



## Study of Decimal in Elementary Mathematics Textbooks from Ministry of Education and Culture of the Republic of Indonesia

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**Abstract:** Textbooks are still used as the main learning resource used by teachers in school. The book must provide content that is very supportive in helping students to achieve understanding related to a topic. This study aims to analyze how decimal material is studied in mathematics textbooks published by the Ministry of Education and Culture of the Republic of Indonesia. The analysis focuses on the content and presentation of math problems available in books. This study uses a qualitative approach with analytical methods. Research findings show that the decimal material focuses more on procedural knowledge than on trying to deepen conceptual understanding. The problems in the book are dominated by problems that only reveal procedural knowledge. There are no questions that reveal representation skill, reasoning, and conceptual understanding. Based on this research, it appears that teachers should make more efforts to find learning resources that more supportive of success in learning mathematics. Because the success of learning mathematics can be seen from the development of mathematical proficiency, not only in computational or numerical skills.

**Keywords:** Decimal fraction, mathematics textbook, elementary school, analysis.

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### INTRODUCTION

Books are still used as the main source by teachers in providing learning materials. Books are also a representation of the curriculum and are one of the factors that influence learning activities (Mullis, et al., 2009; Rezat & Strässer, 2014). Research conducted by Fan, Zhu, & Miao, (2013) shows that the success of students in learning mathematics has a very close relationship with the textbooks used. This is also shown by the results of research that discusses the comparison of mathematics textbooks from various countries (Karr, et al., 2017; Yang, 2017; Butuner, 2019). Differences in the way the textbook presents the subject or the approach used to present the subject affects the success of students in understanding mathematics and having mathematical proficiency.

This study analyzed elementary school mathematics textbooks to determine the

presentations of decimal fractions in the book. The analysis focus on decimal fraction which is in mathematics material in fourth grade and fifth grade. This material was chosen because researchers found that there are still many difficulties and misconceptions in students (Aini & Wiryanto, 2020; Johar, et al., 2016; Mohyuddin, 2012).

In Indonesia, decimal fractions were introduced in grade IV to grade V. Basic Competencies in the curriculum for the material presented in table 1. A decimal fraction is important to implement and acts as a foundation in mathematical activities and to achieve the next level of mathematical skills (Van de Walle, 2013; National Mathematics Advisory Panel, 2008; Siegler, et al., 2012). If students fail to understand or get misconceptions, they will find it difficult to learn the next material and have difficulty in solving problems.



**Table 1.** Mathematical Basic Competencies for Class IV and V Elementary Schools

Basic Competencies 3 (knowledge)	Basic Competencies 4 (Skill)
IV grade	
3.2 describes the various forms of fractions (regular, mixed, decimal, and percent) and their relationships	4.2 identifies the various forms of fractions (regular, mixed, decimal, and percent) and their relationships
V grade	
3.2 Explain and perform multiplication and division of fractions and decimals	4.2 Solve problems related to the multiplication and division of fractions and decimals

\* Source: Permendikbud no 37, 2018

There are still many misconceptions about decimal fraction material. As shown by Aini & Wiryanto (2020), Johar, et al. (2016), and Mohyuddin, (2012). Students have difficulty intertwine the concept of based ten fractions with decimal numbers, difficulties in comparing two decimals, and difficulties in decimals computation. This can be caused by various factors, one of which is textbooks that are used as learning resources. This textbook has a considerable influence because both teachers and students still have a dependency on textbooks. What is presented in the textbook they will follow? Therefore, it is important to analyze textbooks, so that researchers can see how decimal material is presented and studied on a large scale (Li, Chen, & An, 2009). Researchers will find out the root causes of the many misconceptions experienced by students.

This study analyzed mathematics textbooks for fourth grade and fifth grade. The analysis focused on the material of decimal fractions. This study aims to describe the development of the decimal fraction material presented in the book and to describe the results of the mathematics problem analysis of decimal fractions in the textbook. With the analysis of the results of textbooks, it is hoped that the results of the analysis can be used as

consideration for teachers and for the government that provides books to present material by paying attention to the essence of mathematics learning.

