A Comparative Analysis on Algebraic Questions in Chinese and Indonesian textbook

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Abstract. Textbook has a significant impact on students’ mathematical ability. This research aims to analyse algebraic questions in Chinese and Indonesian junior high school textbooks. This research was done at Guangxi Normal University, China from November to December 2020. The textbook analysis was done using a quantitative method on three aspects, which were presentation, context, and type of answer. Other aspects considered were proportional of algebra chapter in the textbook and how questions were presented. Chinese textbooks gave more contextual questions but there were a lot more of open-ended questions in the Indonesian textbook. From this research, we can conclude that both Indonesian and Chinese textbooks have their own advantages that can be adopted in both countries. Future research can talk about how class activity and teacher teaching method can affect students’ mathematical ability on algebra.

Keywords: Algebra, junior high school, textbook

1. Introduction

Textbook plays an important role since it serves as a learning media used by teachers to teach students and it has a huge impact on learning quality [1], [2]. Purnama et al. [3] showed that most mathematics teachers use textbook as their main source of information. Textbooks also affect how teachers teach, practice question difficulties and teaching-learning activity in class [4], [5].

Every book has its own characteristic and different teaching approach [6]. Every country has its own curriculum which can affect the form of questions and teaching methods given in the book. A comparison of books between countries is very interesting and worth doing. There has been some research on book comparison in these past few years. Jinfa Cai [7] analysed the problem-posing task in Chinese and American textbooks. He found that the problem-posing task in the two countries is still low and should be improved. Hak Ping Tam and Ou Yung Chih [8] also analysed the statistical contents covered in China, Singapore and Taiwan. They found that Chinese textbooks have better statistical content, which can serve as a reference for the Singapore and Taiwan textbooks when they make the next version. Lianghuo Fan et al. [2] also analysed proving geometry in Chinese, Indonesian and Saudi Arabia textbooks and found that Chinese textbooks have better and more detailed proving geometry contents compared to other textbooks. Based on the results of the previous studies, it can be concluded that Chinese textbooks are generally better than other mathematical textbooks from other countries [9].

The results of Program for International Student Assessment (PISA) 2018 showed that the mathematical ability of students in China was the best of all countries while the mathematical ability of students in Indonesia was on the 7th rank from the bottom [10]. In International Mathematics Olympiad (IMO),
Chinese students always show excellent performance in solving complex mathematical problems using higher order thinking skills [11]. Based on this initial analysis, the researchers wanted to compare Chinese and Indonesian mathematics textbooks.

The function of exercise questions in textbooks is to develop students’ mathematical ability and evaluate students’ ability towards a mathematics topic [12]. When students do practice questions, their mathematical ability will naturally improve. That is why practicing questions in the textbook is an important teaching component. The better the presentation of questions, students’ mathematical ability will be better. Based on this analysis, the researchers are interested in comparing practice questions and analysing questions in mathematics textbooks of two different countries.

Algebra is an important topic in mathematics [13, 14]. Algebra is taught at every level of education with different difficulty levels. Algebra can also improve students’ thinking ability [15]. Many studies analysed mathematics textbooks, especially on the topic of algebra. Siew and Tin [16] examined how algebra concepts are presented in Singapore textbooks. They found that both books had good questions to improve algebraic reasoning. Davis et al. [17] examined student tasks in algebra and explained the importance of questions to improve reasoning and proving abilities. Zhang and Qi conducted the same research on reasoning and proof of algebra in China [18]. They explained that textbook analysis is very important, and further research could further explore the many aspects of mathematics textbook. From some of these studies, it can be concluded that textbook analysis is fundamental to improve the quality of teaching and learning, evaluate materials, and student learning outcomes.

Based on the explanation above, this research aims to compare algebra that is taught in Chinese and Indonesian mathematics textbooks. This research result can be used by both countries to improve their education quality, especially in Indonesia.

2. Method
This research used a mixed method to analyse the practice questions by examining the content of practice questions in Chinese and Indonesian mathematics textbooks. The study was conducted in Guangxi Normal University for the period of two months, from November 2020 to December 2020.

The sample textbooks of the study can be seen in figure 1 and the detail description of each sample is displayed in table 1.

