Eğitimde Kuram ve Uygulama
Journal of Theory and Practice in Education
ISSN: 1304-9496

Articles /Makaleler
2016, 12(2), 447-463

INVESTIGATING PROSPECTIVE TEACHERS' ABILITY TO WRITE CONTEXT-BASED PROBLEMS

(ÖĞRETMEN ADAYLARININ BAĞLAM TEMELLİ PROBLEM YAZABİLME BECERİLERİNİN BELİRLENMESİ)

Neslihan ÜLTAY[1]
Necla DÖNMEZ USTA[2]

ABSTRACT

The aim of this study is to investigate the prospective teachers' ability to write context-based problems about the concepts in radioactivity unit. The study is carried out in a university in Turkey with 21 prospective teachers in physics, chemistry and biology in 2014-2015 fall terms. In the study, data are collected through the papers on which prospective teachers write context-based problems about the concepts in radioactivity unit. Data are analyzed with a rubric which is developed by the researchers. According to the findings, prospective teachers are found as 'not adequate' at selecting daily life context. At the end of the study, it is revealed that prospective teachers understand the 'context-based' concept as 'only relating something with daily life'. It is suggested that in-service courses may solve and eliminate this problem.
Keywords: Context-based assessment, context-based problems, prospective science teachers

ÖZET

Bu çalışmanın amacı fen bilimleri öğretmen adaylarının radyoaktivite konusundaki kavramlar ile ilgili bağlam temelli soru yazabilme becerilerinin belirlenmesidir. Çalışma Türkiye'de bulunan bir üniversitede 2014-2015 güz döneminde 21 fizik, kimya ve biyoloji öğretmen adayıyla yürütülmüştür. Çalışmada veriler öğretmen adaylarının radyoaktivite konusundaki kavramlar hakkında yazmış oldukları bağlam temelli sorular aracılığıyla toplanmıştır. Elde edilen veriler, araştırmacılar tarafından geliştirilen bir rubric yardımıyla değerlendirilmiştir. Elde edilen bulgulara göre, öğretmen adayları günlük hayattan bağlam seçmede 'yetersiz' bulunmuşlardır. Çalışmanın sonucunda, öğretmen adaylarının 'bağlam temelli' kavramı ile 'günlük yaşamla ilişkili olan herhangi bir şey'i kastettikleri sonucuna ulaşılmıştır. Bu durumun giderilebilmesi için hizmetiçi kurslar önerilerek çalışma sonlandırılmıştır.
Anahtar Sözcükler: Bağlam temelli değerlendirme, bağlam temelli problem, fen bilimleri öğretmen adayları

1 Assist Prof., Giresun University Faculty of Education Primary Education Department, neslihanultay@gmail.com
2 Assist Prof., Giresun University Faculty of Education BÖTE Department, nozlemdonmez@gmail.com

Introduction

In the literature, there is the statement that "enthusiasm of learning increases with the connection of knowledge to the students' daily life" about the context (Choi & Johnson, 2005). So, what does the context that helps to increase learning desire of the student in science teaching mean? The context is described as "in any concept, the pattern of events, cases and relationships or connection or context in any concept." by Turkish Language Association (TLA, 2015). Although context is described as subject, story, case and problem, the most commonly used counterpart is the "case" (Bennett, Holman, Lubben, Nicolson & Otter, 2005; Pilot & Bulte, 2006). In science programs, with the "context-based" concept it is meant that the content should be associated to a real situation or an event which the students encounter or may encounter in daily life. The content should also be associated to any technological device which students are closely familiar (National Ministry Education, 2012). The conducted studies reveal that the most important way to increase the students' interests to science (physics, chemistry, biology) is associating the scientific information with the events in daily life (Barker & Millar, 1999; 2000; Potter & Overton, 2006). The association of scientific knowledge with the events in daily life positively affects the attitudes of the students towards science (Graber, Erdmann & Schlieker, 2002; Hofstein & Kesner, 2006; King & Ritchie, 2007). In order to help students to develop positive attitudes towards science, the subjects should be taught within the contexts which the students are familiar in their daily life. On the other hand, some of the problems encountered in traditional science/chemistry education were not solved. These problems were that scientific knowledge were not associated with daily life (Demircioğlu, Demircioğlu & Çalık, 2009; Gilbert, 2006; Stolk, Bulte, de Jong & Pilot, 2009a) and the students had difficulties in application of scientific knowledge in different contexts (Gilbert, 2006). In order to eliminate these problems and to increase the quality of the education, context-based approach has begun to be used in the education more commonly in recent years. In Turkey, the physics program in high schools had primarily been organized according to context-based approach and the program was used from 2007 to 2013-2014 years. But it was found that physics teachers did not use context-based approach in their classrooms because some researches showed that they were not informed about the new approach (Ayvacı, 2010; Ayvacı, Ültay & Mert, 2013). The most important obstacle that prevented implementing context-based approach in learning environments in Turkey may be that teachers were not informed enough by experts and they were not given enough time to focus on the approach and discuss the advantages/disadvantages. The program was put into practice by ignoring the teachers' opinions about it. However, if the teachers who was the real implementers of the approach had been included in the development of the new program, it would have been more effective and useful (Stolk et al., 2009a; Stolk, Bulte, de Jong & Pilot, 2009b).

Through the literature, there are a lot of definitions about context-based approach stated by many researchers. Review (2003) defined context-based approach as an approach that based on the applications of context and science in

