Ilkogretim Online - Elementary Education Online, 2020; 19 (1): pp. 310-323
http://ilkogretim-online.org.tr
doi:10.17051/ilkonline.2020.656880

Contexts used for real life connections in mathematics textbook for 6th graders

Mesture KAYHAN ALTAY, *Hacettepe University,* Turkey, *mkayhanaltay@gmail.com*
ORCID: 0000-0002-1917-2430
Gönül KURT ERHAN, *Başkent University,* Turkey, *gonulkurt@gmail.com* ORCID: 0000-0002-3655-0093
Elif BATI, *Hacettepe University,* Turkey, *elifbati12@gmail.com* ORCID: 0000- 0003-1828-8113

Abstract. The aim of this study is to examine the real life connections in the mathematics textbook for 6th graders and to identify how the contexts used in these connections are handled depending on learning areas. Document analysis of qualitative research methods was used in the study. The results of the study revealed that almost half of the activities (46.6%) in the textbook was connected with real life. The contexts used in these real life connections were analyzed by categorizing them under two different context types: weak and rich context. It can be concluded from the results of this research that the weak contexts were mostly utilized (68.4 %) in real life connections. When these contexts were analyzed on the basis of the learning area itself, it was revealed that weak contexts are frequently employed in the learning area of algebra, while rich contexts are most commonly used in the learning area of data processing.

Keywords: Real life connections, context, mathematics textbook

Received: 21.12.2018 Accepted: 29.03.2019 Published: 15.01.2020

INTRODUCTION

One of the main objectives of mathematics education is to enable students to apply mathematics to real life situations (Wijaya, van den Heuvel-Panhuizen and Doorman, 2015). In the Turkish mathematics curriculum, mathematics is stated as a part of life, and especially the importance of relating mathematics to real life and other disciplines is emphasized (Ministry of National Education (MoNE), 2016). To achieve this objective, it is necessary that students acquire the fundamental skills for comprehending, interpreting, and applying concepts in mathematics and their connections to each other (Van de Walle, Karp and Bay-Williams, 2010). One of the process standards stated in the Principles and Standards for School Mathematics set by the National Council of Teachers of Mathematics (NCTM, 2000) in the United States is the ability to connect. These process standards encompass the skills that students must acquire and use. Connecting skills are categorized as the skills for connecting mathematics course with real life and other disciplines, establishing relationships between concepts and processes, and connecting different forms of representation of concepts and rules with each other (MoNE, 2013; NCTM, 2000). In the mathematics curriculum revised in 2018 in Turkey (Primary (1st, 2nd, 3rd, 4th graders) and Secondary (5th, 6th, 7th, and 8th graders) Schools), students are expected to develop their connection skills (MoNE, 2018).

In addition to the mathematics curriculum and NCTM standards, connecting mathematics with real life establishes the basis of certain learning theories and approaches in the field of mathematics education. To illustrate, in Realistic Mathematics Education (RME) developed by Freudenthal, mathematics education is described as the real life itself, and the reality here is the mathematics related to real life contexts and problem situations in students' minds. This approach suggests that teachers introduce a new mathematical concept through the use of a relevant and meaningful problem situation that students experience in their lives. The basic principle is to enable students to make a connection between the mathematical concepts and their own life experiences. In other words, the most fundamental feature of RME is that mathematical concepts

[1] This study was presented as an oral presentation at the 13th National Science and Mathematics Education Congress (UFBMEK-13) held on 4-6 October 2018.

should be developed with by means of the problems encountered in in real life contexts. That's to say, the materials to be mathematized by the students should be realistic for them (Cobb, Zhao & Visnovska, 2008). These real life situations can be either contextual problems or authentic situations (Barnes, 2004). Likewise, in their mathematical model and modeling perspective, Lesh and Doerr (2003) define, model-eliciting activities as the problem-solving activities though which students construct models in complex real-life problems and then test these models. Moreover, among the six principles necessary for designing model-eliciting activities is the reality principle. The reality principle can also be considered as the principle of relevance because it is significant that students make sense of the given situation depending on their own knowledge and experiences. One way of ensuring whether the principle of reality is achieved or not is to ask the following question: Is it a situation that one can experience in real life?" At this point, it is of great importance to keep in mind that the reality of adults and children will differ to a great extent. On the other hand, the reality of a child might as well vary from the reality of other children (Lesh, Hoover, Hole, Kelly, & Post, 2000).

As stated in the above mentioned approaches, to make mathematical concepts more meaningful for students, real-life contexts are used in real life connections in mathematics course materials. Research suggests that meaningful real-life contexts provide opportunities for students to explore mathematical ideas (Boaler, 1993; Kent, 2000). At this point, a clear definition of the context should be put forward first. In many studies in the literature, the most widely referred definition of context is that of Borasi (1986): "Context is the situation that is embedded or placed within a problem" (p.129). Contexts can sometimes be presented with a verbal problem text, and other times, they can be presented in different ways such as via pictures, graphics, or tables (Meyer, Dekker, & Querelle, 2001). The key role of the context is to provide the problem solver with the necessary cue to solve the problem. Contextualized situations or context-oriented situations help students notice the relation between informal information and formal mathematical ideas either in reality or through imagination (Kent, 2000).

