Preface

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The fourth industrial revolution (4.0) is marked by the advancement of technologies and powered by artificial intelligence which creates opportunities and challenges for education systems. University and vocational school graduates face a world transformed by technology which in turn transforms the workplace from task-based to human-centered characteristics. Certain skills such as critical thinking, emotional intelligence, problem solving, cognitive flexibility, and knowledge production are required. To address this demand education system should put revolutionary innovation in its agenda. Scholars, researchers, and practitioners are invited to share their ideas, research outcomes, and best practices about education, social sciences and humanities now and in the future in an The 1st International Conference on Education, Science and Technology (ICESTech) 2019.

ICESTech 2019 has been held on March, 13th - 16th 2019, at the Universitas Negeri Padang, West Sumatera, Indonesia. ICESTech 2019 is to bring together innovative academics and industrial experts in the field of education, science, and technology to a common forum. The primary goal of the conference is to promote research and developmental activities in education, education, science, and technology and another goal is to promote scientific information interchange between Scholars, researchers, students, and practitioners working all around the world.

ICESTech 2019 has received 312 papers and the papers come from both academia on the international flavor of this event in the topics of Industrial Revolution 4.0. Based on the peer review reports, 175 papers were accepted to be presented in ICESTech 2019 by the editors. All the accepted papers have been presented on the conference, mainly by oral presentations in three sessions: education, science, and technology.

We sincerely express our thanks to all the members ICESTech 2019. Thanks are also given to IOP JPCS for producing the proceeding.

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Analysis of the junior high school mathematics textbook in Indonesia based on the content of higher order thinking skills

Analysis of the junior high school mathematics textbook in Indonesia based on the content of higher order thinking skills

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Abstract. High-order Thinking Skills (HOTS) are strategic skills that individuals must have in order to succeed in life. Textbooks are important tools to facilitate the development of these skills in the teaching and learning activities. This literature study is intended to analyze the content of HOTS which includes analytical, evaluation and creation skills in junior high school mathematics textbooks in Indonesia. The analysis focused on the HOTS content in some parts of this book, namely the explanation of concepts, example problem and solution and assignment or exercise problem. The results of qualitative data analysis indicate that the HOTS content category in this book for analytical skills is categorized as good, while evaluation skills and creative skills still need to be enriched. Based on the results of the analysis, this article also presents enrichment alternatives to the HOTS content in this book so that it can be used adequately to develop HOTS in the mathematics teaching and learning.

1. Introduction

One of the important tasks of education is to develop a number of strategic skills in students for successful life. These strategic skills include communication skills, digital literacy, teamwork, presentation skills, critical thinking, creativity and financial literacy [1]. Teaching and learning need to be designed to teach these strategic skills. The Curriculum 2013 being implemented in Indonesia was developed to prepare students to have strategic skills to succeed in the future by having attitude, mastering knowledge and having the skills to think and act creatively, productively, critically, independently, collaboratively and communicatively [2].

Thinking skills are the main skills students need to have. The results of Trends in the International Mathematics and Science Study (TIMMS) 2015 show that Indonesian students' mathematical thinking skills are still low [3]. TIMSS is conducted in order to compare mathematics and science achievements of 8th and 4th grade students in several countries in the world. Table 1 shows the achievements of Indonesian students in the field of mathematics in the study.

Table 1. TIMMS 2015 Indonesian result in mathematics

Country	Overall Average	Content Domain			Cognitive Domain		
		Number	Geometry	Data	Knowing	Applying	Reasoning
Indonesia	26	24	28	31	32	24	20
International	50	49	50	57	56	48	44

TIMSS classifies students' abilities in three cognitive domains, namely knowing, applying and reasoning in the content domain of numbers, geometry and data. The knowing domain includes recall, recognize, compute, retrieve, classify/order and measure. The implementing domain include determine, represent/model and implementation. The reasoning domain includes analysis, synthesis, evaluate, draw conclusions, generalize and justify [3]. The reasoning cognitive domain is categorized as a Higher-Order Thinking Skills (HOTS). HOTS is thinking on a higher level than memorizing facts that requires the tasks to be understood, connected to each other, categorized, manipulated, put together in new or novel ways and applied as new solutions to new problems [4].

There are six cognitive levels, namely remembering, understanding, applying, analysing, evaluating and creating. The level of analysing, evaluating and creating is categorized as HOTS [5]. The cognitive level of analysing includes breaking information into parts to explore understandings and relationships, comparing, organizing, deconstructing, interrogating and finding. The cognitive level of evaluating includes justifying a decision or course of action, checking, hypothesising, critiquing, experimenting and judging. The cognitive level of creating includes generating new ideas, products, or ways of viewing things designing, constructing, planning, producing and inventing.

Researchers have found that HOTS can be taught, nurtured and developed among learners. To achieve HOTS, students should be involved in understanding and transformation of knowledge which are described as the ultimate goals of learning [6]. Without good understanding, students may not be able to reach HOTS. Students should learn mathematics with good understanding, meaning that students must develop their new knowledge based on previous experience and knowledge [7]. To achieve this understanding, are determined five general learning objectives for mathematics, namely learn to communicate, learn to reasons, learn to solve the problems, learn to connect and form the positive attitude towards mathematics.