## METHOD

This study uses a qualitative approach with document analysis methods. Limitations and textbook samples are presented in the following discussion.

### Sample of textbooks

The books analyzed in this study are mathematics textbooks published by the Indonesian ministry and culture of the Republic of Indonesia published in 2018 (Hobri, et al., 2018). For high-grade mathematics lessons, specifically grades 4, 5, and 6, the government has made a separate companion book for lessons. The titles of the three books are the same, namely *Senang Belajar Matematika* for elementary school grades 4, 5, and 6. Furthermore, *Senang Belajar Matematika* for grade 4 will be coded as SBM4, and the textbook for grade 5 will be coded as SBM5 to make it easier to explain the results of the analysis. Many other publishers have published this companion book for learning mathematics. However, because this book was published by the Ministry of Education and Culture directly, this book must be an example of a credible source in implementing mathematics learning. This is what underlies researchers to analyze this book. This mathematic textbook is made in two versions, one for students and teachers. In this study, researchers limited the analysis to students' textbooks only.

Decimal materials began to be studied in grade 4 and grade 5. Therefore, only two books will be analyzed and focus on the chapter that discusses decimal material. For grade 4 books (Hobri, et al., 2018), the analysis will focus on chapter 1 entitled fractions and for grade 5 books (Purnomosidi, et al., 2018) in chapter 1, which is entitled Computational of fractions. In both chapters, it discusses decimal fraction numbers.



### Content Analysis

Researchers found previous research that analyzed mathematics textbooks (Kar, et al. 2017; Yang, D.C. 2017; Butuner, 2019). In this study, the method refers to the research. The content and problems in the book are analyzed in-depth to see how the decimal material is studied.

In this study, books were analyzed on content and problems to see how decimal material was presented. The content analyzed focuses on the learning approach adopted by the book, the decimal concept

presented in the book, and how decimal number operations are taught.

### Problems Analysis

The mathematical problems used in this study refers to previous research (Jader, 2019; Kar, et al. 2017), which is a question exercise, mathematical activity, or problems in the book that is suggested for students to do and to support student learning. In this study, researchers would not separate routine or non-routine tasks or problems. The problem analysis indicator will follow the indicators in the research conducted by Kar, et al (2017) as in the following table 2.

**Table 2.** Problem Analysis Indicator

Indicator	Category (Code)
Number of steps	Single-step (S)
	Multiple steps (M)
Types of possible answers	Only numerical answer (A)
	Numerical expresion (E)
	Need explanation or solution (ES)
Question form	Purely numerical or word form (NW)
	Illustrative question using daily problems, diagrams, or combined (IC)
Cognitive expectation	Procedural Knowledge (PK)
	Conceptual knowledge (CK)
	Representation (R)
	Problem-solving (PS)
	Reasoning (MR)
	Problem posing (PP)

In the Number of step indicators, the researcher categorized it into 2 categories, namely the single steps which only required one step to answer the problems (code: S), and multiple steps that required several steps to answer the problems (code: M). In the types of possible answers indicator, the researcher categorized them into 3 categories, that are only need Only numerical answers (code: A) such as multiple-choice, answers that required a mathematical expression (code: E) such as how to solve them, and answers that needed an explanation of the answers obtained and the solution used (code: ES). In the question form indicator, the researcher categorized it into 2 categories, that are questions that only

used numbers or words (NW) and questions that used illustrations, both daily life and diagrams or pictures (IC).