It is seen that different criteria are suggested for a quality context in the related literature. For example, Meyer, Dekker, and Querelle (2001) summarized the characteristics of a good context under six headings and proposed a conceptual framework for the use of context in the literature. These headings are as follows: (1) Context should support mathematics: In this statement, it is emphasized that context should not overshadow mathematics. This can happen when the context of the problem is discussed rather than mathematics itself. (2) Context should be real for students, at least imaginable for them: the word real does not necessitate that students experience this context. Even if they do not experience it themselves, at least these activities or situations should be in such a way they can imagine. (3) Context should be various, not repetitive: This statement suggests that context can be boring when it is repeated, even if it is a very interesting one for students. (4) Context should provide realistic solutions for the solution of the problem: For example, while it is realistic to give the height of a child and ask for the height of a tree standing next to him, it is not realistic to provide the height of the tree and ask how tall the child is. Although both problem situations include the same mathematics, the second case is not rational because height of a tree is difficult to measure directly. There is no need for a tree to measure the child's height. (5) The context should be sensitive to different cultures, gender, and ethnicity. For example, the choice of context should be done in a way to attract all students' attention and to balance the situations. Finally, (6) context should provide an opportunity for student to create a mathematical model.

Sullivan, Zevenbergen, and Mousley (2003) stated that the necessary criteria that should be considered for the use of contexts are the appropriateness of the selected contexts to the socioeconomic status, lives, and culture of the students. Cheng (2013), on the other hand, defined real-life problems as the problems already embedded in everyday life situations, and the concept of context as situations. She explained the characteristics of a good context as its purpose and utility. Utility means that mathematical ideas are useful for children. Similarly, Ainley, Pratt, and Hansen (2006) emphasized that mathematical problems or situations should be useful for students and have a purpose in the process of developing problems involving real life contexts. What is meant by 'purpose and utility" here is to create situations where students will have the chance for not only carrying out mathematical operations but also figuring out the instances where these mathematical concepts can be used. Researchers explain this situation with an example: “If an insect has 6 legs, how many legs do 9 insects have in total?” In this example, it is emphasized that students should not be expected to understand the utility of multiplication here.

In studies carried out in different fields, especially in science, context is defined as contextual approach. In a study conducted to investigate the criteria to be followed to write contextual questions, three basic and eleven sub-criteria were identified (Elmas and Eryılmaz, 2015). These basic criteria for context are as follows: (1) including a problem that concerns the individual or society (e.g., the contexts that arouses curiosity and interest, does not favor any gender or experience, does not create an emotional imbalance on the part of the child, and presents an incentive for solving the problem), (2) presenting the science concepts, formulas and laws within a pattern when creating the setting of the problem (such as clearly revealing the relationship with real life, providing realistic data, avoiding unnecessary details, and using pictures, diagrams, or figures to support the connection) and (3) reaching the solution not only through memorization but via reasoning (in the sense that questions should not be too easy or too difficult and they should not be solved by memorization). Although these criteria have been proposed for the field of science, it is thought that they can be adapted to mathematics education.

In these approaches and researches, it is emphasized that the use of real life connections and contexts in mathematics teaching increases students' interest and motivation towards mathematics (Boaler, 1993; Gravemeijer and Doorman, 1999; Stylianides and Stylianides, 2008), helps building positive attitudes towards mathematics contributing to conceptual learning and preparing students for real life (Karakoç and Alacacı, 2015; Lee, 2012; Özgen, 2013). However, there are some arguments that placing mathematics within a context may cause certain difficulties for some students (Elmas and Eryilmaz, 2015, Meyer et al., 2001; Sullivan, Zevenbergen and Mousley, 2003). For example, students may have difficulty in comprehending the problem when it is encountered in a context (Bernardo, 1999) because they first attempt to convert problems into context-free problems (Meyer et al., 2001). Moreover, sometimes context can overshadow the problem and be distracting for the students. There are even examples in mathematics textbooks that cause misconceptions due to the random use of classroom practices and problems just for the sake of including real life contexts, ignoring students' past experiences, beliefs, and diversity (Boaler, 1993). An example for this can be given from a research conducted by Sullivan et al. (2003). In a lesson about measuring and estimating the heights of students, the students were presented with a so-called realistic context with following question “The police lined up five suspects and asked them to find out which person was described.” Some of the teachers who participated in this study stated that the students' answers would reflect their socio-economic status and that the use of the police context was not particularly suitable for some students with low socioeconomic status. One needs to be cautious when using such contexts in questions. In such cases, context sometimes overrides the mathematical concept and causes students to focus on the context rather than the concept itself. If the social and cultural values of students are taken into consideration when selecting and using contexts, their learning will be more meaningful. Unless the analysis of mathematical conditions is supported with appropriate real life contexts, school mathematics remains as the school mathematics, and will not go beyond the curriculum (Boaler, 1993). For this reason, teachers, prospective teachers, and textbook writers should have a sound knowledge as to in the requirements of a quality contexts for teaching mathematical concepts.

