BLACK FRIDAY DISCOUNTS: PERCENTAGE CALCULATION ACTIVITIES

Mihriban Hacısalihoğlu Karadeniz[1], Ahmet Karahan[2]

ABSTRACT

This paper introduces a percentage activity based on the context of "Black Friday" discounts. The aim of the study was to reveal the existing and new conceptions of the 7th grade students regarding the topic of percentage calculation. The activity was designed considering the students' prior knowledge in the concept of "Ratio and Proportion" as well as in "Percentages." The participants of the study were 17 seventh grade students attending a state middle school in a province in the Eastern Black Sea region of Turkey during the academic year 2019-2020. The data were collected using a worksheet created by the researchers based on the realistic mathematics education framework. After implementing the activity, a form was completed by the students to find out their views on the activity. As the present study reveals the students' conceptions and mistakes, it offers suggestions for future implementation and development to researchers and teachers.
Keywords: Black Friday, legendary Friday, percentage, realistic mathematics education.

EFSANE CUMA İNDİRİMLERİ: YÜZDE HESAPLAMA ETKİNLİKLERİ

ÖZ

Televizyonlarda, internette, gazetelerde, dergilerde, alışveriş merkezlerinde sıklıkla duyulan bir "indirim" sözcüğü vardır. Bu indirimlerin çoğunda indirimin yüzdesi veya indirimin miktarı belirtilmektedir. Bu çalışmada indirim ve yüzde hesaplama kavramlarına güncel bir örnek oluşturan "Efsane Cuma" indirimleri tercih edilmiştir. Çalışmanın amacı, 7. sınıf öğrencilerinin "Oran ve Orantı" alt öğrenme alanına ilişkin hazırbulunuşluklarından ve "Yüzdeler" alt öğrenme alanındaki öğrenmelerinden yararlanarak, yüzde hesaplama konusundaki algılayış ve öğrenmeleri ortaya çıkarmaktır. Çalışma grubu, 2019-2020 eğitim öğretim yılında Doğu Karadeniz bölgesinin bir ilinde bulunan bir ortaokulun 7. sınıfında öğrenim gören 17 öğrenciden oluşmuştur. Veriler, araştırmacılar tarafından gerçekçi matematik eğitimi anlayışına dayanarak geliştirilen bir çalışma kâğıdı kullanılarak toplanmıştır. Etkinliğin uygulanmasının ardından öğrencilerin etkinlikle ilgili görüşlerinin alındığı bir form uygulanmıştır. Mevcut çalışma, öğrenci cevapları ve hatalarını yansıtması sebebiyle araştırmacı ve öğretmenlere, uygulanış ve geliştirme ipuçları içermektedir. Öğretmenlerin bu tür uygulamalara alıştırılması sağlanarak, öğrencilerin zorlandıkları kavramların öğretiminde bu tür etkinliklerin sınıf içi uygulamalarda kullanılması önerilebilir.
Anahtar Kelimeler: Kara Cuma, efsane Cuma, yüzde hesaplama, gerçekçi matematik eğitimi.

---

[1]Assoc. Prof. Dr., Giresun University, Faculty of Education, Department of Mathematics and Science Education, mihrideniz61@gmail.com, ORCID:https://orcid.org/0000-0002-7836-6868
[2]Ministry of National Education, Primary Education Mathematics Teacher, ilkmat.ahmet@gmail.com, ORCID:https://orcid.org/0000-0002-8104-5352

INTRODUCTION

In the mathematics teaching process, it is important to support students to develop strategies and skills that will help them solve real life problems and to teach them how to search for and reach knowledge, rather than simply passing the knowledge on to them (Ozcelik & Tutak, 2017). The mathematics curricula revised within the last 15 years advocate for teachers who can design positive learning environments where students are given opportunities to build their own knowledge (Baki, 2008). On these grounds, teachers can promote students' comprehension of complex concepts within the mathematics curriculum by developing a variety of activities. In order to make the mathematics teaching process more effective, program development studies have been conducted, various instructional approaches have been highlighted, and how these approaches affect the teaching process has been examined (Altun & Memnun, 2008). One of these approaches is Realistic Mathematics Education (RME) (Aydin-Unal, 2008; Freudenthal, 1991).

A prominent purpose of the RME approach, which was brought forward as a revolt against the traditional teaching approach, is to transform mathematics teaching into an experience in which the need to do mathematics is accepted as the basic principle of teaching (Altun, 2008). In this approach, the mathematics lessons start with a real life problem and the students associate mathematical concepts with real life experiences. The students discover mathematical relationships under the guidance of the teacher (Freudenthal, 1991).

Although we encounter with mathematics in almost all areas of our daily life, individuals often perceive it as an independent discipline from the life (Cavus-Erdem & Gurbuz, 2019). On the one hand, we draw attention to the role of mathematics in daily life; on the other hand, we seek an answer to the question how mathematics learned in schools will be used in real life (Moschkovich, 2002; Van Den Heuvel-Panhuizen, 2003). The answer to this question might be found in the RME approach which examines the role of real life connections in school mathematics. According to the RME, school mathematics should start and continue with authentic situations (Gravemeijer & Terwel, 2000). This approach stresses the use of multiple strategies in the solution of real life problems (Moschkovich, 2002). The examples, problems, tasks, and activities to be used in connecting mathematics with real life should enable students to explore and enjoy doing mathematics and to develop a positive attitude towards the discipline (Romberg & Kaput, 1999).