Cognitive expectations that will be needed to solve problems are interpreted as mathematical knowledge and skills (Kar, et al., 2017). This knowledge and skills are needed for mathematical activities. There are 6 categories as shown in table 2. Problems that require procedural knowledge, that are problems need solutions using mathematical operations or algorithms. Problems that require conceptual understanding are problems that need questions of the meaning of certain concepts such as examples of the decimal



concept. Problems that require representation skills are problems that need solutions in the form of diagrams, pictures, or their interpretation of the answers obtained. Problems that require problem-solving skills are shown by non-routine questions that students cannot memorize strategies to solve these problems (Van De Walle, 2017). Problems that require

reasoning skills are problems that need an explanation of the answers and explanations of the strategies used. Problems that require problem-posing skills are questions or situations that require the creation or submission of new problems or questions. Problems analysis in textbooks is shown in table 3.

**Table 3.** Problem Analysis in the textbook

Examples	Indicator and Category			
	Number of steps	Types of possible answers	Question form	Cognitive expectation
1. Convert the following fractions to decimal form! a. $\frac{8}{10}$ b. $\frac{65}{30}$	S	E	NW	PK
2. Meli accompanied her mother shopping at the traditional market. Mom bought 5 Kg of rice, 2,5 Kg of chicken, $\frac{1}{2}$ Kg of carrots, and $\frac{3}{4}$ Kg of potatoes. How many Kg did mom buy??	M	E	IC	PK
3. Result of $1,2 \times 0,25 = \dots$ a. 300,0    b. 30,0    c. 3,0    d. 0,3	S	A	NW	PK
4. 5 times a pick-up car carries 7.5 tons of rice. If the rice to be transported is 13.5 tons, how many times is it needed to transport the rice by the pick-up car?	M	E	IC	PK/PS
5. Create math problems that deal with multiplying and dividing fractions and decimals. Then solve the problems you made!	M	E	IC	PP/PS

\*Problem 1, SBM4, pp.29; problem 2, SBM4, pp.42; problem 3, SBM5, pp.43; problem 4, SBM5, pp.41; problem 5, SBM5, pp.42

In the cognitive expectation category, one question allows having 2 or more cognitive skills needed to solve a problem. For example, numbers 4 and 5. The word problem in question number 4, is an example of a non-routine problem. This problem requires students to look for problem-solving strategies because the required settlement steps are different from the completion steps as exemplified in the example questions. Therefore, question number 4 requires problem-solving skills as

well as procedural skills to answer the questions. In contrast to question number 2, this question is a routine problem that students can solve the problem easily because the steps needed have been exemplified in the example problem, which is just adding it up.

## RESULTS AND DISCUSSION

### Findings on the Learning of Decimal Materials Presented in Books

Decimal material began to be studied in grade 4 and grade 5 elementary school. This is by the basic competencies in the 2013 curriculum which is shown in table 1. Decimal material is in the fractions chapter so it doesn't have its chapter. Just like percent, the decimal is more directed as another form of fraction than as other types of numbers such as whole numbers or integers.

The learning adopted by the SBM4 book is a scientific approach so that the flow of material presented is by the 5 stages (5M) of learning the scientific approach, namely observing, asking, trying, reasoning, and communicating (Permendikbud, 2014). In each part, it is quite clear that there are instructions that indicate each activity of scientific activity.

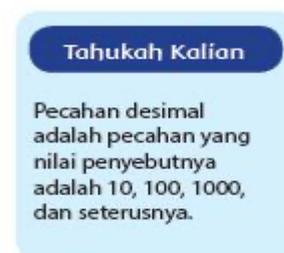
In the observing section, a narrative text is presented which tells of someone buying 4.5 kg of passion fruit. Students are asked to read the text and copy it in the task book using their own words. Furthermore, in the asking section, two sample questions are presented that can be used by students to ask questions during learning. like what do fractions look like, and how to convert regular fractions to percent. After these examples, students are asked to make other questions they want to ask. In the reasoning section, a text presenting materials concepts such as regular fractions, decimals, and percentages. In the decimal material, readers are directed to remember the previous observation text regarding someone who bought 4.5 kg of passion fruit. Then they are told that 4.5 is a decimal number and are presented with steps to convert a decimal number into a fraction. Furthermore, in the trying section, math problems are presented that can be used as training for students. The form of the problem varies, such as multiple-choice forms, short answer questions, and word problems. The results of the analysis regarding the math problems will be discussed in the next topic. Lastly, the communication part. In this section, there are instructions that direct students to discuss with their friends the summary that they made.