Similar findings can be observed in the studies carried out in Turkey with teachers, prospective teachers, and academicians to investigate how real life connections are made. To illustrate, Yiğit Koyunkaya, Uğurel and Tataroğlu Taşdan (2018) found out that although prospective high school mathematics teachers had a good understanding of how to make real life connections in mathematics teaching, they often failed to apply their knowledge in their activities. The reason of that is the limited sources related to real life connections in mathematics teaching. Similarly, Karakoç and Alacacı (2015) uncovered that the majority of high school mathematics teachers and academicians held the belief that using real life contexts has a lot of advantages emphasizing its utility for any classroom setting. They even highlighted the need for including questions regarding these contexts into the university entrance exams, yet they were also found to be insufficient in utilizing real life contexts when teaching mathematics. In a similar study, Yavuz-Mumcu (2018) investigated mathematical connection skills in the learning area of derivative concept with prospective mathematics teachers. The results of the study showed that prospective teachers could not use their connection skills effectively for the derivative concept. On the other hand, in a study conducted by Özgeldi and Osmanoğlu (2017), it was found that the prospective teachers believed that they could make real-life connections in all subjects of mathematics.

There are also several other studies that analyze mathematics textbooks in terms of teaching certain mathematics concepts using different evaluation criteria. For example, Bulut, Boz-Yaman, and Yavuz (2016) found that to teach the concept of transformation geometry, real life connections were utilized more frequently than the other connections (e.g., connections with concepts in mathematics itself, with other subjects and other courses) in the textbooks and workbooks used in 7th grade in 2009 academic year. It was even uncovered that connection skill was more frequently involved when compared to other skills (e.g., communication, reasoning and psycho-motor skills). In addition to this, it was stated that all of the analyzed textbooks included connections with other disciplines such as science and technology, Turkish and social studies and visual arts courses. Another study examining the relationship with other disciplines is the study of the relationship between mathematics and science in the 7th-grade mathematics teacher's book. The findings of the study showed that the number of science concepts (such as force, motion, heat) in mathematics subjects was quite high.

It is thought that there is not sufficient number of studies that present concrete examples of how to apply real life connections in the course materials in mathematics teaching. In other words, there is an urgent need for research on how to present contexts for real life connections in textbooks and how to use them to teach mathematical concepts. To this end, to the current study aims first to identify the frequency of real life connections in the 6th grade mathematics textbook published by the Ministry of National Education (2016) and approved by the Board of Education, and second to examine the features of the contexts used in these connections. Moreover, considering the criteria of a quality context identified in the literature, it aims to examine how the contexts used in the textbook are presented across learning areas. Based on the findings of the study, curriculum developers, textbook writers, teachers who implement the textbook have been provided with certain suggestions as to how real life connections and contexts can be made effective by means of concrete examples. For this purpose, the following research questions are formulated:

1. How often are real life connections used in the mathematics textbook for 6th graders?
2. How often and how are the contexts used in real life connections in the mathematics textbook for 6th graders handled across learning areas?

METHODS

In this study, document analysis as one of the qualitative research methods was used. Document analysis involves the analysis of written materials about the cases investigated (Yıldırım & Şimşek, 2013). Which documents can be used as a data source is related to the research problem of the study? For example, textbooks can be used as a data source in document analysis (Yıldırım & Şimşek, 2013). The data in this research were obtained from the 6th grade mathematics textbook (MoNE, 2016) prepared by a commission with a protocol entitle as "Cooperation in Education" signed among the Ministry of National Education, Ministry of Science, Industry, and Technology and The Scientific and Technological Research Council of Turkey in the 2016-2017 academic year. The most recently published mathematics textbook which was used for 6th graders at schools at the time the study was conducted was chosen as the document to be analyzed.

This is a 626 page-long textbook with five units in total. The textbook includes the following sections: (1) "Let's remember" that presents previously learnt knowledge, (2) "Let's do it together" which introduces problems with solutions, (3) "Information box" where basic terms and definitions are provided, (4) “Let's try it together” in which individual or groups tasks are given using the resources regarding the topic, (5) Do you know this? which presents interesting, historical or current information about the subject, and finally (6) Where can we use it? which provides tips or information on where to apply the subjects in real life or other disciplines. These sections were considered as classroom applications for mathematics teaching and were included in the data analysis. On the other hand, other sections of the textbook such as “It's Your Turn” which includes questions and problems without solutions, and “Revision Unit” which includes an evaluation unit providing multiple-choice questions as a general review of the unit were not included in the data analysis.

Data Analysis - Coding Process

In the light of the research questions, data analyses were carried out in two stages: the analysis of the real life connections in the textbook and the analysis of the contexts used in these connections to decide whether they reflected the features of weak or rich contexts.

Stage I: Identifying Real Life Connections

At the beginning of the coding process, three researchers assigned a code number to each page and classroom applications on each page (Let's do it together, let’s try it together). For example, for the first, second, and third applications on page 97, codes 97-1 (page number-the order of appearance on page), codes 97-2 and 97-3 were given respectively. Thus, a common template was prepared for three researchers to complete their coding independently. In-class applications coded in the textbook were discussed under three categories: relationships between concepts, connection with real life, and other disciplines.

