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Comparison of Indonesian and Japanese Textbooks on Integer Concepts: A Praxeological Analysis

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Abstract: Mathematics textbooks played a crucial role in shaping students' understanding and mastery of mathematical concepts. As essential resources in formal education, they fostered critical thinking, problem-solving, and analytical skills. However, textbook quality and design varied significantly, affecting their effectiveness in supporting meaningful learning. This study examined how mathematics textbooks from different educational systems addressed the teaching of integers, focusing on Indonesia's *Kurikulum Merdeka* and Japan's *Gakko Tosho* textbooks. Using qualitative methods and hermeneutic phenomenological approaches, the analysis evaluated how these textbooks presented integer concepts to align with students' needs and contexts. The findings revealed significant differences in contextual alignment, task design, and concept integration. *Kurikulum Merdeka* textbooks emphasized procedural skills and provided theoretical support but lacked contextual relevance and coherence. In contrast, *Gakko Tosho* textbooks adopted a systematic, exploratory approach with integrated real-world tasks, enhancing conceptual understanding. This study contributed to mathematics education by highlighting the strengths and weaknesses of these didactic approaches. The findings served as a foundation for improving mathematics textbook design in Indonesia and globally, promoting a balance between procedural skills and conceptual understanding.

Keywords: Praxeological analysis, Mathematics textbooks, Integer concepts

Introduction

Mathematics textbooks are an essential part of formal education for students and teachers. As the main source in the learning process, textbooks not only present mathematical concepts but also develop students' analytical thinking, problem-solving solving, and communication skills(Kristanto & Santoso, 2020; Rezat et al., 2021). However, mathematics textbooks are often not optimally designed to meet students' needs (Muljo et al., 2024). Studies have shown that poor textbook design can affect students' ability to understand basic and complex concepts, as well as critical thinking skills, which are important in mathematics education (Erbaş et al., 2012; Fan et al., 2013).

Several previous studies have shown that the quality of mathematics textbooks affects the effectiveness of student learning. For example, research by Mullis et al. (2000) showed that countries with high-quality textbooks, such as Singapore, had better student performance in the TIMSS assessment. Meanwhile, research by Keshavarz (2020) shows that textbooks that do not match students' experiences can create epistemological barriers that make it difficult for students to understand mathematical concepts. This is also supported by the research of Kusharyadi et al. (2024), who compared mathematics textbooks from Malaysia and Indonesia and showed that the systematic organization of material can help students understand mathematical concepts better.

In the context of education in Indonesia, the results of international assessments such as PISA show a significant gap between Indonesian students and other Southeast Asian countries (Schleicher, 2019). This is consistent with research by Hendriyanto et al. (2023), which showed that mathematics textbooks used in Indonesia often do not take into account the local context, students' abilities, and everyday experiences that can help students relate mathematical concepts to real-life situations. Research by Charalambous et al. (2010) also showed that didactic components in textbooks, such as the types of tasks, teaching techniques, and examples used, play an important role in students' learning process.

Textbooks often reflect how curricula are structured and how mathematical knowledge is transformed from academic knowledge into instructional materials that are accessible to students (Li, 2000; Pepin & Gueudet, 2014). However, textbooks are often not systematically designed to help students understand mathematical concepts in depth. As a result, students critical thinking and problem-solving skills are hindered and their ability to relate mathematics to everyday life is limited (Berisha et al., 2015).

Through an in-depth comparative analysis of mathematics textbooks from Indonesia and Southeast Asian countries, this research not only makes a significant contribution to the development of mathematics educational resources at the national and international levels but also provides valuable theoretical insights into didactic design principles (Utami et al., 2023). By evaluating didactic elements in textbooks, such as task types, teaching techniques, technologies, and theories, this study can help to understand how mathematics materials can be systematically and effectively designed to improve students' conceptual understanding (Chevallard & Bosch, 2020; Suryadi, 2019). In addition, the findings of this study also enrich the mathematics education literature with perspectives that take into account the local context, culture, and real-life experiences of students to provide more adaptive, relevant, and effective teaching strategies.

With this approach, it is expected that this research will provide practical recommendations for textbook developers, educators, and researchers, both locally and internationally, to create more meaningful, effective, and relevant mathematics learning experiences for students in different educational and cultural settings (Lusiana & Andari, 2019; Masykur, 2023). This research can also serve as a basis for further studies in the development of mathematics curricula and teaching methods, and make an important contribution to efforts to improve the quality of mathematics education worldwide.

Theoretical Framework

This research refers to the Anthropological Theory of Didactics (ATD) formulated by Chevallard (2006). This theory sees learning as a human activity involving interaction between individuals and educational institutions. In this context, the learning process focuses not only on the transfer of knowledge but also on how knowledge is adapted to be relevant to student's needs and educational goals (Bosch & Gascón, 2014). One of the key concepts in ATD is didactic transformation, which is the transformation of knowledge from an academic form into a form that can be taught in the classroom. This transformation involves simplification, contextualization, and organization of the material to ensure student understanding (Chevallard, 2006). ATD thus provides a framework for understanding how knowledge is taught and learned in different contexts.

