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Analysis on Geometric Mathematics Textbooks for Grade 5 of Elementary Schools in Malaysia, China, and Indonesia

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Abstract: Analysis on Geometry Mathematics Textbooks for Grade 5 of Elementary Schools in Malaysia, China, and Indonesia. Objective: This research analyzes the differences in the geometry material presented to grade 5 students of elementary schools and determines the characteristics of the questions in mathematics textbooks. **Methods:** The content analysis compared the geometry materials in the best mathematics textbooks widely used in grade 5 of elementary schools in Indonesia, Malaysia, and China. The analysis discussed several important points on geometry material, including sub-chapter, chapter content, and the presentation of practice questions. **Findings:** The results show that 66.36% of questions in the Indonesian textbook asked about knowing, 24.54% applying, and 0.09% reasoning. In the Malaysian textbook, 71.42% of questions asked focused knowing, 23.8% applying, and 4.76% reasoning. Furthermore, 49.6% of questions in the Chinese textbooks asked about knowing, 30.4% applying, and 20% reasoning. **Conclusion:** questions on knowing had the highest percentage in the Indonesian and Malaysian textbooks but balanced in Chinese.

Keywords: mathematics textbook, geometry, Indonesian, Malaysian, China.

Abstrak: Analisis Buku Ajar Matematika Geometri Kelas 5 SD di Indonesia, Malaysia dan China. ***Tujuan:*** Penelitian ini bertujuan untuk menganalisis perbedaan materi geometri yang disajikan kepada siswa kelas 5 SD dan menentukan karakteristik soal pada buku teks matematika. ***Metode:*** Analisis isi membandingkan materi geometri dalam buku teks matematika terbaik yang banyak digunakan di kelas 5 sekolah dasar di Indonesia, Malaysia, dan Cina. Analisis membahas beberapa poin penting pada materi geometri, antara lain sub bab, isi bab, dan penyajian soal latihan. ***Temuan:*** Hasil penelitian menunjukkan bahwa 66,36% pertanyaan dalam buku teks bahasa Indonesia menanyakan tentang mengetahui, 24,54% menerapkan, dan 0,09% penalaran. Dalam buku teks Malaysia, 71,42% pertanyaan yang diajukan terfokus mengetahui, 23,8% menerapkan, dan 4,76% penalaran. Selanjutnya, 49,6% pertanyaan dalam buku teks bahasa Mandarin menanyakan tentang mengetahui, 30,4% menerapkan, dan 20% penalaran. ***Kesimpulan:*** pertanyaan tentang mengetahui memiliki persentase tertinggi dalam buku teks bahasa Indonesia dan Malaysia tetapi seimbang dalam bahasa Cina.

Kata kunci: *buku teks matematika, geometri, Indonsia,Malaysia, China.*

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INTRODUCTION

Each country has a different curriculum, as seen from the textbooks due to different histories, culture, language, economy, and geographic landscapes (Alajmi, 2012; Charalambous et al., 2010; Cheng & Wang, 2012; Delaney et al., 2007; Erbas et al., 2012; Ozer & Sezer, 2014). Textbooks affect the content presented by the teacher and the students' understanding and problem-solving techniques (Fan, 2013; Yang & Wu, 2010). In line with this, previous research showed that textbooks play an important role in learning, especially mathematics (Alim et al., 2020; Baker et al., 2010; Cai & Ni, 2011; Fan, 2013; B. Reys et al., 2010; Schoen et al., 2010; Zhu & Fan, 2006)

Mathematics textbooks influence teaching and learning (Fan et al., 2013; B. J. Reys et al., 2004; Yang et al., 2017) as a resource to build students' knowledge and measure their achievement. Additionally, textbook quality affects teaching effectiveness and student performance (Fan et al., 2013; Stein et al., 2007; Törnroos, 2005; Yang & Sianturi, 2020). Therefore, a cross-country comparison of mathematics textbooks provides input to improve learning quality. This is presented from the research on textbooks, which show differences in mathematical content and design in various countries (Fan, 2013; Fan et al., 2013) (Author et al., 2010; Fan, 2013; Schmidt, 2004; Zhu & Fan, 2006).

Geometry is the main material in mathematics textbooks and curriculum (Clements et al., 2002; Hoyles et al., 2002; K. Jones et al., 2013), with theoretical and practical characteristics (Choi & Park, 2013). Also, it is an important part of the Program for International Student Assessment (OECD, 2013) and Trends in International Mathematics and Science Study (Mullis et al., 2012).

