

# COMPARATIVE ANALYSIS OF TEXTBOOKS IN PRESENTING MATHEMATICAL OBJECTS AND PROBLEM SOLVING ON MATRIX TOPICS

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## COMPARATIVE ANALYSIS OF TEXTBOOKS IN PRESENTING MATHEMATICAL OBJECTS AND PROBLEM SOLVING ON MATRIX TOPICS

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### Abstract

This research aims to analyze the comparison of textbooks in presenting mathematical objects and problem solving on matrix topics. The object of this research consists of three books, namely mathematics textbooks used in the previous curriculum, mathematics textbooks used in the current curriculum, and mathematics textbooks from abroad. This type of research is descriptive research with a qualitative approach. The data collection method uses content analysis. Content analysis is carried out objectively and systematically to describe the content communicatively. The results of the analysis show that the presentation of facts in the three books are correct in the use of symbols, notation and mathematical terms, but in the previous curriculum books there are still several parts that are incorrect in the use of mathematical symbols and notation. When presenting the concept, the three books are correct in interpreting the concept and providing examples that are in accordance with the concept, however the previous curriculum book does not provide the conditions and universe of discussion on a definition at all, while the other two books contain only a few definitions. Then, when presenting principles, of the three books, only the foreign book connects two or more concepts or facts with concepts, while the other two books do not at all. Then when presenting operations, the three books were correct in the calculation process, however in the previous curriculum book there were several parts where the workflow did not match the information provided, while the other two books were all in accordance. Furthermore, regarding the presentation of problem solving, it is only found in the current curriculum book, while the other two books do not exist at all. So of the three books, the mathematics textbook used in the current curriculum is better at presenting mathematical objects and problem solving compared to the other two books.

**Keywords:** Mathematics Textbook; Mathematics Objects; Problem Solving; Matrix

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In the current era of digitalization, the development of science makes it easy for educational practitioners to access knowledge from various sources. One of the learning sources in question is textbooks. The textbooks used should be able to increase learning outcomes (Pramesti, 2017). This is in accordance with the superiority of book texts as sources of information, being able to provide stimulation as needed, presenting certain material, and being able to influence readers' attitudes.

This textbook has a very important role in determining the success of mathematics learning (Suharyono & Rosnawati, 2020). In agreement with this, according to Dewantara (2019) the importance of the role of textbooks in learning activities is that mathematics textbooks have good quality content, including the questions presented. The central role of textbooks in empowering, among other things, is that books can be placed as a source of information that is equipped with information with gradual levels of difficulty, including practice questions and related problem solving (Pramesti, 2017).

Mathematics textbooks continue to develop along with the development of the curriculum, starting

from the 2004 curriculum, the 2006 curriculum, the 2013 curriculum, and up to the current independent curriculum which has been assessed by Badan Standar Nasional Pendidikan (BSNP) (Hidayat & Usodo, 2023). Even though the textbook has been assessed for suitability by BSNP, it does not rule out the possibility of errors (Mayangsari et al., 2021). BSNP is tasked with assessing the suitability of using a textbook. In the assessment of mathematics textbooks by BSNP, there are several assessment points that must be assessed on the accuracy of the material, namely the accuracy of the presentation of mathematical objects (facts, concepts, principles, procedures), examples and questions (Giani et al., 2015). If errors occur in the presentation of mathematical objects, it will most likely lead to a wrong understanding of the mathematical material in students' mathematics textbooks (Zigoto & Dakhi, 2018). The presentation of mathematical objects in a good textbook can help readers understand the full meaning of the material being studied and make it easier for readers to solve problems completely and precisely.

Apart from that, one of the aspects assessed by BSNP is whether there are problem solving questions in each textbook (Wijayanti, 2018). Teaching problem solving to students allows students to become more analytical in making decisions in their lives (Siahaan & Surya, 2020). This means that the presentation of problem-based questions in mathematics textbooks can influence readers to see the perspective of problems in their lives. In agreement with this, according to Nurmutia et al. (2013) that textbooks have great power in changing students' brains because they can influence children's knowledge and certain values.

The importance of mathematics textbooks as the main material to support learning has led to an increase in the variety of types of mathematics textbooks circulating from various mathematics textbook publishers (Romyati & Tjahjono, 2021). So this research aims to compare textbooks in presenting mathematical objects and problem solving on matrix topics.