The framework also includes the concept of praxeology, which consists of four main elements. First, task type (T), refers to the type of activity students are given to understand a particular concept. Second, technique (τ), which is the method or way students use to complete the task with learning needs. Then, thirdly, the technology (θ), which serves as an explanation and justification for the techniques used. Finally, theory (Θ), is the conceptual basis that supports the technology and provides broader guidance for learning (Chevallard et al., 2015). In this study, ATD was used to analyze how the Merdeka Curriculum and Gakko Tasho textbooks present the concept of whole numbers. This analysis includes how task types are designed, the techniques provided, and the justifications provided in both textbooks.

Method

This research uses a qualitative method with a hermeneutic phenomenological approach. This approach aims to understand the meaning behind the phenomenon under study through the interpretation of subjective experiences. This is in line with the research of Fuster Guillen (2019) and Keshavarz (2020), who used this method to interpret the content of mathematics textbooks. Phenomenology was used to explore learners' experiences in understanding material, while hermeneutics helped to interpret the cultural, historical, and

educational system contexts that influenced the content of the textbooks. With this approach, the research focused on analyzing the content of the two textbooks using a praxeological theoretical perspective that combines task analysis (T), technique (τ), technology (θ), and theory (Θ) in the presentation of mathematics materials (Chevallard et al., 2015).

The hermeneutic phenomenological approach was chosen for its relevance in understanding the relationship between the content taught in the textbook and the way students interpret the concepts in everyday learning contexts. This method allows the researcher to explore the unique and subjective nature of learning experiences while uncovering how didactic elements in the textbook can shape students' understanding. In this way, the research not only examines the content of the textbook but also considers its influence on the learning process.

Selection of Textbooks for Comparison

The textbooks selected for analysis are the Indonesian Merdeka Curriculum Mathematics book and the Japanese Mathematics book, translated by Sugiman and Achmad Dhany Fachrudin and published by Gakko Tosho. The Merdeka Curriculum mathematics book is compulsory provided by the Indonesian Ministry of Education, Culture, Research, and Technology (Kemendikbudristek), which focuses on developing 21st-century skills such as critical thinking, collaboration, and creativity (Trilling & Fadel, 2009). Although the Gakko Tosho book was originally produced in Japan by the Japanese Ministry of Education, Culture, Sports, Science and Technology (Monbu-Kagaku-shō), it has been translated into Indonesian and adopted as teaching material in the Merdeka curriculum. The book emphasizes concept-based learning with an exploratory and contextual approach (Schleicher, 2019).

There are several reasons for choosing these two books. First, both books teach the same topic, the concept of whole numbers, at the secondary level. Second, the use of Gakko Tosho books in Indonesia provides an opportunity to compare the didactic approaches used in local and international contexts. Thirdly, both books are widely used in schools, so the results of the analyses are expected to provide relevant insights for improving learning design in the Merdeka curriculum.

Data Collection

Data collection was carried out through document analysis, which included text, illustrations, and the structure of the presentation of material in the textbooks relevant to the topic of whole numbers. In the first stage, sections relating to the introduction of concepts, practice problems, and application examples from both textbooks were carefully identified. The information collected included the narrative approach used to present the material, how the visualization of concepts was used to support understanding, and how the textbooks provided instructions to support student learning.

Each of these elements was analyzed to identify significant similarities and differences between the two textbooks. The data also helped to understand how the two textbooks related the material to students' real-life contexts. This data collection process was carried out systematically to ensure that each aspect analyzed was relevant to the research objectives. The results of this data collection provided the basis for a more in-depth analysis of the didactic design of the textbooks.

Data Analysis

Data analysis was carried out to explore the four main components of praxeological theory, namely task type (T), technique (τ), technology (θ), and theory (Θ). The analysis process began by identifying the types of tasks presented in the textbook, such as exploration of basic concepts, problem-solving, or application to everyday life. The techniques students use to complete the task are analyzed to understand the extent to which explicit steps are provided in the textbook. Furthermore, how the textbook supports the use of particular techniques is evaluated to ensure that its conceptual justifications and explanations are relevant to the learning objectives. Finally, the mathematical theories underlying the presentation of whole number concepts were analyzed to see how these theories were used to extend students' understanding. This descriptive approach helped to identify the patterns of presentation of the material in the two textbooks, allowing an in-depth comparison of their didactic designs. This analysis provided insights into the appropriateness of the design to students' needs and its effectiveness in helping students build a solid understanding of whole number concepts.

Results and Discussion

This study focuses on two main analyses, the praxis block and the logos block, each of which is an implementation of the praxeological theory developed by Chevallard Sensevy (2014) The praxis block covers the practical aspects of learning, while the logos block focuses more on the theoretical and structural aspects underlying the understanding of mathematical concepts. BI refers to the abbreviation for Buku Indonesia, a mathematics textbook used in Indonesia, while JTB stands for Japanese Textbook, a mathematics textbook from Japan translated into Indonesian.

Before discussing in more detail, the differences between the two blocks in BI and JTB, this study begins with a preliminary visualization that illustrates how the two textbooks present whole number material. The purpose of this visualization is to give an initial idea of the approach and structure of the presentation of the material used in the two books. Figure 1 shows the visualization of the Indonesian book (BI), while Figure 2 shows the visualization of the Japanese textbook (JTB). Both figures give a clear picture of how the whole number material is structured and presented in the two books, which will then be analyzed in the context of praxeological theory.

