Journal name	International e-Journal of Educational Studies
Abbreviation	IEJES
e-ISSN	2602-4241
Founded	2017
Article link	http://doi.org/10.31458/iejes.1354835
Article type	Research Article
Received date	04.09.2023
Accepted date	13.12.2023
Publication date	21.03.2024
Volume	8
Issue	16
pp-pp	14-31
Section Editor	Prof.Dr. Kürşat YENİLMEZ
Chief-in-Editor	Prof.Dr. Tamer KUTLUCA
Abstracting & Indexing	Education Source Ultimate Database Coverage List EBSCO Education Full Text Database Coverage List H.W. Wilson Index Copernicus DRJI Harvard Library WorldCat SOBIAD
Article Name	Examining 5th Grade Students' Learning on Surface Area Calculations with Realistic Mathematics Education Approach

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Abstract

The fact that the mathematics course is abstract, that it is not possible to associate it with daily life, and that it is impossible to concretize abstract expressions causes a prejudice against the this course and leads to a decrease in the academic achievements of students. It is seen that throughout history, various studies have been carried out taking this situation into consideration. A group of these studies is on realistic mathematics education. Realistic mathematics education is an approach that aims to concretize the abstract concepts of mathematics by relating them to real-life situations. The purpose is to make mathematics more understandable by concretizing it. In the study, the subject of calculating the surface area of prisms with the use of realistic mathematics education was taught, and the purpose of the study was to examine the effects of this application. The study group consisted of 20 5th grade students. While determining this group, maximum variety sampling strategy was preferred. In the study, action research, one of the qualitative research methods, was used, and the data were interpreted with the help of descriptive analysis and content analysis. The data collection tools in the study included semi-structured interview forms, video recordings, photos and activity sheets prepared by the students under the guidance of the researcher in accordance with the realistic mathematics education approach. When the findings were examined, it was seen that the students showed a positive development in the meaning and visualization processes; that they could reach mathematical inferences on their own; that they enjoyed the mathematics lesson; and that the realistic mathematics education approach gave positive results on learning. Based on these results, it was suggested that not only the application of the realistic mathematics education approach for different acquisitions but also the inclusion of these activities in the textbooks in accordance with the curriculum will result in improvements in favor of learning.

To cite this article:

Ertem-Akbaş, E. & Yıldırım, L. (2024). Examining 5th grade students' learning on surface area calculations with realistic mathematics education approach. *International e-Journal of Educational Studies, 8* (16), 14-31. https://doi.org/10.31458/iejes.1354835

Research Article

Examining 5th Grade Students' Learning on Surface Area Calculations with Realistic Mathematics Education Approach*

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Abstract

The fact that the mathematics course is abstract, that it is not possible to associate it with daily life, and that it is impossible to concretize abstract expressions causes a prejudice against the this course and leads to a decrease in the academic achievements of students. It is seen that throughout history, various studies have been carried out taking this situation into consideration. A group of these studies is on realistic mathematics education. Realistic mathematics education is an approach that aims to concretize the abstract concepts of mathematics by relating them to real-life situations. The purpose is to make mathematics more understandable by concretizing it. In the study, the subject of calculating the surface area of prisms with the use of realistic mathematics education was taught, and the purpose of the study was to examine the effects of this application. The study group consisted of 20 5th grade students. While determining this group, maximum variety sampling strategy was preferred. In the study, action research, one of the qualitative research methods, was used, and the data were interpreted with the help of descriptive analysis and content analysis. The data collection tools in the study included semi-structured interview forms, video recordings, photos and activity sheets prepared by the students under the guidance of the researcher in accordance with the realistic mathematics education approach. When the findings were examined, it was seen that the students showed a positive development in the meaning and visualization processes; that they could reach mathematical inferences on their own; that they enjoyed the mathematics lesson; and that the realistic mathematics education approach gave positive results on learning. Based on these results, it was suggested that not only the application of the realistic mathematics education approach for different acquisitions but also the inclusion of these activities in the textbooks in accordance with the curriculum will result in improvements in favor of learning.

Keywords: Mathematics education, realistic mathematics education, prisms, surface area

1. INTRODUCTION

Mathematics is a course including various abstract models and the relationships between them. It is a science, a way of thinking and an art. There is an order and consistency in its character. It is a language and a tool made up of carefully defined terms and symbols (Yıldırım, 1996). Therefore, it was inevitable to benefit from actions that facilitated learning. In this respect, the emphasis was put on the learner-centeredness of mathematics education, one of the variables affecting the learning process, and on the reflection of daily life situations in the classroom environment (Çilingir & Artut, 2016). More than one sensory organ should be addressed in the education given (Yenilmez & Bozkurt, 2006). In this way, the mathematics course concretized will lead to an increase in the level of learning (Dündar et al., 2015). In addition, students will be active in their learning processes, and they will be able to gain the skills, attitudes and knowledge important for their own lives (Piht & Eisenschmidt, 2008; cited in Çilingir & Artut, 2016). This will make learning permanent, yet it is important to ask the right questions to the students in this process. In addition to the questions asked, the solutions

Received Date: 04/09/2023 **Accepted Date:** 13/12/2023 **Publication Date:** 21/03/2024

*__To cite this article:__ Ertem-Akbaş, E. & Yıldırım, L. (2024). Examining 5th grade students' learning on surface area calculations with realistic mathematics education approach. *International e-Journal of Educational Studies, 8* (16), 14-31. https://doi.org/10.31458/iejes.1354835