In her study, Gur (2006) argued that teaching mathematics via problems chosen from the immediate surroundings of the students would help them make sense of the mathematical concepts and comprehend them easier. In addition, she suggested that such education would enable students to transfer their learning to different situations. This perspective supports the importance of the RME in the learning process. The current study was built on the RME framework and designed a teaching activity emerging form a daily life situation.

Altun (2016) defined the concept of "percentage" as a special name given to those fractions with a denominator of 100 and stressed that it was of particular importance because of its use in real life. The areas where the concept of percentage is used frequently in daily life are interest, tax, profit-loss, and discount rates. The concept of "percentage" is also used for showing the share of the part in relation to the whole (Olkun & Toluk Uçar, 2012). The concept of "percentage" plays an undeniably important role in mathematics and also in daily life (Altun, 2016).

Due to its significance in real life, the present study focused on the topic of percentage to help the students evaluate, interpret, and apply the knowledge of percentage in real world scenarios. The aim of the study was to reveal the existing and new conceptions of the seventh grade students regarding the topic of percentage calculation. The activity was designed considering the students' prior knowledge in the concept of "Ratio and Proportion" as well as in "Percentages." The concept of percentage was chosen because it is used in many areas of daily life and is important to educate conscious consumers.

Furthermore, the topic of percentages has connections with many other topics in mathematics. The current mathematics curriculum introduces the topic of percentage to students in the fifth grade under the domain "Numbers and Operations." Students revisit this concept in the seventh grade to learn about calculations with percentages. The curriculum introduces this topic in connection to some other related topics such as fractions, decimals, rational numbers, and ratio and proportion (Ministry of National Education [MoNE], 2018). The current study was conducted with the seventh grade students because it was also concerned with the students' readiness levels. As the concept of percentages is important for students to become good problem solvers in this topic and conscious consumers in real life, we think that the current study will be of interest to teachers and other educators.

DETERMINING AND PLANNING THE ACTIVITY CONTENT

Black Friday, a concept used in the United States for the first Friday following Thanksgiving celebrated on the last Thursday of November, expresses the onset of the Christmas holiday shopping season. Black Friday is not accepted as a public holiday; however, most employees call it a holiday "Following Thanksgiving" (Simpson et al., 2011). As a reference to the profit of retailers, the term Black Friday began to be used in the 1970s. It is believed that in the period when the accounting records were kept with pens, the losses indicated with a red pen turned into profit owing to the shoppings done on the Friday following Thanksgiving for the first time and this was marked with a black pen (Smith & Raymen, 2017).

Black Friday today continues as a shopping tradition for most people and many famous brands offer significant discounts and various opportunities for their products on this special day. On Black Friday, which has gone beyond the United States and is celebrated by many countries, the firms create shopping activities with different, new, and unusual campaigns. Consumers in such a shopping environment try to evaluate the most attractive opportunity offered to them in a competition.

The term Legendary Friday is a new expression used by some shopping stores and internet sales sites in Turkey as a sales strategy for the term Black Friday that is mentioned in the literature (Dagtas & Yildirim, 2018). The activity designed in this study discusses the Legendary Friday/Black Friday discounts that have become famous on many platforms like the internet, television, and radio with advertisements and sales ratings. It also contains percentage calculations of the Legendary Friday discounts.

In the study, the questions used as the data collection tool were developed based on two seventh grade content standards related to the topic of "Percentages" in the learning domain "Numbers and Operations" included in the mathematics curriculum (MoNE, 2018). These content standards are as follows:
CS1. M.7.1.5.2.   Calculates a quantity as the percentage of another quantity.
CS2. M.7.1.5.3.   Performs calculations to increase or decrease a quantity by a specific percentage.

Two teachers who were experts in the area of mathematics education examined the content validity and readability of the questions on the worksheet. After receiving expert opinion, revisions were made on some questions and 12 questions related to the two content standards were determined to be included on the worksheet. These questions were used as the main data collection tool of the study. The worksheet is given in Appendix 1.

Materials

The materials required for the activity were a worksheet (Appendix 1) and a pen. The interactive whiteboard was used actively throughout the process to aid the teaching process.

Place and Time of Activity Implementation

The second author taught the activity to 17 seventh grade students attending a state middle school in the province of Giresun located in the Eastern Black Sea region of Turkey. The study took place during the fall semester of the academic year 2019-2020. Necessary permissions were obtained from the directorate of national education. The researchers planned

the time for the application to be 2 lesson hours. In the beginning of the first lesson, the students were reminded about the basic percentage concepts via interactive whiteboard. The worksheet given in Appendix 1 was distributed to each student and was also displayed on the interactive whiteboard. The students individually answered the questions on the worksheet under the guidance of the teacher. Then, the students shared their answers in a whole class discussion.

ACTIVITY IMPLEMENTATION

The two content standards, CS1 and CS2, were examined in two different sections of the worksheet. CS1 was examined in the context of "Black Friday Retail Prices" and CS2 was explored in the context of "Black Friday Online Discounts." The worksheet included five questions related to CS1 and seven questions related to CS2. In this section of the article, an overall implementation of the activity is described along with example questions related to both content standards.