Introduction in BI (Susanto et al., 2022)

Introduction in JTB (Tosho, 2021)

The introduction to whole numbers in BI books starts with an understanding of the sign of a number, which is positive or negative. However, there is a mismatch between the content and the context presented, which can lead to student confusion. For example, the temperature mentioned in Puncak Jaya Papua does not match the pictures shown, which are Mount Semeru and a savings book. Also, the text only mentions unit numbers, but the pictures show thousands. This inconsistency hinders students' understanding of the basic concept of whole numbers. Didactically, this inconsistent presentation interferes with the comprehension process. Meanwhile, epistemologically, the mismatch between numbers and context can damage students' knowledge structure regarding positive and negative number signs.

In contrast, in the JTB book, the presentation of whole numbers is more integrated between context and content. The picture of the thermometer showing the temperature in Dieng and Surabaya is consistent with the explanation in the text. A temperature of -2°C below 0 uses a negative sign (-), a temperature of 2°C above 0 uses a positive sign (+), and a temperature of 27°C above 0 indicates a positive number. This harmonious presentation helps students to understand the concepts of positive and negative numbers in a more relevant and contextual way. Didactically, JTB allows students to develop a more intuitive understanding. Meanwhile, epistemologically, the harmony between pictures and explanations strengthens their knowledge structure about whole numbers.

The difference in the way integers are presented in BI and JTB books reflects different didactic approaches to teaching mathematical knowledge. In the ATD framework, this difference can be understood in terms of the stage of didactic transposition, i.e. the transformation of scientific knowledge into knowledge learned by

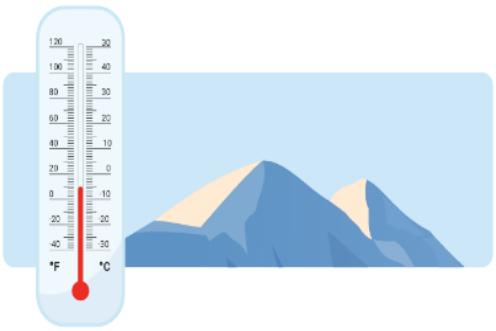
students. The more systematic and contextualized presentation in JTB reduces didactic barriers such as mismatches between pictures and explanations. It also reduces epistemological barriers that can hinder students' understanding of the concept of whole numbers. By adapting the approach used in JTB, BI books have the potential to develop materials that are more coherent, relevant, and effective in supporting students' understanding of mathematical concepts.

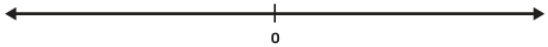
Praxis Block Analysis

The types of tasks (T) presented in the textbook serve as part of the praxis block that underpins the learning process. In the topic of integer arithmetic, there is a significant distinction between BI and JTB, both in terms of quantity and task design approaches. BI presents six types of tasks (T_1, T_2, ..., T_6), whereas JTB offers eleven types of tasks (T_1, T_2, ..., T_{11}) with higher levels of complexity. While both textbooks adopt a context-based approach, the relevance of the context in BI's tasks does not fully meet the student's needs. In contrast, JTB provides more contextual tasks, fostering a stronger connection between the concept of integers and real-life situations.

In this context, the tasks in BI and JTB allow for the application of various techniques. According to Takeuchi and Shinno (2020), techniques in task-solving can be classified into four categories, each representing a different approach: (τ_1) perceptual techniques, which focus on direct observation of objects or phenomena; (τ_2) physical techniques, which involve the use of physical tools or media; (τ_3) operational techniques, which guide students through systematic procedures to solve tasks based on established rules; and (τ_4) algebraic techniques, which involve the use of symbols or mathematical formulas to solve problems.

Table 1. Praxis block in BI

Praxis		
Type of Task (T)	**Technique (τ)**	**Description of technique of each textbook**
T_1 a. What is the approximate temperature in  Puncak Jaya today? b. What do you think is the difference between the number above 0°C and the number below on the room temperature thermometer?	τ_1	Perform mental processes to create clear visualizations and understand positive and negative integers based on prior knowledge
T_2  a. Which city has the coldest weather? b. Which city has the hottest weather?	τ_1	Engage in mental processes to visualize and represent positive and negative integers accurately on a number line based on relative positioning and intuitive understanding

Praxis		
Type of Task (T)	**Technique (τ)**	**Description of technique of each textbook**
c. Which city is colder than Seoul? d. Which city is hotter than Tokyo? e. Which city is colder, Seoul or Tokyo? f. Which city is hotter, New Delhi or Titlis? g. Write the approximate temperature location of the above cities on the number line below.  		
T_3 Description: Getting symbolized with a sign (+) Letting go is symbolized by the sign (-) Player criteria: Good (+) , bad (-) Write down the value calculation and performance effects for the club after making the player transfer below. a. Club A: get 3 good players, get 2 bad players. b. Club B: get 4 good players, give up 2 good players. c. Club C: get 1 good player, release 2 good players, release 3 bad players. d. d. Club D: get 5 good players, get 2 bad players, release 3 good players, release 4 bad players.	τ_1, τ_3	Perform mental processes to calculate and analyze operations involving positive and negative integers based on prior knowledge.
T_4  A space cooling machine whose working principle can increase and decrease cold air and hot air in certain temperature increments. The temperature will appear on the indicator as shown in Figure. Answer the questions below. • The current room temperature is 3^0C, predict whether the new temperature will be above or below zero degrees if you press the button: a. × (+3) b. × (-3) Explain your answer.	τ_1, τ_3	Utilize logical reasoning, systematic calculations, and visual interpretations to analyze temperature changes involving positive and negative integers, while drawing connections to prior knowledge

