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The Opinions of Prospective Science Teachers towards the Efficiency of Constructivist Approach Centered Science Laboratory Practices on Student Motivation

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Abstract

Laboratory practices are very important to ensure students' motivation to subjects related to science. The purpose of this study is to identify the opinions of prospective science teachers towards the efficiency of constructivist approach centered science laboratory practices on student motivation. Case study model which is one of the qualitative research models is used for the research. 60 prospective science teachers which are determined through criterion sampling method were interviewed and the data were analysed by using the content analysis. Suggestions towards increasing students' motivation to science subjects were made according to the result of the study.

1. Introduction

It is expected that students have general knowledge about science, comprehend the characteristics of scientific knowledge and gain the process for obtaining scientific knowledge. Briefly, students' being a scientific literacy individual stands out. In this respect, all the countries go to revision in the education programs from time to time and focus on what to be done for effective science teaching. Turkey also did some radical changes about science teaching programs in especially primary schools in 2005. Including in particular the name of course, the philosophy of the education program was changed. The name of the science program applied in the primary schools was changed as science and technology education program, and it was prepared on the basis of constructivist approach. The alternative measurement and evaluation activities were included; the topics were presented in a spiral structure; the concept teaching was focused and students' active learning was highlighted (MEB, 2005).

In this regard, the laboratory practices should be regulated based on active learning. When the laboratory practices were examined, it is seen that the closed-ended experiments were focused and not many activities based on research basis which provides students to gain scientific process skills were done. Laboratory studies should include the open-ended based on constructivist approach and contribute to students' attitudes and motivations. For example, Büyük, Demir and Erol (2010) states in their research that the laboratories are necessary to provide permanent information and that the teachers trust themselves about laboratory knowledge but the environment and conditions are insufficient. Coştu and the others (2005) applied a test to the students in three different science departments and they stated that the students made many mistakes although they had laboratory lessons in their research. Erökten (2010) applied a concern scale to the sophomore of science prospective teachers before and after the laboratory lesson and he tries to determine whether there was any decrease in the concern of the prospective teachers in his study. As a result, it was seen a 3% increase in the skills which they showed in the laboratory skills and it was stated that there was a decrease in the amount of their concern.

According to the results of the studies to be done, it is seen that the laboratory studies contribute to the students' scientific process skills and the attitude and motivations have increased. In this regard, it is important that the science prospective teachers to study in primary schools are educated through the laboratory activities based on constructivist approach. The prospective teachers who learn how to do the applications will have the chance to apply the education programs more actively.

2. The Purpose of the Study

It was asked through this study that the changes of the opinions about constructivist centered laboratory activities in the process. In this regard, the answers to the questions as follows were sought:



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on the science prospective teachers' ;

What are the opinions of the science prospective teachers about the effects of constructivist centered laboratory;

1. on understanding of nature of science?
2. on development of academic success and scientific process skills?
3. on effects of attitude and motivation?
4. on communication and collaboration skills?
5. on conceptual change effect
6. on creative and critical thinking skills?

3. Method

3.1. Research Model

Case study model one of the qualitative research models was used in the research. Case studies are used as a distinctive approach for seeking answers to scientific questions. Case studies are defined as the method in which one or more events, environments, programs, social groups or the other systems connected to each other are examined (Büyüköztürk et al, 2008).

Criteria sampling method was used to determine the study group in the study. The basic understanding in criteria sampling method is to study all the cases satisfying some predetermined criteria (Yıldırım and Şimşek, 2008). In this regard, it was paid attention to choose the prospective teachers from the ones who have had the constructivist centered laboratory activities and who haven't had them.

3.2. Study Group

30 junior prospective teachers who haven't had the constructivist centered laboratory activities and 30 senior prospective teachers who have had these activities were included in the study.

3.3. Data Collecting Tool

6 semi-structured questions were asked by the researchers in order to examine the change in the laboratory activities in which constructivist approach were applied during the process. These questions were determined according to the potential impacts of the laboratory activities.

3.4. Data Analysis

The data obtained from the study were analyzed by content analysis technique. Content analysis technique is defined as a systematic replicable technique in which some words of a text are summarized with smaller content categories through some codification based on some certain rules (Büyüköztürk et al, 2008).

4. Findings

The opinions of the students who have had the constructivist centered laboratory activities and who haven't had are presented in this part.

1. The opinions of the science prospective teachers about the effects of constructivist centered laboratory on understanding of science nature

Table 1: The Opinions of The Prospective Teachers About The Understanding of Science Nature

The Prospective Teachers Who Have Had The Constructivist Centered Laboratory Activities	The Prospective Teachers Who Haven't Had The Constructivist Centered Laboratory Activities
Opinions	Opinions
1.It helps the aims and nature of the experiments.	1. It helps to relate the cases associated with everyday life.
2. It helps to relate to the environment.	2. It helps to get information about
f	f
5	19
10	6



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3. It helps to understand the basis of humanity and life.	1	scientific literate.	
4. It contributes to the understanding of science.	9	3. It helps to extrapolate through observation and interpretation of result.	
5. It provides active participation in experiments.	7		
6. It contributes to understand the studies made by scientists.	2		
7. It contributes to meaningful learning.	5		
8. It presents the accessing ways to information.	5		
9. It encourages approaching to scientific studies.	1		

When the opinions of the prospective teachers about the understanding of science nature are taken into consideration: The prospective teachers who haven't had the constructivist centered laboratory activities stated such opinions as "It is provided to get information about science literacy" and "It helps to relate the cases associated with everyday life". The prospective teachers who have had the constructivist centered laboratory activities stated such opinions as "It contributes to the understanding of science.", "It provides active participation in experiments." and "It contributes to meaningful learning".