Previous research analyzed mathematics textbooks between countries at various elementary school levels (Boonlerts & Inprasitha, 2013; Daud, 2020; Erbas et al., 2012; Kar et al., 2018; Vula et al., 2016; Yang & Sianturi, 2020), focusing on fractions and algebra. Choi & Park (2013), Park & Leung (2006), and Purnama et al. (2020) analyzed statistical, probability, and trigonometric material in high schools. Similarly, Miyakawa (2017), Takeuchi & Shinno (2020), and Yang et al. (2017) analyzed the form of representation, contextual features, and response types as the three aspects of proving statements and mathematical theorems in high school geometry textbooks. Yang et al. (2017) analyzed the differences in presenting geometry concepts and the characteristics of its questions in mathematics textbooks of elementary schools in Finland, Singapore, and Taiwan. There is limited cross-country analysis of textbooks on geometry material, especially in elementary schools. Therefore, it is interesting to study the geometry material of mathematics textbooks for grade 5 of elementary schools in China, Malaysia, and Indonesia by analyzing the composition of the sub-chapters, content, and the presentation of practice questions. The analysis of this book was conducted to see the differences in the presentation of geometry material in books in three countries, namely Indonesia, Malaysia and China. Studies have shown that the use of textbooks can affect students' mathematics achievements, especially in the field of geometry (Abdullah & Shin, 2019).

The strengths and weaknesses of mathematics textbooks in a particular country are determined through an international comparative analysis (Cai & Ni, 2011; Fan, 2013). Therefore, this research compared the geometry content for the 5-grade elementary schools in Indonesia, China, and Malaysia to answer two questions. The first question concerns the differences in the composition of the geometry material presented to 5-grade among the three-textbook series. The second question is about the characteristics of

the geometry questions in the three-textbook series.

METHODS

This research is a descriptive research that aims to obtain information about the scope of geometry material taught in the three countries of Indonesia, Malaysia and China. The population in this study is geometry material in class V Elementary School in mathematics textbooks analyzed. The sample in this study is a few pages in a book that analyzed. Samples were taken by multistage technique sampling. The textbooks analyzed were 3 books that were most widely used in schools in each country, the material being analyzed was from each book.

Content analysis was used to compare geometry material in mathematics textbooks for the grade 5 of elementary schools in Indonesia, Malaysia, and China. Based on previous analysis and comparison (Charalambous et al., 2010; D. L. Jones & Tarr, 2007; Wijaya et al., 2015; Yang & Lin, 2015; Yang & Sianturi, 2017, 2020; Zhu & Fan, 2006), the selected textbooks are the best and widely used in their respective countries. The specifications are displayed in Table 1.

Table 1. Indonesian, Chinese, and Malaysian textbook versions

Country	Publisher	Textbook Title	Publication Year
Indonesia	Center for Curriculum and Textbooks, Research and Development Agency, Ministry of Education and Culture	Senang Belajar Matematika SD/MI Kelas 5 (Happy to Learn Mathematics in Elementary/Islamic Elementary School for Grade 5)	2018
Malaysia	Language and Library Council of Kuala Lumpur	Matematika Sekolah Kebangsaan Tahun5 (National School Mathematics for Grade 5)	2017
China	People's Education Press	Buku Wajib Pendidikan Matematika Kelas 5 Volume 1 (Mathematics Education Textbook for Grade 5 Volume 1)	2013
		Buku Wajib Pendidikan Matematika Kelas 5 Volume 2 (Mathematics Education Textbook for Grade 5 Volume 2)	

The selection of Indonesian mathematics books was chosen based on the Curriculum and Textbook Center, Research and Development Agency of the Indonesian Ministry of Education and Culture, which is the official Indonesian language textbook for grade 5. This book was approved and distributed free of charge to the Ministry of Education and Culture.(Kusmawati et al., 2020).Meanwhile, Malaysia has a book-centered education system published by the Ministry of Education (MOE) which coordinates and oversees textbook material(Han et al., 2011).

The textbook published by the Language and Library Council of Kuala Lumpur is one of the learning resources used in Malaysia. The Chinese version of the mathematics textbook is published by the People's Education Press and is the most widely used as a good source of learning (Purnama et al., 2020).