## METHOD

This type of research is **descriptive research with a qualitative approach**. Description is done by giving an overview of the entire contents of the book. The data collection method uses content analysis. Content analysis is carried out objectively and systematically to describe the content communicatively. This research was conducted to analyze differences in the presentation of mathematical objects and problem solving on matrix topics in three categories of mathematics textbooks, namely mathematics textbooks used in the previous curriculum, mathematics textbooks used in the current curriculum, and mathematics textbooks from abroad.

<i>Book Category</i>	<i>Book title</i>	<i>Book Symbol</i>
Mathematics textbooks used in the previous curriculum.	Matematika Inovatif 3: Konsep dan Aplikasinya Kelas XII from	Book 1

	the KTSP (Siswanto & Supretisnah, 2009).	
Mathematics textbooks used in the current curriculum.	Matematika Tingkat Lanjut kelas XI from the Independent Curriculum (Masta et al., 2021).	Book 2
Mathematics textbooks originating from abroad.	Tamil Nadu State Board Textbooks Samacheer Kalvi 10 <sup>th</sup> Maths Books from abroad Ten (2020).	Book 3

This analysis process is aimed at mathematical objects and problem solving in textbooks which are divided into: facts, concepts, principles, operations, and problem solving. The types of indicators that can be reviewed are in the following table:

Table 1. Indicators on Mathematical Objects and Problem Solving

<i>No.</i>	<i>Mathematical Objects</i>	<i>Indicators</i>
1.	Fact	1.1. Accurate use of symbols or mathematical notation. 1.2. Correct use of mathematical terms.
2.	concept	2.1. Accuracy in interpreting concepts. 2.2. roviding examples that match the concept. 2.3. Completeness of providing conditions or a universe of discussion in a definition.
3.	Principle	3.1. Accuracy in connecting two or more concepts or facts with concepts.
4.	Operation	4.1. Accuracy in the calculation process. 4.2. Work flow according to the information provided.
5.	Problem Solving	5.1. Presents non-routine questions. 5.2. Can be completed using a variety of strategies.

The book is categorized based on the appearance of the indicators. Indicators of mathematical objects and problem solving to be analyzed are categorized based on the following table:

Table 2. Indicator Occurrence Category

No.	Category	Indicators Appearance Symbol
1.	All	●
2.	Several	⊙
3.	None at all	○

The content analysis process in this research is reading and analyzing the book which is the data source to find out whether there is a presentation of mathematical study objects and problem solving. The data obtained is then grouped based on the presentation of facts, concepts, principles and operations and problem solving in mathematics textbooks is then described.

## 10 RESULTS AND DISCUSSION

The results of the analysis that have been carried out show that there are mathematics textbooks used in the previous curriculum, mathematics textbooks used in the current curriculum, and mathematics textbooks from abroad. Bring up indicators of mathematical objects and problem solving as follows:

Table 3. Results of the Appearance of Mathematical Object Indicators and Problem Solving

No.	Indicators	Appearance of Indicators		
		16 Book 1	Book 2	Book 3
1.1	Accurate use of symbols or mathematical notation.	⊙	●	●
1.2	Correct use of mathematical terms.	●	●	●
2.1	Accuracy in interpreting concepts.	●	●	●
2.2	Providing examples that match the concept.	●	●	●
2.3	Completeness of providing conditions or a universe of discussion in a definition.	○	⊙	⊙
3.1	Accuracy in connecting two or more concepts or facts with concepts.	○	○	●
4.1	Accuracy in the calculation process.	●	●	●
4.2	Work flow according to the information provided.	⊙	●	●

5.1	Presents non-routine questions.	○	●	○
5.2	Can be completed using a variety of strategies.	○	●	○

Based on the analysis of the third book, the results showed that in presenting facts in matrix material only in book 1, several contents were found that were not appropriate in the use of mathematical symbols or notation. Then, in presenting the concepts in the matrix material in book 1, it was not found to provide conditions or universality at all, whereas in book 2 and book 3 it was found that some had provided conditions or a complete discussion. Then, in presenting principles in matrix material, only book 3 was found to have connected two or more facts with concepts correctly, whereas in book 1 and book 2 it was not found to have connected two or more facts with concepts at all. Then, in presenting operations on matrix material, only in book 1 it was found that several workflows did not match the information provided, while in book 2 and book 3 it was found that all workflows were in accordance with the information provided. Furthermore, in presenting problem solving on matrix material, only book 2 was found to have presented non-routine problems and the solutions could use a variety of strategies, whereas in book 1 and book 2 there were no non-routine problem presentations at all and the solutions could use a variety of strategies.