The approach used in the SBM5 book also uses a scientific approach. It's just that the 5M stages are not as visible or explicit as in the SBM4 book. Only the stages let's observe and let's try to have subtopics. The activity of asking, reasoning, and communicating are not raised explicitly but can be tricked by the teacher.

As in the SBM4 book, the observing section is presented with a narrative text about a person buying four oranges and each weighing 0.125 kg. Furthermore, an example is given to calculate the total weight of 4 oranges that directed to the concept of multiplication, which is repeated addition.

At the trying stage, students are presented with a lot of questions or math problems. In one sub-topic there can be up to 10 questions. These questions such as multiple-choice questions, short answer questions, and word problems. Furthermore, there are no instructions for asking, reasoning, and communicating activities.

The decimal concept in the SBM4 book is presented using an approach to the concept of fractions. As shown in Figure 1, the definition of the decimal is not presented in the body of the text but is only written in a small column beside the body of the text. There is no further explanation regarding this definition. The presentation of the material focuses more on converting decimals to fractions or fractions to decimals. As in figure 1.



**Figure 1.** Decimal Fraction definition, Source: SBM4, Hobri, et al. (2018), p. 28

Langkah-langkah mengubah bentuk pecahan desimal menjadi pecahan biasa.

**Penyelesaian Pertama**

**Langkah 1**  
Hitung jumlah angka dibelakang koma. 0,5 Angka dibelakang koma ada 1 yaitu angka 5.

**Langkah 2**  
Hilangkan tanda koma dan angka nol di depan koma. Jika nol dan koma pada angka 0,5 dihilangkan. Maka hanya tinggal angka 5.

**Langkah 3**  
Tetapkan angka yang diperoleh dengan langkah 2 sebagai pembilang

**Langkah 4**  
Tentukan penyebut mengacu pada hasil langkah 1.  
Jika terdapat 1 angka di belakang koma, maka penyebutnya 10.  
Jika terdapat 2 angka di belakang koma, maka penyebutnya 100.  
Jika terdapat 3 angka di belakang koma, maka penyebutnya 1000, begitu seterusnya.

**Langkah 5**  
Tulis bilangan pecahan.

**Figure 2.** First way procedure for converting decimals into fractions. Source: SBM4, Hobri, et al. (2018), p. 25

**Penyelesaian Kedua.**

Jika kalian ingin mengubah 0,5 menjadi bilangan pecahan, maka kalian harus memasukkan angka 5 pada kolom sepersepuluh.

**Tabel 1.1 Mengubah desimal menjadi pecahan**

1.000	100	10	1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1.000}$
Seribu	Seratus	Sepuluh	Satu	Sepersepuluh	Seperseratus	Seperseribu
				5		

Bilangan 0,5 dapat ditulis :  $5 \times \frac{1}{10} = \frac{5}{10}$ .

**Figure 3.** Second way procedure for converting decimals into fractions Source: SBM4, Hobri, et al. (2018), p. 26

Besides the steps shown in Figure 2, the SBM4 book also offers a second way of converting decimals to fractions through the use of a place value table as shown in Figure 3. There is no further explanation as to why 5 is put in the tenth column and why the algorithm becomes  $5 \times \frac{1}{10}$ . Besides the steps shown in Figure 2, the SBM4 book also offers a second way of converting decimals to fractions through the use of a place value table as shown in Figure 3. There is no further explanation as to why 5 is put in the tenth column and why the algorithm becomes  $5 \times \frac{1}{10}$ . It is becoming the teacher's responsibility to be able to explain the concepts in Figure 3 appropriately so that students avoid misconceptions. If the teacher cannot explain clearly or even the

teacher does not understand the core concept of Figure 3, then the students' conceptual understanding will not be achieved and can have misconceptions.