order to develop the scientific opinions. Ingram (2003) stated; "context-based learning includes learning in the contexts and the learning takes place in close relationship with the experienced daily life". In Sözbilir, Sadi, Kutu, and Yıldırım (2007)'s study, they explained context-based learning as; "submitting the scientific concepts with the events chosen from daily life to the students". In the literature, it is found that context-based approach have a positive effect on the academic success (Ingram, 2003; Potter & Overton, 2007; Ültay, 2012, 2015; Ültay, Durukan & Ültay, 2015; Yavuz & Kepçeoğlu, 2011), interest and motivations of the students (Bennett et al., 2005; Holman & Pilling, 2004; Ramsden, 1997; Rayner, 2005; Tekbıyık & Akdeniz, 2010; Ültay & Çalık, 2011; Ültay & Ültay, 2014). Besides, in the literature, there are many studies supporting the thoughts of that context-based approach is a more catchy learning method since the students can internalize the events that the students encounter in daily life more (Ültay, 2012; 2014; Ültay & Çalık, 2012) and it positively contributes to associating the chemical knowledge with daily life (King & Ritchie, 2007). Being different from the studies mentioned above, in the literature it is stated that science and physics lessons should be assessed in accordance with the context-based approach (Akpınar, 2012) and daily life examples should be used in order to develop the problem-solving abilities of the students (Park & Lee, 2004; Taasoobshirazi & Carr, 2008). During learning process, problems are said to have the functions of directing the students and monitoring their development, facilitating classroom management, ensuring the interaction between the individuals in learning environment, increasing motivation and developing problem-solving abilities (Kurnaz, 2013.) So, in science lessons, the problems acquiring students to make analysis, synthesis and evaluation should be preferred to develop students' problem-solving abilities (Knecht, 1971). So, in this case it will be possible to deepen the conceptual learning and to gain a deeper understanding. In recent years, the importance of science teaching based on the real life and problem solving abilities has been widen by the conducted studies (Campbell, Lubben & Dlamini, 2000; Park & Lee, 2004). Although the effects of the context-based courses on students' interest, motivation and success are investigated in many studies, very few numbers of studies focused on the context-based assessment (Heller & Hollabaugh, 1992; Kurnaz, 2013; Park & Lee 2004). Hence, it is needed the studies presenting different viewpoints about context-based approach. For example, the studies investigating prospective teachers' context-based problem writing abilities about radioactivity and the related concepts should be needed.

Radioactivity is an interdisciplinary subject that is closely related to the daily life of the student and science/chemistry/physics concepts. This subject has also some difficulties in teaching. Since most of the concepts in radioactivity unit are seen as abstract concepts, their learning is rather difficult and complex (Dönmez Usta & Ayas, 2013; Dönmez Usta, Karslı & Ayas, 2014; Janiuk, 1993). This unit also consists of important information affecting real life in the world. In the literature, there are some studies indicating that the students have some misconceptions about the concepts in this unit (Alsop, 2001; Brown & Clement,

1987; Ceng, Dönmez, Karslı & Ayas, 2007; Dönmez Usta, 2011; Dönmez Usta & Ayas, 2010a; Dönmez Usta, Karslı, Ceng & Ayas, 2009; Matsuuar & Iiri, 2002; Morgil, Yılmaz & Uludağ, 2004; Prather & Harrington, 2001; Ronneau, 1990; Williams, 1995). Because of the nuclear accidents of Chernobyl and Fukushima, and the negative effects of the bombs thrown to Hiroshima and Nagasaki on the living cells caused that the concepts of "radioactivity" or "radiation" is thought with altogether (Cohen, 1998; Dönmez Usta & Ayas, 2010b; Max, 1993). But, it is important to note that radiation is used in the detection of the important illnesses for the health of society and it is also an environmentally friendly technology (Morgil et al., 2004). In teaching radioactivity, the daily life examples such as gas phase of the radiaoactivity, ultraviolet, nuclear energy, nuclear power plants should be included (Andersson, 1986; Dönmez Usta, 2011; 2015).

In the literature, it is stated that context-based problems made the subject more interesting (Rennie & Parker, 1996) and they are considered to be more appropriate after a context-based teaching (Akpınar, 2012; Rennie & Parker, 1996). Traditional problem requires recalling knowledge, whereas context-based problem requires deeper understanding (Wilkinson, 1999). Furthermore, the students may find the context-based problems more interesting and they may incite the students solving the problems with enthusiasm. Hence, the context-based problems may measure deeper understanding instead of recalling the knowledge and this gives more detailed information about students' learning of the subject (Akpınar, 2012). In order to understand the difference between traditional problems measuring the skill of recalling knowledge and context-based problems measuring students' understanding, sample problems in radioactivity are presented in Figure 1.

Traditional problem

Does radioactive rays have any effects on living cells? If yes, what can they be?

Context-based problem

Mrs. Demir became aware of decreasing the productivity in her vegetables in the garden. After careful examination, she understood that her neighbor Mrs. Duru set up a spraying mechanism in her garden. She was suspicious about that this mechanism may have been affected her vegetables' production because it was written that radioactive rays may have been radiated on the mechanism. What do you think about this case? What can be the reason?

Figure 1. Traditional and context-based problem samples

From this point of view, the aim of this study is to investigate the prospective teachers' ability to write context-based problems about the concepts in radioactivity unit.

METHOD

In this study, case study method is used because this research method gave opportunity to investigate the properties of a sample group deeply (Creswell, 2003). The study is carried out in a university in Turkey with 21 prospective teachers in

physics, chemistry and biology. Prospective teachers in the sample group were graduated from Physics, Chemistry and Biology Departments of Science Faculties with a bachelor's degree before. Then, because they wanted to become a physics, chemistry or biology teacher, they had to complete a pedagogical formation program successfully. Pedagogical formation program which was organized by the Education Faculties of universities lasts two semesters. The sample group is randomly selected from 4 classes consisting of physics, chemistry or biology prospective teachers. The sampling method is stratified because the classes were created before the study and the researchers selected randomly among the classes (Balcı, 2011).

Graduate students of Education Faculties had already been interested in physics, chemistry and biology education courses during their training, so they were more used to implement different learning approaches in their lessons, but graduate students of Science Faculties had firstly faced learning approaches in pedagogical formation program.

The sample group consisted of 5 physics, 10 chemistry and 6 biology prospective teachers (aged 20-24 years). Prospective teachers were coded as PT1, PT2, PT3, …. PT21 in the study.

Implementation

In the study, firstly prospective teachers were informed and taught context-based approach and context-based assessment during 8 hours (8*50 minutes). Example lesson plans which were formed in accordance with context-based approach were presented and discussed in the class. Then context-based assessment was presented and example problems were shown. The differences between traditional and context-based problems were discussed. At the end of this period, prospective teachers were supposed to write context-based problems in radioactivity unit which was thought as a common interest for physics, chemistry and biology prospective teachers. For this aim, they were given 2 weeks to prepare the context-based problems.

