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The Indonesian Independent Curriculum Requires Student-Centred Teaching Approaches: Does the Teacher Guide Accompanying a Grade VIII Ministry-Published Mathematics Textbook Assist Teachers?

Dewi Rahimah¹, Agus Susanta², Edi Susanto¹, Tria Utari¹

¹The Study Program of Bachelor of Mathematics Education, The Faculty of Teacher Training and Pedagogy, Universitas Bengkulu, Bengkulu, Indonesia

²The Study Program of Master of Mathematics Education, The Faculty of Teacher Training and Pedagogy, Universitas Bengkulu, Bengkulu, Indonesia

Correspondence: Dewi Rahimah, The Study Program of Bachelor of Mathematics Education, The Faculty of Teacher Training and Pedagogy, Universitas Bengkulu, Bengkulu, Indonesia. E-mail: dewirahimah@unib.ac.id

Abstract

The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia published mathematics textbooks accompanied by teacher guides to support the implementation of the independent curriculum requiring student-centred teaching approaches. It is important to know whether the teacher guides provide sufficient guidance for teachers in implementing student-centred teaching approaches in classrooms. This study was qualitative research applying textual analysis and a text-coding method. This research study found that in the teacher guide, pedagogical guidance for handling students' errors was provided only for one section of the textbook, namely, *Let Us Explore*, while pedagogical guidance for handling students' difficulties was not provided for any section of the textbook. An answer key without an explanation was provided for most of *Let Us Explore*, *Let Us Think Creatively*, and *Let Us Communicate* sections; an answer key with an explanation was provided for most of *Let Us Think Critically* sections; and for most of *Let Us Use Technology* and *Let Us Work Together* sections, an answer key was not provided. An explanation of how to use sections of the textbook was provided for most of *Let Us Explore*, *Let Us Work Together*, and *Let Us Communicate* sections, and it was dominated by teaching scenarios to use these sections.

Keywords: pedagogical guidance, teacher guide, mathematics textbook, student-centred teaching approach

1. Introduction

Indonesia has emphasised student-centred learning since the 1975 curriculum (Mailizar, Alafaleq, & Fan, 2014). The Indonesian curriculum has changed several times, and one of its purposes is to direct teaching and learning processes from teacher-centred learning to student-centred learning (Kementerian Pendidikan dan Kebudayaan

[The Ministry of Education and Culture], 2014). However, teacher-centred learning still dominates Indonesian classroom teaching. Student-centred learning has not been implemented in Indonesian classrooms as expected by the Indonesian curriculum (Sembiring, Hadi, & Dolk, 2008).

Since 2022, Indonesia has implemented a new curriculum called the independent curriculum. One of the learning principles in the implementation of the independent curriculum is applying various teaching models that support the holistic development of students' competencies and characters, such as inquiry-based learning, problem-based learning, and project-based learning (Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia [The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia], 2022a). These teaching models are in line with student-centred learning. These teaching models were also emphasised in the 2013 curriculum, a curriculum developed before the independent curriculum. However, Rahimah (2022) found that teachers faced difficulties in applying a student-centred teaching approach in the implementation of the 2013 curriculum.

The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia published textbooks to support the implementation of the independent curriculum. The textbooks are books prepared for learning based on national education standards and the independent curriculum, and must be used in learning (Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia [The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia], 2022b, 2022c). Textbooks are the main teaching resources for Indonesian teachers (Mailizar & Fan, 2014). In addition to the textbooks, the Indonesian government also provides teacher guides.

Teacher guides direct teachers on how to do classroom teaching (Remillard, 2018). Matic and Gracin (2020) suggest that teacher guides support teaching methods used in classroom teaching. However, Rahimah (2022), who did research on a teacher guide accompanying a Ministry-published textbook supporting the 2013 curriculum, found that teachers did not get sufficient assistance from the teacher guide to apply a student-centred teaching approach.

Pedagogical guidance is an essential part of teacher guides (Hemmi, Krzywacki, & Koljonen, 2018). Remillard (2018) explains that teachers usually consider and interpret pedagogical guidance and insights presented in curriculum resources when they use them in making lesson plans and in teaching. Furthermore, Remillard (2018) elucidates that pedagogical guidance and insights consist of instructional objectives, directions on how to conduct classroom activities and how to explain mathematical content, examples of students' responses to tasks and concepts underlying the responses, examples of students' difficulties and errors, and how to handle these. Pedagogical guidance provided in teacher guides to apply student-centred teaching approaches using the independent curriculum textbooks published by the Ministry of Education, Culture, Research, and Technology needs to be explored.

This research study analysed how pedagogical guidance was provided in a teacher guide accompanying a Ministry-published Mathematics Junior High School Grade VIII textbook. It is important to know how the teacher guide assisted teachers in conducting student-centred teaching approaches in classrooms. The findings of this research study revealed how pedagogical guidance was provided in the teacher guide to support teachers in implementing student-centred teaching approaches. These findings are useful for the improvement of the teacher guide in the future.