![Figure 1. Sample of (a) Chinese and (b) Indonesian mathematics textbook](image-url)
In the Chinese textbook, algebra is divided into two parts which are taught in 7th grade and 8th grade. Wherein the same topics are taught in 7th grade of 1st semester in the Indonesian textbook.

For data analysis, a Charalambous approach [12] was used to analyse the practice questions in this research. Using this approach, the researchers compared the textbooks on three aspects: presentation, context, and type of answer. Firstly, the researchers analysed in which chapter algebra was placed in the book and the proportion of algebra in the textbooks was counted. Then, the researchers continued analysing practice questions given in the Indonesian and Chinese textbooks. Here, the textbook was analysed based on three aspects: presentation, context, and type of answer. The detail of the aspects can be seen in table 2, and examples of questions according to different aspects can be seen in figure 2, figure 3 and figure 4 respectively.

| Aspects   | Category         | Explanation                                                                 |
|-----------|------------------|------------------------------------------------------------------------------|
| Presentation | Pure mathematics | The practice question is pure mathematics without any story or pictures       |
|           | Verbal           | Practice questions are in the form of word problem                           |
|           | Visual           | Practice questions are in the form of tables, graphics, pictures, maps that can be visually presented |
|           | Combination      | The practice question is a combination of two or three categories above       |
| Context   | Applicable       | Practice questions can be applied to students’ daily life                    |
|           | Non-applicable   | Practice question cannot be applied to students’ daily life                  |
| Type of answer | Open-ended   | Practice question has various solutions                                       |
|           | Close-ended      | Practice question has only one solution                                       |

Table 1. Description of sample textbook

| Country | Textbook Series                                                                 | Abbreviation | Publisher       |
|---------|--------------------------------------------------------------------------------|---------------|----------------|----------------|
| China   | Seventh-grade mathematics textbooks published by People’s Education Press (2012) | PEP           | People’s Education Press |
|         | Eighth-grade mathematics textbooks published by People’s Education Press (2012)  |               |                 |
| Indonesia | Matematika SMP/MTs Kelas VII Semester 1 Revisi 2017 | MSK           | BSE             |

Table 2. An analytical framework of algebraic problems in textbooks
Example

Sederhanakan bentuk aljabar $9a^2 + 3ab - 7b^2 - 12a^2 + 6ab + 2b^2$.

Di antara ketiga gambar berikut, manakah yang memiliki keliling terpanjang? Jelaskan.

Perusahaan $X$ mengemas kelereng-kelereng ke dalam kotak-kotak, yaitu kotak merah dan kotak putih.

Wafi memiliki 15 kotak merah dan 9 kotak putih. Kotak-kotak tersebut berisi kelereng. Jika banyak kelereng di kotak merah dinyatakan dengan $x$ dan banyaknya kelereng di kotak putih dinyatakan dengan $y$, maka banyak kelereng di kedua kotak dinyatakan dengan $15x + 9y$.

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Berdasarkan hasil pengamatan kalian, buatlah pertanyaan yang berkaitan dengan perkalian bentuk aljabar, mungkin kalian bertanya dua hal berikut.
1. Bagaimana cara mengalikan suku-suku bentuk aljabar?
2. Adakah cara singkat untuk mengalikan dua suku bentuk aljabar?
Sekarang cobalah buat pertanyaan yang serupa atau memuat kata “perkalian” dan “dua suku”.

Sederhanakan hasil kali bentuk aljabar dari
a. \(4(3a + 2)\)

b. \((x + 3)(x - 2)\)

c. \((2x - 1)(x + 2y - 3)\)

**Figure 4.** Example of questions based on type of answer

### Results and discussion

Based on table 3, the Chinese textbook had 310 pages and 78 of them contained algebra while Indonesian textbooks had 290 pages and 44 of them contained algebra. From this, we can see that Chinese textbooks had a bigger algebra proportion compared to Indonesian textbooks. We can conclude that the Chinese textbook was more focused on algebra than other topics.

**Table 3.** Algebra proportion in the textbooks

| Textbook   | Total number of pages | Number of pages allocated to algebra | Proportion of algebra over whole textbook |
|------------|-----------------------|--------------------------------------|------------------------------------------|
| Chinese    | 310                   | 78                                   | 25.16%                                   |
| Indonesian | 290                   | 44                                   | 15.17%                                   |

Table 4 presents the findings obtained for practice questions in terms of presentation aspect, contextual feature and type of answer for both China and Indonesia textbooks.