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should be shaped accordingly. In addition to the questions asked, the solutions to these questions should be shaped accordingly. As there is a direct proportion between a good-quality teaching process and understanding mathematics, it is necessary to make use of different approaches (Turgut, 2021). Different methods and techniques will have a positive impact on students (Piht & Eisenschmidt, 2008). Realistic Mathematics Education (RME), which emerged as a way of combining mathematics education with the situations students have experienced in this process, will be able to help students focus on the problem, question the problem and think (Akbaş & Alan, 2022). Regarded as an alternative to blending the language of mathematics with real-life situations, RME also provides students with the opportunity to use mathematical tools so that they can organize and solve the problem situations (Heuvel- Panhuizen & Drijvers, 2014). The term *real* is stated as expressing real-life situations from an empirical point of view, and it is seen that problems do not have to involve only real-life situations. In addition, the actions that students will perform should be something they can experience (Gravemeijer & Kapıcı, 1999). Therefore, it is seen that in mathematics teaching, reality and student experiences should be closely interrelated (Van den Heuvel-Panhuizen, 2001). RME plays an important role in moving from everyday life to the world of symbols. With the help of mathematical activities carried out in this way, more than one focal point is formed in students, and it is important for the student to find the right questions and follow-up instructions in this process.

RME was first used as an approach in mathematics teaching by the Freudenthal Institute in the Netherlands. Later, it was seen that it was adopted as a popular approach in countries such as England, Denmark, Germany, Spain, Brazil, Portugal, Japan and Malaysia (Demirdöğen & Kaçar, 2010). RME is based on Freudenthal's view that "Mathematics has to be connected with reality" and "Mathematics is a human activity" (Freudenthal, 1991). Formalization happens by modeling, symbolizing and schematizing. In this process, which is described as mathematization, students reach mathematical information themselves (Altun, 2002). The realistic Mathematics Education approach starts with a real-life problem. Students learn mathematics while solving this problem. Mathematization involves reaching the mathematical concept through the concept acquired as a result of daily experiences; in other words, reaching the formal information is the last step. The first step of mathematization is horizontal mathematization. Horizontal mathematization is the transition from everyday life to the world of symbols. The second step of mathematization is vertical mathematization, which is defined as moving through the world of symbols (Çilingir & Artut, 2016). This last point should not be the first point of the mathematics we teach (Üzel, 2007).

When the literature is reviewed, it is seen that the Realistic Mathematics Education approach increases the quality and success in teaching, provides meaningful and permanent learning, and helps students develop a positive view towards mathematics (Çilingir, & Artut, 2016; Kutluca, & Gündüz, 2022; Saracoğlu & Uça, 2017; Üzel, 2007). This is an indication that RME has had positive effects on learning.

Calculation of surface area in mathematics education is an important problem in mathematics education because these calculations have been used to reveal not only the practical applications in many different fields but also many problems in daily life. Here are some areas where calculating the surface area is important:

Construction and Architecture: Calculating the surface area is important in construction and architectural projects, when designing a construction or calculating the materials. For example, surface area is used to calculate the amount of paint needed to paint the exterior of a house or to determine the wall cladding material needed for a building. In a study conducted to investigate the effect of building envelope surface area and insulation thickness on energy saving in Elazig, one of the coldest cities in Turkey, it was concluded that in an energy-efficient building design, the building envelope surface area must be taken into account; that the surface area was shaped according to the direction of the

building; and that the surface area was a parameter to be taken into account (Aksoy & Keleşoğlu, 2007).

Industrial Manufacturing: In manufacturing processes, it is important to manage the surface area to identify resources. In a study on energy saving and emission reduction opportunities in industrial annealing furnaces, it was concluded that insufficient heat transfer surface area was a factor on savings and that a new recuperator with more heat transfer surface area was needed to reduce the flue gas temperature at the furnace exit (Eyidoğan et al., 2014). This reveals that surface area calculations are of vital importance as well as being effective in terms of economic factors.

Engineering: In engineering, surface area calculation is important in many design and analysis processes. For instance, calculating the surface width of a pipe passing through a heat exchanger or a screen is an important factor for efficiency and performance analysis.

Agriculture: With the rapid increase in population, it is important to make more systematic estimations of agricultural production and consumption. Here, again, the surface area calculation comes into play. There are various studies in relation to this. Hobson (1972) presented the first studies on the estimation of real surface area values. On the other hand, Jennes (2004) conducted studies on why it is important to calculate real surface area values correctly.

Graphic Design and Drawing: The field of graphic design and drawing is important in terms of directing the surface effect, use of materials and visual impact. For example, when designing an advertising distribution or creating a 3D model, the surface area must be calculated correctly.

Computer Graphics and Game Development: Surface area calculation is important for computer graphics and game development, 3D imaging and visual effects. Accurate surface area calculations are used for operations such as lighting, shading, and collision detection. It is known that the perception of space in computer games is directly related to the user's point of view (Ayanoğlu, 2006). Accurate reflection of this point of view is also possible with the correct calculation of the surface area.

Mathematical Modeling: Mathematical modeling is defined as a field that transforms real-life situations into a mathematical problem, allows creating the necessary mathematical models to solve the problem and helps interpret the results (Berry & Nyman, 1998, cited in Bukova Güzel, 2011). Therefore, it is important to calculate the surface area while modeling. Similarly, mathematical modeling activities have a supportive role in students' mathematical explanation of a situation that requires area measurement as well as in their structuring mathematical relations (Kutluca, & Kaya, 2023; Erdem & Gürbüz, 2018). For this reason, it is possible to see mathematical modeling and surface area calculation as mutually contributing factors.