Data Analysis

Rubric is used to evaluate the resulting data. Rubrics (or rating scales) are scoring scales used by the teachers and the other people interested in assessment to guide students in the learning process or to help to discover their understanding. In addition, rubrics help the teachers how to analyze learning products and how to support learning (Moskal, 2000; Truemper, 2004).

Rubrics are of two types as holistic and analytic are of two types namely. Holistic rubrics make assessment by giving points on a single provision expressing the quality of the performance (Linn & Gronlund, 1995). Within the scope of this research, a holistic rubric was developed. While developing rubrics, relevant literature was first examined. As a first step, it was determined what the end goal was that can be summarized as points for any event. The cases which prospective teachers were supposed to show in their products, processes and performances were

described. By brainstorming, the features describing each case were determined. In each case the narrative/descriptive definitions were written with the help of Tekbıyık and Akdeniz (2010)'s criteria they defined earlier. By defining the distinction of the degrees of each cases and revising the rubrics, the necessary arrangements were made. These processes were in parallel with certain steps to be taken as a priority to design a rubric in literature (Eppink, 2002; Gallo, 2004; Mertler, 2001).

Validity and Reliability

In order to detect the validity of rubrics, there are some questions to be answered about rubrics. Within the scope of this research, related to the validity of content, the question was that "is there any content field in the assignment/activity that is not described to be evaluated with rubrics?". Also, related to construction validity, the question was that "are there all important surfaces of the structures designed to be evaluated with scoring measurements?" and related to criterion validity, the question was that "is there any surface of the related performance that is not revealed in scoring measurement?". These questions were tried to be answered and the validity of rubrics were tried to be ensured. Additionally, the reliability of the rubrics were tried to be ensured by answering the questions "are the scoring categories described well?" and "are the differences between categories defined clear?". These items were formed in parallel with Tuncel (2011)'s study. To evaluate the prospective teachers' questions, two chemistry educators different from the researchers evaluated the data and the interrater reliability coefficient (Cohen's Kappa) between the researchers and the chemistry educators was found to be 0.90. After that, the researchers evaluated the papers according to the criteria in the rubric. Overall, these procedures have been done to ensure the research's validity and reliability.

The rubric is displayed in Table 1. As can be seen from in Table 1, the rubric includes six criteria and three categories.

Tablo 1. The rubric which was developed and used in this study

	Criteria	Not Adequate	Partially Adequate	Adequate
1.	Selecting daily life context.	Daily life context is not selected.	Daily life context is selected but it is partially related to the radioactivity.	Daily life context is selected and it is related to the radioactivity.
2.	Relating radioactivity and related concepts with daily life.	Context-based problems do not make feel that radioactiviy and related concepts are related to daily life.	Context-based problems make feel that radioactiviy and related concepts are partially related to daily life.	Context-based problems make feel that radioactiviy and related concepts are related to daily life.
3.	Containing a scenario, an event or a story.	Each context-based problem does not contain a scenario, an event or a story.	Each context-based problem contains a partially relevant scenario, an event or a story.	Each context-based problem contains a scenario, an event or a story.

4.	Facing with a case that students may solve or propose a solution.	In the context-based problem, students do not face with a case that they may solve or propose a solution.	In the context-based problem, students face with a case that they may partially solve or propose a solution.	In the context-based problem, students face with a case that they may solve or propose a solution.
5.	Creating context-based problems that can be encountered in real life.	Context-based problems are not created as can be encountered in real life.	Context-based problems are created as can be partially encountered in real life.	Context-based problems are created as can be encountered in real life.
6.	Taking all objects in the context-based problems from real life.	All objects in the context-based problem are not taken from real life.	Some objects in the context-based problem are taken from real life.	All objects in the context-based problem are taken from real life.

FINDINGS AND DISCUSSION

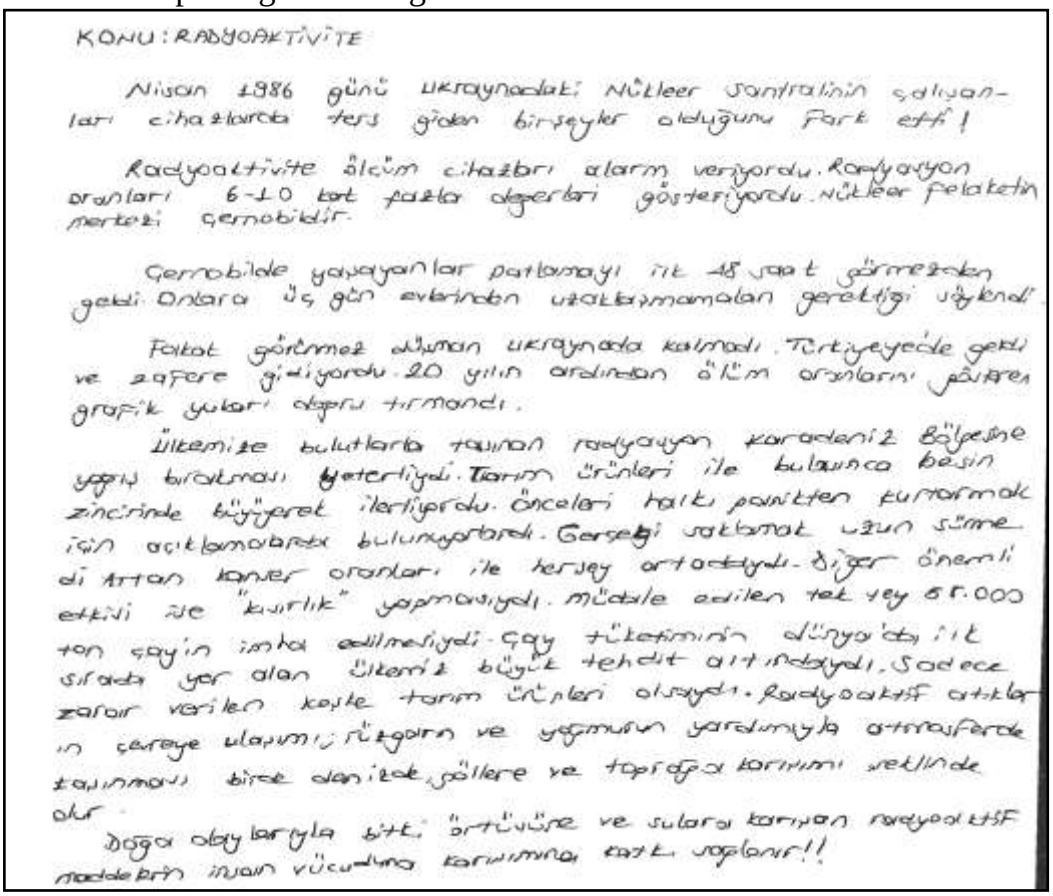
The findings obtained from the prospective teachers' context-based problems are presented in Table 2.