**Table 4.** Statistics on the presentation forms of practice questions in mathematics textbooks

| Aspect              | Category                  | China       | Indonesia   |
|---------------------|---------------------------|-------------|-------------|
|                     | \(n\) \(\%\)           | \(n\) \(\%\) |             |
| Presentation form   | Pure mathematics form    | 110 62.50% | 68 59.65%   |
|                     | Verbal form              | 40 22.73%  | 28 24.56%   |
|                     | Visual form              | 3 1.70%    | 11 9.65%    |
|                     | Combined form            | 23 13.07%  | 6 5.26%     |
|                     | Total                    | 176 100.00%| 114 100.00%|
| Contextual Feature  | Applicable problems      | 41 23.30%  | 16 14.04%   |
|                     | Non-applicable problems  | 135 76.70% | 98 85.96%   |
|                     | Total                    | 176 100%   | 114 100%    |
| Type of answers     | Open-ended problem       | 8 4.55%    | 16 14.04%   |
|                     | Close-ended problem      | 168 95.45% | 98 85.96%   |
|                     | Total                    | 176 100.00%| 114 100.00%|

In terms of presentation aspect, we can see that practice questions in the form of pure mathematics had the biggest proportion in the two countries' textbooks (figure 5). The visual form of practice question had the smallest proportion in the Chinese textbook, while the combined form had the smallest proportion in the Indonesian textbook. Overall, the Chinese textbook had more practice questions on algebra compared to the Indonesian textbook.
A good practice question can improve students’ mathematical ability. The verbal, visual and combined form of practice questions need mathematical connection and communication ability. When students are given a visual type of question, they should convert and interpret the pictures into mathematical forms. When students are given verbal questions, they should take important information in the word problem and convert them into mathematical form.

Mathematics learning aims to solve daily life problems [19], [20]. That is why it would be better if questions are given in a contextual form or connected to daily life problems. Based on the analysis that can be seen in figure 6, both countries have more practice questions that are non-applicable. The result shows that the percentage of applicable problems in Chinese textbooks is higher compared to Indonesian textbook. The amount of contextual questions in the Chinese textbook can serve as a reference to the Indonesian textbook so that they would be able to add more contextual questions.

Figure 6. Comparison of the contextual feature of practice questions in mathematics textbooks

An open-ended question is a type of question that has many solving methods and answers [21], [22]. When students are given an open-ended question, it can improve students’ mathematical reasoning ability, problem solving ability and other mathematical ability [23], [24]. With this, we can conclude that an open-ended question is better than a fixed type of question. Based on figure 7, both countries of China and Indonesia have a relatively low percentage of open-ended questions type in the textbook.
From the analysis above, we can see that both countries have their own strengths in giving practice questions. The analysis result shows that Chinese textbook tends to have more practice questions and contextual problems to train and evaluate students’ mathematical ability towards algebra. While the Indonesian textbook tends to have more open-ended questions than fixed problems, it can improve students’ mathematical ability.

An example of good practice questions is in the form of open-ended problems. The study conducted by Wijaya showed that open-ended problems could improve students’ creative thinking skills [25]. Open-ended problems also help students to form mind-sets and improve students’ problem solving abilities [26]. Therefore, it is better to develop practice questions in the form of open-ended problems than closed-ended problems. If there are very few open-ended problems in mathematics textbooks, the teacher can give additional open-ended problems to students.

4. Conclusion
The comparative analysis result of practice questions on algebra in this research shows that the Chinese textbook has a bigger proportion (25.16%) of algebra in the number of pages than the Indonesian textbook. The Chinese textbook has more practice questions on algebra than Indonesian textbooks, and the percentage of contextual questions in the Chinese textbook is bigger than that in the Indonesian textbook. The percentage of the open-ended question in the Indonesian textbook is better than that in Chinese textbook.

This study only investigated a Chinese and an Indonesian textbook among many more textbooks in Indonesia and China with different practice questions. Practice question in textbooks are only of the factors that can affect students’ mathematical ability. There are still a lot more factors that can affect students’ mathematical ability. Future research can discuss about the difference of teaching method on algebra in the two countries.

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