2. Method

This research study analysed pedagogical guidance given in a teacher guide (Tohir, As'ari, Anam, & Taufiq, 2022a) accompanying the "Matematika SMP/MTs Kelas VIII" ["Mathematics Junior High School Grade VIII"] textbook published by Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia [The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia] (Tohir, As'ari, Anam, & Taufiq, 2022b). I analysed the teacher guide because it accompanies a textbook published by the Ministry of

Education, Culture, Research, and Technology of the Republic of Indonesia, in which the textbook and the teacher should be in line with the teaching approaches expected by the independent curriculum. In addition, each chapter of the “Matematika SMP/MTs Kelas VIII” [“Mathematics Junior High School Grade VIII”] textbook published by Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia [The Ministry of Education, Culture, Research, and Technology of Republic of Indonesia] (Tohir et al., 2022b) to support the Independent curriculum contains several sections that are similar to sections of the “Matematika SMP/MTs Kelas VIII Semester 1” [“Mathematics Junior High School Grade 8 Semester 1”] textbook published by Kementerian Pendidikan dan Kebudayaan [The Ministry of Education and Culture] (As'ari, Tohir, Valentino, Imron, & Taufiq, 2017) that representing steps of a student-centred teaching approach in the implementation of the 2013 curriculum. Rahimah (2022) found that the teacher guide accompanying the 2013 curriculum textbook did not well support teachers to apply a student-centred teaching approach. Examining pedagogical guidance in a teacher guide accompanying the independent curriculum textbook also revealed whether there was improvement or not in a teacher guide accompanying a Ministry-published textbook in supporting teachers to apply a student-centred teaching approach.

This was a qualitative research study. This research study used textual analysis with a text-coding method and then analysed the data descriptively. By applying the text-coding method, researchers can reveal patterns in texts (Auerbach & Silversten, 2003). The teacher guide was examined as designed (cf. Remillard, 2005) or as written (cf. Remillard, 2012). This research study scrutinised words (cf. Braun & Clarke, 2013; cf. Merriam & Tisdell, 2016) and explored problems (Creswell, 2021).

This research study applied the *horizontal* analysis, in which the *horizontal* analysis focused on elements presented in curriculum resources (Charalambous, Delaney, Hsu, & Mesa, 2010). The horizontal analysis can be used to identify features in curriculum resources designed to provide student learning opportunities (Rahimah & Visnovska, 2021). This research study examined the pedagogical guidance provided by the teacher guide in using *Let Us Explore*, *Let Us Think Critically*, *Let Us Think Creatively*, *Let Us Use Technology*, *Let Us Work Together*, and *Let Us Communicate* sections of the textbook. It is important to analyse the pedagogical guidance provided for using these sections because these sections provided tasks for students to find and understand mathematical concepts (Tohir et al., 2022a, 2022b). The numbers of these sections in the textbook are presented in Table 1.

Table 1: The numbers of the sections

Sections	Numbers
<i>Let Us Explore</i>	33
<i>Let Us Think Critically</i>	33
<i>Let Us Think Creatively</i>	24
<i>Let Us Use Technology</i>	15
<i>Let Us Work Together</i>	7
<i>Let Us Communicate</i>	15

The framework used for examining the texts is presented in Table 2 below. The framework was created based on the types of pedagogical guidance provided in the teacher guide.

Table 2: The categories for each type of pedagogical guidance in the teacher guide

Types	Categories
An additional explanation	No additional explanation provided An additional explanation about a teaching scenario An additional explanation about mathematical content
An answer key	No answer key provided An answer key without an explanation An answer key with an explanation No answer key needed
Pedagogical guidance for handling students' mathematical content problems	No pedagogical guidance for handling students' mathematical content problems provided Pedagogical guidance for handling students' difficulties Pedagogical guidance for handling students' errors

3. Results

The results of the exploration of pedagogical guidance presented in the teacher guide are grouped based on the types of pedagogical guidance, namely, an additional explanation, an answer key, and pedagogical guidance for handling students' mathematical content problems. Several examples of pedagogical guidance are also provided.

3.1 An additional Explanation

The proportions of each category of additional information provided in the teacher guide for each section of the "Matematika SMP/MTs Kelas VIII" ["Mathematics Junior High School Grade VIII"] textbook published by Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia [The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia] (Tohir et al., 2022b) textbook are presented in Figure 1.

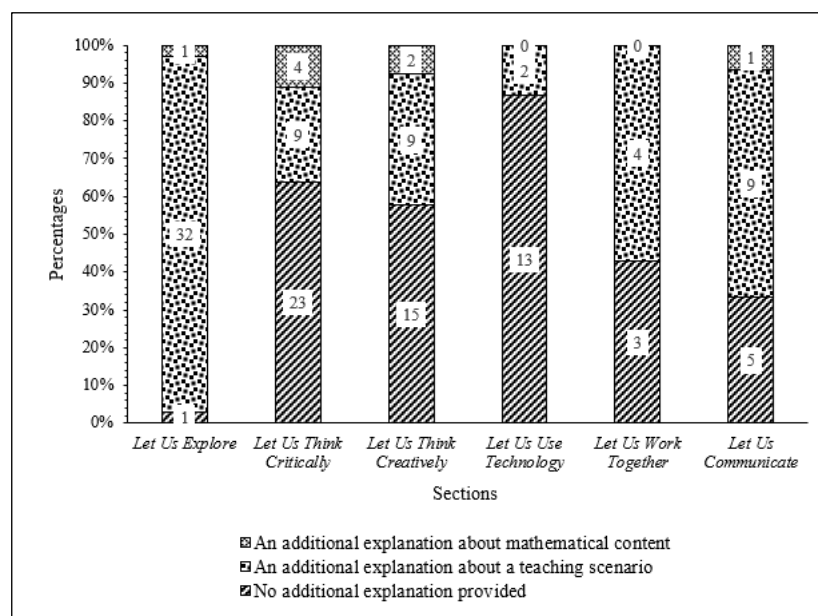


Figure 1: The proportions of the categories of an additional explanation

An additional explanation about how to use the Ministry-published textbook sections was provided for almost all of *Let Us Explore* sections. However, the additional explanation was provided only for about 60% of *Let Us Work Together* and *Let Us Communicate* sections, and less than 50% of *Let Us Think Critically*, *Let Us Think Creatively*, and *Let Us Use Technology* sections.