2. The opinions of the science prospective teachers about the effects of constructivist centered laboratory on the development of academic success and scientific process skills

Table 2: The Opinions of The Prospective Teachers About development of academic success and scientific process skills

The Prospective Teachers Who Have Had The Constructivist Centered Laboratory Activities		The Prospective Teachers Who Haven't Had The Constructivist Centered Laboratory Activities	
Opinions	f	Opinions	f
1. It provides the development of scientific process skills.	23	1. It contributes to learning by doing-living.	8
2. Academic success increases.	13	2. It contributes to active learning.	5
3. It provides a better understanding of scientific process skills.	3	3. It supports per-service development.	10
4. It contributes to individual and group success.	2	4. It provides cognitive-affective-psychomotor development.	16
5. It encourages to be a scientist.	4		
6. It contributes to the comprehension of topics.	4		
7. It provides to use knowledge in daily life.	4		
8. It helps to design different experiments.	2		
9. It contributes to meaningful learning.	8		

When the Opinions of The Prospective Teachers About development of academic success and scientific process skills are taken into consideration:

The prospective teachers who haven't had the constructivist centered laboratory activities stated the opinion "It provides cognitive-affective-psychomotor development." while the prospective teachers who have had the constructivist centered laboratory activities stated such opinions as "It provides a better understanding of scientific process skills.", "It encourages to be a scientist.", "It helps to design different experiments." and "It provides to use knowledge in daily life".

3. The opinions of the science prospective teachers about the effects of constructivist centered laboratory on the development of attitude and motivation

Table 3: The Opinions of The Prospective Teachers About development of attitude and motivation

The Prospective Teachers Who Have Had The Constructivist Centered Laboratory Activities		The Prospective Teachers Who Haven't Had The Constructivist Centered Laboratory Activities	
Opinions	f	Opinions	f
1. It increases attitude and motivation.	24	1. Providing active learning, it helps to increase emotional development.	11
2. Motivation increases through group study.	5	2. It provides to relate daily life.	8
3. Individual interaction is provided.	3	3. Providing a positive attitude, it helps to increase success.	18
4. It presents security to person.	4	4. It provides a motivation for the profession.	7
5. It develops student's self-competence.	4		
6. It creates thought for student achievement.	5		
7. It presents an enjoyable environment.	6		
8. It provides a motivation for the profession.	1		
9. It contributes to increase in success.	2		
10. It provides to relate daily life.	3		
11. It provides creative thinking.	2		

When the opinions of prospective teachers about attitude and motivation are taken into consideration:

The prospective teachers who haven't had the constructivist centered laboratory activities stated such opinions as "Providing a positive attitude, it helps to increase success." and "It provides a motivation for the profession." while the prospective teachers who have had the constructivist centered laboratory activities stated such opinions as "Person's trust increases.", "It presents an enjoyable environment.", "It contributes success to increase." and "Creative thinking develops."

4. The opinions of the science prospective teachers about the effects of constructivist centered laboratory on the communication and collaborative activities

Table 4: The Opinions of The Prospective Teachers About the communication and collaborative activities

The Prospective Teachers Who Have Had The Constructivist Centered Laboratory Activities		The Prospective Teachers Who Haven't Had The Constructivist Centered Laboratory Activities	
Opinions	f	Opinions	f
1. Group works provides	18	1. It contributes to the realization of	27

communication skills.		collaborative approach with the group.	
2. It provides knowledge information.	7	2. It provides an inductive learning environment.	9
3. It develops individuals' sense of responsibility.	3	3. It bases on individual learning.	4
4. It contributes to work together.	7		
5. It provides classroom interaction.	5		
6. It provides social interaction.	3		
7. It provides collaborative learning.	6		
8. It provides tolerance and a respectful environment.	2		
9. It presents study skill.	2		
10. It causes discipline problems in crowded groups.	1		
11. New ideas emerge.	2		

When the Opinions of The Prospective Teachers About the communication and collaborative activities are taken into consideration: The prospective teachers who haven't had the constructivist centered laboratory activities stated such opinion as "It contributes to the realization of collaborative approach with the group.", "It provides an inductive learning environment." while the prospective teachers who have had the constructivist centered laboratory activities stated such opinions as "Classroom and social interaction increase.", "Tolerance and a respectful environment increase.", "The individuals who to create new ideas will emerge." and "Working together will increase".