- **Fact**

Facts are any consensus or agreement or convention in mathematics such as symbols, notations, or rules that prioritize multiplication operations over addition operations. In agreement with this, according to Sari (2016) revealed that facts are agreements in using terms and symbols so that there is no confusion in understanding mathematics.

Suatu matriks dinyatakan dengan huruf kapital  $A, B, C$ , dan seterusnya. Bilangan-bilangan yang terdapat di dalam matriks dinamakan *elemen matriks*. Adapun bentuk umum matriks  $A$  yang mempunyai  $m$  baris dan  $n$  kolom adalah

$$A = \begin{pmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ a_{m1} & a_{m2} & \dots & a_{mn} \end{pmatrix} \begin{array}{l} \leftarrow \text{baris ke-1} \\ \leftarrow \text{baris ke-2} \\ \leftarrow \text{baris ke-}m \end{array}$$

$\begin{array}{ccc} \uparrow & \uparrow & \uparrow \\ \text{kolom ke-1} & \text{kolom ke-2} & \text{kolom ke-}n \end{array}$

**Keterangan:**  
 $a_{ij}$  adalah elemen pada baris ke- $i$  kolom ke- $j$  matriks  $A$ .  
 $a_{11}, a_{12}, \dots, a_{1n}$  adalah elemen-elemen baris ke-1.  
 $a_{11}, a_{21}, \dots, a_{m1}$  adalah elemen-elemen kolom ke-1.  
 Bentuk umum matriks  $A$  tersebut ditulis secara singkat menjadi  
 $A = (a_{ij})_{m \times n}$

Figure 1. Presentation of facts in the book 1

This research found factual errors in the book 1 on page 34. The factual errors occurred because the book did not display indicator 1.1. Accurate use of mathematical symbols or notation and indicators

in figure 1. The presentation of facts contained in the mathematics textbook in figure 1 above will cause errors by the reader, in this case students, because the book uses the symbols  $m$  and  $n$  in presenting the matrix elements in brackets. Meanwhile, in the description, the book author uses the terms  $i$  and  $j$ . This will create confusion for readers in this case for students to understand the general form of the matrix itself. Apart from that, the facts presented are also incomplete in writing symbols and terms, the terms  $m$  and  $n$  should be explained only to represent the size of the matrix, not to represent rows and columns as shown in Figure 1.

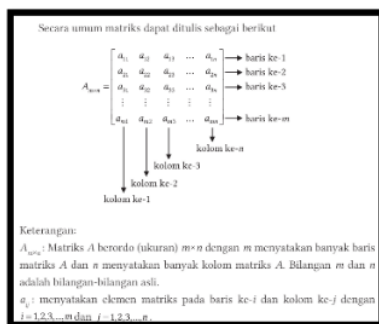


Figure 2. Presentation of facts in book 2

Different from the presentation of facts in the book 2 on page 126. As seen in Figure 2, the presentation of facts in the mathematics textbook is better than in the book 1. Readers, in this case, students can understand the meaning of the matrix elements symbolized and the explanation is also quite clear, because in the explanation it is explained that the members of  $i = 1, 2, 3, \dots, m$  and  $j = 1, 2, 3, \dots, n$  which intends to provide an understanding that  $m$  and  $n$  are the same as  $i$  and  $j$ . However,  $m$  and  $n$  in Figure 2 are explained as the size of the matrix, while  $i$  and  $j$  represent the positions of the elements in the matrix.