In the beginning of the first lesson, in order to grab the students' attention, the teacher talked about the concept of Black Friday that was frequently heard in the TV advertisements and social media at the time of the study. The students were asked "Have you ever encountered with advertisements or news content related to Black Friday? Please explain." Most of the students (n=15) answered that they were familiar with this concept through social media and advertisements. The activity, which was designed based on the RME framework, continued with a real life scenario. The scenario in Figure 1 was introduced to the students. They were asked "Do you find the discount offered by the shop interesting? Please explain." to help them understand the context and share their understanding with the classmates. The first lesson was completed with five questions emerging from the scenario given in Figure 1.

The second lesson focused on CS2 and started with a discussion on the importance of interpreting the mathematics involved in the discounts in online advertisements. As an example, the discount given in Figure 2 was examined. To scaffold students' reasoning on the discount, the students were asked "What

percentage discount do you think this expression refers to? Might the firm be referring to a 100% discount?" The students shared their responses, however, the answer to the question was not given at this stage of the lesson. The students answered seven more questions on the worksheet to delve deeper into the concept of percentage discount.

Mr. Ahmet always followed the products of three clothing shops that he believed to be of good quality. The shops had both physical stores and online shopping sites. Mr. Ahmet wanted to buy one coat, one pair of trousers, one shirt, and one pair of shoes during the Black Friday sales. However, he had doubts about their sizes. Thus, he decided to visit the physical stores first.

When he visited the shops, he realized that the discount ratio was not specified. The regular price was strikethrough and the sale price was written, as in the following example. He determined the products matching his size and noted down their prices. When taking notes, he rounded the numbers to the nearest whole number. Following is a pricing example.

299.99 lira	999.99 lira
Sale Price	**Regular Price**

Figure 1. The Real Life Scenario of the Activity

Figure 2. An Example Black Friday Discount: A Discount Advertisement on an Online Site

At the end of the second lesson, the students were asked to express their views of the activity on Black Friday discounts. Accordingly, they completed the form given in Appendix 2. The activity was completed in 2 hours as it was planned by the researchers.

FINDINGS

Table 1 shows the frequency (f) and percentage (%) values calculated as a result of analyzing the students' answers to 12 questions on the worksheet and categorizing them as correct, partly correct, incorrect, or blank answers. The students' answers for each question are examined in detail in the following section.

Table 1. Students' Answers to the Questions

Content Standard	Questions	Answers							
		Correct (C)		Partly Correct (PC)		Incorrect (IC)		Blank (B)	
		%	f	%	f	%	f	%	f
	Q1	94.11	16	5.88	1	-	-	-	-
	Q2	76.47	13	-	-	23.52	4	-	-
C S 1	Q3	23.52	4	11.76	2	41.17	7	23.52	4
	Q4	52.94	9	-	-	47.05	8	-	-
	Q5	41.17	7	11.76	2	35.29	6	11.76	2
	Q6	76.47	13	17.64	3	5.88	1	-	-
C S 2	Q7	47.05	8	23.52	4	29.41	5	-	-
	Q8	64.70	11	-	-	35.29	6	-	-
	Q9	58.82	10	-	-	35.29	6	5.88	1
	Q10	29.41	5	23.52	4	41.17	7	5.88	1
	Q11	29.41	5	5.88	1	41.17	7	23.52	4
	Q12	47.05	8	-	-	35.29	6	17.64	3

Section 1: Black Friday Retail Prices

This section comprises the first five questions associated with the CS1. The first five questions examined the Black Friday discounts in physical stores. In order to grab the students' attention, a shop's discount example was given (Figure 1) and they were asked, "Do you find the discount offered by the shop interesting? Please explain." All the students gave positive answers to this question.

The first question (Q1) on the worksheet is "Find the ratio of the sale price to the regular price (Round the result to the nearest whole number). Write a percentage equivalent to the ratio you have calculated. What percentage of the regular price is the sale price?" Analysis of the answers to the first question revealed that 94.11% of the students gave correct answers, while 5.88% gave partly correct answers. S1's (student 1) answer that was counted as partly correct involved the required ratio in the question, but failed to express it as a percentage. The answers except this answer were correct.

In question two, the students were asked to "Find the percentage of discount considering the regular price and the sale price." To this question, 76.47% of the students gave correct answers, while 23.52% gave incorrect answers. Although the question was asking for the percentage discount, some students calculated the sale price percentage asked in question one. S5 and S7 made the aforementioned mistake and gave the answer 30%. S7's answer is given in Figure 3. The two incorrect answers were 3% and 20%.

Figure 3. S7's Answer to Q2

Question three was "You have calculated the percentages related to the sale price and discount in questions 2 and 3. How are they related?" Although the majority of the students answered the first two questions correctly, only 23.52% were able to provide a correct answer to this question. Of the students, 11.76% gave partly correct answers and 41.17% gave incorrect answers to the question, while 23.52% left the question blank. S13's answer, which was an exemplary correct answer, is given in Figure 4. The student wrote that the two percentages add up to 100%. In the partly correct answers, the students specified the percentage difference instead of calculating the whole. S6 confused the percentage difference with price difference (wrote 40 lira instead of 40%). Thus, his answer was counted as incorrect.

