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CHARACTERISTICS OF MATHEMATIC BOOKS FOR JUNIOR HIGH SCHOOL GRADE 7 MERDEKA CURRICULUM: PRAXEOLOGICAL ANALYSIS OF CUBOIDS VOLUME

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Abstrak: Penelitian ini bertujuan untuk menganalisis karakteristik buku matematika yang digunakan dalam Kurikulum Merdeka pada kelas 7 SMP, dengan fokus pada analisis praksiologi dalam konteks balok volume. Metode penelitian yang digunakan adalah analisis konten dengan pendekatan empat komponen praksiologi. Empat komponen itu adalah jenis tugas, teknik, teknologi dan terakhir adalah teori. Hasil penelitian menunjukan bahwa desain buku teks tidak memberikan type of task yang memfasilitasi siswa untuk memperoleh teori secara mandiri. Hal ini, memandu peneliti untuk membuat desain alternatif untuk task yang menyediakan pengalaman belajar yang bermakna pada pengacuan materi volume balok.

Kata kunci : *Buku Ajar Matematika, Praksiologi, volume Balok*

Abstract: This study aims to analyze the characteristics of the mathematics books used in the Merdeka Curriculum in grade 7 junior high school, with a focus on praxeological analysis in the context of volume cuboids. The research method used is content analysis with a four-component approach to praxeology. The four components are types of tasks, techniques, technology and the last is theory. The results of the research show that the design of textbooks does not provide a type of task that facilitates students to acquire theory independently. This, guides researchers to create alternative designs for the task that provides meaningful learning experience in reference to cuboids volume material.

Keywords: *Mathematics Textbooks, Praxeology, cuboids volume*

INTRODUCTION

Mathematics education has an important role in helping students understand mathematical concepts in depth and develop their ability to solve mathematical problems. One of the topics taught in mathematics is the volume of a flat side shape. This concept involves understanding how to calculate the volume of geometric shapes, such as cuboids, cubes, and cylinders. Understanding the concept of the volume of geometric shapes such as cuboids also plays a role in developing students' spatial skills. Understanding the volume of a geometric shape helps students visualize and manipulate objects in NCTM space (2000). The concept of geometric volume has direct relevance to everyday life situations. Clements & Sarama (2007) said that understanding the concept of volume shapes helps students

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associate mathematics with real contexts, and apply mathematical knowledge in everyday life. In teaching the concept of geometric volume, the use of effective and relevant teaching materials is very important. Previous research has shown that the quality of mathematics teaching materials has a significant influence on students' understanding. However, there are only a few studies that specifically analyze volume teaching materials on flat side shapes using a praxeological approach. Therefore, this study aims to fill this gap by analyzing the volume teaching materials of existing flat side shapes using a praxeological approach.

In the world of education, praxeology has been widely used both in research and in the learning process. Praxeology in research is used for book analysis. According to Chevallard (2019) no human action is carried out without the thoughts behind it. The ideal human action is one that fulfills the four elements which are then better known as components in praxeology. The components in praxeology are the Type of Task, Technique, Technology and Theory. According to Cobanoglu & Silay (2018) the praxeological approach can be a useful theoretical framework in analyzing teaching materials. In the context of this research is a textbook in the material of cuboids volumes. The praxeological approach involves an understanding of the practices that occur in the classroom and the learning context.

By using a praxeological approach, researchers can analyze how the teaching materials used facilitate students' understanding of the concept of volume of cuboids and how students interact with these teaching materials. In this study, the teaching materials to be analyzed were textbooks that were often used in junior high school mathematics learning. The book being analyzed is the student handbook for grade 7 junior high school using the independent curriculum published by Erlangga. An analysis will be carried out on the content of teaching materials and how these teaching materials facilitate students' understanding of the concept of volume of cuboids. The results of this study are expected to provide a better understanding of the effectiveness of existing flat sided volume volume teaching materials in supporting mathematics learning. In addition, this research can also provide recommendations for the development of teaching materials that are better and more relevant to the praxeological approach in the context of learning the volume of a flat side shape in this context is the volume of a cuboids.