Table 2. Distribution of prospective teachers' context-based problems according to the criteria in the rubric

	Criteria	Not adequate		Partially adequate		Adequate	
		PT	f	PT	f	PT	f
1.	Daily life context is selected.	PT2, PT6, PT8, PT13, PT18, PT19, PT21	7	PT3, PT4, PT5, PT7, PT9, PT10, PT12, PT15, PT16, PT20	10	PT1, PT11, PT14, PT17	4
2.	Context-based problems make feel that radioactiviy and related concepts are related to daily life.	PT12	1	PT2, PT4, PT5, PT13, PT14, PT19, PT20, PT21	8	PT1, PT3, PT6, PT7, PT8, PT9, PT10, PT11, PT15, PT16, PT17, PT18	12
3.	Each context-based problem should contain a scenario, an event or a story.	PT2, PT4, PT5, PT6, PT12, PT13, PT14, PT18, PT19	9	PT8, PT11, PT15, PT16, PT17, PT20	6	PT1, PT3, PT7, PT9, PT10, PT21	6
4.	In the context-based problem, students should be faced with a case that they may solve or propose a solution.	PT2, PT3, PT4, PT21	4	PT5, PT6, PT8, PT10, PT11, PT12, PT13, PT14, PT15, PT16, PT18, PT19	12	PT1, PT7, PT9, PT17, PT20	5
5.	Context-based problems should be created as can be encountered in real life.	PT12	1	PT2, PT3, PT5, PT6, PT7, PT8, PT10, PT11, PT13, PT14, PT16, PT18, PT21	13	PT1, PT4, PT9, PT15, PT17, PT19, PT20	7

6.	All objects in the context-based problem should be taken from real life.	PT7, PT12, PT14	3	PT2, PT3, PT5, PT6, PT10, PT11, PT13, PT21	8	PT1, PT4, PT8, PT9, PT15, PT16, PT17, PT18, PT19, PT20	10	

According to Table 2, prospective teachers' context-based problems were analyzed in terms of criteria explained in the rubric. In the study, however prospective teachers were taught that selecting appropriate context was the most important part of writing context-based problems, they were mostly found 'partially adequate' and 'not adequate'. Only 4 prospective teachers could have selected an appropriate context and adequately formed a daily life context for the problems. As seen in Table 2, prospective teachers were not good at selecting appropriate daily life context. Most of them selected Chernobyl disaster and its negative effects on people. An example is given in Figure 2.


KONU: RADYOAKTİVİTE

Nisan 1986 günü Ukraynadaki Nükleer santralinin çalışan-
ları cihazlarda ters giden birşeyler olduğunu fark etti!

Radyoaktivite ölçüm cihazları alarm veriyordu. Radyasyon
oranları 6-10 kat fazla değerleri gösteriyordu. Nükleer felaketin
merkezi Çernobildir.

Çernobilde yaşayanlar patlamayı ilk 48 saat görmezden
geldi. Onlara üç gün evlerinden uzaklaşmamaları gerektiği söylendi.

Fakat görünmez düşman Ukraynada kalmadı. Türkiyeyedde geldi
ve zafere gidiyordu. 20 yılın ardından ölüm oranlarını gösteren
grafik yukarı doğru tırmandı.

Ülkemize bulutlarla taşınan radyasyon karadeniz Bölgesine
yağış bırakması yeterliydi. Tarım ürünleri ile bulaşınca besin
zincirinde büyüyerek ilerliyordu. Önceleri halk panikten kurtarmak
için açıklamalarda bulunuyorlardı. Gerçekte saatlerce uzun süre
di Artan kanser oranları ile hersey ortaya çıktı. Diğer önemli
etkisi ise "kuşluk" yapmasıydı. müdahale edilen tek yer 6.000
ton çayın imha edilmesiydi. Çay tüketiminin dünyada ilk
sırada yer alan ülkemiz büyük tehdit altındaydı. Sadece
zarar verilen kayıt tarım ürünleri olsaydı. Radyoaktif atıklar
ın çevreye ulaşımı; rüzgarın ve yağmurun yardımıyla atmosferde
taşınması birde denizek, göllere ve toprağa karışımı şeklinde
olur.

Doğal olaylarıyla bitki, örtüsüne ve suları karışan radyoaktif
maddelerin insan vücuduna karışımına kanser oluşturur!!

Figure 2. An example context of PT18 which is under 'not adequate' category

It shows that prospective teachers were mostly affected from TV or magazine news about the Chernobyl disaster and they reflected this negative impression to their papers. But it is important to note that most of prospective teachers mentioned Chernobyl disaster in an informing text about radioactive accidents. Not only prospective teachers had a negative viewpoint on radioactivity but also almost all

people had such a view, because of this, when they heard radioactivity, they imagined radioactive accidents, namely Chernobyl or Nagasaki or Fukushima disasters. The reason of this may arise from the negative effects of Chernobyl, Nagasaki and Hiroshima on people (Cohen, 1998; Dönmez Usta, 2011; Max, 1993). Contrarily, it can be taught that radioactivity is used to diagnose important diseases and it can be seen as environmentally friendly if necessary precautions are taken (Morgil et al., 2004). In this way, the negative image of radioactivity can be turned into positive.

According to Table 2, in the second criterion, almost all prospective teachers were found 'adequate' in making feel that radioactivity and related concepts were related to daily life. Because prospective teachers mostly focused on Chernobyl disaster and its negative effects on people, in context-based problems it is obvious to see the relations between radioactivity and its related concepts with daily life. Additionally, as Andersson (1986) stated in his study, ultraviolet, gas state of radiation and radioactive rocks examples may have been used in a daily life context in teaching radioactivity. Some parts of an example context-based problem which is found 'adequate' through all criteria is given in Figure 3.