Most of the additional explanations was about a teaching scenario. An example of tasks in the textbook having an additional explanation about a teaching scenario in the teacher guide can be seen in Figure 2. The task was given in a *Let Us Explore* section.

There are many uses of the Pythagorean theorem in everyday life. One of them is in the field of building construction. A handyman and his workers get a project to build a house. Before starting construction, the builders must first make right-angled threads on the *baw plank* installation as a reference for making foundations, walls, and other elements so that the house can be built properly and firmly. Below is an illustration for forming a right angle.



Figure 2.2 Creating a right angle.

Figure 2.2 above shows that some builders ensure that the corner of the house foundation must form a right angle by using a wire and tape measure. The comparisons of sizes prepared by the builders are

30 cm, 40 cm, 50 cm
 12 cm, 5 cm, 14 cm
 60 cm, 80 cm, 100 cm
 90 cm, 120 cm, 140 cm
 12 cm, 16 cm, 20 cm

How can you help the builder prove that the comparisons form a right triangle or not?

Figure 2: An example of tasks in the textbook having an additional explanation about a teaching scenario in the teacher guide

Note. Translated from “Matematika SMP/MTs Kelas VIII” [“Mathematics Junior High School Grade VIII”] (pp. 51-52), by M. Tohir, A. R. As'ari, A. C. Anam, & I. Taufiq, 2022, Jakarta, Indonesia: Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia [The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia]. Copyright 2022 by Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia [The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia].

An additional explanation about a teaching scenario for the task given in the teacher guide is presented in Figure 3.

The teacher invites students to observe the drawings of builders who are checking the certainty of right angles on the basic design of a building. The teacher is expected to be able to provide illustrations and explanations regarding right triangles and not right triangles in the image given, or the teacher can provide other illustrations related to the activity.

In this section, the teacher is expected to be able to provide guidance and understanding to students through the exploration activity and be able to provide examples regarding the shape of a right triangle and not a right triangle.

Figure 3: An example of an additional explanation about a teaching scenario in the teacher guide

Note. Translated from “Buku Panduan Guru SMP/MTs Kelas VIII” [“Teacher Guide of Mathematics Junior High School Grade VIII”] (p. 95), by M. Tohir, A. R. As'ari, A. C. Anam, & I. Taufiq, 2022, Jakarta, Indonesia: Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia [The Ministry of Education,

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The task presented in Figure 2 asked students to prove whether each comparison of sizes formed a right triangle or not. In Figure 3, the teacher guide explained a teaching scenario to do the task, which consisted of activities to help students understand the concept of the Pythagorean triple and information that teachers need to explain to their students. With this pedagogical guidance, teachers knew what they should do when carrying out the task designed by the textbook authors. This could help teachers achieve the learning purposes that the textbook authors had set up to achieve through working on the task. Pedagogical guidance about teaching scenarios could prevent tasks that had been designed for a student-centred teaching approach from transforming into a teacher-centred teaching approach for achieving learning purposes.

An additional explanation about mathematical content was provided for less than 12% of *Let Us Explore*, *Let Us Think Critically*, *Let Us Think Creatively*, and *Let Us Communicate* sections, while for *Let Us Use Technology* and *Let Us Work Together*, this category of an additional explanation was not provided.

An example of tasks in the textbook having an additional explanation about mathematical content in the teacher guide is presented in Figure 4. The task was given in a *Let Us Think Critically* section.

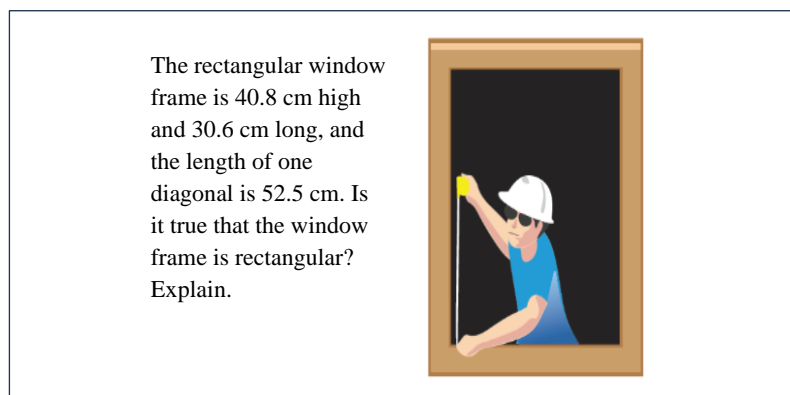
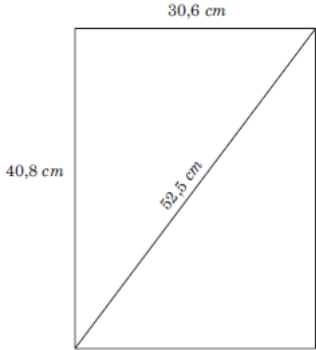


Figure 4: An example of tasks in the textbook having an additional explanation about mathematical content in the teacher guide

Note. Translated from “Matematika SMP/MTs Kelas VIII” [“Mathematics Junior High School Grade VIII”] (p. 75), by M. Tohir, A. R. As'ari, A. C. Anam, & I. Taufiq, 2022, Jakarta, Indonesia: Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia [The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia]. Copyright 2022 by Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia [The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia].