There are various ways to develop HOTS, including by asking potential questions to ensure students do not only provide easy and simple answers, but can think more deeply [8]. These questions can lead participants from "what" questions associated with lower-order thinking into the "how" and "why" associated with higher-order thinking.

Textbooks are the main operational tool for implementing curriculum and learning resources [9]. From a number of curriculum support materials, textbooks have a very significant role [10]. Textbooks also provide the possibility of strong relationships between curriculum and learning activities [11]. Textbooks are designed to translate abstractions from curriculum policies operationally so that teachers and students can implement them [12]. Textbooks have a very strategic role that can provide organized ideas and information that can provide learning support that can provide guidance for students to gain understanding, thinking and feeling [13]. Thus, textbooks are important tools to develop strategic skills that are the objectives of the curriculum, including developing HOTS.

As a tool for developing HOTS, textbooks need to contain a number of constructive activities that can facilitate students to gain good understanding and at the same time facilitate the development of HOTS. Research on textbooks has grown rapidly in the last three decades [14]. The following is a classification of research on textbooks.

Table 2. Classification of research on textbooks

Category	Scope
Role of textbooks	This study includes the role of textbooks in mathematics learning
Textbook analysis and comparison	his study focuses on analysis and comparisons (similarities and differences) of the features of a series of mathematical textbooks, including math books from several countries
Textbook use	This study focuses on how textbooks are used by teachers and/or students and how textbooks help teachers on how to teach mathematics
Other areas	Broadly this study includes all studies of textbooks such as those concerning electronic textbooks and about the relationship between textbooks and student achievement

Textbooks are not only intended to explain concepts, but also to train the development of special skills, such as HOTS. Analysis of textbook is needed to identify whether the textbook is adequate as a means to develop HOTS.

2. Method

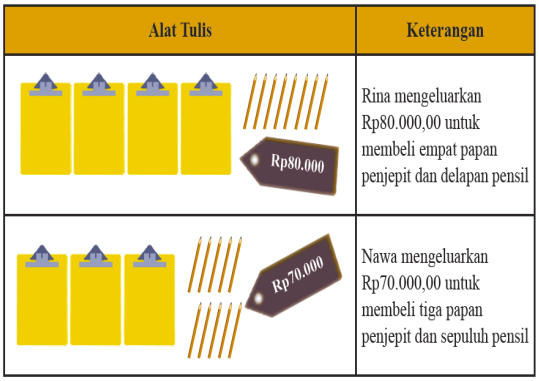
This literature study is intended to systematically analyse HOTS content in junior high school mathematics textbooks in System of Linear Equation in Two Variables (SLETV). Analysis of textbooks is only focused on one chapter because the organization of all the chapters in this book is similar, which begins with the presentation of the relevant context as an introduction to explain the concept followed by giving example problem and solution and exercises problem or projects.

The analysis of the textbook in this study is aimed at the components of the presentation of the book, namely the explanation of concepts, examples of problems and solutions, and practice questions that cover three cognitive levels of HOTS, namely analysing, evaluating, and creating [5]. Based on the results of the analysis, this article also presents enrichment alternatives to the HOTS content in this book so that it can be used adequately to develop HOTS in the mathematics teaching and learning.

3. Results and Discussion

The basic competencies of knowledge and skills that correspond to the topic of SLETV are (1) describing the SLETV and its solution associated with the contextual problem and (2) solving the problem related to the SLETV. Some of the concepts discussed in the presentation of this material are SLETV as models of contextual problems, understanding solutions of TVLES, solutions of TVLES with graph, substitution and elimination methods.

Explanation of the SLETV begins with the presentation of relevant contextual problems, for example the determination of the price of goods (paperclips and pencils) as follows.



$4j + 8p = 80.000$		$3j + 10p = 70.000$	
j	p	j	p
10.000			4.000
	4.000	12.000	
15.000			2.500
	2.000	16.000	
17.000			1.900

Figure1. Informal strategy for solving SLETV

To determine the price of each paperclip and pencil, was arranged a linear equation system with two variables, namely 4j + 8p = 80,000 and 3j + 10p = 70,000, with j and p being the price of each paperclip and pencil. Then students are stimulated to solve the problem informally. Such a method can stimulate students to think higher, especially in finding or creating and identifying possible solutions. However, the informal method used in this chapter to identify SLETV solutions is less systematic. In addition, contextual problems used should involve simple numbers to operate. For example, here is an informal method that corresponds to a SLETV involving two linear equations j + p = 5,000 and j + 2p = 7,000.