According to the template prepared, three researchers firstly performed coding independently. Consistency among coders was calculated using the formula [Consensus / (Consensus + Disagreement)] x 100 (Miles and Huberman, 1994) and 80% consistency was obtained. Then, after all the researchers discussed the codes and reached a consensus, this ratio was recalculated and increased to 95%. To understand the coding process more clearly, a sample coding in Table 1 is given.

Table 1. *An example for coding across connection types*

Objectives	Code	Real life connections	Connections with different disciplines	Relationships between concepts
6.3.1.1	97-1	1	0	0
6.3.1.1	97-2	0	0	0
6.3.1.1	97-3	1	0	0

Although the textbook was analyzed under three different categories, only real life connections were discussed within the scope of this study. The sample application coded as 97-1 in Table 1 and the real life connections to define the concept of angle is shown in Figure 1.

Angle

If we consider our shoulder as the common point of our hands and body; we can use the concept of angle to define the space between our hand, shoulder and body.

FIGURE 1. *An example for real life connection (MoNE, 2016, p.97)*

II. Stage: Analysis of Contexts Used for Real Life Connections

Before moving on to the second stage of the data coding process, the identified real life connections were removed from the coding template and analyzed separately for the second round of coding. In total, 495 codes covering real life connections were obtained at the end of the first round of coding. As a result of the analysis of real life connections in the second coding, these connections were grouped under two different categories as rich and weak contexts by taking into consideration the necessary criteria and features for a context mentioned in the introduction (see Table 2). The rich context refers to the contexts with realistic and meaningful situations as well as familiar contexts for the students (Van De Walle et al., 2010) to teach mathematical concepts; in other words, they can be encountered in real life and arouse curiosity by fully drawing the students' attention to the problem situation (Meyer, Dekker, & Querelle, 2001) and at the same time the context is familiar to the student.

Table 2. *Criteria for rich and weak contexts*

Rich Context	Weak Context
▪ realistic, meaningful, and appropriate for students ▪ authentic ▪ intriguing enough to get students' attention to the problem situation ▪ diverse	▪ inappropriate context ▪ non-authentic ▪ including the use an image or person's name only (forced context)

Weak contexts, on the other hand, are the contexts in which the chosen situations are not suitable for teaching mathematical concepts, and do not reflect the actual use in everyday life. Besides, using an image or providing personal names only are considered as a feature of weak contexts. For example, in the third unit of the algebra learning area, on page 398, the following question has been presented: "Yusuf asks Ümit to keep a number in his mind and take 2 times that number and add 3 to the result." This question is coded as a weak context within the context of real life connection since person names are the only contextual information provided. However, in the second unit related to the learning area of numbers and operations, on page 161, the question "How many quarter toasts are made out of three loafs of bread? is given. This question is coded as a rich context because it is realistic and appropriate to students' real life. The frequency tables are given to illustrate how the context used (rich and weak contexts) in each page. Contexts used in real life connections across learning areas are presented in detail together with their page numbers and images in the results section.

RESULTS

In this section, the frequency for the use of real life connections in the mathematics textbook for 6th graders and how the contexts in these connections are handled across their learning areas are presented.

Findings for the First Research Problem

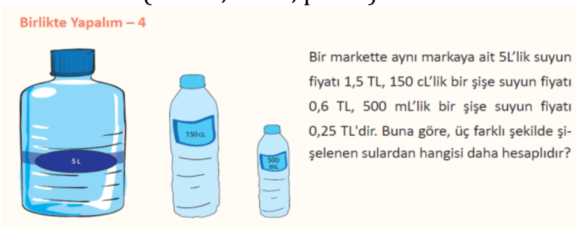
Throughout the textbook analyzed, a total of 495 codes were identified regarding the use real life connections (see Table 3). As a result of the coding, it was found that almost half (46.6%) of the units related to in-class applications in the textbook included real life connections.

Table 3. *Frequency of real life connections used in the mathematics textbook for 6th graders*

Real Life Connections f (%)		Total Number of Codes
Yes	No	
231 (46,6%)	264 (64,4%)	495 (100%)

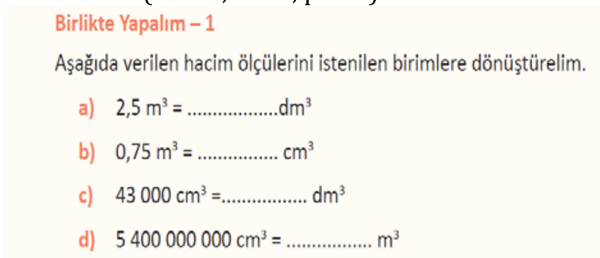
Examples of these connections can be found on page 523 and 509 in the textbook (Figures 2a, 2b). Figure 2a exemplifies the use of a mathematical concept (i.e., the conversion of the liquid measuring units to each other) in real life by teaching it in a shopping context. On the other hand, Figure 2b illustrates teaching a mathematical concept without using a real life context where students are only expected to convert volume measurement units and apply standard algorithms.

a. An example for teaching through real life connections (MoNE, 2016, p.523)



Let's Do It Together-4
The price of 5 liters of water from the same brand in a market costs 1,5 Turkish Liras (TL), while the price of a bottle of 150 centiliter water is 0.6 TL, a bottle of 500 milliliters of water costs 0.25 TL. Accordingly, among these, which bottle of water is cheaper?

b. An example for teaching without real life connections (MoNE, 2016, p.509)



Let's Do It Together-1
Convert the volume measurements given below to the desired units.

