PRAXEOLOGICAL ANALYSIS OF 8th GRADE MATHEMATICS TEXTBOOK

[*1]Rivani Adistia Dewi,[2]Dadang Juandi

[1,2]Mathematics Education, Faculty of Mathematics and Natural Sciences Education
Universitas Pendidikan Indonesia, Bandung, Indonesia

Author's email:
[1]rivaniadistiadewi@upi.edu;[2]dadang.juandi@upi.edu

**Corresponding author:rivaniadistiadewi@upi.edu*

Abstract. *Based on research, students still have difficulty learning the data centralization material. One way to overcome this is to pay attention to the textbooks that used in the learning process. Yves Chevallard's praxeology theory can be used to analyze the textbooks. So, this study aims to analyze data centralization material in 8th grade textbooks published by the Ministry of Education, Culture, Research, and Technology based on praxeology. This study is a qualitative study with a anthropological theory of the didactic approach, especially praxeology which consists of two components, namely praxis and logos. Praxis consists of tasks (T) and techniques (τ), while logos consists of technology (θ) and theory (Θ). Based on the results of analysis, the causes of ontogenic and didactic obstacles were identified in Task 1, the causes of epistemological obstacles were identified in Task 2, and the causes of didactic and epistemological obstacles were identified in Tasks 3 and 4.*

Keywords: *Book Analysis, Data Centralization, Learning Obstacles, Praxeology.*

1. INTRODUCTION

Mathematics is one of the subjects taught at every level of education in Indonesia. Statistics is one of the branches of mathematics, and data centralization is a topic in statistics. The topic of data centralization is studied in elementary, junior high, and high schools. However, students still face difficulties in learning this material. Based on research by Nurmatin & Senjayawati (2023), which aligns with the findings of Mediyani & Mahtuum (2020), it was explained that students struggle due to a lack of conceptual understanding, poor problem-solving skills, limited calculation abilities, incorrect formula usage, and the inability to draw conclusions. One contributing factor is the lack of teaching materials and learning media to support the learning process (Maharani et al., 2022).

One of the most used teaching materials in schools is the textbook. Tanujaya et al., (2017) stated that textbooks are the primary source used by teachers when teaching or providing exercises. Textbooks influence the learning topics and how those topics are delivered (Ham & Heinze, 2018). In addition to being important for teachers, textbooks also benefit students by helping them find information to enhance their competence (Rahmawati, 2015).

Considering the importance of textbooks in the learning process, researchers have conducted various studies to evaluate the content of school textbooks. These include research on textbook analysis based on Bell's Criteria (Fajriatin, 2017), textbook analysis based on praxeology (Rizqi et al., 2021; Siagian et al., 2023), and other related studies. These studies have revealed that many textbooks still have content deficiencies, suggesting the need for further analysis. One theory that can be used to analyze textbooks is the praxeology theory introduced by Yves Chevallard (Azzahra, 2023). This theory analyzes examples and exercises through praxeological elements: type of task (T), technique (τ), technology (θ), and theory (Θ) (Pansell & Boistrup, 2018).

Textbook quality is crucial because poor-quality textbooks can lead to learning obstacles, including oncogenic obstacles, didactical obstacles, and epistemological

obstacles (Brousseau, 2006). Oncogenic obstacles stem from students' mental readiness, didactical obstacles are due to the methods or media used in learning, and epistemological obstacles arise from students' limited understanding of the subject matter (Rahmi & Yulianti, 2022).

Based on the explanation above, textbook analysis is essential to prevent learning obstacles, particularly in the topic of data centralization, which is still considered difficult. Although many studies have analyzed textbooks, none have specifically examined the data centralization material in 8th grade textbooks using praxeology. Thus, this study aims to analyze data centralization content in 8th grade textbook published by the Ministry of Education, Culture, Research, and Technology using the praxeological framework.

2. RESEARCH METHODS

This study is a qualitative research using the didactic anthropology approach, specifically praxeology theory (Chevallard, 2006), with the aim of analyzing the data centralization material in 8th grade textbook based on praxeology. The subject of this study is 8th grade mathematics textbook published by the Ministry of Education, Culture, Research, and Technology, particularly the Statistics chapter, subchapter Data Centralization. This book serves as the main textbook used in junior high school mathematics learning in Indonesia.

The research consists of three stages: analysis of the praxis block, analysis of the logos block, and evaluation of textbook content based on praxeology theory (Brata, Nurjanah, & Suryadi, 2024). In the praxis block analysis stage, the researcher analyzes the tasks (T) presented and the techniques (τ) that may be used by students to complete those tasks. Next, in the logos block analysis stage, the researcher examines the technologies (θ) and theories (Θ) presented in the textbook. Finally, the researcher evaluates the textbook content based on praxeology theory to determine whether the presentation of material in the textbook may cause learning obstacles for students.