Proses Transfer Pemain	Perhitungan Nilai	Efek Performa Bagi Klub
Mendapatkan satu pemain bagus	$+(+1)$	Performa naik
Mendapatkan satu pemain buruk	$+(-1)$	Performa turun
Melepaskan satu pemain bagus	$-(+1)$	Performa turun
Melepaskan satu pemain buruk	$-(-1)$	Performa naik

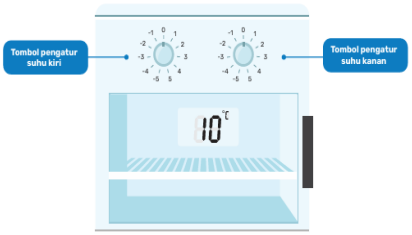
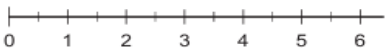
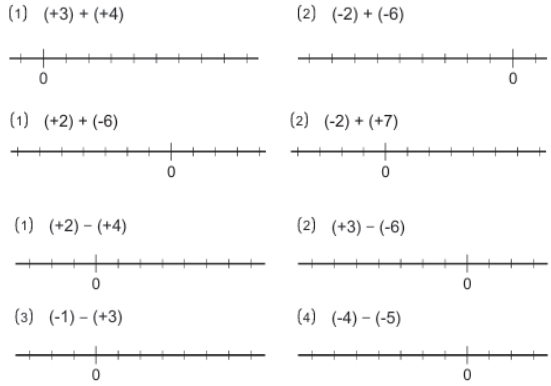
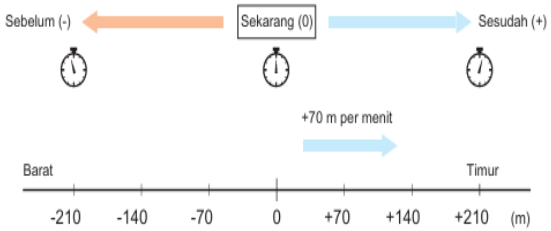
Praxis		
Type of Task (T)	**Technique (τ)**	**Description of technique of each textbook**
• The current room temperature is -5^0C, predict whether the new temperature will be above or below zero degrees if you press the button: c. × (+2) d. × (-2) Explain your answer.		
T_5  If the user wants a certain temperature to be reached by the machine, the user simply turns the two temperature control knobs located on the right and left sides. The temperature seen on the machine is the product of the numbers shown on the two temperature control dials. There are negative to positive numbers on the temperature control dial. Based on the description above, write down the various possible temperature pairs that can be indicated on the two temperature control dials. 10^0C Tombol Pengatur Suhu Kiri | Tombol Pengatur Suhu Kanan ..... |	τ_1, τ_3	Engage in cognitive processes to develop accurate visual representations and devise effective strategies for completing tasks by utilizing prior knowledge.
T_6  During the Covid-19 pandemic, many relatives and friends became ill. Anita bought oranges and apples to share and show concern for relatives who were in self-isolation. Anita wanted to share equal amounts of both types of fruit with several people. After counting, Anita bought as much fruit: Jeruk: 16 buah Apel: 24 buah What are the possible number of friends or relatives the fruit can be sent to? Explain your answer?	τ_3	Utilize arithmetic operations to systematically identify integer factors for solving problems related to equitable distribution

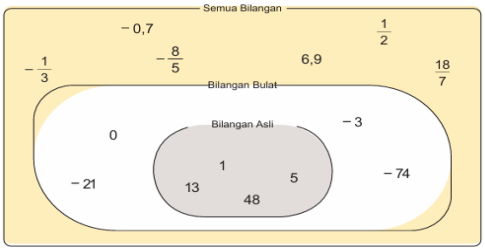
Table 2. Praxis block in JTB

Praxis		
Type of Task (T)	**Technique (τ)**	**Description of technique of each textbook**
T_1 The height of Mount Semeru is 3,676 meters above sea level, and the depth of the Java Trench is 7,140 meters below sea level. The base point for reference is the coastline. How do we express the quantities in the following figure using positive and negative signs? 	τ_1	Perform mental processes to represent quantities using positive and negative integers based on a reference point.
T_2 Express the following numbers using positive and negative signs. (1) Numbers 8 bigger than 0 (2) Numbers -4 less than 0	τ_1	Perform mental processes to represent numbers using positive and negative signs based on their relation to zero.
T_3 • Mark the points corresponding to 2 ; 2.5 ; 1/2 on the number line below. Compare the values. • What is needed to present negative  numbers on a number line? Answer using the number line above. • Which is bigger, -2 or -5? Explain using a number line.	τ_1, τ_3	Perform perceptual reasoning to place the given numbers on a number line and apply operational reasoning to compare their values
T_4  By using game cards, Fill in the following table with addition math sentences to express the number of steps the card moves.  Continuing the card game, fill in the following table 	τ_1, τ_3	Use operational reasoning to perform addition and fill in the table, while applying perceptual skills to understand the movement of the cards

	Banyaknya langkah pada giliran pertama	Banyaknya langkah pada giliran kedua	Kalimat matematika penjumlahan untuk menghitung jumlah total banyaknya langkah	Banyaknya langkah perpindahan
ⓐ	-5	-3		?
ⓑ	+5	-3		?
ⓒ	-5	+3		?