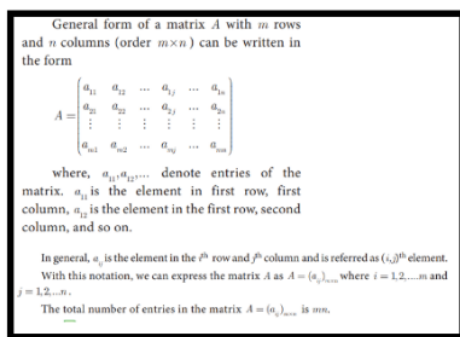


Figure 3. Presentation of facts in Book 3

It's the same as presenting facts in a book 3 on pages 138-139. Based on Figure 3, the book has

presented the facts completely. It can be seen that the book has provided an explanation if  $m$  and  $n$  represent the number of rows and the number of columns in a matrix. The presentation of facts in this book uses mathematical symbols or notation accurately and clearly, because in the matrix elements above, examples are presented that  $i$  and  $j$  symbolize the position of rows and columns, up to  $m$  and  $n$  which symbolize the number of rows and columns in a matrix. The precise and clear use of mathematical terms in this book can be seen in the explanation regarding the elements in the matrix which can make readers, in this case students, easily understand the meaning of the symbols presented previously. Meanwhile, for the completeness of writing symbols or mathematical notation in this book, you can see the matrix statement based on its elements. However, these three books have produced indicator 1.2 well, namely accuracy in the use of mathematical terms.

As a result of errors and incompleteness in presenting facts in book 1, it causes reader errors, in this case students, in expressing contextual problems into symbols and mathematical notation. In agreement with this, according to Nur et al. (2018) Students experience errors in expressing problems using mathematical symbols because the presentation of facts in textbooks is incomplete, causing ambiguous understanding by students. Apart from that, students also do not know the meaning of the symbols presented. Fact errors also cause errors in understanding related to the material presented in the problem (Widodo, 2013).

- **Concept**

A concept is an (abstract) idea that can be used or allows someone to group or classify an object, so that the object is an example of a concept or not a concept. Furthermore, the opinion is clarified Mayangsari et al. (2021) that objects related to concepts are abstract ideas for classifying and categorizing objects. Concepts are markers of knowledge and concepts are markers of mathematical objects. Mastery of mathematical concepts is a challenge for reforming mathematics teaching (Rizqi et al., 2021).

Each of these three books has given rise to indicator 2.1 of accuracy in interpreting concepts by giving interpretations using simple, more concise sentences to describe the meaning of the concept given so that it is easier to understand and has also given rise to indicator 2.2 by giving examples that are in accordance with the concept by giving the right example fits the concept of the square matrix itself. These examples are important for readers, in this case students, because these examples illustrate the concepts used. From this example, readers, in this case students, can more easily understand the matrix concept presented. According to (Radiusman (2020) When students understand mathematical concepts, they will easily solve problems in mathematics lessons.



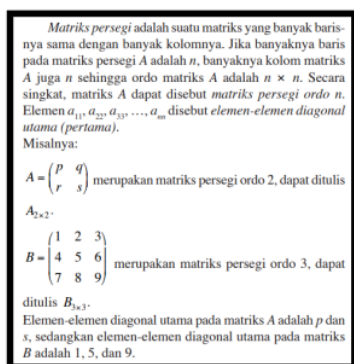


Figure 4. Presentation of 1 concept in the book 1

However, these three books have not yet produced indicator 2.3 Completeness of the terms or universe of discussion in a definition. Presentation of the concept based on figure 4 above, in the book 1 on page 69 there are errors or incompleteness in the presentation of the matrix material. Based on Figure 4 above, it can be seen that the author of the book is incomplete in providing an understanding of the concept of square matrices. The writer creates a number that satisfies the value of  $n$ . The author should add an explanation to this concept that numbers that satisfy  $n$  are natural numbers. In this case, it means that the author of the book is incomplete in providing conditions or the universe of discussion in a definition.