FIGURE 2. *Examples for real life connections*

Findings for the Second Research Problem

In this section, findings related to the contexts used in real life connections identified in the textbook are presented. Of the 495 codes included in the entire textbook, 231 have been connected with real life. These 231 codes have been re-analyzed to identify whether they reflected the features of rich or weak contexts. The results of the analysis are given in Table 4 across learning areas.

Table 4. *Frequency of the contexts used in real life connections across learning areas*

Learning Areas	Rich Context	Weak Context	Total
Numbers and Operations	36 (28,6%)	90 (71,4%)	126
Algebra	3 (15%)	17 (85%)	20
Geometry and Measurement	25 (37,9%)	41 (62,1%)	66
Data Processing	9 (47,4%)	10 (52,6%)	19
Total	73 (31,6%)	158 (68,4%)	231

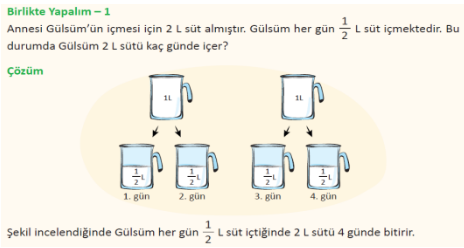
It is seen in Table 4 that the weak context is used more frequently than the rich context in real life connections across all learning areas. Among these learning areas, however, data processing has the highest frequency of rich context usage (47.4%) while algebra includes the lowest number (15%). These contexts are discussed in detail below on the basis of the learning areas.

1. Contexts used in the learning area of numbers and operations

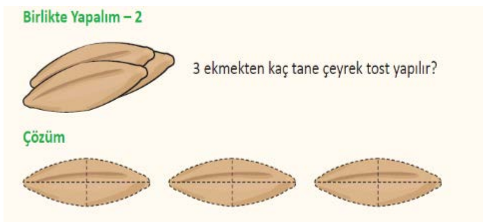
It can be said that rich contexts are generally used less in the learning area of numbers and operations. According to Meyer et al. (2001), one of the characteristics of a rich context is that context should support mathematics. Sometimes the time spent on the context itself can lead to the loss of the mathematical concept and make it difficult for students to switch from context to mathematical content. Although the use of prime numbers in real life such as encryption (internet, banking, communication, etc.) is found in the introduction section of the analyzed textbook where it is aimed that students will be able to identify prime numbers with their characteristics, there are no examples that support this use in the rest of the textbook. However, different activities can be developed using encryption content. In the textbook examined, in the "Let's Have Fun with Math" section, the foundation years of some football teams were provided to fulfill the learning objective "The students will be able to identify prime numbers with their characteristics", and it was stated that 1907, the establishment year of Fenerbahçe team, is the only prime number (p. 74). This situation does not reflect the actual utility of the concept of prime numbers in real life, and the context overshadows the mathematical concept. Similarly, the question "Did you know that students born in 2003 were born in a prime year whose total numbers are prime?" (p. 74), does not cover the use of prime numbers as used in real life either.

On the other hand, in another section called "Let's Try It-1" (p. 84), the use of football team as a context can be given as an example for rich context usage to fulfill the following learning objective: "The students will be able to find the common multiples of two natural numbers with common divisors and solve related problems." In this example, every fourth member will be gifted with a t-shirt of the club, while every sixth with shorts of the team. It can be said that this example, where students are supposed to find the membership numbers of the people who won both t-shirt and shorts as gifts, is a meaningful and rich context appropriate for achieving the learning objective. The students will be able to see the real life correspondence of the mathematical concept through this example. Other rich context applications given in the textbook to find the common multiples of the two natural numbers with common divisors, and solve the related problems, are the examples given in the contexts of arranging the time schedule of public transportation and the break times for schools.

Another feature of rich contexts is that contexts should include diversity. Research shows that even interesting contexts can be boring when and if used repetitively (Meyer et al., 2001). Accordingly, it is possible to say that the contexts used in teaching the concept of fractions are weak in the textbook examined. To teach the concept of operations with fractions, sharing chocolate has been utilized to create context only (pp. 150, 157, 165, 168, 170, 174, 216). All of these applications are related to sharing chocolate, and generally include similar images. Besides, the context where the students are asked to solve the problem: "A mother distributed ½ of the 8/3 chocolate in her hand to her children. How much chocolate did the mother distribute? (p.157) is a weak context because it is evident that both the repetitive use of the chocolate context and the specified amount used (8/3) do not represent the possible encounters in real life. Although the use of such weak contexts to teach operations with fractions is high in number, it is possible to come across rich context examples as well. It can be said that both examples given in Figure 3 are appropriate for students' lives and offer meaningful contexts in understanding the concept.