	Banyaknya langkah pada giliran pertama	Banyaknya langkah pada giliran kedua	Jumlah langkah perpindahan	Kalimat pengurangan untuk menghitung banyaknya langkah pada giliran kedua
ⓑ	+4	?	+1	
ⓐ	-3	?	+2	
ⓒ	-2	?	-6	

Praxis		
Type of Task (T)	**Technique (τ)**	**Description of technique of each textbook**
with subtraction sentences to calculate the number of moves on the second turn.		
T_5 Calculate using the number line.  	τ_3	Engage operational reasoning to solve calculations with the help of the number line.
T_6 Does the addition rule we learned in elementary school also apply to the addition of positive and negative numbers? Calculate a and b then compare them. Verify again by using several other numbers. (1) a. (5) + (-7) b. (-7) + (5) (2) a. {(-3) + (6)} + (4) b. (-3) + {(6) + (-4)}	τ_3	Use the commutative and associative properties of addition to solve and compare the results of adding positive and negative numbers.
T_7 Given mathematical sentences that contain two operations. Can you find a way to solve them? (1) (+2) + (-5) - (-4) (2) (-6) - (+7) - (-6)	τ_3	Perform the operations of addition and subtraction on integers to solve the given mathematical sentences step by step
T_8 Munir walks eastward at a speed of 70 m per minute. The starting point is set as 0 m. The east direction is considered the positive direction. Each passing minute is counted as +1 minute. 1. At which point is Munir after walking for one minute? After two minutes? At which point was he one minute earlier? Two minutes earlier? Mark Munir's location (using arrows) on the following diagram.  	τ_1, τ_3	Analyze and determine positions on a number line by applying positive and negative integers to represent direction and time

Praxis		
Type of Task (T)	**Technique (τ)**	**Description of technique of each textbook**
2. State Munir's location at the specified times by filling in ( ) and [ ] with the correct numbers.  		
T_9 Calculate, then compare the results between a and b. (1) a. (+4) × (-3) b. (-3) × (+4) (2) a. {(+2) × (-4)} × (-5) b. (+2) × {(-4) × (-5)}	τ_3	Use the commutative and associative properties of multiplication to solve and compare the results of adding positive and negative numbers.
T_{10} • Fill in the boxes [ ] with the appropriate numbers. (1) ([ ]) × (+2) = +6 (2) ([ ]) × (+2) = -6 (3) ([ ]) × (-2) = +6 (4) ([ ]) × (-2) = -6 To determine the numbers to fill in [ ], we use division as the inverse of multiplication. • Observe (3) and (4) below, then fill in the blank with the appropriate number. (3) Since (-3) × (-2) = +6, (+6) ÷ (-2) = [ ] (4) Since (+3) × (-2) = -6, (-6) ÷ (-2) = [ ]	τ_3	Use the relationship between multiplication and division to determine missing numbers, applying the rules of operations with positive and negative integers.
T_{11}  To which group do the following numbers in the image above belong? Write the numbers in the appropriate place in the image. -16, 92, 1,000, 0.3, and 1/60.	τ_1, τ_3	Classify numbers into their respective groups, including natural numbers, integers, and all numbers, based on their properties and values

The block of practical tasks in BI covering T_1 to T_6 and in JTB extending from T_1 to T_{11} showed a similar pattern, namely the dominance of τ_1 and τ_3. This pattern suggests that whole number items tend to use students' prior knowledge to support problem solving with a direct approach. Although effective in helping students understand the basics of the material, this approach provides minimal opportunities for students to explore new concepts or develop knowledge through exploratory activities and observations (Hendriyanto et al., 2023).

As Rashidov (2020) points out, effective learning involves more than just the transfer of knowledge. The learning process must be designed to integrate the acquisition of information with the development of new ideas that enhance students' competence. However, many textbooks in Indonesia are still dominated by tasks that focus on procedural skills without providing sufficient space for deep conceptual understanding (Hidayah &

Forgasz, 2020; Fuadah et al., 2021). This suggests that task design needs to be revised to reflect the need for students to learn actively and creatively.

Good task design should include elements of exploration, reflection and application of concepts in different contexts. With this approach, learning will not only improve students' procedural skills but also provide relevant and lasting deeper understanding. The materials in BI show good quality in covering sub-materials such as whole number factors, which are an integral part of the whole whole number concept. However, weaknesses are still found, such as the lack of tasks related to integer division, the lack of support for broad knowledge development, the mismatch between context and content, and the task design that does not fully emphasise deep understanding of concepts and procedures (Hidayah & Forgasz, 2020; Wijaya, 2015).

