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What are the pre-service physics teachers' opinions about context based approach in physics lessons?

Ozgur Ozcan^{a*}, Cem Gercek^a

^a*Hacettepe University, Faculty of Education, Secondary Science and Mathematics Education, 06800 Betyepe, Ankara, Turkey*

Abstract

It is known that the new teaching program based on the context based approach has been performed gradually from the 2005-2006 academic year in Turkey to facilitate the students' understanding of the science and technology subject matter. Therefore, it is aimed to teach the students according to the new program supported with daily life activities. Thus, the students can establish a link between physics and everyday life. In this sense, the preliminary knowledge of the pre-service physics teacher about the context based approach is important before they became in-service teachers at schools. From this point on, the purpose of this study is to determine the pre-service physics teachers' prior knowledge about the subject of context based learning. The study was conducted with 16 senior students who have taken the major part of the physics and physics education courses. The collected data was analyzed by using the content analysis method. The results of the analysis showed that the pre-service physics teachers have some lack of knowledge and lack of applications about the context based approach used in physics lessons. According to the results, the pre-service physics teachers' knowledge on this subject should be improved by using the context based approach activity in courses at university level.

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* Ozgur Ozcan. Tel.: +903122976788; fax: +903122978600.

E-mail address: ozcano@hacettepe.edu.tr

1. Introduction

Physics courses generally cover topics which are difficult to understand by students. These courses include both difficult concepts and complex mathematical background information. Therefore, students develop negative attitudes towards physics courses mainly due to such complexity and difficulty of them. One of the ways to make the physics courses more attractive is to provide strong connections between courses and daily life. Therefore, preservice physics teachers should be provided with necessary opportunities to practice such connections in teacher training programs. In fact, the nature of the physics courses is appropriate for developing such connections with daily life. For instance, the physics courses can be easily related to natural events (Gurel, Guven & Gurdal, 2003). However, research suggests that students could not manage to make connections between the physics courses and daily life as much as it is required (Gurel, Guven & Gurdal, 2003; Erduran & Yagbasan, 2004; Tasdemir & Demirtas, 2010; Gocmencelebi & Ozkan, 2011; Emrahoglu & Mengi, 2012). Lack of such necessary connections seems to be one of the factors accounting for underachievement of students in physics courses. In order to eliminate or at least, reduce such problems the science literacy should be improved and the physics courses should be supported through various connections (Gilbert, 2006).

Context based approach can be defined as a teaching method in which the concepts and skills of students with different learning experiences are used in teaching and learning process (Glynn & Koballa, 2005). While learning the topics of physics, the students tend to make connections between concepts and real world. In the teaching and learning process in the physics courses students generally ask themselves the following questions: “Why should I know it?” or “Where will I use this information?” Given that the answers to these questions become clear in the course with context based approach, students easily comprehend how and when to use these information and ability they acquired (Glynn & Koballa, 2005). In contrast to traditional teaching methods when students’ interest is directed towards scientific discussion the desired gains are significantly improved (Redish, 2003) and their motivation becomes much higher (Dufresne, Gerace, Leonard, Mestre, & Wenk, 1996). On the other hand traditional physics problems and context based physics problems significantly differ. Benckert (2005) is the first figure who introduced this difference. More specifically, in contrast to traditional physics problems context based physics problems can be solved using examples taken from real-life cases, require much more reading and reflection and the solutions require much longer time. Although problems designed based on the context based approach differ in terms of difficulty levels, students could use similar daily life situations to those situations which are employed to understand the content of the physics courses. The contexts covered in physics courses can be expanded to those which students regard as much more appropriate. For instance, movies and TV programs can be employed to provide contexts (Rogers, 2007). On the other hand, contexts to be used should have certain characteristics. For instance, contexts should not be very interesting and attractive in terms of affective qualities. When such contexts are provided students become extremely concentrated on these contexts and could not manage to reflect on the underlying physical concepts or events (Shiu-sing, 2005).