Figure 4. S13's Answer to Q3

Figure 5. S6's Answer to Q3

In question four, which was created based on Mr. Ahmet's shop tour on Black Friday and required the students to find the percentage

discounts using the data on the table, 52.94% of the students were able to calculate the correct answers, while 47.05% gave incorrect answers to the question. S3, one of the students who were able to calculate the correct answers, found the percentages for the sale prices first and then specified the discounts in percentages (Figure 6).
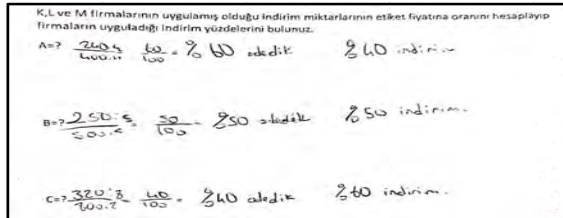

Figure 6. S3's Answer to Q4

In the other correct answers, the discount amount was calculated first and then the correct answers were obtained by using ratios. Figure 7 shows the answer given by S9, who made a mistake because she found the sale price percentage instead of the discount. S5 made a mistake regarding the concept of percentage. The student used the denominator of the ratio to write the percentages (Figure 8).
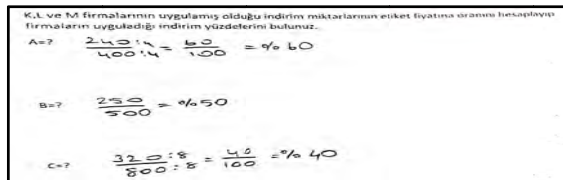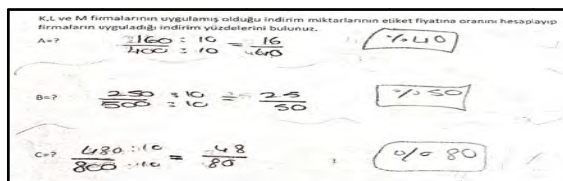

Figure 7. S9's Answer to Q4

Figure 8. S5's Answer to Q4

In question five, which was the final question of the first lesson, the students were asked to find the shop offering the highest discount. They were briefly reminded of the percentage calculation and were asked to find the prices of the coat, trousers, shirt, and shoes in the firm they had chosen. They were asked to think about the relationship between the discount and sale price percentages and were reminded that the question was specifically aimed at sale prices. In addition, using the interactive whiteboard, they were reminded that no matter

which firm they would choose in the previous stage, the price of a product was available on the new table. Thus, the students were asked to find the prices of the three remaining products.

In this question, 11.76% of the students provided partly correct answers, 35.29% gave incorrect answers, while 11.76% left the question blank. Only 41.17% of the students were able to calculate the correct answers. S6's answer, which was among the correct answers, is given in Figure 9.
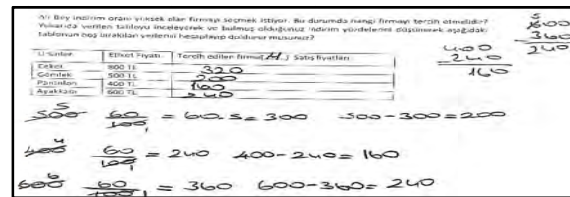

Figure 9. S6's Answer to Q5

Although the students whose answers were accepted to be partly correct wrote the ratio and values accurately, they made errors in their operations. The answer given by S16 who found incorrect results because of the erroneous percentage calculation in the previous question is given in Figure 10.
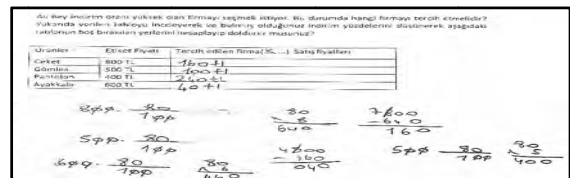
Figure 10. S16's Answer to Q5

Besides students who made calculation errors, there were worksheets left blank without any operations. These students were instructed using examples from the worksheet. Thus, the physical shop tour part of the activity and the first lesson were both completed.

Section 2: Black Friday Online Discounts

This section comprises eight questions related to the second content standard, CS2. The second lesson started with the example of Mr. Ahmet's experience with online sale prices. The students were shown the discount advertisement in Figure 2 and were asked "What percentage discount do you think this expression refers to? Might the firm be referring to a 100% discount?" Four students gave positive answers to this question, while

13 students did not agree that it was a 100% discount. The students were told that they would work on a similar problem to make sense of these types of discounts.

The questions six through nine included a four-step question/answer process to make sense of 50%+40% discount. Discounts were applied one by one to 100 lira (lira is the currency used in Turkey). Question six asked "Calculate 50% of 100 lira. Now, use this number to find the sale price after the 50% discount." Of the answers given to the question, 76.47% were correct, 17.64% were partly correct, and 5.88% were incorrect. The answers given by the students who found the discount and yet did not specify the sale price were accepted to be partly correct. In her answer, S17 wrote the expressions 50% mentioned in the question side by side and performed the operations on this number "5050", which is an example of an incorrect answer. The student's answer is given in Figure 11.
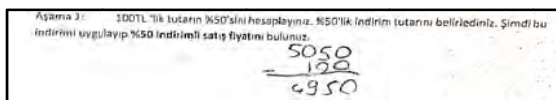

Figure 11. S17's Answer to Q6

Question seven was "Calculate 40% of the sale price you have found in step 1. Use this discount to find the final sale price." The percentage of students who correctly answered this question was 47.05%. The percentage of partly correct answers was 23.52%, while the percentage of incorrect answers was 29.41%. As in question six, the answer of the students who found the discount and yet had a problem with applying the discount was accepted to be partly correct. Incorrect answers were either caused by giving incorrect answers to the previous question or making mistakes in percentage calculations.