In this respect, knowing the surface area of the prism, which is one of the geometric shapes, is important in real life because a prism is a geometric shape used in many areas in real life. Joining the surface of prisms plays an important role in many practical applications and design processes. Here are some known reasons why the surface arrangement of the prism is important:

Construction and Architecture: Prisms are building elements commonly used in construction and architectural projects. For example, the roof of a house or the facade of a building can be prism-shaped. It allows an accurate calculation of the surface coating of the prism, material consumption and costs. It is also important in design-related decisions, with factors such as surface area, heat transfer, utilization, and energy consumption.

Packaging and Transportation: Prism-shaped boxes are used in the packaging and transportation industries. For example, a product packaging or a shipping box can be prism-shaped. Expanding the surface of the prism also helps not only calculate material consumption and cost but also design it in ways suitable for safe handling and distribution.

Optics and Lighting: Prisms are used in optics, mirrors, mirroring and lighting. For example, prisms are essential parts of an optical device because of their reflecting light, scanning or scattering

properties. The surface area of the prism also has influence on the interaction of light and optical performance effects. Additionally, prismatic magnifiers consist of prisms, and this type of magnifier refracts light with the help of the prisms on it. These prisms increase the magnification ratio and the field depth by extending the path of the light with the help of mutual mirrors between the lenses. They also increase the field of vision by providing a longer distance for working (Karaca & Gündoğdu, 2018). Due to these connections, it is possible to talk about the importance of prisms in many areas like expanding the surface of the prism, design, cost calculations, material usage, performance analysis and system optimization.

1.1. Purpose of the Study

Within the scope of the study, 5th grade students were taught the learning outcome of "students can calculate the surface area of a rectangular prism" with Realistic Mathematics Education, and the purpose of the study was to determine the opinions and suggestions of the students.

1.2. Research Problem

The main problem of this research was to determine students' views about the RME-based teaching of the learning outcome of "can calculate the surface area of the rectangular prism" within the scope of the lesson unit of "Geometry and Measurement" in the 5th grade primary school mathematics course. It is possible to list the sub-problems of the study as follows:

- Within the scope of the education given in line with the RME approach, what kind of strategies were developed related to the learning outcomes of "students can recognize the rectangular prism and determines its basic elements" and "students can draw the surface expansions of the rectangular prism and decide whether the given different expansions belong to the rectangular prism"?
- Within the framework of RME approach, can the students construct formal knowledge regarding the learning outcome of “students can solve problems that require calculating the surface area of a rectangular prism”?
- To what extent 5^{th} grade students could transfer their knowledge about the rectangular prisms to different kind of prisms?

2. METHOD

2.1. Research Model

In this study, action research, one of the qualitative research methods, was used. In action research, process-oriented work is carried out; practice is done; and detailed and in-depth examinations and observations are made. In addition, it is a flexible approach that can bring together the research and application process and make it possible to transfer research results into practice. In this approach, the practitioner is also in the role of researcher (Türkkan et al., 2019; Yıldırım & Şimşek, 2018). This situation also exists in qualitative research itself, and in qualitative research, the researcher is also at the base of the study (Fraenkel et al., 2011).

2.2. Study Group

The study was carried out by the researcher with the participation of 20 5th grade students in a public school in Turkey by taking the necessary permissions. Maximum variation sampling was preferred as the purpose was to increase the variety in sample selection. The purpose of using maximum variety sampling is to increase the diversity of individuals in the study conducted on a small sample and to approach to the problem from different perspectives (Yıldırım & Şimşek, 2018). In this study, the aim was not to give the formula directly while calculating the surface area of the prisms, but to allow the students to discover the calculation on their own. As the practitioner undertook the role of

researcher in the study, the students were selected from the class that the practitioner taught. While examining the data, the students were coded as S1, S2,…, S20, and the researcher was coded as "A".

2.3. Data Collection Tool

The research data were collected using more than one data collection tool in order to ensure diversity in the study. The data were collected with the help of a semi-structured interview form made up of 5 open-ended questions, video footage, photographs and activity sheets prepared by the students with the help of the researcher by taking into account the RME approach. While preparing the semi-structured interview form, the related literature was reviewed, and the interview questions used in the study were examined. Likewise, the questions to be directed during the activity were determined and examined. The preparation stages of the activity sheets prepared by the students are presented in Appendix 1. In the semi-structured interview technique, the researcher prepares the draft of the questions in advance which he/she intends to ask (Türnüklü, 2000). The semi-structured interview form is presented in Appendix 2. This interview form generally aimed to obtain information about how the RME approach had an impact on learning. Necessary permissions were obtained for the video and photo shooting. Photos for the use of RME are presented in Appendix 3.

2.4. Data Analysis

While analyzing the data obtained in the research process, descriptive analysis and content analysis, which are among qualitative analysis methods, were used. With descriptive analysis, the data were made meaningful and transferred to the process in that way (Merriam, 2009). These data were interpreted considering the themes determined before the process, and the opinions of the individuals were directly included (Yıldırım & Şimşek, 2018). In content analysis, on the other hand, the basic operation ensures that similar data are combined on a common denominator and that this can be interpreted for the reader in accordance with the principle of clarity (Yıldırım & Şimşek, 2018). In this respect, while coding the data, concepts with similar meanings were brought together on a common denominator and named. This would make it possible for concepts from different sections to come together (Yıldırım & Şimşek, 2018).