RESEARCH METHOD

The research method used is qualitative research with content analysis. Content analysis of textbooks involves an analysis of the content and activities presented in the content. According to Zuchdi & Afifah (2021) Content analysis always involves connecting or comparing findings with several criteria or theories. The theory used for the process of analyzing textbooks is to use the theory of praxeology. According to Chevalard et all (2022) Praxeology has 4 components, namely the first type of task is the

task presented in the book. The second is technique, namely the consequences and orders of what can be done based on the type of task. The third is technology related to the motives or reasons behind the technique by the author of the book. The last is theory. At this stage will be analyzed whether the type of assignment is in accordance with the theory.

The research process for the analysis of geometric material books with praxeological theory involves the following steps, Heinze & Reiss (2019):

1) Selection of Textbook Samples in which the researcher chose mathematics textbooks for class VII junior high school independent curriculum publishers erlangga with material limitations being the volume of cuboids.
2) Content Analysis: Researchers read the contents of the textbook thoroughly. record relevant information about the type of task and the representation of the concept.
3) Praxeological Analysis: Researchers identify and analyze how textbooks on material are volumes of cubes and cuboids applying praxeological principles in presenting the material and activities presented.
4) Recommendations for design alternatives: Based on the results of the analysis, the researcher tries to compile recommendations for improving textbooks in supporting learning of cuboids volumes with a praxeological theory approach.

RESULTS AND DISCUSSION

The material in the textbooks analyzed is limited to the volume section of cuboids and cubes. There are several types of tasks presented in textbooks. In the following, the material design for the volume of a cuboids formula is presented in the textbook.

1. Learning activity 1 (material design 1) for the volume of cuboids

The volume of a cube with a side length of 1 cm will be referred to as the volume of an object of 1 cm3. Besides the cm size, we will also use other length sizes.

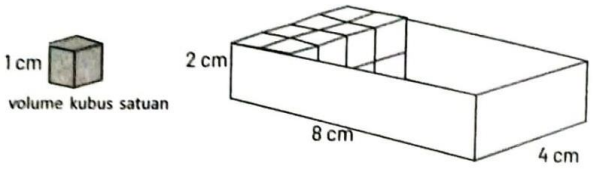

Figure 1. Objective exercise 1

Suppose we have a box measuring 8 cm long, 4 cm wide and 2 cm high. We can arrange a cube measuring 1 cm along 4 lanes, each lane containing 8 pieces of 2 layers. So, the number of unit cubes that can be loaded is 8 x 4 x 2 = 64. This number is called the volume of the box and is written as V =

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64 cm3 . Like area, the volume of a 3-dimensional object is the ratio of the volume of the object to the volume of a cube with a side length of 1 cm.

Table 1. praxeological components

Type of task	Technique	Technology	Theory
The volume of a cube with a side length of 1 cm will be referred to as the volume of an object of 1 cm3. Suppose we have a box measuring 8 cm long, 4 cm wide and 2 cm high. We can arrange a cube measuring 1 cm along 4 lanes, each lane containing 8 pieces of 2 layers. So, the number of unit cubes that can be loaded is 8 x 4 x 2 = 64	Put the small cubes into the big box (cuboids) until it is full. Verify that the volume of the cuboids = length x width x height	The contents of the large box (cuboids) are the number of small cubes that fill the cuboids	The volume of the cuboids is the number of small cubes that fill the cuboids

This approach helps in conceptual understanding through practical experience. However, the type of task above does not support students to build their own new knowledge. The type of task above only carries out direct verification, namely students are asked to carry out these activities and immediately get the formula for the volume of a cuboids. The technique used in the activity above is that students are directed to verify that the volume of a cuboids is length x width x height through 1 activity. This technique does not support the fact that students' academic abilities and students' ways of thinking are different.