Instead, JTB offers a more substantial and systematic approach. Although this book does not cover the subset of integer factors, it presents various basic concepts of integers and other types of numbers in a structured manner. This is in line with the research findings of Kusharyadi et al. (2024) who highlighted the advantages of Malaysian mathematics textbooks in terms of systematicity and comprehensiveness, which can reduce learning gaps and make it easier for students to understand the material. These findings are consistent with those of Hendriyanto et al. (2023), who found that differences in task design in mathematics textbooks in different countries, such as Singapore and Indonesia, reflect adaptations to students' culture and character, thereby supporting learning effectiveness. JTB's strengths in systematic approach and content organization illustrate an alternative that can be adapted. To improve the quality of learning in Indonesia, it is important to consider developing task designs that not only emphasize procedural skills, but also provide space for students to explore and understand concepts more deeply.

Logos Block Analysis

In the logos block analysis two main elements complement each other, namely technology (θ) and theory (Θ). Technology (θ) serves to explain and justify the methods or techniques (τ) used in the learning process. Technology includes tools, strategies, or approaches used to facilitate learning. Theory (Θ), on the other hand, is the conceptual foundation that supports technology and provides broader guidance. It brings together and generalizes different elements such as problem types (T), techniques (τ), and technologies (θ) to create a more structured theoretical knowledge framework.

To apply this logic block analysis framework, the concept of integers in BI is elaborated through three main theoretical elements, which have specific objectives and approaches. The first theoretical element (Θ_1) helps students understand the basics of integers, including positive numbers, zero numbers, and negative numbers. At this stage, students are asked to identify the characteristics of each type of number and to understand the relationship between them. The second theoretical element (Θ_2) builds on this understanding by focusing on whole-number operations, including addition, subtraction, multiplication, and division. Furthermore, the third theoretical element (Θ_4) extends this scope to enable students to understand a whole number of factors based on previously acquired knowledge. This approach ensures that students not only recognize whole numbers but are also able to use them in more complex operational contexts, such as solving everyday problems related to financial transactions or temperature changes.

As an extension of the approach in the BI book, the JTB book also develops the concept of integers through three main theory elements with different emphases. The first theory element (Θ_1) aims to help students understand the basics of integers, including positive, zero and negative numbers. This element provides an initial introduction to build a solid foundation. The second theoretical element (Θ_2) builds on this understanding with a focus on whole number operations such as addition, subtraction, multiplication and division. The third theoretical element (Θ_3) continues this development by emphasising the properties of whole numbers, such as the commutative and associative properties of addition and multiplication. This understanding builds on prior knowledge so that students are able to see the relationship between these properties in a wider context.

Comparison of BI and JTB

Please embed tables and figures in appropriate areas within the document and center them horizontally. Tables and figures should not exceed the given page margins. Provide captions (maximum length: 6 to 8 words) for each table or figure. Centre the caption above the table and below the figure. Please reference the table or figure in the text (see Table 1). Please do not use vertical lines in tables. For figures, GIF and JPEG (JPG) are the

preferred formats. This study explores the comparison of approaches to teaching whole number concepts in BI and JTB using a regional praxeological framework. This framework has three main components: technique (τ), technology (θ), and theory (Θ). The focus is on three main topics: positive and negative integer recognition, integer operations, and integer factors. Several studies support the relevance of this framework for analyzing mathematics learning. Research by Rocena and Joaquin (2021) highlights differences in mathematical thinking approach between students from different countries, which can be used to understand how mathematical creativity is developed. However, their focus is not directly on BI and JTB. In addition, a study by Hasti Yunianta et al. (2023) strengthens the analytical framework with a praxeological approach, while Gunawan et al. (2024) provides a relevant comparative perspective on the curricula of the two countries. This research uses these findings to examine how techniques, technologies, and theories effectively support whole number learning.

Table 3. Regional praxeology of integer concepts in BI and JTB

Theme	Types of Books	Number *T*	Technique (τ)	Technology (θ)	Theory (Θ)
Understanding whole numbers (Positive and negative numbers)	BI	T_1, T_2	τ_1	θ_1: Numbers that consist of negative integers, zeros, and positive integers are called integers	Θ_1: Integers are numbers that consist of negative integers, zeros, and positive integers.
	JTB	T_1, T_2,			
		T_3, T_{11}	τ_1, τ_3	-	-
Whole number counting operations	BI	T_3, T_4	τ_1, τ_3	θ_2: Combining or removing quantities, as well as multiplying, dividing, and performing mixed operations, involves the addition, subtraction, multiplication, and division of integers, while considering their positive or negative signs	Θ_2: The addition, subtraction, multiplication, division, and mixed operations of integers involve combining or removing quantities, multiplying, dividing, and adjusting signs accordingly
		T_4 , T_5	τ_1, τ_3		
		T_7	τ_3		
		T_8 , T_{10}	τ_1, τ_3		
	JTB	T_6 , T_9	τ_3	θ_3:The associative property allows flexibility in grouping numbers without changing the result. In contrast, the commutative property ensures that the order of operations in addition and multiplication does not affect the outcome.	Θ_3:The commutative property means the order of numbers does not affect the result, while the associative property means grouping numbers does not affect the result in addition and multiplication.
Integer factors	BI	T_5 , T_6	τ_1, τ_3	θ_4:The numbers that divide a given integer exactly, leaving no remainder, are called integer factors	Θ_4: Factors of a number are certain numbers that can completely divide a number.
	JTB	-	-	-	-

Table 3 shows that BI is structured in building techniques and providing technology explanations for each theme. On the topic of understanding whole numbers (positive and negative), BI uses τ_1 with the technique θ_1, which provides an explicit definition of whole numbers. In contrast, JTB broadens the scope with an additional technique τ_3 to develop understanding through exploration, in line with the didactic situation theory that emphasises the teacher's role in guiding students to understand basic concepts.