2.5. Procedure

The teaching was carried out by the researcher. For the study, the general principles of teaching based on RME were explained to the students, and activities regarding the learning outcome of "can calculate the surface area of the rectangular prism" found in the curriculum. In these activities which included contextual problems, there was actually a real situation in each problem. While the students were looking for solutions to the problems, they reached the concepts and formulas in the lesson unit themselves.

Problem: Ali Asaf goes to the mall to buy a gift box with his father to put the gift he made for his mother. He likes the gift boxes he sees here, and the shapes of these boxes attract his attention.

2.5.1. Sample Activity 1

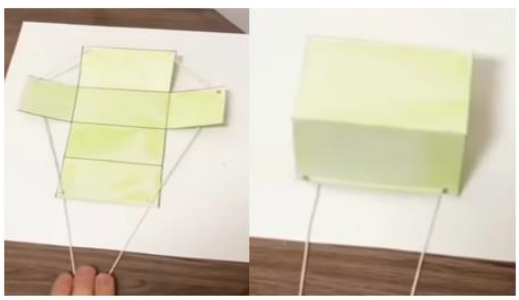

Figure 1. Rectangles Prism

- What is the name of this shape? Produce its definition
- Represent the opened form of the shape you have defined
- Define the geometric shapes you have obtained in their opened form
- Determine the areas of these geometric shapes
- Calculate the area of the geometric figure by using these areas.

The objectives of area calculation of the rectangular prism and knowledge of the properties of the rectangular prism were achieved with this study.

While a certain group in the class stated that it was due to the rectangular base, the remaining majority stated that it was due to its side surfaces. However, as a result of the shapes designed in different sizes, it was agreed that it was caused by the base. All the students were able to draw the opened form of the figure, and in this respect, as a result of the desired steps, the students discovered the formula for calculating the area of the rectangular prism.

Sample Activity 2

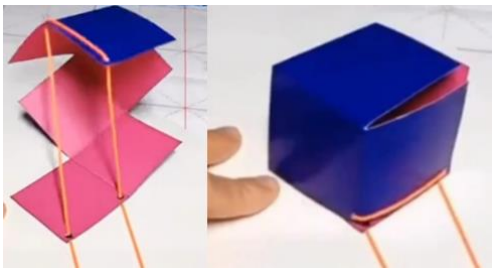

Figure 2. Cube

- *What is the name of the sample shape? Make its definition.*
- *Define the open form of this shape, and interpret its similarities and differences with the rectangular prism.*
- Calculate the area of the shape using its open form.

As the students came across the cube shape frequently in daily life, all of them knew the name of the shape correctly. In the square prism, the students were sure that the naming stems from the shape in the base. In this study, the students who examined the similarities and differences with the rectangular prism concluded that the square prism and the cube are special cases of the rectangular prism. The students who obtained the open form of the shape again obtained the areas of the prisms as a result of their own discoveries.

3. FINDINGS

In this part of the study, the activity sheets prepared by the students during the process, semi-structured interview forms, the photographs and videos taken during the lesson, and the findings obtained via the analysis of the data collected as a result of the observations are included.

Table 2. Flexible prisms activity

Theme	Categories	Codes	Frequency
Flexible Prisms	Theoretical Approach	Using Formulas	17
		Prism-Cube Misconception	3
		Factor Confusion in Prism Naming	15
	Practical Approach	Lack of Element Knowledge Required to Build	6

	Prisms	
Thinking Based on Visualization	Prism-Cube Distinction	3
	Square Prism and Rectangular Prism Distinction	14
	Square Prism-Cube Distinction	8
Formula-Based Thinking	Ability to Determine Side Lengths	9
	Having a Result-Oriented Approach	9
	Making Use of Geometric Shapes Obtained by Expansion	20
Transferring Knowledge	Using Prior Knowledge	20
	Making Sense with the Help of Model	18
	Desire to Visualize	18
Staticized Knowledge	Rectangular Prism-Square Prism-Cube Distinction	3
Positive Acquisition	Obtaining the Formula	18
	Ability to Transfer Knowledge to Other Prisms	20
Negative Acquisition	Dimension-Height Misconception	7

The themes and codes obtained with the Flexible Prisms Activity are given in Table 2. When the table was examined, it was seen that all of the students found the area of the prisms by making use of the expansion of the prism and associating it with their previous learning. Similarly, they made generalization about making area calculations for different prisms.

The analysis revealed that the students experienced conceptual confusion especially in relation to rectangular prism, square prism and cube shapes. It was seen that they were able to distinguish the cube after establishing a relationship with daily life, yet there was confusion between rectangular prism and square prism. An example of this situation was as follows:

Researcher: (The students were shown the Rectangular Prism shape) What is the name of this shape you see?
Students: Rectangular prism.
R: (Showing the Square Prism shape): So what's the name of this shape?
Students: This is a rectangular prism too.
R: Are you sure, children?
S6: Teacher, the sides of both are rectangular.

R: So what is the difference between the two shapes?
S19: All the rectangles on the side in one of them are the same, and in the other, two are different, and two are the same.

R: And if we change the dimensions, will this change?
S4: No, teacher, all the rectangles are the same in one of them, and in the other, two will be the same.

R: Then what distinguishes these shapes from each other is their side faces, isn't it?
S1: Teacher, can it be the base?

R: How?
S1: When the base is square, the rectangles on the side are the same, but when the base is rectangular, only two on the sides are the same.

R: Good for you. Then what would their names be?

S1: The first is rectangular prism, and the second is square prism.