3. RESULTS AND DISCUSSION

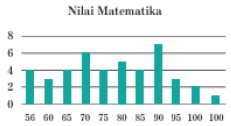
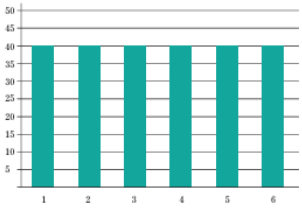
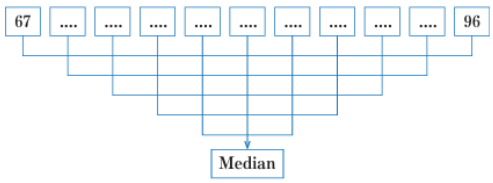
The data source used in this study is 8th grade mathematics textbook aligned with the Merdeka Curriculum, specifically the Statistics chapter, subchapter Data Centralization. Below is a description of the analyzed textbook:

Title : Matematika untuk SMP/MTs Kelas VIII
Author : Mohammad Tohir, Abdur Rahman As'ari, Ahmad Choirul Anam, and Ibnu Taufiq
Publisher : Ministry of Education, Culture, Research, and Technology
Year of Publication : 2022 (Tohir, As'ari, Anam, & Taufik, 2022)

Based on the praxeological analysis of the data centralization material in 8th grade textbook published by the Ministry of Education, Culture, Research, and Technology, the types of tasks (T), techniques (τ), technologies (θ), and theories (Θ) identified are presented in Table 1.

Table 1. Praxeological Analysis Results

Tasks (T)	Techniques (τ)	Technologies (θ)	Theories (Θ)
T_1: Determine the mode of a given dataset.	τ_1: Count the frequency of each value to find the one occurring most often.	$\theta_{1.1}$: Use a frequency table to organize data and make mode identification easier. $\theta_{1.2}$: Use a histogram to visualize data patterns for identifying the mode.	$\Theta_{1.1}$: Mode $\Theta_{1.2}$: Frequency Table $\Theta_{1.3}$: Bar Chart

Data ukuran sepatu siswa kelas 8 ditunjukkan dalam tabel berikut. Ukuran Sepatu / Frekuensi 36 2 37 4 38 8 39 12 40 8 41 5 42 1 .... Nilai ulangan matematika siswa kelas 8 ditunjukkan dalam tabel berikut. 			
T_2: Determine the mode of shoe sizes of 8th-grade students using a diagram showing all values are identical.  Pada diagram batang tersebut terlihat bahwa semua ukuran sepatu 6 siswa memiliki ukuran yang sama yaitu ukuran 40. Tentukan modus dari data tersebut? Apa yang dapat kalian simpulkan?	τ_2: Identify the tallest bar in the diagram to determine the mode and interpret the pattern.	$\theta_{1.1}$: Use bar charts to visualize data and determine the mode.	$\Theta_{1.1}$: Mode $\Theta_{1.2}$: Bar Chart
T_3: Determine the median of a dataset with an even number of elements. Nilai UTS dari dari 10 siswa adalah sebagai berikut 67, 89, 78, 96, 80, 77, 68, 90, 72, 88 Tentukan Median dari data tersebut. Untuk menentukan median lakukan beberapa langkah berikut. ***Langkah ke-1*** Urutkan data tersebut dari data terkecil ke besar, sehingga diperoleh data sebagai berikut ..... ***Langkah ke-2*** Pasangkan data yang sudah terurut dari sisi terluar ke sisi dalam, sehingga menyisakan satu data tunggal 	$\tau_{3.1}$: Sort the data from smallest to largest. $\tau_{3.2}$: Pair the data from the outside in until the middle values remain. $\tau_{3.3}$: Calculate the average of the two middle values.	θ_3: Use tables or diagrams to assist in separating data.	Θ_3: Median

<table>
<tr>
<td>Langkah ke-3
Karena ada dua data pada bagian tengah, maka nilai median berada di tengah-tengah kedua data tersebut. Cara menentukan median adalah dengan membagi dua jumlah dari dua data pada bagian tengah, yaitu $\frac{\cdots+\cdots}{2}=\cdots$