An additional explanation about the mathematical content of the task given in the teacher guide is presented in Figure 5.

The window frame forms a rectangle if all four corners are right angles. To prove that each angle on the window frame is a right angle, you need to use the Pythagorean triple.



Based on the picture above, it must be proven that

$$52,5^2 = 40,8^2 + 30,6^2$$

A Pythagorean triple occurs if $c^2 = a^2 + b^2$ the length of the diagonal

$$c^2 = (40,8)^2 + (30,6)^2$$

$$c^2 = 1664,64 + 939,36$$

$$c^2 = 2601$$

$$c = \sqrt{2601} = 51$$

The corners will be a right angle if the length of the diagonal is 51 cm. Because the diagonal of the window frame on the problem is 52.5 cm. So, the window frame does not form a rectangle.

Figure 5: An example of an additional explanation about mathematical content in the teacher guide

Note. Translated from “Buku Panduan Guru SMP/MTs Kelas VIII” [“Teacher Guide of Mathematics Junior High School Grade VIII”] (p. 115), by M. Tohir, A. R. As'ari, A. C. Anam, & I. Taufiq, 2022, Jakarta, Indonesia: Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia [The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia]. Copyright 2022 by Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia [The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia].

The task presented in Figure 4 asked students to scrutinise a window frame that looked like a rectangle. In Figure 5, the teacher guide provided an explanation of how a Pythagorean triple could be used to prove that the window frame was rectangular. The steps for how to apply the Pythagorean triple by using the information given in the task were provided in the teacher guide. The explanation was categorised as an additional explanation about mathematical content.

More than 55% of *Let Us Think Critically*, *Let Us Think Creatively*, and *Let Us Use Technology* sections did not have an additional explanation about a teaching scenario or mathematical content. An example of tasks in the textbook having no additional explanation in the teacher guide is presented in Figure 6. The task was given in a *Let Us Use Technology* section.

To make it easier to complete **Let's Think Creatively**, you can use the calculator at the following link
<https://www.geogebra.org/calculator> or
<https://www.desmos.com/scientiic?lang=id>

Figure 6: An example of tasks in the textbook having no additional explanation in the teacher guide

Note. Translated from “Matematika SMP/MTs Kelas VIII” [“Mathematics Junior High School Grade VIII”] (p. 9), by M. Tohir, A. R. As'ari, A. C. Anam, & I. Taufiq, 2022, Jakarta, Indonesia: Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia [The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia]. Copyright 2022 by Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia [The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia].

The teacher guide presented the same thing as what was written in the textbook (see Figure 7). So, there was no additional explanation for the task given in the teacher guide.

To make it easier to complete **Let's Think Creatively**, you can use the calculator at the following link
<https://www.geogebra.org/calculator> or
<https://www.desmos.com/scientiic?lang=id>

Figure 7: An example of an explanation given in the teacher guide that was the same as the task presented in the textbook

Note. Translated from “Buku Panduan Guru SMP/MTs Kelas VIII” [“Teacher Guide of Mathematics Junior High School Grade VIII”] (p. 42), by M. Tohir, A. R. As'ari, A. C. Anam, & I. Taufiq, 2022, Jakarta, Indonesia: Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia [The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia]. Copyright 2022 by Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia [The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia].

The task presented in Figure 6 asked students to use certain websites to help them solve problems given in the previous section. However, as it was presented in Figure 7, instead of giving guidance for teachers in using the websites to solve the problems, the teacher guide simply copied the task given in the textbook without any additional explanation. The teacher guide did not provide any additional information about the teaching scenario or the mathematical content of the task. In terms of providing pedagogical guidance for teachers in using the task, the teacher guide could not have an educative and directive impact on teachers. Additional information about teaching scenarios is directive materials for teachers (Matic & Gracin, 2020), while additional information about mathematical content is educative materials for teachers (Davis & Krajcik, 2005).

3.2 An Answer Key

The proportions of each category of answer keys provided in the teacher guide for each section of the “Matematika SMP/MTs Kelas VIII” [“Mathematics Junior High School Grade VIII”] textbook published by Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia [The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia] (Tohir et al., 2022b) textbook are presented in Figure 8.

