms. We seek to answer major attitudes by the students and the teachers and as well as teachers’ most utilized teaching strategies in their classrooms. Then, we compared these three results among each other.
Laboratory activities have long had a distinctive and central role in the science curriculum and science educators have suggested that many benefits accrue from engaging students in science laboratory activities (Hofstein and Lunetta, 1982; 2004; Tobin 1990; Hodson, 1993; Lazarowitz and Tamir, 1994; Garnett et al., 1995; Lunetta 1998; Hofstein, 2004; Lunetta et al., 2007)

The laboratory was first used in 18th century in science education as scientific revolutions dominated in every levels of the scientific world. Later, it became worldwide in a very short period of time. Currently, laboratory activities are adapted for science curriculum in most of OECD countries. About ¼ of total times are devoted to laboratory experiments. Students generally conduct scientific experiments they learn in science classroom.

Three questionnaires were employed to generate data in the study. Attitudes Scale towards Science Laboratory (ASSL) was developed by Yesilyurt and friends (2005). The items of ASSL included 34 questions about how laboratory approach affects learning, conducting experiments, scientific skills. It was designed based on five Likert-scale. The participants consisted of 196 pre-service science teachers at two midsize universities called University A and University B for research purposes in central and west Turkey regions. Students were enrolled in 2-4th year in teacher preparation programs at the time of the study. Data were collected in 20015. 42 of them (%21) were male and 152 (%79) were female students.

Figure 1. Averages for the University A

As can be seen from above figure, teachers candidates at the university A indicated that items 2, 4, 11 an 34 as their top favorable statements as they agree. Averages of these 4 items are higher than 4.50. This result was exceedingly high compared to the overall average of 3.29 for whole statements in the questionnaire. The least favored items were 21, 22, 24, 26, 31, and 33 with around 2.50. Item 33 was structured, as opposite meaning items so its results should be considered opposite.

At the university B, the average scores were illustrated at the figure 2. Items 1, 6, 7 and 34 were among top selected statements students favored with average of higher than 4.50. This group had the average of 3.28 out of 5.00. The students indicated that items 21, 22, 24, 26, 27, 31 and 33 as their lowest preferences.
Based on two groups of the participants in the study, it was achieved that students felt insecure about items 21, 22, 24, 26 and 31 in common. Items 21 and 26 are related to attitudes towards science courses and science applications in the classroom. Items 22, 24 and 27 contain attitudes towards laboratory experiments in science. Item 31 is related to viewpoints towards science projects.

Figure 1. Averages for the University A

![Bar Chart for University A]

**Conclusion**

In conclusion, the importance of laboratory settings in science learning has been investigated for decades (Hofstein and Lunetta, 1982; Hofstein and Lunetta, 2004; Yesilyurt et al., 2005). Also, hands-on learning a type of laboratory approach has been studied as well (Lineberg and Zajicek, 2000; Collison, 1993). Above studies found out that students feel insecure themselves about scientific experiments and applications due to their lack of scientific process skills. In summary, researchers emphasized that science curriculum should be revised in order to enhance students’ science process skills. Additionally, discovery learning should be the main focus when preparing revised curriculum.

The results of the current study revealed that teachers indicated that they favor experimental science activities but they do not possess some of the science process skills such as conducting laboratory experiment. Also, They feel themselves extremely poor on science projects, which explains why they thought that they were incapable of doing science application. They don’t think they have necessary teaching skills to teach science. Other results indicate that students are very fond of learning science in laboratory. On the other hand, they strongly believe that science in laboratory is fun and exciting.

Based on the findings, it is suggested that teacher candidates should be trained better in their laboratory courses in teacher preparation programs. Also, it will be a good idea to revise method courses to more inclined to include more application activities. In order to achieve why students believe that way a more detailed and comprehensive study models should be designed. Teacher candidates should be interviewed, observations should be conducted and more data collection tools should be applied.
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