2. Learning activity 2 (material design 1) for the volume of cuboids

Robert really likes swimming because he thinks swimming is very fun. In addition, Robert felt the many benefits of swimming. Swimming can reduce stress, improve heart health, increase endurance,

tone muscles. and increased hand and leg strength. Robert swims once a week in a swimming pool with a length of 10 m, a width of 5 m and a height of 1.2 m. The sketch of the swimming pool is as follows:

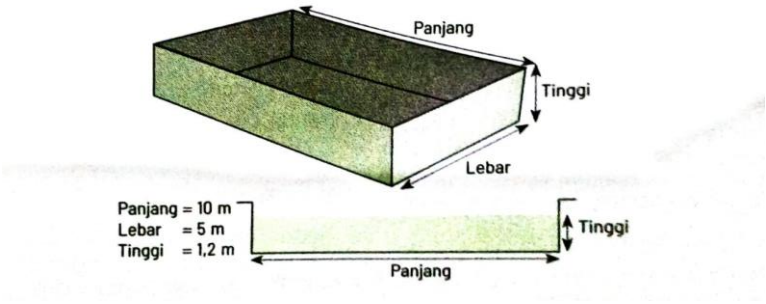

Figure 2. Objective exercise 2

Based on the information above, put a tick (✓) in the box in front of the statement for the correct answer.

☐ The volume of the swimming pool is 60 liters.

☐ The swimming pool can hold a maximum of 60,000 liters of water.

☐ The volume of the swimming pool is 60 m^3.

☐ The capacity of the swimming pool can be filled with water as much as 6,000 dm^3.

Table 2. praxeological components

Type of task	Technique	Technology	Theory
Robert swims once a week in a swimming pool with a length of 10 m, a width of 5 m and a height of 1.2 m. Check whether the statement below is true! • The volume of the swimming pool is 60 liters.	Do the questions as requested. Practice how to determine the volume of a pool with the formula volume of a cuboids = length x width x height.	Determine the volume of the pool by calculating the length x width x height	Volume of the cuboids = length x width x height

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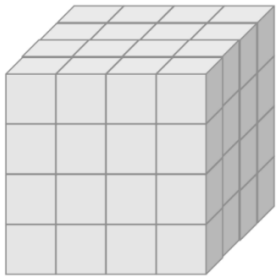
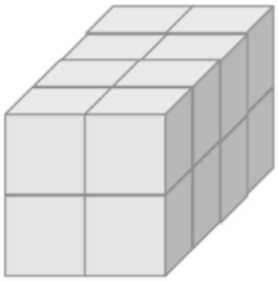
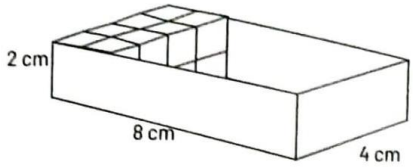
Type of task	Technique	Technology	Theory
• The swimming pool can hold a maximum of 60,000 liters of water. • The volume of the swimming pool is 60 m^3. • The capacity of the swimming pool can be filled with 6,000 dm^3 of water.			

For the type of task above it is closed so that students cannot develop their own way of thinking and students' creative power cannot be raised. The technique used is to calculate the volume of the pool with the volume of the beam = length x width x height. This technique also cannot support the diversity of students in terms of their way of thinking. With a closed type of task it will affect the didactic situation. According to Suryadi (2018) a didactic design that has a closed nature will result in epistemological obstacles. In addition, the questions presented are a form of verification of the volume of the pool or cuboids. This results in obstacles to children's creative thinking power. According to Suryadi (2013) based on the theory of imitation from Albert Bandura that if students are given learning with a verification process, consider background and foreground students so that ontogenic barriers do not occur.

3. Recommendations for alternative design of learning activities for volume cuboids.

Table 3. praxeological components

Type of task	Technique	Technology	Theory
The volume of a cube with a side length of 1 cm will be referred to as the volume of an object of 1 cm3  volume kubus satuan	Counting in various ways depending on the student's point of view.	Get the number of cubes according to the learning experience and abilities of each student	Volume = Length x width x height based on the size of the small cube

Type of task	Technique	Technology	Theory
Then the stack of cubes below has 64 pieces. Can you explain how to calculate it.. 			
How many small cubes are in the image below? How do you calculate it? 	The way to calculate what you want is to multiply the length, width and height according to the previous task	It is desirable that the learning experience in task 1 can help direct how to calculate in task 2	Volume = Length x width x height based on the size of the small cube
If there is a box with the size as below. Try to fit in small cubes with 1 cm edges. How many small cubes are in the big box? What is the relationship between the pile of small cubes and the contents of the box? 	Calculate the volume of a box with length x width x height	Remembering previous experiences on how to connect small cubes with cuboids boxes so that you can apply it	Volume = Length x width x height based on the size of a small cube and units of cm
The big box below has the name of the rib as in the picture. Determine the Volume of the box in the image!	Calculating the volume of a box with length x width x height with	With the help of the teacher, students can use symbols to find the volume of a cuboids	Volume = p x l x t