① Geleneksel Problem:
- Yarılanma ömrü nedir?

Bağlam Temelli Problem:
- İbni Abdullah'ın incelediği bir maddenin kütlesi zamanla azalmıştır. Bu maddenin kütlesinin azalma nedeni nedir?

② Geleneksel Problem:
- Radyoaktif maddelerin insan sağlığına etkileri nelerdir?

Bağlam Temelli Problem:
- Simyacı İbni Abdullah'ın incelediği maddeler ile vücudunda çıkan yaralar ve sonucunda ölmesi arasındaki ilişki nedir?

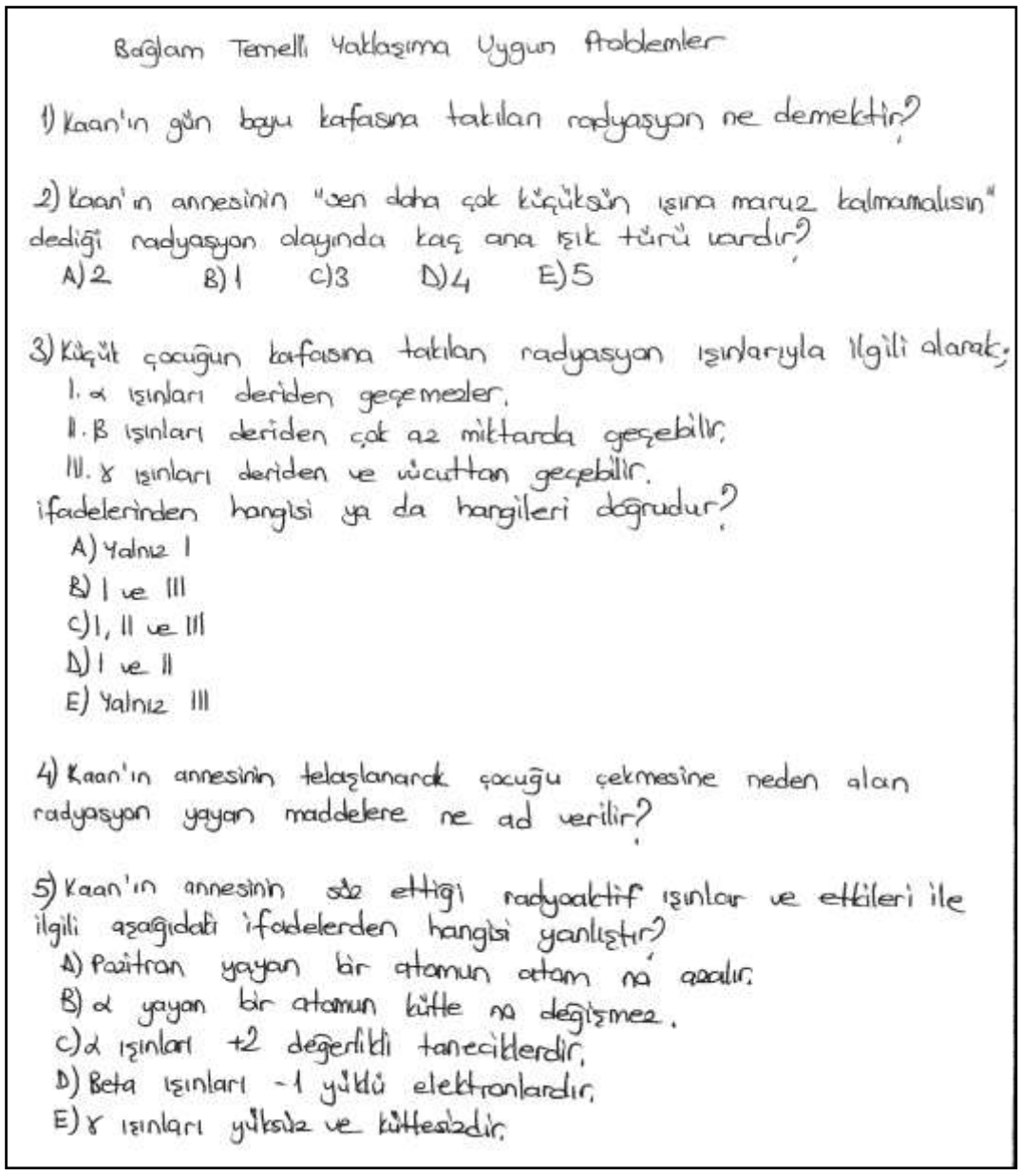
③ Geleneksel Problem:
- Radyoaktif maddelerin canlı maddelere etkileri nelerdir?

Bağlam Temelli Problem:
- İbni Abdullah'ın laboratuvarında bulunan padişahın tablosunun bozulmasının sebebi nedir?

Figure 3. An example of PT1 which is under 'adequate' category in all criteria

As seen in Table 2, in the third criterion, most of prospective teachers were found ‘not adequate’ about that each context-based problem should have contained a scenario, an event or a story. Prospective teachers firstly wrote a story or an explanatory text about radioactive accidents or disasters and then they wrote the problems in a traditional style, not in a context-based style. Only 6 of them used the story in a relation with the problems. If the topic was taught in a context-based approach, then the assessment should have been prepared in a context-based style (Akpınar, 2012). In addition, although there is little support that claiming context-based problems improved students’ achievement in the literature (Rennie & Parker, 1996; Taasoobshirazi & Carr, 2008), Georghiades (2006) found that in case the context, which the lesson was taught with, was used in the problems, and then achievement increased. If teachers had created a relevant and interesting scenario, event or story for students, then the text and the context-based problems drew more attention of students (Tekbıyık & Akdeniz, 2010) because context-based approach tended to positively change the students’ attitudes and motivation towards science/chemistry (e.g. Bennett & Lubben, 2006; Demircioğlu et al., 2009; Graber et al., 2002).

In the fourth criterion in Table 2, prospective teachers were expected to write context-based problems that can be faced with a case that they may have solved or proposed a solution. Most of prospective teachers could have written problems in ‘partially adequate’ category. An example is given in Figure 4.