The analysis discussed several points adopted from Purnama et al. (2020) on geometry material in the three countries. The analysis points include: (1) The composition of sub-chapters; (2) Sub-chapter content; (3) The presentation of the practice questions the questions were assessed with the TIMSS 2019 assessment framework that discussed students' mathematical reasoning and applying them to everyday life.

The analysis involved describing and grouping questions based on the cognitive domain of the TIMSS 2019 assessment framework that consisted of knowing, applying, and reasoning.

■ RESULT AND DISCUSSIONS

Analysis of the Sub-Chapter Composition of Geometry Material

The geometry sub-chapters were composed by analyzing the curriculum of each country at various aspects, such as learning structure and objectives, the number of subject hours, competency standards, and other important factors related to teaching and learning activities. Each country has a different material arrangement and discussion. Table 2 displays the

Table 2. The composition and sub-chapters of geometry material for grade 5 elementary school in China, Indonesia, and Malaysia

Material	Sub-sub	Indonesia (Research and Development Agency, Ministry of Education and Culture)	Malaysia (Language and Library Council of Kuala Lumpur)	China (People's Education Press)
Geometry	Flat Shape	• Identify the properties of flat shapes • Determine the area of a flat shape Determine the area of the combined flat shape	Chapter 2: Polygon • Determine the properties of flat shapes Calculate the angles of flat shapes	(First Volume) Polygon area • Identify the area of a square, parallelogram, rectangle, trapezium, triangle, and kite. • Calculate the area of the combined flat shape Calculate the area of squares and rectangles as nets
	Geometry	• Explain the combination of several geometries completed with their surface area and volume • Name the parts of the cylinder • Mention the parts of a pyramid Name the parts of the sphere	Geometry: Calculate the volume of the combined geometry	Cubes and Blocks • Identify the nets on blocks and cubes • Observe the properties of blocks and cubes Calculate the volume of cubes and cubes

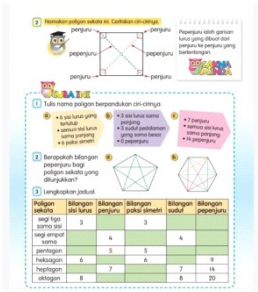
differences in the composition and sub-chapters of geometry material between Indonesian, Chinese, and Malaysian textbooks.

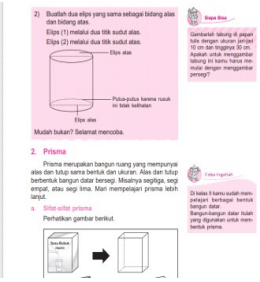
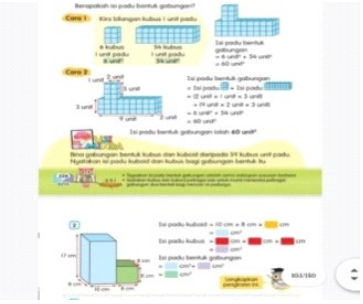
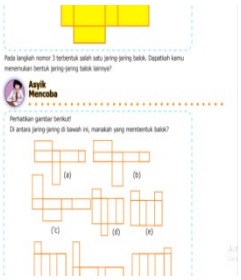
Table 2 presents the composition of sub-chapters in geometry material for grade 5 elementary schools in Indonesia, Malaysia, and China. There are seven flat shape and geometry indicators in Indonesia, three in Malaysia, and six in China. Some of the topics studied in grade 5 in Indonesian and Chinese textbooks, such as geometry volumes and nets, have featured in Malaysian textbooks for grade 4. Furthermore, the material is presented in general terms in Indonesian textbooks, but briefly, concisely, and clearly in Malaysian. The Chinese textbooks convey less material and more exercises and discussion of questions. Material presentation for Indonesia, China, and Malaysia is shown in Table 3.