Jadi median dari data 67, 68, 72, 77, 78, 80, 88, 89, 90, 96 adalah .....</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T_4: Calculate the mean of a given dataset.
<table>
<tr><th>Data dalam kehidupan sehari-hari</th><th>Data</th><th>Banyak data</th><th>Cara menghitung rata-rata</th><th>Kesimpulan</th></tr>
<tr><td>Penjualan sepeda motor dari dealer adalah
Senin : 12, Selasa : 15, Rabu : 9 Kamis : 18, Jumat : 16, Sabtu : 20
Berapa rata-rata sepeda motor yang terjual dalam sepekan?</td><td>.....</td><td>.....</td><td>.....</td><td>.....</td></tr>
<tr><td>Pasien Covid-19 yang sembuh setelah di rawat di rumah sakit selama 10 hari terakhir adalah: 12 orang, 15 orang, 10 orang, 17 orang, 14 orang, 19 orang, 17 orang, 24 orang, 20 orang, dan 25 orang. Tentukan rata-ratanya?</td><td>.....</td><td>.....</td><td>.....</td><td>.....</td></tr>
<tr><td>Hasil Ulangan Harian Matematika siswa kelas 8 adalah sebagai berikut
<table>
<tr><th>Nilai ulangan matematika</th><th>Frekuensi</th></tr>
<tr><td>60</td><td>2</td></tr>
<tr><td>65</td><td>3</td></tr>
<tr><td>70</td><td>4</td></tr>
<tr><td>75</td><td>8</td></tr>
<tr><td>80</td><td>10</td></tr>
<tr><td>85</td><td>6</td></tr>
<tr><td>90</td><td>4</td></tr>
<tr><td>95</td><td>2</td></tr>
<tr><td>100</td><td>1</td></tr>
</table></td><td>.....</td><td>.....</td><td>.....</td><td>.....</td></tr>
</table></td>
<td>$\tau_{4.1}$: Organize data into a structured format.
$\tau_{4.2}$: Sum all the values.
$\tau_{4.3}$: Divide the total sum by the number of data points.</td>
<td>θ_4: Use a frequency table for better data structuring.</td>
<td>$\Theta_{4.1}$: Mean
$\Theta_{4.2}$: Frequency Table</td>
</tr>
</table>

(Source: Authors, 2025)

Learning obstacle analysis based on Brousseau's Theory derived from praxeological analysis in Table 1:

1. Task 1 (T_1)

Students are asked to determine the mode, but the textbook does not provide a prior definition of mode. This can result in cognitive leaps that lead to oncogenic obstacles (Fauziyyah et al., 2024). A didactical obstacle may also arise if the task is given without an explanation of the term "mode," as students may misinterpret the task.

In the final item of this task, a bar chart shows the number "100" twice on the horizontal axis an error that could lead to confusion when reading data and identifying the mode. This mistake could create didactical obstacles and misconceptions in interpreting quantitative data.

2. Task 2 (T_2)

Students are asked to determine the mode of a data set in which all values are the same (e.g., identical shoe sizes). The concept of mode is often simply understood as "the most frequently occurring value". When all values are the same, students may be divided, some might conclude that the mode is that repeated value, while others may think there is no mode. This shows the emergence of an epistemological obstacle (Rahmah & Maarif, 2021).

The interpretation reflects that the concept of mode goes beyond frequency, it includes understanding the data's distribution context. In homogeneous data, although a mode technically exists, it adds little value in describing data variability.

3. Task 3 (T_3)

Students are asked to determine the median of a dataset with an even number of values. However, the diagram provided contains more boxes than the number of actual data points. This may cause both didactical and epistemological obstacles.

From a didactical perspective, the extra box can confuse students during the step-by-step process to find the median. From an epistemological view, it might reinforce the misconception that the median is always a single number. In fact, for even-sized data, the median is the average of the two central numbers (Rahmah & Maarif, 2021).

4. Task 4 (T_4)

In the final item, students are asked to calculate a weighted average, but they may be familiar only with the simple average. An epistemological obstacle arises when students fail to incorporate frequency into their calculations. They might sum all listed values in a frequency table without accounting for how often each value appears. According to Fauziyyah, Rohaeti, & Amelia (2024), epistemological obstacles result from a lack of conceptual depth when faced with unfamiliar problem types (Fauziyyah et al., 2024).

Didactical obstacles also emerge if students misinterpret tasks. For instance, if they are used to calculating the average from raw data and are now faced with a frequency table, they may not know how to adapt their prior knowledge (Suryadi, 2019).

Learning obstacles must be carefully addressed so students can grasp the material well. Errors in textbook content can negatively affect students' knowledge construction, making them doubt what they previously understood (Rahmi & Yulianti, 2022). Therefore, the presentation of the data centralization material in 8th grade mathematics textbook still needs revision to minimize the learning obstacles.

CONCLUSION

Based on the analysis results, several issues were identified that have the potential to cause learning obstacles for students in the presentation of the data centralization material in 8th grade mathematics textbook aligned with the Merdeka Curriculum, published by the Ministry of Education, Culture, Research, and Technology. In Task 1, oncogenic and didactical obstacles were identified; in Task 2, epistemological obstacles were found; while in Tasks 3 and 4, both didactical and epistemological obstacles were observed. Based on these findings, the 8th grade mathematics textbook, particularly the Data Centralization subchapter, still requires improvements to minimize the occurrence of learning obstacles among students.

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