Let's Do It Together-1
Her mother bought 2 liters of milk for Gülsüm to drink. She drinks ½ liter of milk every day. In this case, how many days will it take for Gülsüm to drink 2 liters of milk?
Solution
As can be seen the figure, when Gülsüm drinks ½ liter of milk every day, she finishes 2 liters of milk in 4 days.



Let's Do It Together-2
How many quarter toasts are made from 3 loaves of breads?

FIGURE 3. *Examples for rich context usages (MoNE, 2016, p.161)*

The findings also show that the examples of real life connections used to teach the concepts of whole numbers include different contexts such as elevator, credit-debt, profit-loss, shopping, and temperature. These contexts are also suggested in the related literature (Van de Walle et al., 2010) for teaching the mathematical concept of whole numbers. To illustrate such connections, form the textbook examined, a shopping context was chosen to teach subtraction of two negative numbers with the following questions: "Ahmet has broken eight of the eggs he bought from the market. If the mother throws 3 of these broken eggs into the litter bin, how many broken eggs will remain? "(p.368). Presenting such examples of real life contexts in middle school where students have difficulty in connecting concepts with real life (Bozkurt and Polat, 2011) in teaching the concept of operations with integers, especially when two negative numbers are subtracted from each other, was considered as a rich context example by the researchers.

2. Contexts used in the learning area of algebra

The results related to the learning area of algebra showed that the contexts used for real life connections did not reflect the features of rich contexts. The learning area of algebra was found to include the highest number of weak context usages (85%) when compared to other learning areas (see Table 4). For example, as shown in Figure 4, in the given question, the image of Silifke and Hereke carpets with shape patterns were used as a context, and the students were asked to calculate the area of the large rectangle formed by placing the two carpets side by side. The context used in this question (Silifke and Hereke carpets) has no relation with the concept (i.e., algebraic expression of the area of the rectangle, "2 hm²") required for the solution of the problem. In other words, a mathematical concept such as shape pattern, symmetry, and ornamentation reflecting the characteristics of carpet types as given in the image is not questioned. However, what is expected from a rich context is to address to the intended mathematical concept via the context.

Let's Do It Together-9
Silifke and Hereke carpets with short edge length of 1 meter and long edge length of h meter are laid side by side in a hall.
a) Find the sum of areas of carpets.
b) Find the area of the large rectangle consisting of two carpets.

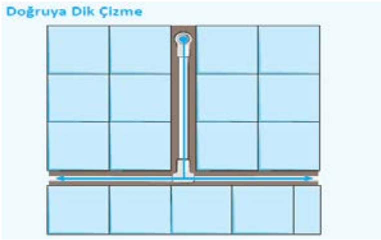
FIGURE 4. *Example for the use of weak context (MoNE, 2016, p. 400)*

Another example for the weak context is the one with inappropriate images. This can be exemplified in Figure 5 where the students are asked to express the pattern rule created with the flowers in the basket and marbles in an algebraic way, and they are expected to find the increasing number pattern. However, the shapes of both images (i.e., arrangement of flowers and balls) do not contribute to finding the rule of the pattern. Such a context may lower the validity of the problem by distracting students. Presenting the questions in this way is not inaccurate, but it is not found appropriate either.

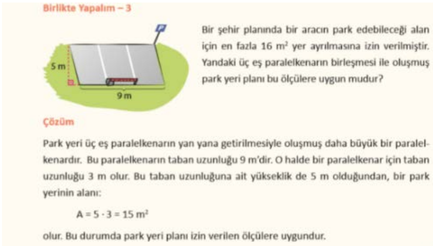
FIGURE 5. *Visual examples used in a weak context (MoNE, 2016, p. 386 & 389)*

3. Contexts Used in the learning areas of geometry and measurement

It can be said that the real life connections utilized in the textbook to teach geometry and measurement mostly included weak contexts (62.1%). These contexts are considered to be weak because of the use of inappropriate images. According to Meyer et al. (2001), students should be able to visualize the context in their minds even if they have not experienced it themselves. For instance, in the first example displayed in Figure 6, the image utilized to present the mathematical concept of drawing a perpendicular to a line from an external point decreases the effectiveness of the context because the visual description of the context might not be sufficient for students to visualize the event in their minds. For students who have not experienced such a context, the use of more comprehensive images reflecting the whole context can facilitate students' visualization. Therefore, it is suggested that more detailed images are needed.



Draw A Perpendicular Line to A Line

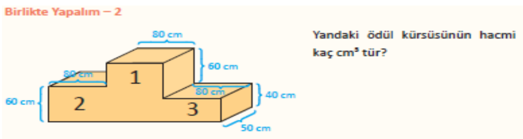


Let's Do It Together-3
In a city plan, a space up to 16 square meters is allowed for the space a car can park. Is the parking plan formed by 3 congruent parallelograms side by side suitable for these measurements?