Bağlam Temelli Yaklaşıma Uygun Problemler

1) Kaan'ın gün boyu kafasına takılan radyasyon ne demektir?

2) Kaan'ın annesinin "sen daha çok küçüksün ışına maruz kalmamalısın" dediği radyasyon olayında kaç ana ışık türü vardır?
A) 2 B) 1 C) 3 D) 4 E) 5

3) Küçük çocuğun kafasına takılan radyasyon ışınlarıyla ilgili olarak;
I. α ışınları deriden geçemezler.
II. β ışınları deriden çok az miktarda geçebilir.
III. γ ışınları deriden ve vücuttan geçebilir.
ifadelerinden hangisi ya da hangileri doğrudur?
A) Yalnız I
B) I ve III
C) I, II ve III
D) I ve II
E) Yalnız III

4) Kaan'ın annesinin telaşlanarak çocuğu çekmesine neden olan radyasyon yayan maddelere ne ad verilir?

5) Kaan'ın annesinin söz ettiği radyoaktif ışınlar ve etkileri ile ilgili aşağıdaki ifadelerden hangisi yanlıştır?
A) Pozitron yayan bir atomun atom no azalır.
B) α yayan bir atomun kütle no değişmez.
C) α ışınları +2 değerlikli taneciklerdir.
D) Beta ışınları -1 yüklü elektronlardır.
E) γ ışınları yüksüz ve kütlesizdir.

Figure 4. An example of PT11 which is under 'partially adequate' category in fourth criteria

Because most of them formed their problems in a traditional style, their problems needed to be solved without so much thinking and lacking proposing solution ways. Only 5 prospective teachers formed problems that needed some creative thinking and interesting cases that needed to be proposed solution ways. The reason of this case can be explained that prospective teachers could not have written problems in a context-based style. It is claimed that traditional textbook problems appear to encourage students to focus on forming and manipulating equations rather than considering the conceptual knowledge needed to solve the problems, leading to poor problem solving (Heller & Hollabaugh, 1992). However, context-based problems should have been formed at least at comprehension level in Bloom's taxonomy in order to improve students' thinking abilities (Tekbıyık &

Akdeniz, 2010). Because of this, it is important to have the ability of writing context-based problems for teachers.

In the fifth criterion, most of prospective teachers were found partially adequate at creating problems that can have been encountered in real life. Only one prospective teacher was found 'not adequate' in this criterion. The reason of this situation can be that prospective teachers may have perceived context-based problem as a simple case that can have been encountered in daily life (Kurnaz, 2013). The same misunderstanding can be seen in the sixth criterion. Except three prospective teachers, the rest of prospective teachers used all objects from real life. In a context-based problem, all objects should be taken from real life and problems should make the reader feel that the case can be faced in real life (Tekbıyık & Akdeniz, 2010). As Kurnaz (2013) stated in his study, teachers thought that if they used real life objects in their problems, then these problems can have been counted as context-based. But all these objects and problem cases should be covered in a selected context. The most important part of the context-based problems is to select the right/appropriate context that can be attractive and interesting for students. Using all the objects from real life in a question does not make the question context-based unless a specific context is chosen.

Conclusion and Recommendations

All things considered, it is seen that prospective teachers were found 'not adequate' at selecting the daily life context. Most of them related radioactivity concept with radioactive disasters. So, they chose radioactive accidents as a context. Although they were found 'adequate' at relating radioactivity and related concepts with daily life, they were not so successful at creating problematic cases that can be needed to be thought on or can be improved students' thinking abilities. It is seen that prospective teachers perceived context-based problems simply as a daily life case (Ayvacı, 2010; Ayvacı, Ültay & Mert, 2013) because they had firstly faced context-based problems. Therefore, it is proposed that in-service courses may provide prospective teachers more experience before being a teacher. If this case was not taken into account, it shows us that context-based courses are carried out arbitrarily in Turkey. In undergraduate programs, current teaching approaches, methods and assessment techniques should have been given more attention and they should be given in a separate course because new measurement tools are aiming to assess understanding conceptual phenomena, applying the concepts to real life (Akpınar & Tan, 2011). Also, in this context, for prospective teachers elective courses can be added to the teaching programs. Elective courses can be updated when the teaching approaches change in the country. Additionally, according to Taasoobshirazi and Carr (2008) there is no sufficient study evidence that supporting the recommendation that teachers should use context-based problems in their classrooms. Therefore, it is recommended that there is a need for more and better designed researches.

REFERENCES

Akpınar, M. (2012). The effect of the conceptual change texts on student achievement gain at physics education carried out with context based approach. PhD Thesis, *Gazi University, Educational Sciences Institute, Ankara, Turkey.*

Akpınar, M. & Tan, M. (2011). Context based multiple choice tests for measuring students' achievement. *2nd International Conference on New Trends in Education and Their Implications*, 27-29 April, Antalya, Turkey.

Alsop, S. (2001). Living with and learning about radioactivity: a comparative conceptual study. *International Journal of Science Education, 23*(3), 263-281.

Andersson, B. (1986). Pupils' explanations of some aspects of chemical reactions. *Science Education, 70*(5), 549-563.

Ayvacı, H. Ş., Ültay, E. & Mert, Y. (2013). 9.sınıf fizik kitabında yer alan bağlamların değerlendirilmesi. *Necatibey Eğitim Fakültesi Elektronik Fen ve Matematik Eğitimi Dergisi, 7*(1), 242-263.

Balcı, A. (2011). *Sosyal bilimlerde araştırma yöntem, teknik ve ilkeler*. 9.baskı. Pegem Akademi Yayıncılık, Ankara.

Barker, V. & Millar, R. (1999). Students' reasoning about chemical reactions: What changes occur during a context-based post-16 chemistry course? *International Journal of Science Education, 21*, 645-665.

Barker, V. & Millar, R. (2000). Students' reasoning about basic chemical thermodynamics and chemical bonding: What changes occur during a context-based post-16 chemistry course? *International Journal of Science Education, 22*, 1171- 1200.

Bennett, J., Holman, J., Lubben, F., Nicolson, P. & Otter, C. (2005). Science in context: The Salters approach in P Nentwig & D Waddington (eds), Making it relevant: Context based learning of science. Waxmann, Munster, Germany, 121-153.