Question eight, the third step, was as follows: "You had 100 lira at the beginning. Considering the final sale price, what percentage of 100 lira does it equal to?" Question nine, the final step, asked "Considering the discount amount between the regular price (100 lira) and the final sale price, what percentage of 100 lira does the discount amount equal to?" These questions were aimed at finding the percentages related to sale price and the discount. To the eighth question,

64.70% of the students gave correct answers, while 35.29% gave incorrect answers. In question nine, the rate of correct answers dropped to 58.82%. Of the students, 35.29% gave incorrect answers, the same rate with the previous question, while 5.88% did not answer the question.

Question 10 asked students to examine a table that includes discounts offered by three different firms and find the firm with the highest percentage discount. Using the table, the students were asked to interpret the "50%+50%" discount of the firm K and the "70%+20%" discount of the firm L as in the previous four-step task and to calculate a single percentage discount. The four steps were displayed on the interactive whiteboard to scaffold their thinking. As the percentage discount of the firm M was given as a single percentage, it did not require complex calculations.

In question 10, which was the first of three questions that were addressed in connection with each other, 35.29% of the students were able to calculate the percentage of the firm K and L accurately. Of the students, 23.52% provided partly correct answers to this question, while 5.88% left the question blank and 41.17% gave incorrect answers. The correct answers showed that the students used the example of 100 lira in their answers. S15's correct answer is given in Figure 12.

Figure 12. S15's Answer to Q10

The answers of some students showed that they performed correct operations regarding only one firm and they performed incorrect calculations regarding the second firm. Their answers were counted as partly correct. In her answer, S2 tried to complete the table by calculating the sale prices, however, there are errors in her calculations. Her answer is given in Figure 13.

Figure 13. S2's Answer to Q10

Figure 14 shows that S17 calculated "50%+50%=100%" for the firm K and "70%+20%=90%" for the firm L. This answer was counted as incorrect.

Figure 14. S17's Answer to Q10

Question 11 asked students to complete a table similar to the table they had completed for the physical shops at the end of the first lesson. They were asked to find the sale prices for the firm with the highest discount. In this question, 29.41% of the students chose the firm L to be the firm with the highest discount and obtained correct sale prices with correct percentages. Of the students, 5.88% provided partly correct answers to this question, while 41.17% gave incorrect answers and 23.52% did not answer the question. S13's answer, which was a correct answer, is given in Figure 15.

Figure 15. S13's Answer to Q11

An example of a partly correct answer was given by S3. This student made an error while subtracting the discount from the regular price and found an incorrect sale price for the coat. Some other students made similar erroneous calculations. And some others found incorrect results because of the errors made in the previous question.

In the final stage of the lesson, the following question (Q12) was addressed: "You have compared the sale prices of physical shops with the sale prices of online shopping sites.

Comparing these data, do you think Mr. Ahmet should go shopping on physical stores or online shopping sites? Explain your answer." To this question, 47.05% of the students provided correct answers, while 35.29% gave incorrect answers and 17.64% left the question blank. An example correct answer, online shopping is cheaper, was given by S12 (Figure 16).

Figure 16. S12's Answer to Q12

In other correct answers, the students arrived at the correct answer by comparing the tables. Some students left this question blank probably because they were not able to complete the online shopping table or the other tables. Incorrect answers were due to completing the tables incorrectly. S10, despite completing both tables correctly, chose the physical shop because he confused the discount amount with the sale price.

The worksheet ended with the statement "Mr. Ahmet thanks you for the extra money in his pocket." This completed the implementation phase of the activity.

Section 3: Students' Views on the Black Friday Discounts Activity

After the lesson, the students completed the interview form given in Appendix 2. They shared their opinions on the activity by answering the questions on the form in writing. The following questions were on the form:

IQ-1. What do you think about Black Friday? Please explain.

IQ-2. What do you think are the interesting and surprising aspects of the activity? Please explain.

IQ-3. Do you think that the activity has advantages for the mathematics lesson? Please explain.

IQ-4. Do you have any suggestions for people who would like to go shopping on Black Friday?

IQ-5. What topics in mathematics can this activity be related to? Please explain.

When the students' answers for IQ-1 were analyzed, it was found that they expressed positive opinions about Black Friday. The following is an example comment given by the majority of the students: "Black Friday is very nice. It is so cheap. Discounts are great." S4 wrote "Black Friday is too expensive. I think one should buy whatever suits his/her income."

Students expressed that working with the percentages was interesting in their answer to IQ-2: "It was surprising to find the percentages. The discounts were surprising. The questions were surprising." In this question, regarding the instructive aspect of the activity, S15 wrote "Instead of learning the questions directly, we learned them gradually." and S10 wrote "I learned that 50%+50% would not make 100%."