FIGURE 6. *Examples for the use of weak contexts (MoNE, 2016, p. 112 & 439)*

The second example presented in Figure 6, defined as the weak context, is a question related to the area of a parallelogram. The question asks whether a car has to be parked for a maximum of 16 square meters and whether the total parking space is suitable for this size. However, there is no information about the minimal space to be reserved for a car, which is both a mathematical and contextual error. For example, if the area reserved for a car is at least 1 square meter, this area would be suitable for parking 16 cars. In this problem, it is thought that this drawback should be eliminated by specifying the minimal space required for parking a car. Another drawback of this question is the lack of clear information about how to use the parking space. In other words, it is not stated in the question that one can park a car in each of these three identical parts. It is observed from the solution to this problem given in the textbook that the students are expected to figure out one can park one car for each part by looking at the images by drawing on their own life experiences. However, parking a car following the lines is a life experience for an adult, and even if the students have such life experiences, the situation should be clearly indicated in the question. In addition, it can be said that the whole parallelogram is suitable for parking two cars without considering the lines. The absence of such shortcomings in the context of a rich real life context can make it easier for students to acquire the targeted knowledge and skills through the context. The context used in this example is presented in a context connected with real life, but it does not reflect the features of a rich context. This finding shows that in general, there is a difficulty in finding a rich context for real life connections. Besides, even if proper real life contexts have been found, they are not presented accurately and realistically.

As shown in Figure 7 exemplifying the use of an unauthentic weak context, the question asks the volume of a winner podium. However, why it is necessary to know the volume of this podium is not given in the context. This question is considered as a weak context because it does not include any meaningful purpose.



Let's Do It Together-2
What is the volume of the winner podium?

FIGURE 7. *Example for the use of weak context (MoNE, 2016 p.499)*

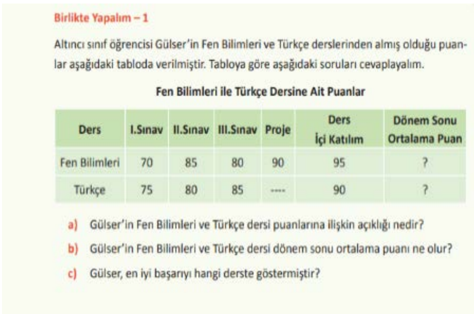
One of the characteristics of the rich context is that it arouses curiosity by getting the students' attention to the problem situation. A realistic context can be created by making some changes to this question. For example, the question of the placement of the winner podium to be used in a competition to be held (considering whether or not it fits anywhere in the school) will make the concept of volume meaningful.

4. Contexts Used in the learning area of data processing

The learning area of data processing is seen as the learning area where rich contexts are most frequently used (47.4%) when compared to other learning areas (see Table 4). It can be stated that the contexts used in the book examined vary. For example, in a question about the learning objective to form a research question, it was observed that contexts such as students' hobbies, population density of provinces, touristic places (MoNE, 2016, p.284) were used. It can be concluded that these contexts in which students gather data from the situations they think, reason, and analyze at a basic level will improve the level of their statistical literacy (Baki, 2018). In return, this skill will play an important role in their understanding of the world around them. Furthermore, rich contexts ensure student participation in the whole process, from data collection to analysis, defined as "making statistics" (Van De Walle et al., 2010).

Figure 8 illustrates the examples reflecting the rich context of real life connections in this section. In the first example, it can be said that the concept of arithmetic mean is questioned, and a context is chosen from the students' experience.

Let's Do It Together-1
Ahmet and four of his friends will play with marbles. The number of marbles that Ahmet and his friends have are given below. They want to start the game with an equal number of marbles. What do you do to share the marbles equally? How many marbles will Ahmet and his friends have in the end?


Birlikte Yapalım – 1

Altıncı sınıf öğrencisi Gülser'in Fen Bilimleri ve Türkçe derslerinden almış olduğu puanlar aşağıdaki tabloda verilmiştir. Tabloya göre aşağıdaki soruları cevaplayalım.

Fen Bilimleri ile Türkçe Dersine Ait Puanlar

Ders	I.Sınav	II.Sınav	III.Sınav	Proje	Ders İçi Katılım	Dönem Sonu Ortalama Puan
Fen Bilimleri	70	85	80	90	95	?
Türkçe	75	80	85	----	90	?

a) Gülser'in Fen Bilimleri ve Türkçe dersi puanlarına ilişkin açıklığı nedir?
b) Gülser'in Fen Bilimleri ve Türkçe dersi dönem sonu ortalama puanı ne olur?
c) Gülser, en iyi başarıyı hangi derste göstermiştir?

Let's Do It Together-1
The scores of Gülser who is in 6th grade taking Science and Turkish courses are given in the table below. Answer the following questions according to the table.

FIGURE 8. *Examples for the usages of rich contexts (MoNE, 2016 p.308)*

In the second example in Figure 8, where the concepts of arithmetic mean and range are presented, scores received from two different courses are given and related questions are asked. It can be clearly stated that it reflects a meaningful situation directly related to 6th graders' real life.

Another example of real life connections to teach data processing is the context where students are guided to access the related data via web-sites of the public institutions (e.g., Turkish State Meteorological Service, Turkish Statistical Institute). This is believed to be an effective context because the Turkish Statistical Institute provides a wide range of data sets as well as enable students to use technology to access information presenting rich and different real life contexts.