Bennett, J. & Lubben, F. (2006). Context-based chemistry: The salters approach. *International Journal of Science Education*, *28*(9), 999-1015.

Brown, D. D. E. & Clement, J. (1987). Nuclear dangers. A resource guide for secondary school teachers, update. Nuclear Information and Research Service. Washington, DC.

Campbell, B., Lubben, F. & Dlamini, Z. (2000). Learning science through contexts: Helping pupils make sense of everyday situations. *International Journal of Science Education, 22*, 239-252.

Ceng, Z., Dönmez, N., Karslı, F. & Ayas, A. (2007). Öğretmen adaylarının radyasyon hakkındaki anlama seviyelerinin belirlenmesi. *Ulusal Kimya Eğitimi Kongresi Kimya Eğitiminde Yeni Ufuklar*, İstanbul.

Choi, H. J. & Johnson, S. D. (2005). The effect of context-based video instruction on learning and motivation in on-line courses. *The American Journal of Distance Education, 19*(4), 215–227.

Cohen, L. B. (1998). Çok geç olmadan- Before it's too late. TÜBİTAK Popüler Bilim Kitapları, Nural Matbaacılık, Ankara.

Creswell, J. W. (2003). Research design: Qualitative, quantitative and mixed methods, approaches (2nd Ed.). Sage Publications, United States of America.

Demircioğlu, H., Demircioğlu, G. & Çalık, M. (2009). Investigating effectiveness of storylines embedded within context based approach: A case for the periodic table. *Chemistry Education Research and Practice, 10,* 241-249.

Dönmez Usta, N. (2011). Developing, implementing and evaluating CAI materials related to "radioactivity" topic based on constructivist learning theory. Unpublished PhD Thesis, *Karadeniz Technical University, Trabzon, Turkey*.

Dönmez Usta, N. (2015). Fen bilgisi öğretmen adaylarının nükleer enerji farkındalığına bilgisayar destekli öğretimin etkisi. *IV.Ulusal Kimya Eğitimi Kongresi*, 7-10 Eylül, Balıkesir.

Dönmez Usta, N. & Ayas, A. (2010a). Common misconceptions in nuclear chemistry unit. *Procedia-Social and Behavioral Sciences, 2*(2), 1432-1436.

Dönmez Usta, N. & Ayas, A. (2010b). Ortaöğretim öğrencilerinin çekirdek kimyasi ünitesi'ne yönelik tutumlarinin belirlenmesi. *IX. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi*, 23-25 Eylül, İzmir.

Dönmez Usta, N. & Ayas, A. (2013). Radyoaktif bozunma kavramına yönelik bilgisayar destekli öğretim materyalinin geliştirilmesi ve uygulanabilirliğinin incelenmesi. *III. Ulusal Kimya Eğitimi Kongresi Bildiri Özetleri*, 5-7 Eylül, Trabzon, p.54.

Dönmez Usta, N., Karslı, F. & Ayas, A. (2014). The development of computer assisted instructional material about types of radioactivity degradation in nuclear chemistry. *International Journal of New Trends in Arts, Sports & Science Education, 3*(1), 51-58.

Dönmez Usta N., Karslı, F., Ceng, Z. & Ayas, A. (2009). Çekirdek kimyası (radyoaktivite) ünitesindeki bazı kavramlara yönelik fen bilgisi öğretmen adaylarının anlama düzeylerinin belirlenmesi. *Fen, Sosyal ve Çevre Eğitiminde Son Gelişmeler Kongresi*, 18-20 Kasım, Giresun.

Eppink, J. A. (2002). Student-created rubrics: An idea that works. *Teaching Music. 9*(4).

Gallo, A. M. (2004). 5 simple steps to designing a rubric. *Strategies, 17*(5), 21-24.

Georghiades, P. (2006). The role of metacognitive activities in the contextual use of primary pupils' conceptions of science. *Research in Science Education, 36*, 29-49.

Gilbert, J. K. (2006). On the nature of "context" in chemical education. *International Journal of Science Education, 28*(9), 957-976.

Graber, W., Erdmann, T. & Schlieker, V. (2002). ParCIS: Partnership between chemical industry and schools. *Paper presented at the 2nd International IPN – YSEG Symposium*, Kiel, Germany.

Heller, P. & Hollabaugh, M. (1992). Teaching problem solving through cooperative grouping. Part 2: Designing problems and structuring groups. *American Journal of Physics, 60*, 637–644.

Hofstein, A. & Kesner, M. (2006). Industrial chemistry and school chemistry: Making chemistry studies more relevant. *International Journal of Science Education, 28*(9), 1017-1039.

Holman, J. & Pilling, G. (2004). Thermodynamics in context: A case study of contextualized teaching for undergraduates. *Journal of Chemical Education, 81*(3), 373-375.

Ingram, S. J. (2003). The effects of contextual learning ınstruction on science achievement of male and female tenth grade students. Unpublished PhD Thesis, *University of South Alabama, The Graduate Faculty, South Alabama*.

Janiuk, R. M. (1993). The process of learning chemistry: A review of the studies. *Journal of Chemical Education, 70*(10), 828-829.

King, D. & Ritchie, S. M. (2007). Implementing a context-based approach in a chemistry class: Successes and dilemmas. *Paper presented at the annual meeting of the National Association for Research in Science Teaching*, New Orleans, LA: April.

Knecht, K. (1971). *Fizik ve matematik öğretiminin koordinasyonu hakkında, bugünkü fizik öğretimi*. Çeviren B. Örnekol, Milli Eğitim Basım Evi, İstanbul.

Kurnaz, M. A. (2013). An investigation of physics teachers' perceptions of context based physics problems. *Kastamonu Education Journal, 21*(1), 375-390.

Linn, R. L. & Gronlund, N. E. (1995). *Measurement and assessment in teaching*. Prentice Hall. USA.

Matsuuar, T. & Iiri, Y. (2002). The importance of making right knowledge about radiation popular-activity of "radiation education forum". http://www.irpa.net/irpa10/cdrom/01306.pdf Access date: 20 April 2015.

Max, G. (1993). Everyday risk. *Physics Education, 28*, 22-25.

Mertler, C. A. (2001). Designing scoring rubrics for your classroom practical assessment. *Research & Evaluation, 7*(25).