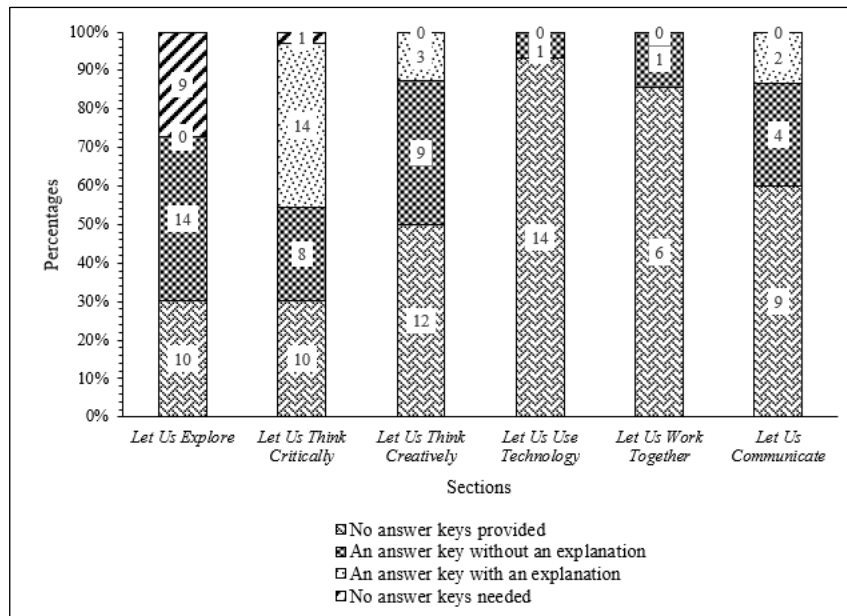


Figure 8: The proportions of the categories of answer keys

No answer key was provided for most of *Let Us Use Technology*, *Let Us Work Together*, and *Let Us Communicate* sections of the textbook. Only one out of the fifteen examined *Let Us Use Technology* sections had an answer key, and the answer key was without an explanation. In addition, most of the *Let Us Use Technology* sections had no additional explanation about a teaching scenario or mathematical content in the teacher guide. Most of the *Let Us Use Technology* sections that had no answer key and no additional explanation in the teacher guide showed that the teacher guide had limited support for teachers in using these sections.

An example of tasks in the textbook having no answer key in the teacher guide is presented in Figure 9. The task was given in a *Let Us Work Together* section.

Discuss with your tablemates. What is the general form of a linear equation with one variable, and why?

Figure 9: An example of tasks in the textbook having no answer key in the teacher guide

Note. Translated from “Matematika SMP/MTs Kelas VIII” [“Mathematics Junior High School Grade VIII”] (p. 111), by M. Tohir, A. R. As'ari, A. C. Anam, & I. Taufiq, 2022, Jakarta, Indonesia: Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia [The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia]. Copyright 2022 by Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia [The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia].

The teacher guide only copied what had been written in the textbook (see Figure 10). So, there was no answer key provided for the task given in the teacher guide.

Discuss with your tablemates. What is the general form of a linear equation with one variable, and why?

Figure 10: An example of an explanation given in the teacher guide that is the same as the task presented in the textbook

Note. Translated from “Buku Panduan Guru SMP/MTs Kelas VIII” [“Teacher Guide of Mathematics Junior High School Grade VIII”] (p. 144), by M. Tohir, A. R. As'ari, A. C. Anam, & I. Taufiq, 2022, Jakarta, Indonesia: Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia [The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia]. Copyright 2022 by Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia [The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia].

The task presented in Figure 9 asked students to find out the general form of a linear equation with one variable and give reasons. However, as it is presented in Figure 10, the teacher guide did not provide the steps on how to do it or the final answer. The teacher guide only presented texts that were exactly the same as the texts given in the textbook.

An answer key without an explanation was provided for about 40% of *Let Us Explore* and *Let Us Think Creatively* sections. In the *Let Us Explore* and *Let Us Think Creatively* sections, students were expected to find information on investigating and understanding new mathematical concepts (Tohir et al., 2022a, 2022b). An example of tasks in the textbook having an answer key without an explanation in the teacher guide can be seen in Figure 11. The task was presented in a *Let Us Think Creatively* section.

Given an equation $\frac{3^a}{3^b} = 3^4$. Determine the values of a and b from 1 to 9 that they fulfill the equation.

Figure 11: An example of tasks in the textbook having an answer key without an explanation in the teacher guide

Note. Translated from “Matematika SMP/MTs Kelas VIII” [“Mathematics Junior High School Grade VIII”] (p. 16), by M. Tohir, A. R. As'ari, A. C. Anam, & I. Taufiq, 2022, Jakarta, Indonesia: Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia [The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia]. Copyright 2022 by Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia [The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia].

An answer key without an explanation provided in the teacher guide for the task is given in Figure 12.

The problem has many solutions.
 a and b having a difference of 4 are $a = 5$ and $b = 1$, $a = 6$ and $b = 2$, $a = 7$
 and $b = 3$, $a = 8$ and $b = 4$, $a = 9$ and $b = 5$.

Figure 12: An example of an answer key without an explanation in the teacher guide

Note. Translated from “Buku Panduan Guru SMP/MTs Kelas VIII” [“Teacher Guide of Mathematics Junior High School Grade VIII”] (p. 51), by M. Tohir, A. R. As'ari, A. C. Anam, & I. Taufiq, 2022, Jakarta, Indonesia: Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia [The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia]. Copyright 2022 by Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia [The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia].

The task presented in Figure 11 asked students to find out the values of variables a and b in an equation. In Figure 12, the teacher guide did not give an explanation of how to get each pair of a and b or the steps to do the task. Students could have questions, such as what they had to start with or what mathematical concepts they could use to answer the question. The teacher guide did not provide assistance for teachers to explain it. The teacher guide

authors did not give an explanation of the answer key. Probably, they believed teachers could find the solution, and they wanted to provide opportunities for teachers to develop their thinking.