DISCUSSION AND SUGGESTIONS

In this research, the real life connections in the mathematics textbook for 6th graders were examined to identify how the contexts used in these connections were handled depending on learning areas. The results of the study showed that almost half of the activities called as in-class applications (46.6%) in the mathematics textbook were connected with real life. This finding is in line with the findings of study done by Bulut, Boz-Yaman, and Yavuz (2016) where they analyzed a sample unit of a mathematics textbook for 7th graders in relation to the requirements of mathematics curricula. Although the real life connections included in the textbook seem to be sufficient in number, it is claimed that how these connections are presented is a more important issue to consider. At this point, it is important to identify the properties of the contexts used in connections. It is expected that the contexts chosen for real life connections should not only be authentic, realistic and meaningful, but also arouse curiosity by getting students' attention to the problem situation. Otherwise, the use of contexts that do not have a direct connection with real life decreases the level of students' motivation and may lead them to think that there is no relationship between mathematics and real life. On the other hand, appropriate and relevant use of contextual situations increases students' motivation and helps to establish a connection between mathematical concepts and real life experiences (Kent, 2000).

In the textbook examined in this study, it was found out that weak contexts were used in most of the real life connections (68.4%). One reason for that might be the lack of national research regarding the definition, criteria, and appropriate use of context in mathematics education (Yiğit Koyunkaya et al., 2018). The findings of the textbook analysis in this study revealed certain features of weak contexts such as inappropriate use of images (water pipe sample), irrelevant targeted mathematical concepts for real life (e.g., providing the establishment years of sports clubs), repetitive use of the same contexts (e.g., sharing chocolate), use of contexts irrelevant to the target mathematical concept (e.g., carpet types), the lack of context connections with a realistic situation (e.g., parking lot), and the idea that only the use of person names or images will meet the requirements of a context (example of winner podium). This finding is similar to the results of the study carried out by Yeniterzi and Işıksal-Bostan (2015) who investigated mathematics and science connections in 7th grade mathematics teacher's books. In this study, the researchers concluded that with the ability to make connections between different disciplines included connecting conceptually and giving real life examples only. It is thought that giving real life examples only is parallel to the concept of weak context mentioned in this study.

On the other hand, the rich contexts found in the analyzed textbook revealed certain differences. First, it is observed that they included situations relevant to students' real life. Second, they are composed of a variety of contexts that are meaningful for the students' needs and lives. When these contexts are considered on the basis of the learning area itself, it has been uncovered that weak contexts are frequently employed in the learning area of algebra, while rich contexts are most commonly used in the learning area of data processing. It can be suggested that the high number of weak contexts in algebra learning might result from forced contexts utilized in this part. This causes the contexts to become unrealistic and turn out to be a weak context. Similarly, conducting a study to identify the necessary criteria for writing contextual questions, Elmas and Eryilmaz (2015) highlighted the need for selecting contexts relevant to students' lives, and put forward that cricket would not be an appropriate example since it is not a common sport in Turkey. Moreover, they further stated that questions based on stories with verbal expressions may not necessarily be contextual.

The reason for the high number of rich contexts in the learning area of data processing when compared to other learning areas can be explained with the inevitable presentation of the basic statistical issues such as generating research questions, data collection and arithmetic mean calculation in a context by its very nature. This is reflected in the related literature as one of the most important differences between statistics and mathematics in the sense that the former is always presented in a context, and it is further emphasized that "Statistics is related to numbers, but numbers in context: these are called data" (Scheaffer, 2006, p. 437).

The findings of the study also revealed frequent usages of sharing chocolate and candy for introducing the concept of fractions in the analyzed textbook. It is noteworthy to underline that in the literature, no criteria related to health have been determined in the necessary criteria and features for a context. One of the significant contributions of this study could be suggesting an addition of a health-related criterion. It can be stated that it is not appropriate to use unhealthy food pictures because they run the risk of stimulating unhealthy food consumption.

Another contribution of this research to the related literature is that it provides concrete examples of how qualified contexts should be established in the mathematics textbook. It is believed that identifying the necessary criteria for a context and providing concrete examples will serve as a guide for teachers, textbook writers, academicians as well as prospective teachers. What is important here is to raise awareness regarding the appropriate criteria for a context to be clear and understandable for all students (Sullivan et al., 2003). To achieve this, it is recommended that in-service trainings be organized to discuss the necessary features of a rich context with concrete examples for mathematics teachers.

It is also suggested that textbook writers use real life connections to teach mathematical concepts which include meaningful, useful, and rich contexts that reflect students' real life. For this purpose, undergraduate courses in mathematics education programs should include in-class discussions regarding the definition of context, its characteristics, and their usages in the classroom. In this respect, the addition of "Connections in Mathematics Teaching" as a compulsory course in the Elementary Mathematics Teacher Education Program which was renewed by the Council of Higher Education (CoHE) in 2018 can be considered as an initial positive step because it is observed that connecting mathematics with real life is also emphasized in the content of this course (CoHE, 2018).

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