In the topic of whole number counting operations, BI used τ_1 and τ_3 for basic operations such as addition and subtraction, enriched with θ_2 technique to explain the properties of operations. In contrast, JTB adds sub-technique τ_3 to emphasize associative and commutative properties, supporting students' exploration in understanding the flexibility of operations. However, this approach reflects learning barriers if students are not given adequate guidance. On the topic of whole numbers, BI used τ_1 and τ_3 accompanied by θ_4 to provide a systematic understanding of whole numbers. This demonstrates BI's focus on supporting students' procedural understanding. In contrast, JTB provides no detail on this topic, which may reflect a difference in pedagogical priorities between the two systems. JTB's greater emphasis on exploratory flexibility may account for the lack of attention to this theme. According to Hastiyunianta et al. (2023), this flexible approach can deepen students' understanding of mathematical concepts. However, the lack of a detailed explanation of the factors in JTB reflects the different emphasis on the teaching strategies of the two systems.

BI is consistent in theory and pedagogical structure, following praxeological principles that emphasize the relationship between technique (τ), technology (θ), and theory (Θ). This approach supports systematic understanding but faces learning barriers, such as didactic barriers arising from task design that does not emphasize deep understanding, ontogenetic barriers due to the lack of support for the development of broad knowledge, and epistemological barriers that limit students' independent exploration. On the other hand, JTB offers flexibility in techniques to support independent exploration and discovery. However, without adequate structure, this flexibility can create barriers to learning, especially for students who need clearer guidance to understand complex concepts. These two approaches present different challenges and learning barriers, reflecting the unique priorities in their respective mathematics education strategies.

Conclusion

This study shows that there are significant differences in didactic approaches between Merdeka Curriculum textbooks and Gakko Tosho. Analyses based on practice blocks (tasks and techniques) and logos blocks (technologies and theories) reveal the strengths and weaknesses of each approach. Indonesian textbooks tend to focus on procedural skills with consistent theoretical support but often lack contextual relevance and are not fully coherent in task design. In the practice block, the techniques used are dominated by instructional approaches with a focus on procedural steps, but with little room for independent exploration. In the logos block, the techniques used adequately support basic understanding but do not provide enough context to broaden students' horizons.

In contrast, Japanese textbooks emphasise flexibility of exploration and better integration of context. In the practical block, the dominant technique is an exploratory approach, which allows students to relate mathematical concepts to real-world situations and supports more meaningful learning. The practical task block in BI, covering T_1 to T_6, and in JTB, extending from T_1 to T_{11}, showed a similar pattern of dominance of τ_1 and τ_3 techniques, reflecting a focus on direct instruction and exploratory tasks. In the logos block, the techniques and theories used support a deeper conceptual approach, with an emphasis on exploring the properties of whole numbers. However, both face challenges in the form of learning barriers, such as the lack of explicit instructions in Japanese textbooks and the incompatibility of contexts in Indonesian textbooks. To improve the quality of learning, it is recommended that the 'Merdeka Curriculum' adopt the systematic approach of 'Gakko Tosho' and adapt it to the local context, such as integrating the context of students' daily lives. The findings of this study make an important contribution to the development of more adaptive and relevant mathematics textbook designs, both nationally and internationally. In addition, this research also opens up opportunities for further studies related to contextualised didactic design that can support curriculum development in different countries.

Scientific Ethics Declaration

* The authors declare that the scientific ethical and legal responsibility of this article published in EPESS journal belongs to the authors.

Conflict of Interest

* The authors declare that they have no conflicts of interest

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References

Berisha, V., Jashari, H., & Thaqi, X. (2015). A mismatch between curriculum intentions and textbook design: An assessment of mathematics textbooks for lower secondary school in Kosovo. *GSTF Journal on Education, 2*(2), 31–35.

Bosch, M., & Gascón, J. (2014). Introduction to the anthropological theory of the didactic (ATD). In A. Bikner-Ahsbahs & S. Prediger (Eds.), *Networking of theories as a research practice in mathematics education* (pp. 67–83). Springer International Publishing.

Charalambous, C. Y., Delaney, S., Hsu, H. Y., & Mesa, V. (2010). A comparative analysis of the addition and subtraction of fractions in textbooks from three countries. *Mathematical Thinking and Learning, 12*(2), 117–151.

Chevallard, Y. (2006). Steps towards a new epistemology in mathematics education. In *Proceedings of the IV Congress of the European Society for Research in Mathematics Education* (pp. 21–30).

Chevallard, Y., & Bosch, M. (2020). Didactic transposition in mathematics education. In S. Lerman (Ed.), *Encyclopedia of mathematics education* (pp. 214–218). Springer.

Chevallard, Y., Bosch, M., & Kim, S. (2015). What is a theory according to the anthropological theory of the didactic? In *CERME 9: Thematic working group 17* (pp. 35–45).

Chevallard, Y., & Sensevy, G. (2014). Anthropological approaches in mathematics education: French perspectives. In S. Lerman (Ed.), *Encyclopedia of mathematics education* (pp. 38–43). Springer.