Let Us Think Critically sections, about 60% of them were given an answer key, and more than half of the answer keys had an explanation in the teacher guide. In the *Let Us Think Critically* sections, students are invited to investigate and understand new mathematical concepts or knowledge through guided re-invention (Tohir et al., 2022a, 2022b). Teacher guidance is needed when students are working on these sections. As in working on these sections, students are investigating new mathematical concepts or knowledge, and teachers need to understand the mathematical concepts or knowledge in order to guide students. Less than 50% of the *Let Us Think Critically* sections having an answer key with an explanation showed that the teacher guide did not provide sufficient support for teachers in guiding students when the students were working on these sections.

An example of tasks in the textbook having an answer key with an explanation in the teacher guide is presented in Figure 13. The task was given in a *Let Us Think Critically* section.

Adults usually take around 24,000 breaths per day. Write an equation that shows the number of times a person breathes in one minute.

Figure 13: An example of tasks in the textbook having an answer key with an explanation in the teacher guide

Note. Translated from “Matematika SMP/MTs Kelas VIII” [“Mathematics Junior High School Grade VIII”] (p. 112), by M. Tohir, A. R. As'ari, A. C. Anam, & I. Taufiq, 2022, Jakarta, Indonesia: Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia [The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia]. Copyright 2022 by Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia [The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia].

An answer key with an explanation provided in the teacher guide for the task is given in Figure 14.

For example:
Breathing in a day = p
In a day there are 24 hours which means $24 \times 60 = 1440$ minutes.
So, the equation is $p = \frac{24.000}{1.440}$

Figure 14: An example of an answer key with an explanation in the teacher guide

Note. Translated from “Buku Panduan Guru SMP/MTs Kelas VIII” [“Teacher Guide of Mathematics Junior High School Grade VIII”] (p. 145), by M. Tohir, A. R. As'ari, A. C. Anam, & I. Taufiq, 2022, Jakarta, Indonesia: Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia [The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia]. Copyright 2022 by Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia [The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia].

The task presented in Figure 13 asked students to make an equation based on the given information. However, the unit of time given in the task was “day,” while the question asked students to write an equation with “minute” as the unit of time. Before reaching the final answer, as it can be seen in Figure 14, the teacher guide presented an explanation that students needed to change the unit of time from “day” to “minute” in making the equation.

3.3 Pedagogical Guidance for Handling Students' Mathematical Content Problems

The proportions of each category of pedagogical guidance for handling students' mathematical content problems provided in the teacher guide for each section of the "Matematika SMP/MTs Kelas VIII" ["Mathematics Junior High School Grade VIII"] textbook published by Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia [The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia] (Tohir et al., 2022b) textbook are presented in Figure 15.

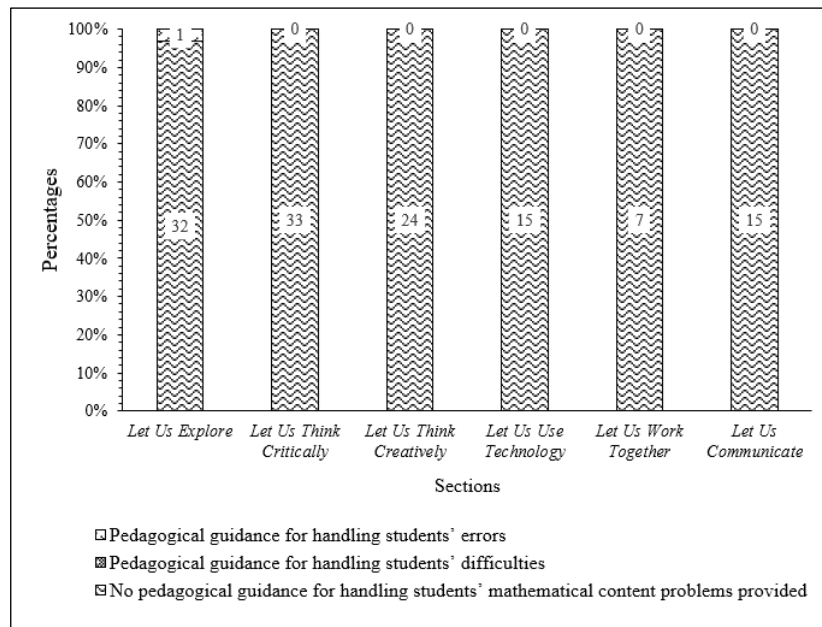


Figure 15: The proportions of the categories of pedagogical guidance for handling students' mathematical content problems

Most of the Ministry-published textbook section had no pedagogical guidance for handling students' mathematical content problems in the teacher guide. Only one section of the textbook had pedagogical guidance for handling students' mathematical content problems in the teacher guide. It was pedagogical guidance for handling students' errors, which was provided for one *Let Us Explore* section of the textbook. Teachers need pedagogical guidance in handling students' errors and difficulties to overcome students' mathematical content problems (Shulman, 1986). This type of pedagogical guidance was rarely provided in the teacher guide. This was a critical issue for the teacher guide.

In the teacher guide, pedagogical guidance for handling students' errors was given for a *Let Us Explore* section of the textbook. In this section, students were invited to define exponential numbers by looking at a table as presented in Figure 16.