While the students had static thoughts in the conversation with the researcher, they discovered this difference with the help of the clues and visuals given after the conversation. In this conversation, the following dialogue shows how to make the cube distinction.

R: (Showing the Square Prism shape) Guys, we called this shape a square prism, right?

Students: Yes, teacher.

R: Well, can I change the height of the rectangles on the side?

S14: But if we change the height, it will not be a square.

At this stage, the student made a dimension-height error and it was observed that six more students repeated the same thing.

S5: Why does the square change if the height changes?

S7: Because all the side lengths of the square are equal

S5: The height does not change the sides of the square.

S14: How so?

S5: Look, the parts that coincide with the sides of the square do not correspond to the height.

S14: Ohh, right.

R: Well done guys. So let's change it. (The height was gradually transformed into a cube shape.) What is the name of this shape then?

Students: Square prism

R: Shall we close our shape?

Students: Yes, teacher.

R: What do you think it looks like

S11: It looks like a sugar cube, teacher.

Students: Yes, it looks like a sugar cube, it's called a cube.

R: What distinguishes this shape from other shapes?

S2: In this, all sides are the same.

S13: The height of the cube is the same as the base sides, teacher.

At this point, the students tried to name them based on memorization, yet with the necessary clues, the students were able to reach the correct answers. While calculating the area of the shape, the students obtained the formula themselves by making use of the open form of the figure. At this stage, the following conversation took place:

S16: Teacher, if we will look at the shape, we will see that

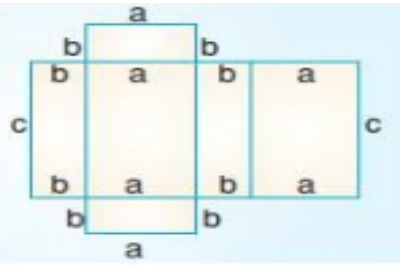

Figure 3. Open Form of the Rectangular Prism

there are six rectangles here (calculates one by one: ab, bc, ac, bc, ac, ab). If we add them up, we find the area: ab+ bc+ ac+ bc+ ac+ ab

R: Good for you. Well, let's show it another way.

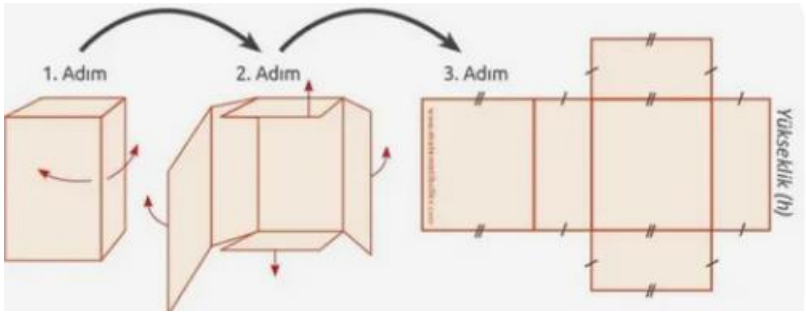

Figure 4. Opening the rectangular prism

S3: Teacher, if we name the sides as a, b, c, we get the same thing again.

S20: Teacher, there are already two of the same shapes. Wouldn't it be easier to find them and multiply them by 2?

R: How?

S20: I mean first we find (ab+ac+ab) and then we multiply it by 2.

R: Well done. very good idea ☺

In this way, the student found the formula of Area = 2(ab+ac+bc) with his own association, and in the later stages of the lesson, the students obtained formulas for square prisms and cubes with similar reasoning.

Table 3. Findings obtained via the semi-structured interview form

Thema	Categories	Codes	Frequency
Calculating the Surface Area of Prisms Using RME	Positive Effects on the Process	Visualization	20
		Having Fun	18
		Positive Thinking about Mathematics	18
		Ability to Open and Close the Shape Anytime	20
		Ability to Interpret Concepts	10
		Developing self-confidence	12
		Being able to see the difference between shapes	20
		Possibility to Distinguish Between Shapes	20
	Negative Effects on the Process	Failure to Place Ropes	8
		Not Closing the Shape Due to Determining the Side Lengths Wrong	9
		Tearing the Shape When Making a Hole	2

4. DISCUSSION and CONCLUSION

In the study, the learning outcome of "Can calculate the surface area of the rectangular prism", which belonged to the elementary school 5th grade mathematics lesson unit of "Geometry and Measurement", was taught to the students with the realistic mathematics education. As a result of the semi-structured interviews held with 20 students in the experimental group after the teaching of this learning outcome, it was observed that the students' thoughts about the realistic mathematics education approach were positive. When the findings obtained in the study were examined, it was seen that the

students were able to reach the rules of mathematics teaching on their own if the necessary environment was provided. It was revealed that after the teaching process conducted with realistic mathematics education activities, the students' attitudes towards the mathematics lesson in general increased. In addition, the students liked the lesson more, and they enjoyed the lesson. Moreover, the lesson became more fun, and they understood the subject better. Additionally, their participation in the lesson and their self-confidence increased as well.

The findings obtained in the study showed that the students' reasoning was in the background and that they tried to progress by using the memorization technique with the help of result-oriented approach. When the literature was examined, it was seen that there were many studies conducted on the negative effects of the memorization approach in mathematics education (Çimen, 2012; Özkan & Sezen, 2017). In addition, there were also other various studies with contents similar to the codes we obtained (Akbaş, 2021; Okuyucu & Erdoğan, 2021). As it can be understood from these studies, educators who consider the process with a memorization approach may cause students to have static thoughts, and students should therefore be allowed to think freely. However, it was observed that the students' lack of self-confidence, fear of making mistakes, inability to adapt to daily life and their inability to make inferences on their own cause them to be weak both in theory and in practice. There are studies in the literature that reached this conclusion (Arslan & Yıldız, 2010; Yenilmez & Dereli, 2009). The situation that the students liked most was that they could turn the object on and off. The fact that the students could touch them personally not only improved their imagination but contributed to their mathematical processing skills as well. There are studies in which similar results were obtained (Mutlu & Söylemez, 2019; Zengin, 2017).