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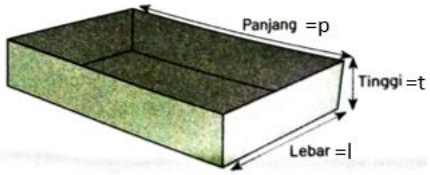
Type of task	Technique	Technology	Theory
	mathematical symbols		

CONCLUSION AND SUGGESTIONS

There are several additional steps to find the formula for the volume of a cuboids and additional instructions so that students can develop their way of thinking. This design aims to facilitate students with different abilities. In addition, students are expected to be able to construct their own knowledge based on their own experiences in order to gain meaningful experiences. According to Masithoh & Prabawanto (2016) that meaningful learning is learning that is based on experiences that students have previously had. If in the process there are student actions that are not as expected based on the tasks that have been given then the role of the teacher as a facilitator is expected to be able to provide guidance

REFERENCES

Chevallard, Y. (2019). Introducing the anthropological theory of the didactic: An attempt at a principled approach. Hiroshima journal of mathematics education, 12(1), 71-114.

Chevallard, Y., Barquero, B., Bosch, M., Florensa, I., Gascón, J., Nicolás, P., & Ruiz-Munzón, N. (Eds.). (2022). Advances in the Anthropological Theory of the Didactic. Springer International Publishing AG.

Clements, D. H., & Sarama, J. (2007). Early childhood mathematics learning. In F. K. Lester Jr. (Ed.), Second handbook of research on mathematics teaching and learning (pp. 461-555). Information Age Publishing.

Cobanoglu, O., & Silay, I. (2018). An analysis of secondary mathematics education curriculum based on praxeology. International Journal of Mathematical Education in Science and Technology, 49(6), 874-889.

Heinze, A., & Reiss, K. (2019). Content Analysis of Mathematics Textbooks: A Review of Literature. Journal for Research in Mathematics Education, 50(3), 284-318.

Masitoh, I., & Prabawanto, S. (2016). Peningkatan Pemahaman Konsep Matematika dan Kemampuan Berfikir Kritis Matematis Siswa Kelas V Sekolah Dasar Melalui Pembelajaran Eksloratif. EduHumaniora| Jurnal Pendidikan Dasar Kampus Cibiru, 7(2), 186-197.

National Council of Teachers of Mathematics. (2000). Principles and standards for school mathematics. Reston, VA: National Council of Teachers of Mathematics.

Masitoh, I., & Prabawanto, S. (2016). Peningkatan Pemahaman Konsep Matematika dan Kemampuan Berfikir Kritis Matematis Siswa Kelas V Sekolah Dasar Melalui Pembelajaran Eksloratif. EduHumaniora| Jurnal Pendidikan Dasar Kampus Cibiru, 7(2), 186-197.

Suryadi, D. (2010). Metapedadidaktik dan Didactical Design Research (DDR) : Sintesis Hasil Pemikiran Berdasarkan Lesson Study. Bandung: FPMIPA Universitas Pendidikan Indonesia.

Suryadi, Didi. (2013) Metapedadidaktik dan Didactical Design Research (DDR) dalam Implementasi Kurikulum Praktik Lesson Study. Conference Handout. Surabaya

Takeuchi, H., & Shinno, Y. (2020). Comparing the lower secondary textbooks of Japan and England: A praxeological analysis of symmetry and transformations in geometry. International Journal of Science and Mathematics Education, 18(4), 791-810.

Yanuardianto, E. (2019). Teori Kognitif Sosial Albert Bandura (Studi Kritis dalam Menjawab Problem Pembelajaran di Mi). Auladuna: Jurnal Prodi Pendidikan Guru Madrasah Ibtidaiyah, 1(2), 94-111.

Zhuchdi, Darmiyati. Afifah, Wiwiek. 2019. Analisis Konten Etnografi & Grounded Theory dan Hermeneutika dalam Penelitian. Jakarta Timur : PT Bumi Aksara