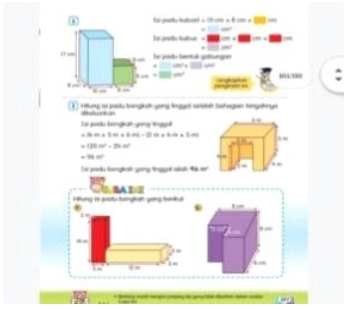
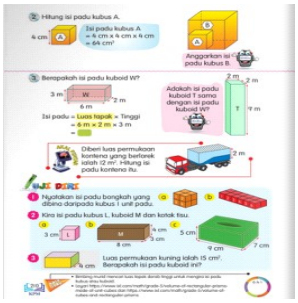
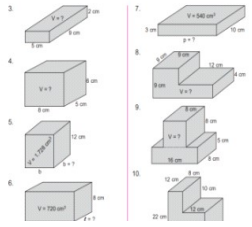
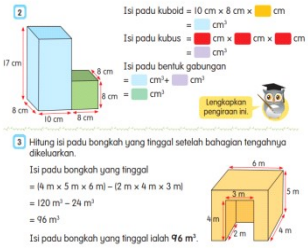
Content Analysis of Geometry Sub-Chapters for Grade 5

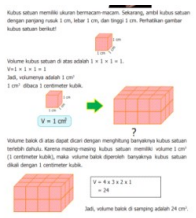
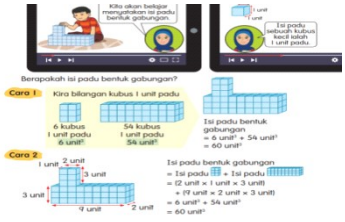
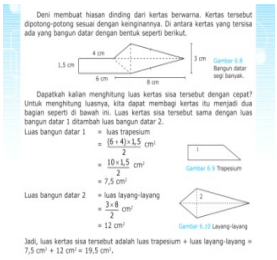
Content analysis was conducted to determine the presentation of material content from

Table 3. The description of grade 5 geometry material in 3 countries

	INDONESIA	MALAYSIA	CHINA
PROPERTIES OF FLAT SHAPE	 Learn the properties for all flat shapes, including squares, rectangles, parallelograms, triangles, trapezoids, kites, and circles	 The properties of flat shapes focus on sides (corners), angles, and axes of rotational and fold symmetry. Not all properties of flat shapes are explained.  (mathematics for grade 4) The properties of flat shapes are discussed in detail in class 4	 Materi yang dipelajari memang membahas mengenai poligon, akan tetapi dalam pembelajaran langsung masuk pada penghitunganan luas menggunakan kertas grafik atau persegi satuan.

PROPERTIES OF GEOMETRY	 The material studied is about the properties of cubes, blocks, circles, prisms.	 Based on the observed Mathematics textbook for grade 5, geometry properties are not discussed and directly calculates the volume (solid content) using unit cubes. Also, it discussed the volume of combined shapes.	 The geometry properties are not studied specifically but only present the shape based on objects around students.
GEOMETRY NETS	 Teaching uses objects such as boxes and others in the form of cubes or blocks. Students open the box and determine the number of geometries to make observations on the nets. From the nets formed according to the box, students analyze other forms of the nets that could be made of cubes, blocks, cylinders, or prisms.	 In Malaysia, the material for nets has been studied in grade 4. It is included in the material for the properties of flat shapes but not discussed specifically.	 After opening the geometry (cubes or beams), students identify the parts with the same area, length, width, and height as previously opened on the sides. Students determine which nets form a block or cube space based on pictures or media examples of available nets.

THE VOLUME OF GEOMETRY	 Students are presented with formulas to determine the volume of various geometry. In determining the volume, the teacher brings students to conduct a project by filling the geometry and calculating the volume.	 The material on the volume of geometry in grade 5 directly calculates the combined shapes as studied in grade 4 (mathematics for grade 4) 	 Determining the volume of the shape and inviting students to observe objects around them that have the same shape as the geometry. Students determine the volume according to the guidebook and carry out realistic math-based learning. Students determine the formula for calculating the volume of a geometric figure accompanied and the volume changes in the filled form when a solid object is inserted into the geometry,
THE AREA OF THE COMBINED GEOMETRY	 Students determine the combined geometry after learning the formula to calculate the volume using the unit cube.	 Students are given a picture of the combined geometry and the formula to determine geometry in the picture. They determine the appropriate formula to find the volume.	 Students are only given in the evaluation section to determine the volume of a combined geometry after finding the volume.