Morgil, İ., Yılmaz, A. & Uludağ, N. (2004). Lise 2 kimya ders kitabında yer alan radyoaktivite konusunun incelenmesi, öğrencilerin bu konudaki bilgilerinin araştırılması ve öneriler. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 27*, 206-215.

Moskal, B. M. (2000). Scoring rubrics: What, when and how? Practical assessment. *Research & Evaluation. 7*(3).

National Ministry Education, (2012). *Ortaöğretim fizik ders kitabı*. Beşinci Baskı. Ankara: Milli Eğitim Bakanlığı.

Park, J. & Lee, L. (2004). Analyzing cognitive and non-cognitive factors involved in the pro-cess of physics problem-solving in an everyday context. *International Journal of Science Education, 29*, 1577–1595.

Pilot, A. & Bulte, A. (2006). Why do you "need-to-know": Context-based education. *International Journal of Science Education, 28*(9), 953-956.

Potter, N. M. & Overton, T. L. (2006). Chemistry in sport: Context-based e-learning in chemistry. *Chemistry Education Research and Practice, 7*, 195-202.

Prather, E. E. & Harrington R. R. (2001). Students understanding of ionising radiation and radioactivity. *Journal of College Science Teaching, 31*(2), 89-93.

Ramsden, J. (1997). How does a context-based approach infuence understanding of key chemical ideas at 16+? *Internotional Journal of Science Education, 19*, 657-710.

Rayner, A. (2005). Reflections on context-based science teaching: A case study of physics for students of physiotherapy. *UniServe Science Blended Learning Symposium Proceedings*. 169-172. http://science.uniserve.edu.au/pubs/procs/wshop10/2005Rayner.pdf Access date: 20.04.2015

Rennie, L. J. & Parker, L. H. (1996). Placing physics problems in real-life context: students' reactions and performance. *Australian Science Teachers Journal, 42*(1), 55-59.

Review. (2003). A systematic review of the effects of context-based and Science-Technology-Society (STS) approaches in the teaching of secondary science.TTA- supported Science Review Group. The EPPI-Centre is part of the Social Science Research Unit, Institute of Education, University of London.

Ronneau, C. (1990). Radioactivitiy: A natural phenomenon. *Journal of Chemical Education, 67*(9), 736-737.

Sözbilir, M., Sadi, S., Kutu, H. & Yıldırım, A. (2007). Kimya eğitiminde içeriğe/bağlama dayalı (context-based) öğretim yaklaşımı ve dünyadaki uygulamaları, I. Ulusal Kimya Eğitimi Kongresi (s. 108). İstanbul: Türkiye.

Stolk, M. J., Bulte, A. M. W., de Jong, O. & Pilot, A. (2009a). Towards a framework for a professional development programme: Empowering teachers for context-based chemistry education. *Chemistry Education: Research and Practice, 10*, 164–175.

Stolk, M. J., Bulte, A. M. W., de Jong, O. & Pilot, A. (2009b). Strategies for a professional development programme: Empowering teachers for context-based chemistry education. *Chemistry Education Research and Practice, 10*, 154-163.

Taasoobshirazi, G. & Carr, M. (2008). A review and critique of context-based physics instruction and assessment. *Educational Research Review, 3*, 155-167.

TLA, (2015). http://www.tdk.gov.tr/index.php?option=com_gts&arama=gts&guid=TDK.GTS.553f85f684f180.17727322 Access date 28.04.2015.

Tekbıyık, A. & Akdeniz, A. R. (2010). An investigation on the comparison of context based and traditional physics problems. *Necatibey Faculty of Education Electronic Journal of Science and Mathematics Education, 4*(1), 123-140.

Truemper, C. M. (2004). Using scoring rubrics to facilitate assessment and evaluation of graduate-level nursing students. *Journal of Nursing Education, 43*(12).

Tuncel, G. (2011). Sosyal bilgiler dersinde rubriklerin etkili kullanımı. *Marmara Coğrafya Dergisi, 23*, 213-233.

Ültay, E. (2012). Implementing REACT strategy in a context-based physics class: Impulse and momentum example. *Energy Education Science and Technology Part B: Social and Educational Studies, 4*(1), 233-240.

Ültay, E. (2014). Investigating the effect of the activities based on explanation assisted REACT strategy in context-based learning approach on impulse, momentum and collisions. Unpublished PhD Thesis, *Karadeniz Technical University, Trabzon, Turkey*.

Ültay, E. & Ültay, N. (2014). Context-based physics studies: A thematic review of the literature. *H. U. Journal of Education, 29*(3), 197-219.

Ültay, N. (2012). Designing, Implementing and comparing "acids and bases" instructional tasks based on REACT strategy and 5E model. Unpublished PhD Thesis, *Karadeniz Technical University, Trabzon, Turkey*.

Ültay, N. & Çalık, M. (2012). A thematic review of studies into the effectiveness of context-based chemistry curricula. *Journal of Science Education and Technology, 21*(6), 686-701.

Ültay, N. (2015). The effect of concept cartoons embedded within context-based chemistry: Chemical bonding. *Journal of Baltic Science Education, 14*(1), 96-108.

Ültay, N. & Çalık, M. (2011). Distinguishing 5E model from REACT strategy: An example of 'acids and bases' topic. *Necatibey Faculty of Education Electronic Journal of Science and Mathematics Education, 5*(2), 199-220.

Ültay, N., Durukan, Ü. G. & Ültay, E. (2015). Evaluation of the effectiveness of conceptual change texts in the REACT strategy. *Chemistry Education Research and Practice, 16*(1), 22-38.

Wilkinson, J. W. (1999). The contextual approach to teaching physics. *Australian Science Teachers Journal, 45*(4), 43.

Williams, D. H. (1995). Successes and techniques associated with teaching the chemistry of radioactive wastes. *Journal of Chemical Education, 72*(11), 971-973.

Yavuz, I. & Kepçeoğlu, I. (2011). Bağıntı konusunda bağlam temelli ile geleneksel öğretimin öğrencilerin başarıları üzerinde etkilerinin incelenmesi. *İstanbul Aydın Üniversitesi Fen Bilimleri Dergisi, 8*(3), 143-166.