Exponential numbers	Multiplication Forms	Values
2^1	2	2
2^2	2×2	4
2^3	$2 \times 2 \times 2$	8
2^4	$2 \times 2 \times 2 \times 2$	16
2^5	$2 \times 2 \times 2 \times 2 \times 2$	32
...		
2^n	$2 \times 2 \times 2 \times 2 \times 2 \times \dots \times 2$ n times	

Figure 16: An example of tasks in the textbook having pedagogical guidance for handling students' errors

Note. Translated from “Matematika SMP/MTs Kelas VIII” [“Mathematics Junior High School Grade VIII”] (p. 7), by M. Tohir, A. R. As'ari, A. C. Anam, & I. Taufiq, 2022, Jakarta, Indonesia: Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia [The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia]. Copyright 2022 by Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia [The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia].

The pedagogical guidance for handling students' errors given by the teacher guide is presented in Figure 17.

Students can make mistakes on exponential numbers, for example, students consider that 3^2 is 3×2 and students consider that 3^3 is 3×3 . Students can experience this if they do not understand the concept of exponential numbers. Therefore, teachers must provide maximum reinforcement and understanding of the concept of exponential numbers.

Figure 17: An example of an answer key without an explanation in the teacher guide

Note. Translated from “Buku Panduan Guru SMP/MTs Kelas VIII” [“Teacher Guide of Mathematics Junior High School Grade VIII”] (p. 41), by M. Tohir, A. R. As'ari, A. C. Anam, & I. Taufiq, 2022, Jakarta, Indonesia: Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia [The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia]. Copyright 2022 by Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia [The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia].

The task presented in Figure 16 asked students to find out the definition of exponential numbers. In Figure 17, the teacher guide gave an example of mistakes that students could make when they worked on the textbook section. The teacher guide explained what teachers should do to handle the error. However, the pedagogical guidance did not give a detailed explanation of how to provide maximum reinforcement and understanding of the concept of exponential numbers.

4. Discussion

The discussion of the exploration of pedagogical guidance presented in the teacher guide is grouped based on the types of pedagogical guidance, namely, an additional explanation, an answer key, and pedagogical guidance for handling students' mathematical content problems.

4.1 An Additional Explanation

More than 55% of *Let Us Think Critically*, *Let Us Think Creatively*, and *Let Us Use Technology* sections of the textbook that did not have an additional explanation about a teaching scenario or mathematical content were a serious weakness of the teacher guide. Teacher guides as curriculum materials should be designed to guide teachers in conducting their teaching (Stein, Remillard, & Smith, 2007). However, the teacher guide authors provide an additional explanation for almost all of *Let Us Explore* sections of the textbook. In the *Let Us Explore* sections, the textbook authors expected students to be actively involved in finding and understanding new knowledge or concepts (Tohir et al., 2022b). Teachers' guidance is needed to avoid partial knowledge, students' confusion, and misconceptions (Kirschner, Sweller, & Clark, 2006). Students are required to use, connect, and describe their knowledge when they think creatively and critically (Raub, Shukor, Arshad, & Rosli, 2015). Students need guidance from their teacher to do this. However, Rahimah (2022), who researched the usage of a Ministry-published textbook aimed at supporting a student-centred approach, found that teachers had difficulties when they use the textbook because of insufficient pedagogical guidance in the textbook and its accompanying teacher guide. Lack of pedagogical guidance to use the Ministry-published textbook sections can cause a student-centred approach that cannot be implemented as it is designed by the textbook authors.

It seems that teacher guide authors were aware that teachers needed guidance to apply the teaching approach that had been designed in the textbook. Teachers' understanding of mathematical scenarios influences the quality of classroom teaching (Zembar & Yasa, 2015). However, it is still possible that classroom teaching is not conducted as the textbook authors expected. Teachers adapted the focus of the task based on their pedagogical beliefs and students' abilities (Looi, Sun, Seow, & Chia, 2014).

Classroom teaching involving inquiry activities in implementing a student-centred teaching approach is a challenging duty for teachers because they tend to tell or show students about what students need to do when they guide students in developing students' thinking (Hähkiöniemi & Francisco, 2019). This can drive the student-centred teaching approach to be a more conventional teaching method, which is contradictory to what the textbook authors tried to develop. Therefore, additional information about teaching scenarios is essential pedagogical guidance that should exist in a teacher guide.

Teachers did not get sufficient guidance from the teacher guide on how to assist students in doing tasks given in the textbook in terms of mathematical content. On the other hand, students need to understand mathematical content before they associate mathematical concepts when they think critically and creatively (Askew, 2015). Insufficient additional explanation about the mathematical content provided for teachers is one of the limitations of the teacher guide. An effective teacher guide should have explanations about mathematical content (Ding & Li, 2014). Teachers need this category of pedagogical guidance to guide their students when they are using or working on tasks. This is because developing students' mathematical thinking for solving mathematical problems requires a high-level understanding of mathematical concepts (Hähkiöniemi & Francisco, 2019).

Teachers need to understand mathematical content and have knowledge about teaching mathematical content (Davis et al., 2014). The way textbooks present mathematical content influences teachers' classroom teaching (Davis, Palincsar, Smith, Arias, & Kademian, 2017). Additional explanations about mathematical content in the teacher guide can help teachers direct their students when they are working on tasks given in the textbook. For example, an additional explanation provided in the teacher guide about the usage of the Pythagorean triple to work on a task from the textbook asking to prove that a window frame is rectangular can help teachers guide students

when they are working on the task (see Figure 5). With pedagogical guidance related to mathematical content, teachers can direct classroom teaching to achieve the purpose of working on tasks designed by textbook authors.