From the academic year of 2005-2006 the context based approach has been used in the new teaching program for the physics courses in Turkey. The goal in this switch was to facilitate the learning of science and technology topics. For this aim the new educational program was supported and complemented with daily life activities. Therefore, students are provided with necessary opportunities to develop connections between physics and daily life. On the other hand, pre-service physics teachers should acquire necessary background information about the context based approach before their future physics teaching activities.

2. Method

2.1. Participants

In this study purposeful sampling method was used to identify the participants. The use of this particular sampling method makes it possible to analyze in-depth the related situations and to provide full answers to the research questions (Patton, 2002). The participants of the study were 16 pre-service physics teachers attending a public university in Turkey. All of the participants completed most of the courses covered in teacher training program. The collected data were analyzed by using the content analysis methods.

2.2. Data collection tool

The data of the study were collected through asking the participants four open-ended items. All of the items were concerned with the context based approach and the goal was to reveal the views of the pre-service physics teachers about this approach. The first item aimed to identify the level of participants' knowledge about it. Next, they were asked to write down the advantages and disadvantages of the approach. The third item was related to the physics topics which were regarded by the participants as the most proper environment in which the context based approach can be employed. The last item was about to generate a context towards any topic covered in the physics course.

2.3. Data analysis

The data obtained through four open-ended items were analyzed using the content analysis which is among the qualitative research techniques. In order to provide a full picture of the findings, direct quotations were also given from the statements by the participants. The direct quotations from the interview by the pre-service teachers are coded using "S#".

3. Findings

In this study the views of the pre-service physics teachers about the context based approach as well as their proposals about the contexts which can be employed in the courses were investigated. It was found that nearly all of the participants (14 out of 16 participants) had basic information about the context based approach. The common answer to the question "what is the context based approach?" was found to be as follows: it is "the delivery of the topics in physics through connections with daily life." Four of the participants also emphasized that student learning lasts longer due to the fact that there are connections between the topics in physics and daily life in the context based approach. They added that abstract topics in physics become concrete with this approach and as a result, the meaningful learning will occur. Some of the statements about the definition of the context based approach are given as follows:

S4: The context based approach is an educational approach in which examples from daily life are used in the teaching and learning process. Students better comprehend and their learning becomes long-lasting due to the fact that concrete events students have come across before and concepts of physics are connected in the courses.

S7: The context based educational approach makes it possible to connect the learned information with daily life events and to make sense of learning.

S9: The context based educational approach refers to the integration of the daily life events observed or experienced into the teaching and learning process. It makes it possible to indicate the use of theoretical information acquired in the learning process at school in daily life and therefore, to have long-lasting information. In addition, it aims at sound learning and using the information learned in daily life.

These quotations indicate that the participants mostly got how the context based educational approach should be implemented in classroom. Given that the participants recognized that fact that student learning becomes long-lasting when the topics in physics are connected with daily life they will use this tendency in teaching those topics in physics and their learning by the students will be facilitated.

The participants were also asked to indicate the advantages and disadvantages of the context based educational approach. They mentioned both the advantages and the disadvantages of the approach at equal level. As an advantage they reported that the approach is a tool to create "sound learning", to avoid "misconceptions" and to improve "student motivation". They also reported some disadvantages of the approach such as "time constraints", "insufficient examples", and "the use of incorrect examples". Some of the answers of the participants to this item are as follows:

S6: Through context based educational approach students are well motivated to learn. Students easily see the correspondences of their learning and the answer to the question "where will I use it?" in daily life and

such a recognition improves the interest of students towards the course. It makes the students inquiry-based learners. However, for teachers to find sufficient examples may be time-consuming and difficult.

S8: Students are much more motivated to learn when they make sense of learning through daily life. Because memorizing is not proper for the developmental process of human. As stated for the organization step developed by Piaget information should be made sense. Therefore, long-lasting learning may be realized. On the other hand, not all topics in physics can be delivered through the context based educational approach or using incorrect examples may lead to misunderstanding of the topics.

S15: Significant advantages of the context based approach include the fact that it improves and maintain student motivation, it provides sound learning and it is effective in terms of time management. Some of its disadvantages include the lack of sufficient examples and poor established contexts.