Analysis of the students' answers to IQ-3 revealed that they found the activity useful because it was useful for enhancing their knowledge in mathematics. They wrote answers like "I have improved my mathematics. We repeated the past topics and performed calculations." Some other comments were as follows: "The questions are very good for repetition and for the development of our mind and logic." (S3), "Yes, I had forgotten this topic and remembered it again, which was good for me." (S4).

The students provided answers like the following comments in their responses to IQ-4: "They can do shopping at online shopping sites, but they should be careful. They should wait for Black Friday for shopping. They should calculate the discount very well so that they will save their money." (S2), "They should do the mathematics very well." (S9), "We should find the percentages and do shopping where the highest discount is offered." (S16). Thus, in line with the answers given to IQ-4, it is possible to claim that the students found the study useful in terms of using mathematics in daily life and accordingly, they offered some suggestions.

The students' answers to IQ-5 included the topics such as ratio, fraction, percentage, decimal notation, discount, multiplication, and subtraction. Some of the student answers to IQ-5 are as follows: "Ratio, fraction, percentage, multiplication. They all have

developed our mathematics skills." (S1), "It's been great help with ratio, proportion, percentage, and decimal numbers. Thanks." (S2). Students' answers indicate that they connected the activity to different concepts/terms of mathematics and expressed opinions about its contribution to themselves.

Evaluation of the Activity

During the activity implementation, we found out that most of the students had heard about the Black Friday advertisements and they were familiar with the discounts. The activity which intended to connect their mathematics learning with daily life situations was implemented as planned. The teacher guided students' activities through reminders, hints, and questions. The students expressed positive opinions about the activity and found it useful for enhancing their mathematical knowledge and skills.

CONCLUSION and SUGGESTIONS

This study used the context of Black Friday, which has turned into a shopping festival, to design an activity related to percentage calculations. The article described the implementation process of the activity and presented findings related to students' performance in the percent problems.

A great majority of the students were already familiar with the concept of Black Friday. They were interested in the lesson context which was connected to the concept of percentage via the questions of the worksheet and the teacher's instructions. Consequently, a teaching activity in which the students were willing to take part actively was carried out. The students' answers to the worksheet problems and interview form questions suggest that the activity revealed students' prior knowledge in the concept of percentage and contributed to their learning, particularly in the area of calculating the price after multiple percentage discounts.

The study showed that the students had positive opinions about the use of mathematics in daily life and made suggestions to consumers regarding discounts. This finding was probably the result of activity design which was based on the RME framework. In

this framework, the relationship between real life situations and mathematics is reflected in the teaching activities (Moschkovich, 2002). The students were also able to associate the concept of "percentage" with other concepts of mathematics. However, they had difficulties in interpreting and calculating the percentage discount and other percentages accurately. During the activity, the students tried to make sense of some other related concepts such as "multiplication, ratio, proportion, decimals, and fraction" in addition to the concept of "percentage" and the meaning of the symbol "%". They used these concepts in the context of Black Friday discounts. These processes are aligned with the expectations of the mathematics curriculum for students to analyze the numbers given in decimal notation form, perform multiplication/division with these numbers, and interpret the concept of ratio (MoNE, 2018). Additionally, Hacisalihoglu Karadeniz and Kaslikose (2019) found in their study that students had difficulties in comprehending the concepts of ratio and proportion, using their properties, and solving ratio and proportion problems. The difficulties that students face can be solved by using activities that relate real life situations to mathematics in the teaching of ratio and proportions.

The present study has several implications that could be useful for teachers and researchers. The study revealed students' responses to percent problems, containing correct, partly correct, and incorrect answers. Possible student responses might give the teachers an idea about what to expect from their students. Students often need reminders in the implementation process according to their readiness levels. Accordingly, the teachers should be prepared for which questions to ask or which clues to provide to the students.

Determining the teacher and student roles in activities will prevent possible confusions and disorders. In this respect, the teacher's and students' role should be specified clearly in the activity. It is also important that the activities should be designed based on students' readiness regarding the mathematical concepts targeted in the activity.

It is very important for everyone to calculate the percentage discount encountered in daily life, especially during shopping. Therefore, students need to acquire learning experiences in this area before adulthood. The most important responsibility here belongs to teachers. It is recommended for teachers to prepare teaching activities relating real life to mathematics. Through such an instructional approach, many symbols/concepts encountered during the activity can be meaningful for the students. As an example, the lessons taught with concept cartoons contribute to the use of mathematical symbols, terms, and concepts. It is suggested that concept cartoons be used in the learning environment (Aygun et al., 2020). In conclusion, activities that integrate mathematics with real life situations would help educate students who can use concepts/terms and symbols related to mathematical language in daily life, have problem solving skills, and develop positive attitudes toward mathematics (MoNE, 2018).

REFERENCES

Altun, M., & Memnun, D. (2008). Matematik öğretmeni adaylarının rutin olmayan matematiksel problemleri çözme becerileri ve bu konudaki düşünceleri [Mathematics teacher trainees' skills and opinions on solving non-routine mathematical problems]. *Eğitimde Kuram ve Uygulama / Journal of Theory & Practice in Education (JTPE)*, *4*(2), 213-238.

Altun, M. (2008). *Eğitim fakülteleri ve ilköğretim öğretmenleri için matematik öğretimi [Mathematics teaching for faculties of education and primary school teachers.* Aktüel Alfa Yayınevi.