THE NUMBER OF CUBE UNITS IN GEOMETRY	 The teachers give the formula to determine the size of a unit cube. The students calculate the volume by determining how many unit cubes fill a cube or block.	 The material on the cube unit is explained more in Malaysia than in the other two countries. Students are given many examples of calculating the cube unit in geometry before studying combined form.	 There is less explanation about this material in the textbooks. Therefore, students are given an evaluation to determine the number of unit cubes and the formula to calculate the volume.
THE AREA OF COMBINED FLAT SHAPE	 The material on calculating the combined area of flat shapes is explained by determining the area to be calculated. The formula is determined according to the existing flat shapes.	 The material for the combined flat shapes is taught with polygons, forming the flat shapes. Students calculate the area of the combined flat shape determined.	 Mathematics material is taught by inviting students to find surrounding objects that consist of two or more types of flat shapes.

each country. The presentation is different due to differences in culture, language, and other factors. Table 3 describes the content analysis of grade 5 geometry for each country.

Analysis of Question Types in Geometry

The presentation of questions affects the students' thinking quality and method, helping them develop their mathematical reasoning abilities. The examples and exercises in the Indonesian textbook contain more discussion questions than the Malaysian and Chinese textbooks. A more complete division of question types is shown in Table 3. In the cognitive domain of knowing, the percentages of questions in the discussion of examples in Indonesian, Malaysia

and Chinese textbooks are 90%, 33.33%, and 72.41%, respectively. In the cognitive domain of applying, the percentages of questions in the discussion of examples in Indonesian, Malaysian, and Chinese textbooks are 10%, 25%, and 6.89%, respectively. Furthermore, the Indonesian textbook has no examples of discussions in the high-level cognitive domain of reasoning, while the question percentages for Malaysian and Chinese textbooks are 16.66% and 20.68%, respectively. Indonesian textbooks provide more type knowing, where students only need to enter the numbers in the questions into the formula. Although the Malaysian Textbook shows no significant difference with the Indonesian questions, it stimulates students' thinking skills in solving problems. Additionally, Chinese textbooks present problems with graded difficulty, increasing the difficulty of solving them.

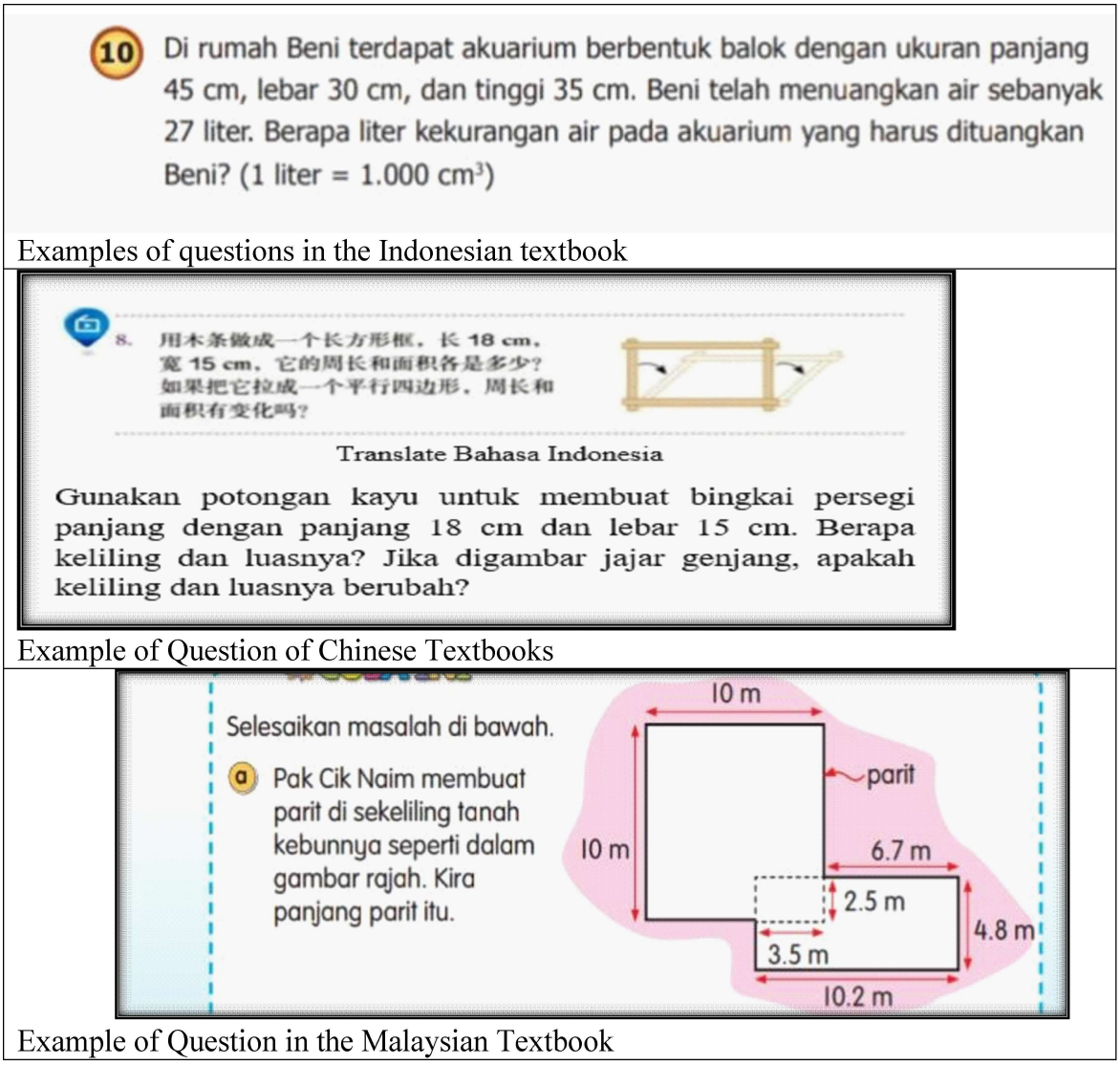
In the Indonesian textbook, discussion examples are given more practice questions but with the appropriate procedures.