Similarly, the students were provided with the opportunity to reinforce the concept of dimension and to develop their three-dimensional thinking skills. According to the findings, it was concluded that the students had positive views on the teaching method supported with realistic mathematics education. Based on the findings of the study, the following suggestions could be put forward:

Especially in geometric subjects, students should be allowed to touch the shape. Realistic mathematics education is suitable for providing this environment. In order to determine the effect of realistic mathematics education, quantitative research could be conducted according to different subjects or to different levels of the mathematics course. Realistic mathematics education could be taught as a course in education faculties of universities, and preservice teachers could be trained accordingly. Teaching materials necessary for the application of realistic mathematics education in teachers' classes can be obtained. In addition, necessary training can be provided so that teachers can have information about realistic mathematics education before they start to work.

It should be considered that if students are encouraged to adopt three-dimensional mathematics, this will have positive academic effects. It is thought that this will make the teaching process efficient and help increase the quality of education.

Ethics Committee Decision

This research was carried out with the permission of Van Yüzüncü Yıl University Publication Ethics Board with the decision numbered 17135 dated 04.08.2023.

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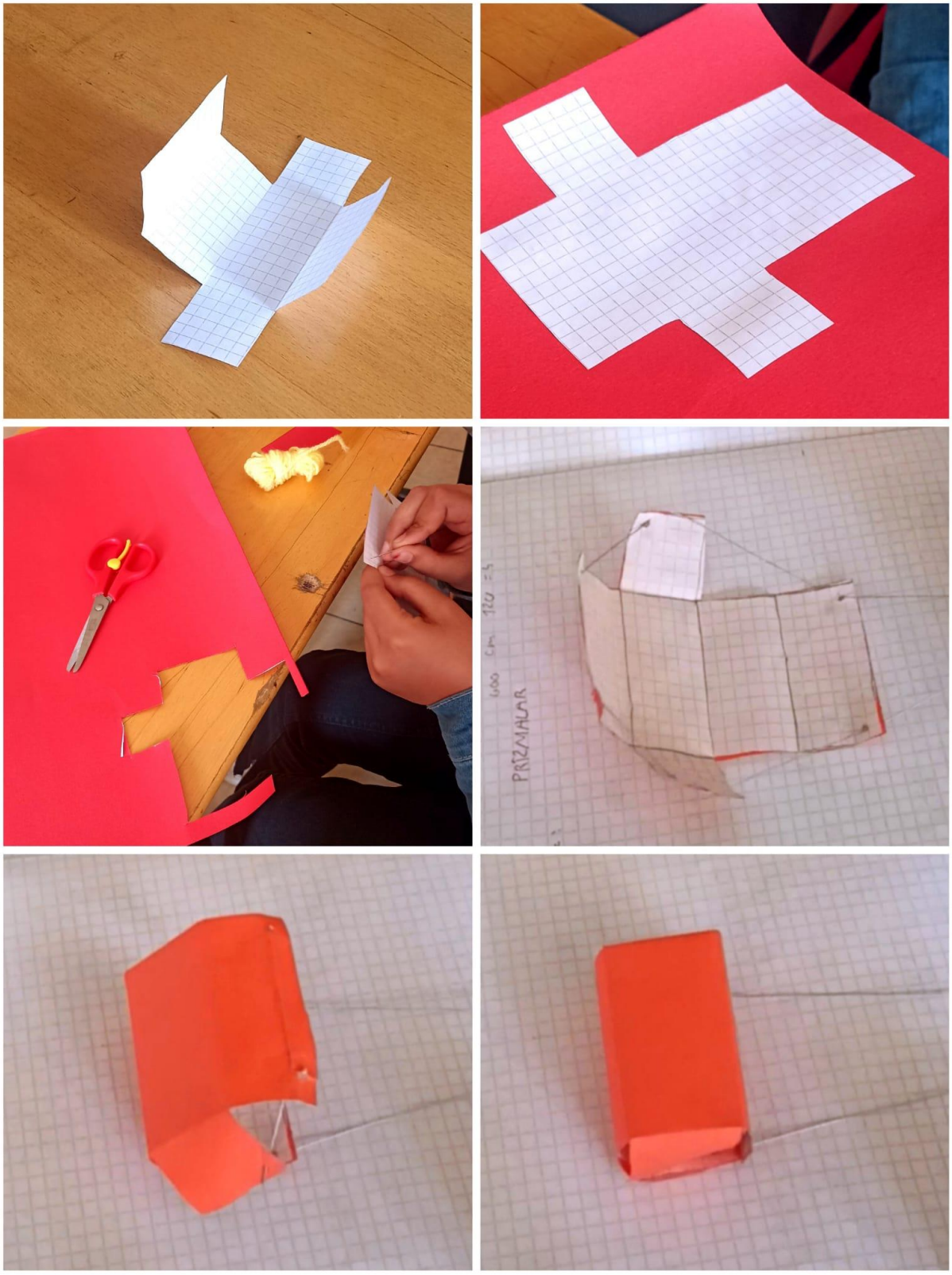
APPENDIX
APPENDIX 1.