Altun, M. (2016). *Ortaokulda matematik öğretimi [Mathematics teaching in middle schools].* Alfa Akademi.

Aydin-Unal, Z. (2008). *Gerçekçi matematik eğitiminin ilköğretim 7. sınıf öğrencilerinin başarılarına ve matematiğe karsı tutumlarına etkisi [The effects of realistic mathematics education on 7th grade students' achievements and attitudes toward mathematics]* [Unpublished master's thesis]. Atatürk Üniversitesi Fen Bilimleri Enstitüsü.

Aygun, D., Hacisalihoglu Karadeniz, M., & Butuner, S. Ö. (2020). Kavram

karikatürü uygulamalarının 5. sınıf öğrencilerinin matematiksel sembol, terim/kavram kullanımına yansımaları [Reflections of concept cartoons applications to 5th grade students' use of mathematical symbols, terms/concepts]. *International Journal of Educational Studies in Mathematics, 7*(3), 151-172.

Baki, A. (2008). *Kuramdan uygulamaya matematik eğitimi [Mathematics education from theory to practice]* (4th edition)*.* Harf Eğitim Yayıncılık.

Cavus-Erdem, Z., & Gurbuz, R. (2019). Matematiksel modellemeye giriş [Introduction to mathematical modeling]. In R. Gurbuz & M. F. Dogan (Eds.), *Matematiksel modellemeye disiplinler arası bakış: Bir STEM yaklaşımı [An interdisciplinary view of mathematical modeling: A STEM approach]* (pp. 9-19). Pegem Akademi.

Dogtas, E., & Yildirim, O. (2018). Kültürel emperyalizm çerçevesinde tüketim pratiklerinin Türkiye basınındaki yansımalarının çözümlenmesi: 24 Kasım 2017 "Kara Cuma" örneği [Analysing how consumption practices are reflected in Turkish media through the framework of cultural imperialism: November 24, 2017 "Black Friday" example]. *Global Media Journal: Turkish Edition*, *9*(17), 96-127.

Freudenthal, H. (1991). *Revisiting mathematics education.* China lectures*.* Kluwer academic publishers.

Gravemeijer, K., & Terwel, J. (2000). Hans Freudenthal: A mathematician on didactics and curriculum theory. *Journal of Curriculum Studies, 32*(6), 777-796.

Gur, H. (2006). *Matematik öğretimi [Mathematics teaching].* Lisans Yayıncılık.

Hacisalihoglu Karadeniz, M., & Kaslikose, B. (2019, 17-19 Mayıs). *Sekizinci sınıf öğrencilerinin oran ve orantı konusunu anlama durumları [Grade eight students' comprehension of the ratio and proportion concepts].* [Conference session]. Uluslararası 19 Mayıs Multidisipliner Çalışmalar Kongresi, Samsun, Turkey.

Ministry of National Education. (2018). *Matematik dersi öğretim programı (İlkokul ve ortaokul 1, 2, 3, 4, 5, 6, 7 ve 8. sınıflar) [Mathematics curriculum (Primary and secondary school grades 1, 2, 3, 4, 5, 6, 7, and 8)].* MEB Yayınları.

Moschkovich, J. (2002). An introduction to examining everyday and academic mathematical practices. In M. Brenner & J. Moschkovich (Eds.), *Everyday and academic mathematics in the classroom* (pp. 1-11). NCTM.

Olkun, S., & Toluk Ucar, Z. (2012). *İlköğretimde etkinlik temelli matematik öğretimi [Activity-based mathematics teaching in primary education]* (5th edition). Ertem Yayıncılık.

Ozcelik, A., & Tutak, T. (2017). 7. Sınıf yüzde ve faiz konusunun gerçekçi matematik eğitimine dayalı olarak işlenmesinin öğrencilerin başarı ve tutumlarına etkisi [The effect of teaching percents and interest issues based on realistic mathematics education on the grade 7th students' achievement and the attitudes]. *Electronic Journal of Education Sciences*, *6*(12), 204-216. https://dergipark.org.tr/tr/pub/ejedus/issue/31928/349880

Romberg, T. A., & Kaput, J. J. (1999). Mathematics worth teaching, mathematics worth understanding. In E. Fennema & T. A. Romberg (Eds.), *Mathematics classrooms that promote understanding* (pp. 3-17). Lawrence Erlbaum.

Simpson, L., Taylor, L., O'Rourke, K., & Shaw, K. (2011). An analysis of consumer behavior on Black Friday. *American International Journal of Contemporary Research*, *1*(1), 1-5.

Smith, O., & Raymen, T. (2017). Shopping with violence: Black Friday sales in the British context. *Journal of Consumer Culture, 17*(3), 677-694.

Van Den Heuvel-Panhuizen, M. (2003). The didactical use of models in realistic mathematics education: An example from a longitudinal trajectory on percentage. *Educational Studies in Mathematics*, *54*(1), 9-35.

Citation Information

Hacısalihoğlu Karadeniz, M., & Karahan, A. (2020). Black Friday discounts: Percentage calculation activities. *Journal of Inquiry Based Activities, 10*(2), 83-99. http://www.ated.info.tr/index.php/ated/issue/view/21

Appendix 1

Activity Worksheet: Black Friday Discounts

M.7.1.5.2. Calculates a quantity as the percentage of another quantity.