After a discussion of converting decimal to fraction or fraction to decimal, the SBM4 book provides a material explanation on estimation. In the estimation of decimal material, an example of the steps and a small note for carrying out the estimations is presented in Figure 4.

**Tahukah Kalian**

Bilangan  
4, 3, 2, 1  
dibulatkan ke bawah  
5, 6, 7, 8, 9  
dibulatkan ke atas.

**Contoh 1.16**

Tentukan hasil operasi hitung berikut dengan taksiran atas.

a.  $16,8 \times 2,4 \approx 17 \times 2 = 34$   
16,8 dibulatkan ke atas menjadi 17  
2,4 dibulatkan ke bawah menjadi 2

b.  $24,7 \div 4,9 \approx 25 \div 5 = 5$   
24,7 dibulatkan ke atas menjadi 25  
4,9 dibulatkan ke atas menjadi 5

c.  $153,7 + 8,2 \approx 154 + 8 = 162$   
153,7 dibulatkan ke atas menjadi 154  
8,2 dibulatkan ke bawah menjadi 8

d.  $32,4 - 5,5 \approx 32 - 6 = 26$   
32,4 dibulatkan ke bawah menjadi 32  
5,5 dibulatkan ke atas menjadi 6

**Figure 4.** How to do estimation in decimals  
Source: SBM4, Hobri, et al. (2018), p. 38

**Mengenal Pecahan Desimal**

Bilangan Pecahan desimal adalah bentuk lain dari suatu pecahan. Ciri dari pecahan desimal adalah tanda koma ( , )

Contoh Pecahan Desimal

- Bentuk pecahan desimal dari  $\frac{3}{10}$  adalah 0,3
- Bentuk pecahan desimal dari  $\frac{3}{100}$  adalah 0,03
- Bentuk pecahan desimal dari  $\frac{3}{1000}$  adalah 0,003

**Figure 5.** Decimals definitions using fraction base ten Source: SBM5, Purnomosidi, et al., (2018), p. 34

Before discussing the estimation of decimal numbers, the SBM4 book first discusses the estimation of whole numbers and fractions. For the estimation of a decimal number, it is the same as an approximation. The approximation material is discussed specifically in Chapter 3. The material on decimal fractions in the SBM5 book focuses more on multiplication and decimal division. However, previously stated the concept of the decimal is shown in Figure 5. The steps to answer the problem for multiplication and decimal division are divided into two ways, respectively.

The first way is multiplication or division by changing the decimal number into a fraction then operating it as shown in Figure 6.

The second way is to directly multiply or divide the decimal number by using a

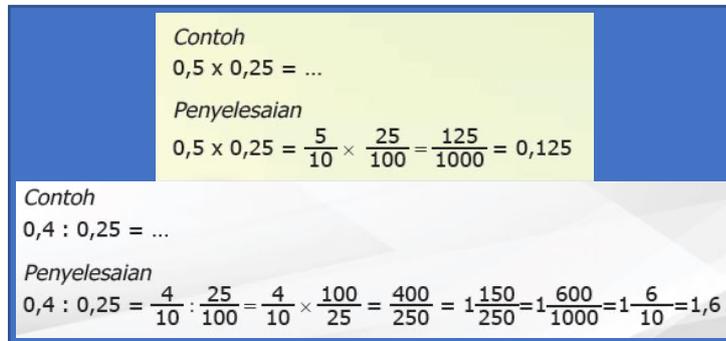
compound method as shown in Figure 7. The researcher found that no section discussed addition, subtraction, or decimal comparison in both the SBM4 and SBM5 books. In the SBM4 book, the discussion only focuses on converting decimals from fractions or fractions to decimals and estimating or approximating. Meanwhile, in the SBM5 book, the discussion focuses on multiplication and division.