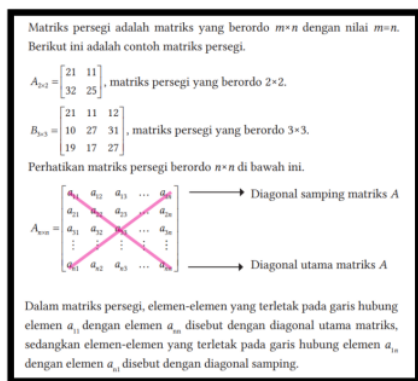


Figure 5. Presentation of 1 concept in the book 2

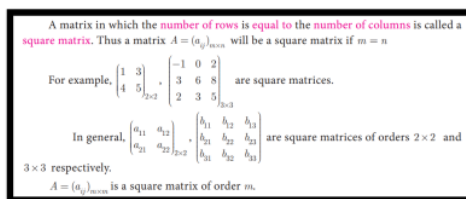


Figure 6. Presentation of 1 concept in book 3

Just like the presentation of matrix concepts, there is a book 2 on pages 130-131 and in a book 3 on page 140. In both books, it is also incomplete to provide conditions or a universe of discussion for a definition. Based on Figure 5 and Figure 6 above, it can be seen that the book does not provide a limitation that the values that meet the  $m$  value or  $n$  value are only natural numbers. So it is feared that

it could lead to misunderstanding of the concept by readers, in this case students.

However, based on other findings only in the two mathematics textbooks (book 2 and book 3) it was found that there were sections that presented the terms or universe of discussion completely, as in the following picture:

$A_{m \times n}$  : Matriks  $A$  berordo (ukuran)  $m \times n$  dengan  $m$  menyatakan banyak baris matriks  $A$  dan  $n$  menyatakan banyak kolom matriks  $A$ . Bilangan  $m$  dan  $n$  adalah bilangan-bilangan asli.  
 $a_{ij}$  : menyatakan elemen matriks pada baris ke- $i$  dan kolom ke- $j$  dengan  $i = 1, 2, 3, \dots, m$  dan  $j = 1, 2, 3, \dots, n$ .

Figure 7. Presentation of 2 concepts in the book 2

Based on Figure 7 above, you can see the presentation of the terms or conditions of discussion in the book 2 on page 126 is complete because the author makes the conditions or universe of his discussion with "The numbers  $m$  and  $n$  are natural numbers" which means that the numbers that contain the numbers  $m$  and  $n$  are only natural numbers.

In general,  $a_{ij}$  is the element in the  $i^{\text{th}}$  row and  $j^{\text{th}}$  column and is referred as  $(i, j)^{\text{th}}$  element. With this notation, we can express the matrix  $A$  as  $A = (a_{ij})_{m \times n}$  where  $i = 1, 2, \dots, m$  and  $j = 1, 2, \dots, n$ .  
 The total number of entries in the matrix  $A = (a_{ij})_{m \times n}$  is  $mn$ .

Figure 8. Presentation of 2 concepts in the book 3

The same as what is presented in the book 3 on page 139. Based on Figure 8 above, it can be seen that the author has made the conditions or universe of discussion the same as in the book 2 on page 126. In the  $i^{\text{th}}$  row and  $j^{\text{th}}$  column, the author has also created the terms or universe of his discussion by writing  $i = 1, 2, 3, \dots, m$  and  $j = 1, 2, 3, \dots, n$ .

From the explanation regarding the presentation of concepts in the matrix material above, it can be seen that of the three books, only book 2 and book 3 have presented the concept well because these books have correctly interpreted the concept, provided examples in accordance with the concept, and have completely provided the terms or universe of discussion in a definition.

- **Principle**

Principles are relationships between several basic mathematical objects so that they consist of several facts, concepts, and are associated with an operation. Many students experience errors in understanding principles because they do not fully understand the relationship between mathematical facts and concepts (Gustianingum & Kartini, 2021).

*Matriks diagonal* adalah suatu matriks persegi dengan setiap elemen yang tidak terletak pada diagonal utama adalah nol.  
Misalnya:

$$A = \begin{pmatrix} 2 & 0 \\ 0 & 1 \end{pmatrix} \quad B = \begin{pmatrix} 2 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 2 \end{pmatrix}$$

Figure 9. Presentation of the principles of the book 1

Presentation of principles in a book 1 on page 70 has not yet produced indicator 3.1, namely connecting facts and concepts accurately and completely. Based on Figure 9 above, it can be seen that the facts agreed upon in the previous discussion cannot yet be connected to the concept of a diagonal matrix. In the picture above, it can be seen that the author understands "every element that is not located on the main diagonal is zero" while the reader, in this case, students do not yet understand the main diagonal. The author of the book should have made connections between concepts and facts in the matrix.