M.7.1.5.3. Performs calculations to increase or decrease a quantity by a specific percentage.

There were many advertisements that used the word "Discount" throughout the Black Friday time period. Shops, shopping malls, and most online shopping sites announced campaigns and discounts. Many news content and advertisements on television and social media tried to draw people's attention.

Have you ever encountered with news content or advertisements related to Black Friday? Please explain.

Mr. Ahmet always followed the products of three clothing shops that he believed to be of good quality. The shops had both physical stores and online shopping sites. Mr. Ahmet wanted to buy one coat, one pair of trousers, one shirt, and one pair of shoes during the Black Friday sales. However, he had doubts about their sizes. Thus, he decided to visit the physical stores first.

When he visited the shops, he realized that the discount ratio was not specified. The regular price was strikethrough and the sale price was written, as in the following example. He determined the products matching his size and noted down their prices. When taking notes, he rounded the numbers to the nearest whole number. Following is a pricing example.

299.99 lira	999.99 lira
Sale Price	**Regular Price**

A Discount Example

Do you find the discount offered by the shop interesting? Please explain.

Q1) Find the ratio of the sale price to the regular price (Round the result to the nearest whole number). Write a percentage equivalent to the ratio you have calculated. What percentage of the regular price is the sale price?

Q2) Find the percentage of discount considering the regular price and the sale price.

Q3) You have calculated the percentages related to the sale price and discount in questions 2 and 3. How are they related?

Examine the table created by Mr. Ahmet. When creating the table, Mr. Ahmet rounded the prices to the nearest whole number and wanted to determine the percentage discount offered by three different firms by considering the products with the same regular prices. The percentage discounts of the firms were valid for all products and were constant.

Products	Regular Price	A% Discount Firm K (Sale Price)	B% Discount Firm L (Sale Price)	C% Discount Firm M (Sale Price)
Coat	800 lira			320 lira
Shirt	500 lira		250 lira	
Trousers	400 lira	240 lira		
Shoes	600 lira			

Q4) Calculate the percentage discounts applied by the firms K, L, and M to the regular prices.

A=?

B=?

C=?

Q5) Mr. Ahmet wants to choose the firm with the highest discount ratio. In this case, which firm should he choose? Fill in the blanks on the following table, examining the table above and considering the percentage discounts you have calculated.

Product	Regular Price	Firm Chosen (........) Sale Prices
Coat	800 lira	
Shirt	500 lira	
Trousers	400 lira	
Shoes	600 lira	

Mr. Ahmet wanted to examine the prices of these firms on online sites. It was important to interpret the discount ratios in a mathematically proper way. For example, a clothing firm advertised the following discount on their site.

What percentage discount do you think this expression refers to? Might the firm be referring to a 100% discount?

Let's solve a similar problem. Let's say the firm had used the expression 50%+40% discount in their advertisement. In order to find the discount on a regular price of 100 lira, let's apply the following steps.

Q6) Step 1: Calculate 50% of 100 lira. Now, use this number to find the sale price after the 50% discount.

Q7) Step 2: Calculate 40% of the sale price you have found in step 1. Use this discount to find the final sale price.

Q8) Step 3: You had 100 lira at the beginning. Considering the final sale price, what percentage of 100 lira does it equal to?

Q9) Step 4: Considering the discount amount between the regular price (100 lira) and the final sale price, what percentage of 100 lira does the discount amount equal to?

As you completed the four steps, you explored the meaning of the expression "50%+40% discount." You can now interpret the advertisement above (50%+50% discount).

Mr. Ahmet wanted to compare the discount advertisements on online shopping sites of the three firms to their physical shop prices. He found out that the firm K, L, and M respectively advertised 50%+50% discount, 70%+20% discount and 75% discount on online shopping sites and the discounts were valid for all products. He identified the products of the same price matching his size and created the following table.

Products	Regular Price	50%+50% Discount Firm K (Sale Prices)	70%+20% Discount Firm L (Sale Prices)	75% Discount Firm M (Sale Prices)
Coat	800 lira			
Shirt	500 lira			
Trousers	400 lira			
Shoes	600 lira			

Q10) Which firm has the highest discount percentage? Show your work.

Q11) Mr. Ahmet wants to choose the firm with the highest discount ratio on online sites. Which firm should he choose? Fill in the blanks on the following table by using the data in the table above.

Products	Regular Price	Firm Chosen (........) Sale Prices
Coat	800 lira	
Shirt	500 lira	
Trousers	400 lira	
Shoes	600 lira	

Q12) You have compared the sale prices of physical shops with the sale prices of online shopping sites. Comparing these data, do you think Mr. Ahmet should go shopping on physical stores or online shopping sites? Explain your answer.

Mr. Ahmet thanks you for the extra money in his pocket. ☺

Appendix 2
Interview Form

Q1) What do you think about Black Friday? Please explain.

....
....
....
....

Q2) What do you think are the interesting and surprising aspects of the activity? Please explain.

....
....
....
....

Q3) Do you think that the activity has advantages for the mathematics lesson? Please explain.

....
....
....
....

Q4) Do you have any suggestions for people who would like to go shopping on Black Friday?

....
....
....
....

Q5) What topics in mathematics can this activity be related to? Please explain.

....
....
....
....