APPENDIX 2.

STUDENT INTERVIEW FORM

Dear students, your sincere answers in the study will contribute to the quality of the study. Thank you in advance for your hard work.

1. Do you think that concrete tools should be used in teaching mathematics? Please explain.

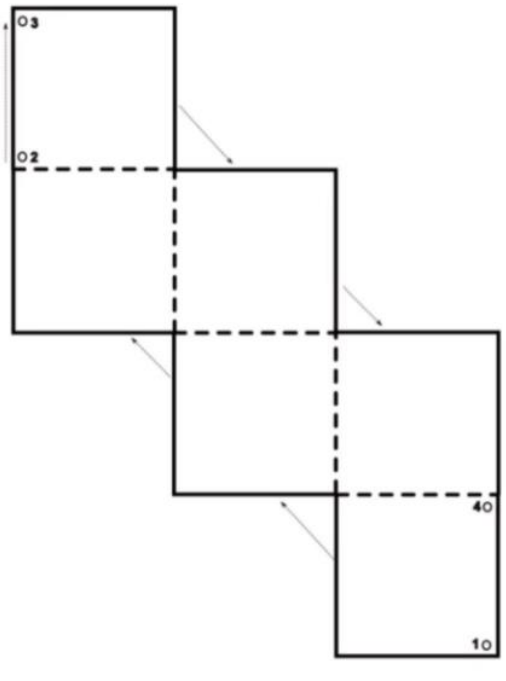
2. Did the use of Realistic Mathematics Education in Mathematics lessons facilitate learning? Please indicate your opinion about this.

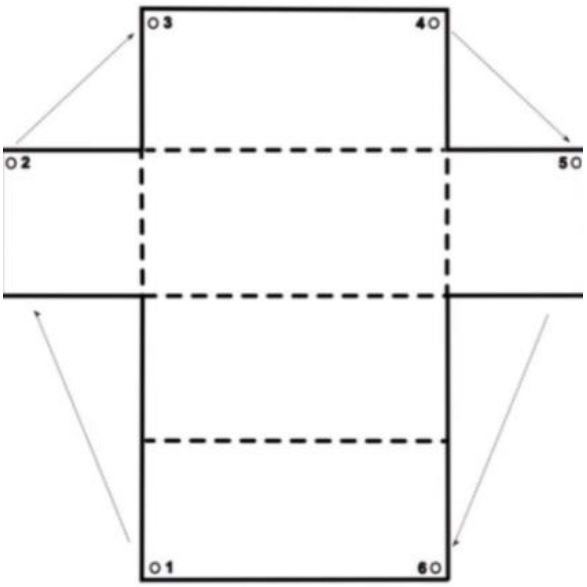
3. How did the use of Realistic Mathematics Education affect in-class participation? Please explain.

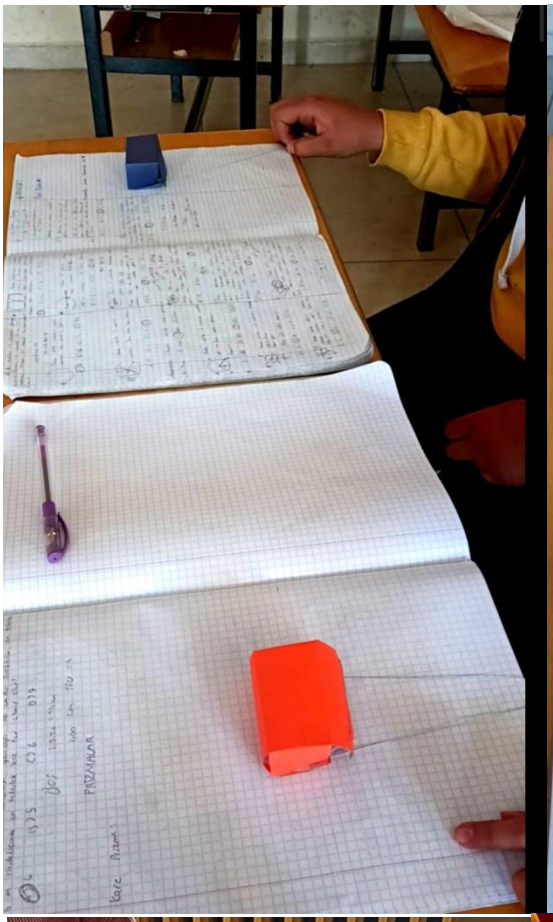
4. In which subjects do you think Realistic Mathematics Education can be more effective?

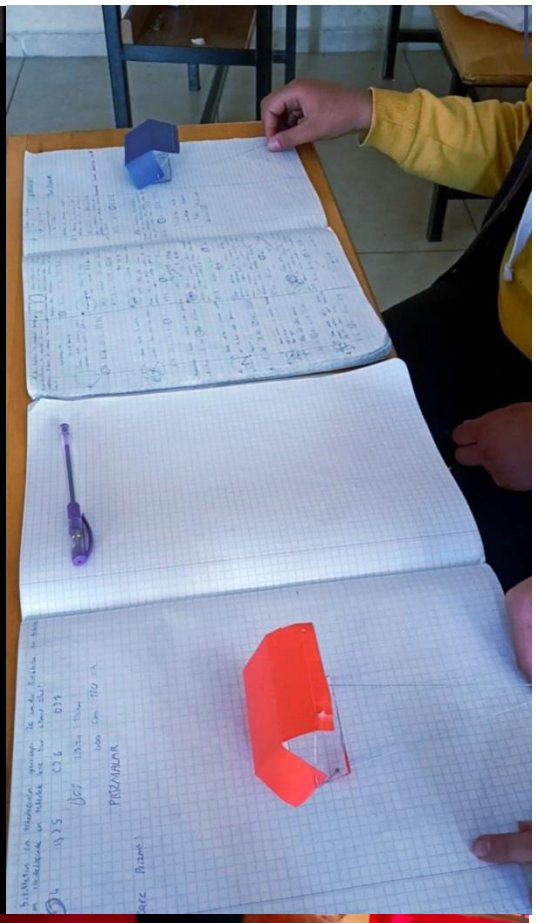
5. Did Realistic Mathematics Education change your attitude towards math lesson? Why?