Perhatikan matriks persegi berikut ini.

$$A_{2 \times 2} = \begin{bmatrix} 21 & 0 \\ 0 & 25 \end{bmatrix} \quad B_{3 \times 3} = \begin{bmatrix} 21 & 0 & 0 \\ 0 & 27 & 0 \\ 0 & 0 & 27 \end{bmatrix}$$

Matriks persegi di atas semua elemennya bernilai nol, kecuali elemen-elemen yang terletak pada diagonal utama. Matriks seperti ini disebut dengan matriks diagonal.

Figure 10. Presentation of the principles of the book 2

Just like the presentation of principles in a book 2 on page 132. Based on Figure 10 above, it can be seen that the presentation of principles in this book also does not provide understanding by connecting concepts with facts from previously agreed upon matrices. The author of the book can make an understanding using facts, for example matrix elements have a value of 0 (zero) if  $i \neq j$ .

A square matrix, all of whose elements, except those in the leading diagonal are zero is called a **diagonal matrix**.

(ie) A square matrix  $A = (a_{ij})$  is said to be diagonal matrix if  $a_{ij} = 0$  for  $i \neq j$ . Note that some elements of the leading diagonal may be zero but not all.

For example,  $\begin{pmatrix} 8 & 0 & 0 \\ 0 & -3 & 0 \\ 0 & 0 & 11 \end{pmatrix}$ ,  $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{pmatrix}$  are diagonal matrices.

Figure 11. Presentation of the principles of the book 3

This is different from what is presented in the book 3 on page 140. Based on Figure 11 above, it can be

seen that the book has presented the principles accurately and completely because it connects concepts and facts in the matrix. The author first provides a conceptual understanding of the elements above and below the zero-valued diagonal and then connects it to the fact that these elements consist of elements for all  $i \neq j$ . Then in the picture above it can also be seen that the author uses facts to strengthen the concept that a diagonal matrix can also be called a square matrix  $A = [a_{ij}]_{m \times m}$ .

- **Operation**

Operational or <sup>1</sup> procedural knowledge is knowledge about how to do something, including knowledge of skills and algorithms, techniques and methods, as well as knowledge of the criteria used to determine or justify.

$A - B = A + (-B)$

dengan  $-B$  adalah lawan matriks  $B$ . Syarat pengurangan matriks adalah ordo kedua matriks itu harus sama.

**Contoh:**

1. Diketahui  $A = \begin{pmatrix} 10 & 3 \\ 7 & 5 \end{pmatrix}$  dan  $B = \begin{pmatrix} -1 & 2 \\ 3 & -3 \end{pmatrix}$ . Tentukan  $A - B$ .

**Penyelesaian:**

$$A - B = A + (-B) = \begin{pmatrix} 10 & 3 \\ 7 & 5 \end{pmatrix} + \begin{pmatrix} 1 & -2 \\ -3 & 3 \end{pmatrix} = \begin{pmatrix} 11 & 1 \\ 4 & 8 \end{pmatrix}$$

2. Carilah matriks  $X$  jika  $\begin{pmatrix} 2 & 5 \\ 4 & 1 \end{pmatrix} + X = \begin{pmatrix} 1 & 3 \\ 4 & 2 \end{pmatrix}$ .

**Penyelesaian:**

$$X = \begin{pmatrix} 1 & 3 \\ 4 & 2 \end{pmatrix} - \begin{pmatrix} 2 & 5 \\ 4 & 1 \end{pmatrix} = \begin{pmatrix} -1 & -2 \\ 0 & 1 \end{pmatrix}$$

Figure 12. Presentation of operations in the book 1

Presentation of operations in a book 1 on page 75 There are inconsistent authors in using matrix reduction operations contained in the book. Based on Figure 12 above, it can be seen that the author was correct in the calculation process, but in problem number 1 the author changed the problem which previously used a subtraction operation to an addition operation according to the concept given previously. However, in question number 2 the writer did not change the subtraction operation to addition as the writer did in question number 1. In question number 2 the writer directly used the subtraction operation. If in number 1 the author changes the operation according to the concept given then the author must also do the same thing in number 2. Likewise, if the author does not change the operation then from the start the author does not change the operation so it can be said that the book has not produced indicator 4.2, namely doing workflow according to the information provided. The examples presented also do not lead to solving problem.