As the quotations given above show in regard to the advantages of the context based approach they reported that the approach enriches the content of the course and that it improves meaningful learning and student motivation. On the other hand, Table 1 shows the answers of the pre-school physics teachers to the question “for which of the topics in physics should be delivered through the use of the context based approach”

Table 1. Distribution of physics subject

| Physics subject | Students (Na) |
|----------------------|---------------|
| Photoelectric Effect | 12 |
| Quantum Physics | 2 |
| Magnetisms | 3 |
| Mechanics | 3 |
| Optics | 5 |

^a Each student preferred more than one physics subject

As can be seen from Table 1 they suggested that the context based approach is much more suitable for the topics in modern physics. The reason for this preference seems to be the fact that the topics covered in modern physics are mostly abstract than other topics. As can be seen from Table 1 they mostly suggested the use of the context based approach for the teaching of the topic of photoelectric effect in order to facilitate its learning. One of the participants reported the following in this regard as follows: “*Photoelectric effect, a topic in modern physics, is hard to understand by students. In order to facilitate its learning we may make use of analogies taken from daily life.*” Another participant expressed his view on the subject as follows: “*while teaching fiber technology, a topic covered in modern physics, we may mention its use in traffic lights, security systems and internet.*” Another participant reported his views as follows:

S12: Various contexts may be developed for the abstract topics in physics. For instance, while teaching quantum physics or topics related to magnetism the context based approach may be employed. Through the use of it those topics which are difficult to comprehend can be better.

The participants were also asked to choose a topic in physics and then, to develop a context for it. Their preference over the topics was consistent with their statements in regard to the third item. They mostly preferred topics from modern physics. Nearly all participants (15 out of 16 participants) developed proper contexts for their topics according to the context based approach. Given that the ultimate goal of the context based educational approach is to reveal the physic-related mechanisms which are the basis of the daily life events the participants stated certain contexts to deliver the topics connecting them with daily life. For instance, one of the participants suggested the teaching of the polarization of light through giving example of sun glasses. Another participant reported the use of snowshoe while teaching the topic of pressure. Another topic given was the Doppler Effect which is also part of modern physics. The following quotation shows the context given by a participant:

S11: Think that the distance between Ahmet and Ali is 50 meter and Ahmet throws the balls to Ali with one second intervals. As long as they do not move the balls reach Ali with one second intervals. However if Ali remains fixed and Ahmet begins to move towards him the balls would reach Ali in shorter periods of time. In other words, the frequency of throwing balls is regarded as increased due to the movement of Ahmet who throws the balls. We may relate this event to the Doppler Effect.

As can be seen from the quotation above difficult to understand and abstract concepts may be made clear and easy to understand through using examples from daily life. On the other hand, some of the participants seemed not to understand the basics of the context based approach. Such participants used analogy in teaching about the topics instead of giving examples from daily life. Although the use of analogy may facilitate the student learning, it has nothing to do with the answer to the question of “where will I use my learning?” which is the basic of the context based approach.

4. Discussion and conclusion

In this study the views of the pre-service physics teachers about the context based approach as well as their proposals about the contexts which can be employed in the courses were analyzed. In addition, they were asked to state the advantages and disadvantages of this approach. The findings indicated that the participants supported the use of the context based approach mostly in those physics topics which are difficult to comprehend. It was also found that the pre-service physics teachers suggested the use of the context based approach for teaching the topics included in modern physics and for teaching abstract concepts. The topics mentioned after modern physics are optical, magnetism and mechanics. The participants stated that provision of contexts for these topics seems to improve the student motivation. The preference of the topics for the context based approach by the participants is consistent with previous findings (Cetin, 2014). The reasons for choosing topics from modern physics for the context based approach are due to the fact that these topics are hardly learned and lead to misconceptions (Ozcan, 2013; Didis, Ozcan & Tasar, 2009).

However, the context based approach may be used in all topics of physics to significantly improve student learning. Therefore, pre-service teachers should learn the the context based approach during their teacher training process. It was also concluded that some of the participants cannot employ the context based approach in an effective or correct way. Some of the student teachers were observed to have difficulty in developing context and some could not developed any. The other major finding of the study is that there were very superficial contexts developed by the participants.

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