Table 4. Types of questions in geometry material

Distributing questions	Cognitive Domain	Number of question			Percentage		
		Indonesian	Malaysian	Chinese	Indonesian	Malaysian	Chinese
Type of discussion example questions	Knowing	27	7	21	90%	33,33%	72,41%
	Applying	3	3	2	10%	25%	6,89%
	Reasoning	-	2	6		16,66%	20,68%
Type of practice questions	Knowing	146	30	62	66,36%	71,42%	49,6%
	Applying	54	10	38	24,54%	23,8%	30,4%
	Reasoning	20	2	25	9,09%	4,76%	20%

For instance, one example has ten practice questions of the same type, with the only difference being the numbers in the question. In contrast, the Malaysian textbook only discusses a few examples and more practice questions considerably different from the Indonesian and Chinese textbooks. Furthermore, the Chinese textbook provides fewer sample questions, and each example has a practice question in various but few forms. The following are examples of questions from each country.

Presenting questions is important in forming students' mathematical reasoning abilities applied in their daily activities. The reasoning is the students' ability to use the knowledge acquired or the ability to think logically and systematically (Hazlita, Zulkardi, & Darmawijoyo, 2014). Indonesian textbooks provide many discussion practice questions with the procedure to solve them according to the previous example. For instance, one example has ten practice questions of the same type, with the only difference being the numbers in the question. In contrast, the Malaysian textbook only discusses a few examples and more practice questions considerably different from the Indonesian and Chinese textbooks. Similarly, the Chinese textbook provides fewer sample questions, and each example has a practice question in various but few forms. Furthermore, it provides more reasoning questions than knowing, meaning that students are required to think to solve a problem. Therefore, the textbook is expected to increase practice questions on reasoning and applying rather than knowing. This would significantly improve students' mathematical and higher thinking abilities (HOTS). Subsequently, they would apply this mindset to solving real-life problems. This is because the purpose of learning is to prepare students to solve real-life problems.



CONCLUSIONS

The geometry material analysis in this research is a reference in compiling books in the new curriculum. Also, the content discussion and item analysis are a reference for teachers when giving practice questions to students to improve mathematical and thinking abilities. This research was limited to only one textbook often used in each country, meaning that the results may not include all analysis and content of geometry material in grade 5 in all books. Second, it did not examine the teachers' use of the textbook in the classroom. Although textbooks have an important role in teaching and learning activities, every teacher has their way of teaching. Furthermore, the success factor for student learning is not only from the textbooks they use. Textbooks are only one supporting factor in teaching and learning activities and student achievement. Moreover, textbook content is always evolving with time. A good textbook directs students to master concepts and understand the material to prevent forgetting or memorizing formulas. With this research, we can

find out what the difference is from the geometry material taught in elementary schools in Indonesia, Malaysia and China. In addition, this research can also be used as a reference in the development of elementary geometry teaching materials in the future in order to present material that is better and in accordance with student development. In this case, recommended by the Indonesian Ministry of Education forrevise the geometry content of mathematics textbooks used today to suit a proven curriculum to produce students who excel in international assessment.

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