$A - B = A + (-B)$

**Contoh 3.5**

**Pengurangan matriks**  
Diketahui matriks-matriks

$$A = \begin{bmatrix} 5 & 2 \\ 1 & 3 \end{bmatrix}, B = \begin{bmatrix} -1 & -2 \\ 1 & -1 \end{bmatrix}, \text{ dan } C = \begin{bmatrix} -1 & 1 & 3 \\ -2 & 2 & 4 \end{bmatrix}$$

Tentukan pengurangan matriks:

- $A - B$
- $A - C$

**Alternatif Penyelesaian**

- $-B = \begin{bmatrix} 1 & 2 \\ -1 & 1 \end{bmatrix}$

$$A - B = A + (-B) = \begin{bmatrix} 5 & 2 \\ 1 & 3 \end{bmatrix} + \begin{bmatrix} 1 & 2 \\ -1 & 1 \end{bmatrix} = \begin{bmatrix} 6 & 4 \\ 0 & 4 \end{bmatrix}$$

- Matriks  $A$  dan  $C$  berordo tak sama, dengan demikian  $A - C$  tidak terdefinisi.

Figure 13. Presentation of operations in the book 2

This is different from the presentation of operations in the book 2 on page 143. Based on Figure 13 above, it can be seen that the book has presented operations according to the indicators, namely that it has been correct in the calculation process and work flow in accordance with the information provided. The calculation process for solving number 1 in the book is in accordance with the concept given previously by changing the subtraction operation to addition. So that it can help readers, in this case students, understand the concept of the example questions given. Then in question number 2 in the book the author gives an example of a problem that is not a concept, this is very well presented so that the reader, in this case, students can differentiate between what matrices can be carried out operations and what matrices cannot be carried out operations.

Two matrices can be added or subtracted if they have the same order. To add or subtract two matrices, simply add or subtract the corresponding elements.

For example,  $\begin{pmatrix} a & b & c \\ d & e & f \end{pmatrix} + \begin{pmatrix} g & h & i \\ j & k & l \end{pmatrix} = \begin{pmatrix} a+g & b+h & c+i \\ d+j & e+k & f+l \end{pmatrix}$

$$\begin{pmatrix} a & b \\ c & d \end{pmatrix} - \begin{pmatrix} e & f \\ g & h \end{pmatrix} = \begin{pmatrix} a-e & b-f \\ c-g & d-h \end{pmatrix}$$

If  $A = (a_{ij})$ ,  $B = (b_{ij})$ ,  $i = 1, 2, \dots, m$ ,  $j = 1, 2, \dots, n$  then  $C = A + B$  is such that  $C = (c_{ij})$  where  $c_{ij} = a_{ij} + b_{ij}$  for all  $i = 1, 2, \dots, m$  and  $j = 1, 2, \dots, n$

**Example 3.60** If  $A = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix}$ ,  $B = \begin{pmatrix} 1 & 7 & 0 \\ 1 & 3 & 1 \\ 2 & 4 & 0 \end{pmatrix}$ , find  $A+B$ .

**Solution**  $A+B = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix} + \begin{pmatrix} 1 & 7 & 0 \\ 1 & 3 & 1 \\ 2 & 4 & 0 \end{pmatrix} = \begin{pmatrix} 1+1 & 2+7 & 3+0 \\ 4+1 & 5+3 & 6+1 \\ 7+2 & 8+4 & 9+0 \end{pmatrix} = \begin{pmatrix} 2 & 9 & 3 \\ 5 & 8 & 7 \\ 9 & 12 & 9 \end{pmatrix}$

Figure 14. Presentation of operations in the book 3

Just like the presentation of operations in a book 3 on page 145. Based on Figure 14 above, even though it can be seen in the book, the operations are presented in accordance with the indicators, that is, they are correct in the calculation process and work flow according to the information provided. However, the example questions presented by these three books do not yet lead to solving the problem. The examples presented are more directed towards procedural solutions and are routine questions for students.

- **Problem Solving**

Realizing the important role of mathematics in solving everyday problems, students need to be trained by providing problems based on problem solving in their learning. (Rahmawati & Permata, 2018). Solving problems presented by the teacher, which are assigned to be done by students, and which are used as evaluations by students come from questions in the textbook (Giani et al., 2015). So mathematics textbooks have a strategic role in helping students to have problem solving abilities.