5. The opinions of the science prospective teachers about the effects of constructivist centered laboratory on the providing of conceptual change

Table 5: The Opinions of The Prospective Teachers About the providing of conceptual change

The Prospective Teachers Who Have Had The Constructivist Centered Laboratory Activities		The Prospective Teachers Who Haven't Had The Constructivist Centered Laboratory Activities	
Opinions	f	Opinions	f
1. It corrects misconceptions.	19	1. It gives a chance to test the concepts in an experimental environment.	17
2. It provides conceptual change.	9	2. It provides exploratory learning.	11
3. Permanent learning is provided.	2	3. It helps to realize misconceptions.	13
4. Learning by doing-living is provided.	3		
5. New conceptions are learned.	4		
6. It provides the knowledge to structure correctly in the mind.	1		

When the Opinions of The Prospective Teachers About the providing of conceptual change are taken into consideration:

The prospective teachers who haven't had the constructivist centered laboratory activities stated the opinion "the realization of misconceptions through based on exploratory learning", while he prospective teachers who have had the constructivist centered laboratory activities stated such opinions as "New conceptions will emerge through learning by doing-living is provided. So, new conceptions can be learned faster and the knowledge is to be structured correctly in the mind."



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6. The opinions of the science prospective teachers about the effects of constructivist centered laboratory on the providing of creative and critical thinking

Table 6: The Opinions of The Prospective Teachers About the providing of creative and critical thinking

The Prospective Teachers Who Have Had The Constructivist Centered Laboratory Activities		The Prospective Teachers Who Haven't Had The Constructivist Centered Laboratory Activities	
Opinions	f	Opinions	f
1. It helps to design experiments for a topic.	9	1. It helps hypotheses establishment skill to develop.	5
2. Creative thinking develops.	14	2. It gives a chance to develop individual learning through querying.	15
3. Critical thinking develops.	20	3. It helps to throw out ideas that can produce alternative solutions.	15
4. Scientific attitude is presented.	1		
5. Different aspects develop.	2		
6. Th practices in daily life are learned.	1		
7. It is provided that topics are discussed with friends.	1		
8. The skill for suggestion making develops.	2		
9. Inquiry skill develops.	4		
10. Problem solving skill is gained.	1		

When the Opinions of the Prospective Teachers About the providing of creative and critical thinking are taken into consideration:

The prospective teachers who haven't had the constructivist centered laboratory activities stated such opinions as "Hypotheses establishment skill develops; moreover, It helps to throw out ideas that can produce alternative solutions." while the prospective teachers who have had the constructivist centered laboratory activities stated such opinions as "As a result of getting different aspects, problem solution skill increases, a discuss environment emerges through critical thinking; to make suggestions by designing experiments individually".

1.4. Conclusion and Comments

The prospective teachers applying the constructivist practices state that they found the chance to test the scientific principals and concepts, and that their active participation in the experiments provided meaningful learning. They add that the providing of conceptual change has effects on encouraging of being a scientist, helping to design different experiments, a better relation of information with daily life. Moreover, it is thought that self-trust will increase; an enjoyable learning environment will be provided; success will be increased and creative thinking will develop. They also put forth the results related that some individuals to produce new ideas and that working together will increase.

In relation with the Science and Technology Program implemented in 2005 as a part of Science Education degree program, the requirement which the prospective teachers have to apply constructivist approach to experimental activities takes part in the course content of Science Teaching Laboratory Practices. When the results reflecting the prospective teachers' expectations before this course are examined it is seen that the most repeated 6 themes reflecting the dimensions of constructivist approach are "relation with life (factual relationships), Cognitive-affective-psychomotor development, a positive attitude towards success, collaborative approach, testing concepts in experimental environments, individual learning, questioning and alternative solution production". Accompanied by these findings, it can be stated that the prospective teachers believe in the fact that this course should be applied through a collaborative learning concept in a questioning and active learning process.



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Related to the change in the conceptions and attitudes reflected in the study, the students' configure of conceptions incorrectly according to the situation which they encounter in life can sometimes drag them to mistakes. The benefit from new and appropriate approaches can be seen as solution to eliminate these misconceptions. In addition, the detection supporting that after chosen the appropriate methods, the conceptual change for science courses in laboratories can be achieved successfully is consistent with the expectations of the prospective teachers (Başer and Çataloğlu, 2005). When the evaluation of the results are made, it is indicated that a questioning learning environment effects students' motivation positively. When the literature is examined, it is seen that learning cycle models in a questioning learning environment increase academic success through providing conception teaching (Avcıoğlu, 2008; Ağgül-Yalçın and Bayrakçeken, 2010). In this case, it is understood that inquiry-based approaches is effective in the development of positive attitudes towards the lesson (Ergin, Kanlı ve Ünsal, 2008; Tessier, 2010, Özbek ve Diğ., 2012). It is seen that constructivist centered learning environments have positive effects on the students in terms of providing conceptual change and meaningful learning. In this regard, prospective teachers should be educated according to this approach. Therefore, the necessary aim will be reached as being the operator of educational programs.

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