Erbaş, A. K., Alacaci, C., & Bulut, M. (2012). A comparison of mathematics textbooks from Turkey, Singapore, and the United States of America. *Educational Sciences: Theory & Practice, 12*(3), 2324–2330.

Fan, L., Zhu, Y., & Miao, Z. (2013). Textbook research in mathematics education: Development status and directions. *ZDM – International Journal on Mathematics Education, 45*(5), 633–646.

Fuster Guillén, D. E. (2019). Investigación cualitativa: Método fenomenológico hermenéutico. *Propósitos y Representaciones, 7*(1), 201.

Gunawan, R. G., Rozika, E., Rusdinal, Gistituati, N., & Ananda, A. (2024). Studi komparatif kurikulum matematika sekolah dasar Indonesia dan Australia. *Jurnal Elemen, 12*(1), 401–407.

Hastiyunianta, T. N., Suryadi, D., Dasari, D., & Herman, T. (2023). Textbook praxeological-didactical analysis: Lessons learned from the Indonesian mathematics textbook. *Journal on Mathematics Education, 14*(3), 503–524.

Hendriyanto, A., Suryadi, D., Dahlan, J. A., & Juandi, D. (2023). Praxeology review: Comparing Singaporean and Indonesian textbooks in introducing the concept of sets. *Eurasia Journal of Mathematics, Science and Technology Education, 19*(2), 1–13.

Hidayah, M., & Forgasz, H. (2020). A comparison of mathematical task types used in Indonesian and Australian textbooks based on geometry contents. *Journal on Mathematics Education, 11*(3), 385–404.

Keshavarz, H. (2020). Hermeneutic phenomenology in supporting research and information services: Contributions to information science. *Journal of Information Science Theory and Practice, 8*(4), 29–39.

Kristanto, Y. D., & Santoso, E. B. (2020). Towards a mathematics textbook for supporting 21st century learning: The student perspective. *Journal of Physics: Conference Series, 1657*(1), Article 012031.

Kusharyadi, R., Fatimah, S., & Kusnandi, K. (2024). A praxeological review of concept sequence and series: Comparing Malaysia and Indonesia textbooks. *Jurnal Elemen, 10*(2), 239–259.

Li, Y. (2000). A comparison of problems that follow selected content presentations in American and Chinese mathematics textbooks. *Journal for Research in Mathematics Education, 31*(2), 234–241.

Lusiana, R., & Andari, T. (2019). Developing an algebra textbook based on problem solving to improve students' learning achievement. *Al-Jabar: Jurnal Pendidikan Matematika, 10*(2), 293–306.

Masykur, M. (2023). Mathematics learning model (based on multicultural education). *JUPE: Jurnal Pendidikan Mandala, 8*(3), 1016.

Muljo, A., Anggreni, F., & Maulida, S. (2024). Pengembangan e-modul persamaan lingkaran kelas XI MA menggunakan aplikasi Heyzine. *Jurnal Ilmiah Pendidikan Matematika Al-Qalasadi, 8*(1), 113–121.

Mullis, I. V. S., Martin, M. O., Gonzalez, E. J., Gregory, K. D., Garden, R. A., O'Connor, K. M., & Smith, T. A. (2000). *TIMSS international results in mathematics and science*. TIMSS & PIRLS International Study Center.

Pepin, B., & Gueudet, G. (2014). Curriculum resources and textbooks in mathematics education. In S. Lerman (Ed.), *Encyclopedia of mathematics education* (pp. 132–135). Springer.

Rashidov, A. (2020). Development of creative and working-with-information competences of students in mathematics. *European Journal of Research and Reflection in Educational Sciences, 8*(3), 10–15.

Rezat, S., Fan, L., & Pepin, B. (2021). Mathematics textbooks and curriculum resources as instruments for change. *ZDM – Mathematics Education, 53*(6), 1189–1206.

Rocena, L. A. M., & Joaquin, M. N. B. (2021). A comparative investigation of the mathematical creativity of Filipino and Japanese students. *International Journal of Studies in Education and Science, 2*(1), 59–73.

Schleicher, A. (2019). *PISA 2018: Insights and interpretations*. OECD Publishing.

Suryadi, D. (2019). *Landasan filosofis penelitian desain didaktis (DDR)*. Pusat Pengembangan DDR Indonesia.

Susanto, D., Sihombing, S., Radjawane, M. M., Wardani, A. K., Kurniawan, T., Candra, Y., & Mulyani, S. (2022). *Matematika SMP/MTs kelas VII*. Kementerian Pendidikan dan Kebudayaan.

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.

Tosho, T. G. (2021). *Matematika untuk sekolah menengah pertama kelas VII*. Pusat Kurikulum dan Perbukuan, Kementerian Pendidikan dan Kebudayaan.

Trilling, B., & Fadel, C. (2009). *21st century skills: Learning for life in our times*. John Wiley & Sons.

Utami, N. S., Prabawanto, S., & Dahlan, J. A. (2023). An analysis of mathematics textbooks of the Indonesian curriculum based on the functional thinking framework. *JRAMathEdu (Journal of Research and Advances in Mathematics Education)*.

Wijaya, A. (2015). *Context-based mathematics tasks in Indonesia: Toward better practice and achievement*.

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