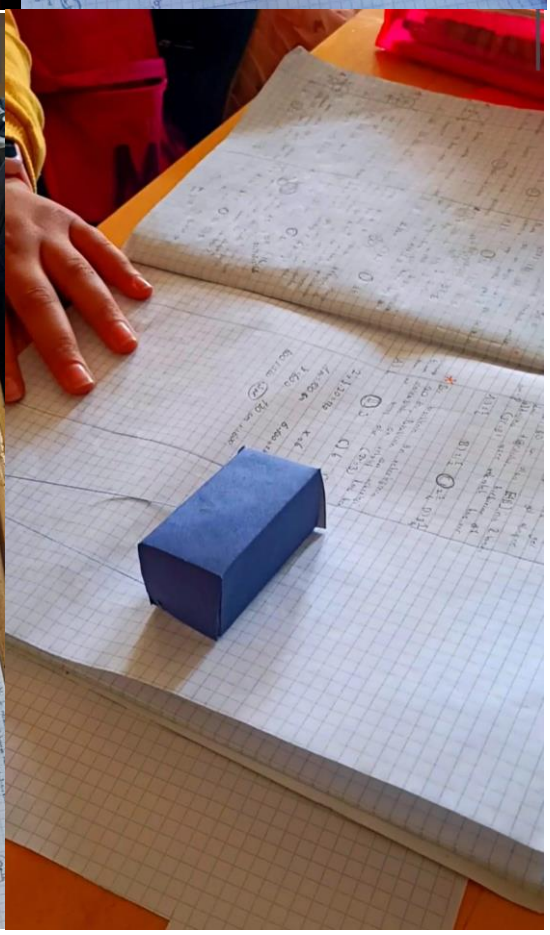
APPENDIX 3.
PHOTOS OF THE USEO F RME

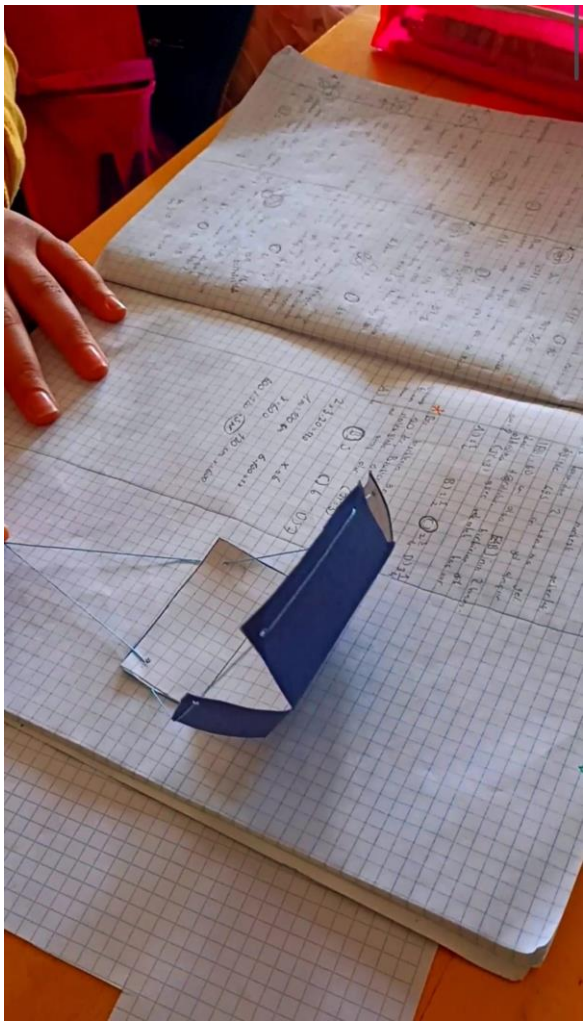


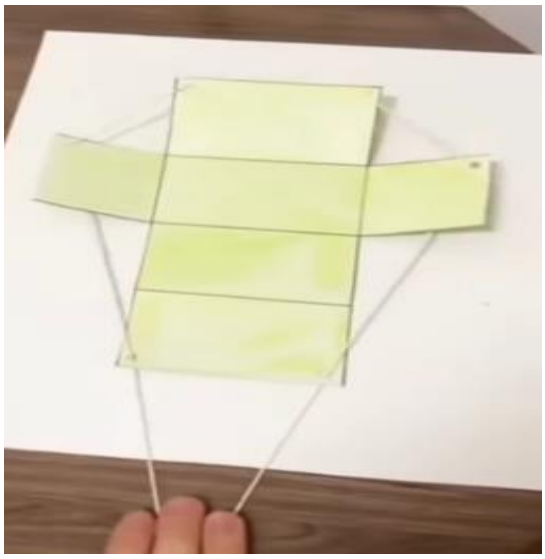












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