Teacher guides are one of the curriculum materials. Curriculum materials are used as learning resources by teachers, and this affects classroom teaching (Ball & Cohen, 1996). Teachers can use the teacher guide as curriculum materials to learn how to conduct classroom teaching as expected by textbook authors and how to assist students in constructing and understanding mathematical concepts. Additional information about teaching scenarios (Matic & Gracin, 2020) and additional mathematical content (Davis & Krajcik, 2005) are essential components of a teacher guide. Without these components, the teacher guides could not be used as a resource to support teachers in implementing the teaching approaches expected by the curriculum.

The data showed that teachers did not get full support from the teacher guide to conduct classroom teaching using the textbook. Without adequate information on how to use textbook sections, teachers would have difficulties using the textbook sections in their teaching (Yıldırım, 2010). Teachers need pedagogical guidance to help students construct their knowledge (Ding & Li, 2014). Nevertheless, if more *Let Us Work Together* and *Let Us Communicate* sections of the textbook had an additional explanation in the teacher guide about how to use them, teachers could get support from the teacher guide to guide students working on these sections. Guidance from teachers can help students develop their mathematical thinking, either to think critically or to think creatively (Kooloos, Oolbekink-Marchand, van Boven, Kaenders, & Heckman, 2022).

4.2 An Answer Key

In *Let Us Work Together* and *Let Us Communicate* sections of the textbook, students were expected to discuss their thinking and ideas as well as work together to solve problems (Tohir et al., 2022a, 2022b). Probably, because of this reason, most of the answers to the problems are not presented in these sections. The answers could be provided in sections of the teacher guide that link to sections of the textbook presenting the problems. In *Let Us Use Technology* sections, students were expected to use technology to solve problems (Tohir et al., 2022a, 2022b). Teachers have difficulties developing their skills and knowledge to use technology, so they cannot provide support for their students in using technology in their classroom teaching (Amuko, Miheso, & Ndeuthi, 2015). Without pedagogical guidance to use the *Let Us Use Technology* sections in the teacher guide, teachers did not have direction from the teacher guide on how to guide their students when the students were working on these sections in the textbook.

A research study conducted by Rahimah (2022) on the use of a Ministry-published textbook and its accompanying teacher guide to support a student-centred approach found that the participating teachers did not use the teacher guide because it was too similar to the textbook. Thus, teachers may not value the teacher guide when the content is similar to the content of the textbook, and the answer keys and explanations of how to solve the problems cannot be found in the teacher guide.

Answer keys provided in a teacher guide can help teachers who do not fully understand mathematical concepts to give many questions for their students, but of course the teachers need to be able to demonstrate how to solve one or two of those questions (Chowdhuri, 2020). Thus, without the answer keys provided in the teacher guide, teachers did not get support in giving many questions to their students from the teacher guide. An explanation related to answer keys is important pedagogical guidance because this could help teachers direct students when they are working on tasks given in the sections of the textbook. Without explanation, teachers would not have a complete description of how to get the correct answers. Even though the explanation is highly formalised and not process-based, teachers will value it (Chowdhuri, 2020).

With explanations of answer keys, teachers, especially those who are weak in understanding mathematical concepts, will have clear guidance on how to answer questions (Chowdhuri, 2020). Without explanations, teachers who still have problems understanding mathematical concepts need to explore solutions on their own in order to

get answers that are similar to the answer keys given in the teacher guide. When the answers that they get are different from the answer keys, without an explanation of the answer keys, the teachers can get confused about what mistakes they made when they were working on the solution. By having an answer key with an explanation, teachers, especially those who did not know the right answer, had a direction on how to guide their students in working on the task.

By using answer keys given in a teacher guide, teachers check the answers to tasks given in a textbook (Rahimah, 2022). Answer keys with an explanation are one type of pedagogical guidance that teachers need in order to guide their students in working on tasks, especially when the teachers still have problems understanding the new mathematical concepts or knowledge being investigated (Chowdhuri, 2020). By providing answer keys with an explanation for each section of the textbook in the teacher guide, teachers can be more confident and have more direction in guiding students when the students are working on tasks given in the textbook. Teachers assess students' answers (Mellone et al., 2020) and facilitate them in building their knowledge (Ding & Li, 2014). As the teacher guide did not provide an explanation of answer keys for most of the tasks given by the textbook sections, it seems that the teacher guide authors provided opportunities for teachers to develop their understanding of mathematical contents.

4.3 Pedagogical Guidance for Handling Students' Mathematical Content Problems

If a teacher guide provides sufficient pedagogical guidance for handling students' errors and difficulties, the teacher guide does not only help teachers overcome students' mathematical content problems but also educates teachers on how to face unexpected conditions during classroom teaching (Matic & Gracin, 2020). This pedagogical guidance makes teachers aware of that sort of misconception and how to handle this problem, even though the information is not very clear.

Teachers consider a teacher guide useful when the guide provides guidance for teachers in teaching mathematical content and handling mathematical teaching problems (Matic & Gracin, 2020; Steenbrugge, Valcke, & Desoete, 2012). Teachers do not consider that reading a teacher guide is helpful when the teacher guide is not giving the pedagogical guidance that teachers need in teaching using its textbook (Rahimah, 2022). Pedagogical guidance to handle students' mathematical content problems, such as students' difficulties and students' errors, is important information that teachers expect to be presented in a teacher guide.

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