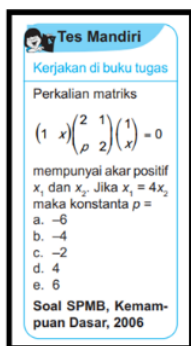


Figure 15. Presentation of problem solving in the book 1

Presentation of problems based on problem solving in the book 1 on page 51 it seems that indicator 5.1 has not emerged, namely presenting problem-based questions in the form of non-routine questions and indicator 5.2, the solution of which cannot be solved using various strategies. Based on Figure 15 above, it can be seen that the author is trying to present a matrix problem whose solution is connected using a quadratic equation. Students who have never studied quadratic equations may think that this question is a non-routine problem. However, this matrix material was studied in class X SMA while the material on quadratic equations was studied in class IX SMP. This means that the questions presented in the book as in Figure 15 are no longer non-routine questions if you look at the level. The strategies that can be used to solve these problems are also not diverse.

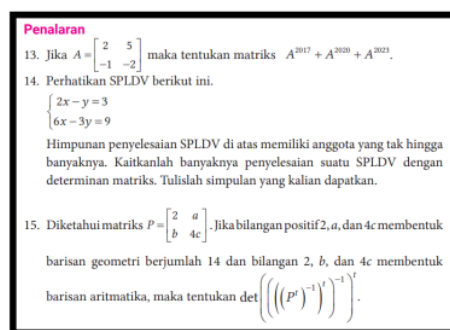


Figure 16. Presentation of problem solving in the book 2

This is different from the presentation of problem solving in the book 2 on page 169. Based on

Figure 16 above, it can be seen that the author has presented problem-solving-based questions in the form of non-routine questions for readers, in this case students. This problem becomes a problem because the reader, in this case, students cannot directly carry out the solution, but rather students have to think about a strategy to carry out a solution to the problem. The problems presented direct students to reason. However, strategies for solving problems in this problem can be done in various ways, such as in question number 13, students can use number patterns. However, in question number 14, a solution strategy has been determined, namely using a determinant matrix.

11. If  $A = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$  and  $I = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$  show that  $A^2 - (a+d)A = (bc - ad)I_2$ .

12. If  $A = \begin{pmatrix} 5 & 2 & 9 \\ 1 & 2 & 8 \end{pmatrix}$ ,  $B = \begin{pmatrix} 1 & 7 \\ 5 & -1 \end{pmatrix}$  verify that  $(AB)^T = B^T A^T$ .

13. If  $A = \begin{pmatrix} 3 & 1 \\ -1 & 2 \end{pmatrix}$  show that  $A^2 - 5A + 7I_2 = 0$ .

Figure 17. Presentation of problem solving in the book 3

However, in the book 3 on page 154 seems not to have presented problem-based questions in the form of non-routine questions. Based on Figure 17 above, it can be seen that the author directs the reader, in this case the students, to carry out proof. The types of questions presented in the book are more application questions whose proof can be done procedurally according to what has been studied previously. The strategy used to prove this problem is also not diverse because it is only to apply operations on matrices that have been studied previously.

## CONCLUSION

Based on the results of the analysis of the presentation of matrix material in textbooks based on the object of study of mathematics textbooks used in the previous curriculum, mathematics textbooks used in the current curriculum, and mathematics textbooks originating from abroad, it can be concluded that the presentation of facts in these three books is correct. in the use of symbols, notation and mathematical terms, however in the previous curriculum book there were still several parts that were incorrect in the use of mathematical symbols and notation. When presenting the concept, the three books are correct in interpreting the concept and providing examples that are in accordance with the concept, but the previous curriculum book does not provide the conditions and universe of discussion in a definition at all, while in the other two books there are several definitions that provide the conditions and universe of discussion. Then, when presenting principles, of the three books, only the foreign book connects two or more concepts or facts with concepts, while the other two books do not connect two or more concepts or facts with concepts at all. Then when presenting operations, the three books were correct in the calculation process, however in the previous curriculum book there were several parts where the workflow did not match the information provided, while the other two books presented a workflow that was in accordance with the information provided. Furthermore, regarding the

presentation of problem solving, it is only found in the current curriculum book, while the other two books do not present problem solving at all.

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