### Problems analysis in the math textbook

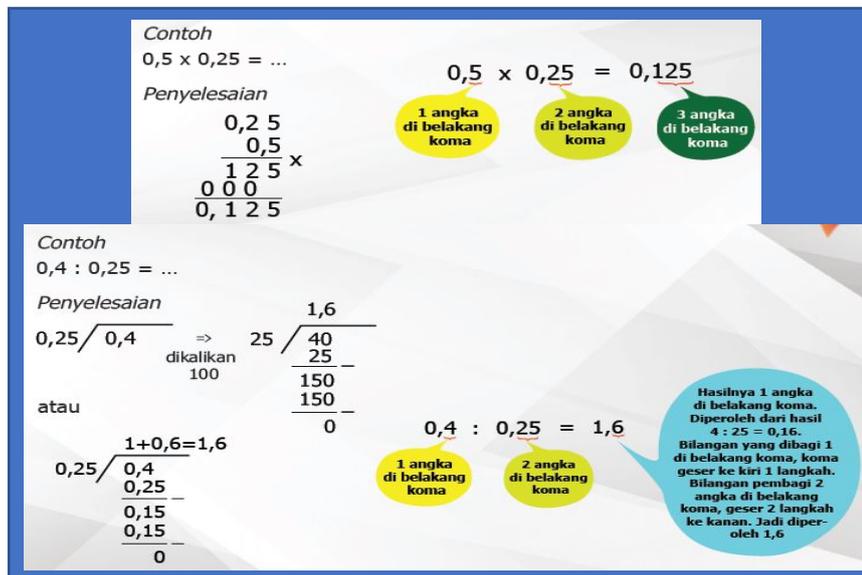
The results of the analysis of problems in the SBM4 and SBM5 books are shown in table 4. It can be seen that from the two books, many questions only require a single solution. Many problems such as multiplying, dividing, and converting fractions to decimals are not too complex and only use one mathematical operation. The answers

requested are also not directed to describe an explanation for the solutions made. Students are only directed to answer questions without emphasizing the explanation. In the cognitive expectation category, many questions only practice procedural skills. There are no questions at all that lead students to give representation or reasoning in the answers. As shown in table 4, there are no questions that contain

words like *explain the solution to the problems used, or use a grid table to describe the decimal number 0.5*. There are fewer questions on the SBM4 book than in the SBM5 book, but the questions on the SBM5 book are more varied, even though they are more dominant in one category and the other categories are empty.



**Figure 6.** Multiplications and dividing procedure with converting to fraction method  
Source: SBM5, Purnomosidi, et al., (2018), pp. 35 and pp.37



**Figure 7.** multiplications and dividing procedure using a compound method  
Source: SBM5, Purnomosidi, et al., (2018), pp. 35 and pp.37

**Table 4.** Distribution of problems in the textbook

Category	SBM4 (N=19)	SBM5 (N=104)
Number of steps		
Single-step (S)	12(63,2%)	93(89,4%)
Multiple steps (M)	7(36,8%)	11(10,6%)
Types of possible answers		
Only numerical answer (A)	0	5(4,8%)
Numerical expression (E)	19(100%)	99(95,2%)



Need explanation or solution (ES)	0	0
Question form		
Purely numerical or word form (NW)	16(84,2%)	94(90,4%)
Illustrative question using daily problems, diagrams, or combined (IC)	3(15,8%)	10(9,6%)

**Table 5.** Distributing cognitive expectations from the questions in the book

Cognitive expectation	SBM4 (N=19)	SBM5 (N=109)
Procedural Knowledge (PK)	19(100%)	96(88,1%)
Conceptual knowledge (CK)	0	0
Representation (R)	0	0
Problem-solving (PS)	0	12(11,0%)
Reasoning (MR)	0	0
Problem posing (PP)	0	1(0,9%)

\*Data is presented in f (%)

The presentation of the material in the SBM4 book follows the flow of the scientific approach. Complete with activities to observe, ask, reason, try, and communicate. For the SBM5 book, the flow of material presentation does not look like using a scientific approach. However, there are activities to observe and try. The rest are critical thinking, exploration, and project assignments. There is nothing wrong with using this approach, but the essence of learning mathematics is less obvious. Today's mathematics learning not only focuses on computational abilities but also must learn to use understanding (NCTM, 2000) and good reasoning. Both of these are very necessary so that students can solve problems, evaluate the problem-solving strategies they use, and also get ideas to solve problems in the future (Van de Walle, 2013).