Price of a paperclip (j)	1,000	2,000	3,000	4,000
Price of pencil (p)	4,000	3,000	2,000	1,000
Price of one paperclip and one pencil ($j + p$)	5,000	5,000	5,000	5,000
Price of one paperclip and two pensil (j + 2p)	9,000	....	....	....
Is it true (Yes or No)	No		Yes	

The explanation of the concept of SLETV in this chapter is categorized as good, especially in the use of informal strategies to complete SLETV before using the graph, elimination, and substitution methods. The use of informal strategies to complete SLETV can potentially develop high-level thinking skills, especially analysing and creating skills for solving SLETV. This explanation can be enriched by the suitability of the SLETV solution to facilitate the development of evaluating skills, for example by writing a number of questions, such as "are (2000, 3000) a solution?, are there other solutions?". Here's another informal strategy for solving SLETV that can enrich students' understanding and stimulate them to think analytically and creatively.

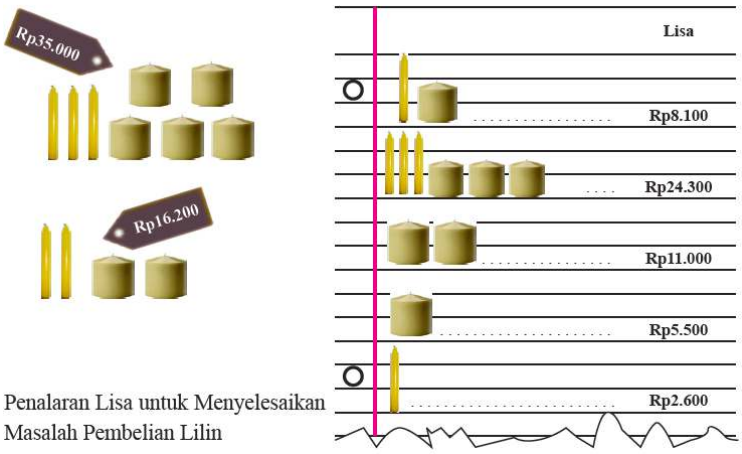


Figure2. Informal strategy for solving SLETV

The next explanation is a graphical method for determining the SLETV solutions, but using different contexts and. It would be better if the discussion of the graphical method uses the previous context so that students' understanding is more comprehensive between concept presentations.
The discussion of the SLETV concept in this book is only limited to SLETV which has one solution. In order for students to gain a comprehensive understanding, the discussion needs to be enriched with SLETV which has more than one solution and which has no solution and is associated with the gradient concept and coordinates of the SLETV graph intersection. Such discussion can enrich students' mathematical understanding, especially the relational understanding of mathematics. There are two types of understanding as instrumental understanding and relational understanding [15]. Instrumental understanding refers to the ability to perform a mathematical procedure or apply an algorithm to solve a problem that is not accompanied by a good understanding of why the procedure was applied or why it gives the right solution to the problem. Relational understanding also refers to the ability to link a concept with another concept or to define a concept with other concepts and the ability to explain the appropriateness of a strategy or solution to the problem.
There are 15 problems in this chapter, most of which (73%) are analytical problem, while the number of questions in the category of evaluating and creating is still very limited (6%). The following is an example of a problem with analysing categories.

3.1 Problem 1

Without calculating each price, which is more expensive?

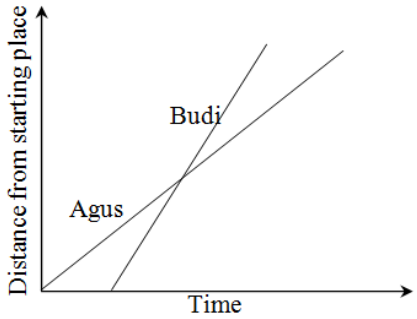
The problem can be modified so that it becomes a problem with the level of evaluation, for example, "based on this information, without calculating the price of each one, is it true that the price of pants is more expensive than the price of a pair of glasses? Why?"
Enrichment in this chapter with STELV types that have more than one solution and SLETV that do not have a solution can facilitate the development of HOTS of students, for example by presenting the following problems.

3.2 Problem 2 (Analysing)
Based on the graphs, how do you know that an SLETV has a solution, has no solution, or has more than one solution? How do you also identify the number of SLETV solutions based on the gradients of the linear equation forming the SLETV?

3.3 Problem 3 (Evaluating)
Suppose a student works on an SLETV below. Is the answer correct? Why?

Solve this System Linear Equation with Two Variables (SLETV) below.
$2x + 3y = 21$
$4x + 6y = 42$
Answer
$2x + 3y = 21 \rightarrow 4x + 6y = 42$
$4x + 6y = 42 \rightarrow 4x + 6y = 42$
$0 + 0 = 0$
So, the solution of the SLETV is (0,0)

3.4 Problem 4 (Creating Problem)
Suppose the two lines correspond to a two-variable linear equation system. Give an explanation of the meaning of the intersection.



4. Conclusion

The results of qualitative data analysis indicate that the HOTS content in this book for analytical skills is categorized as good, while evaluation skills and creative skills still need to be enriched. The explanation of SLETV concept can be enriched by a comprehensive discussion involving the types of SLETV in terms of the number of solutions by linking the concept of gradients and the coordinates of the graph intersection of SLETV. Such discussion can enrich understanding and HOTS of students.

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