If we look at Figure 2 which is an explanation of the initial material on the decimal section in the SBM4 book, understanding the concept of decimals is less emphasized. Even the definition of the decimal is stored beside the body of the main text and has no further explanation. Even though the decimal concept is important for students to understand so that they can perform computations well and be able to solve problems. If the problem-solving steps are explicitly available and students are not allowed to try to find problem-solving strategies themselves, it will only lead

students to problem-solving skills without understanding (Palm, Boesen, & Lithner, 2011; Schoenfeld, 2012). It is important to understand decimal material because decimals also play a role as a foundation in mathematical activities and achieving the next level of mathematics skills (Van de Walle, 2013; National Mathematics Advisory Panel, 2008; Siegler, et al., 2012).

If we see from Table 1 regarding the basic competence of decimals in grade 4, indeed decimal material is only used as part of fractions and does not have a special chapter in the book. Even so, the very basic decimal concept should be used as a starting point for discussion before going into the section on converting decimals to fractions or vice versa. Concepts such as sorting or comparing decimals are not included in books, even though these two things can help in understanding decimal numbers as well as decimal place values (Van de Walle, 2013). Learning by simply stopping procedural skills and not understanding the meaning of the process will only lead students to remember the material (Martinie, 2014; Steinle, Vicki, & Stacey (2004). If it is only remembered and not understood, participants students will have difficulty adjusting the material they remember with demands to solve problems.

The questions in the SBM4 and SBM5 books are dominated by questions that only require a single step, only require answers in the



form of mathematical expressions, problems in the form of pure mathematic, and only develop procedural skills. The success of learning mathematics is not only seen from the ability to count and procedural skills. Students must also understand that the procedure must be assisted by reasoning and other mathematical skills. There are five aspects or skills that indicate a person is successful in learning mathematics. The five skills called the 5 strands of mathematical proficiency, there are (1) understanding concepts; (2) procedural fluency; (3) strategic competence; (4) adaptive reasoning; and (5) productive disposition (Kilpatrick, et al., 2001). The five aspects of these skills are related to one another. A person is said to be successful in learning mathematics if that person has these five skills. If one skill is not mastered, it will affect other skills. For example, if the understanding of the concept of place values in decimal fractions is wrong, then students will also be wrong in doing the procedure for adding decimal fractions. If we see in table 5, there are no problems that reveal conceptual understanding and reasoning. There are no questions that require an explanation of the problem-solving strategy taken.

## CONCLUSION

This study was designed to describe the presentation of decimal material in mathematics textbooks. Especially on decimal material in the SBM4 and SBM5 books. The presentation of the material uses a scientific approach that is very clear in the SBM4 book. Meanwhile, the SBM5 book is not too specific. The decimal material in the SBM4 book is in the fractions chapter. Starting with a discussion of the material for changing the form of a fraction to a decimal, then continuing with the material for estimation. For decimal material, the SBM5 book focuses on multiplication and decimal division. Procedural ways dominate the presentation.

The problems in the book are dominated by problems that only reveal procedural skills. There are no problems that reveal the skills

of representation, reasoning, and conceptual understanding. Problems are dominated by problems that use mathematical numeration and only require answers that use mathematical expressions. Problems are also dominated by questions that only require a single solution.

Based on this research, it appears that teachers should make more efforts to find learning resources that are more supportive of learning mathematics success. Because the success of learning mathematics can be seen from the development of mathematical skills, not only in numeracy skills.

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