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E-Book Design for Problem-Based Learning to Stimulate Creative Thinking Ability

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Abstract: *Creative thinking is a crucial skill for students amidst the challenges of the Fourth Industrial Revolution. Students adept at creative thinking often find problem-solving more manageable. However, efforts to enhance students' creative thinking abilities remain suboptimal, partly due to limited teaching materials. This study aims to address this gap by analyzing the necessity for, designing, and developing an e-book tailored to problem-based learning to foster creative thinking skills. Following the ADDIE model, the research engages teachers and 8th-grade Junior High School students as participants. Data collection involves observations and interviews, followed by data reduction, presentation, and conclusion drawing. The findings include an assessment of e-book requirements and design aligned with problem-based learning to stimulate creative thinking. This study offers a roadmap for mathematics teachers to develop e-books that not only enhance students' understanding of mathematics but also nurture their creative thinking skills. The novelty lies in the integration of creative thinking skills within the e-book, coupled with its alignment to the problem-based learning approach.*

Keywords: *E-book Design, Problem based Learning, Creative Thinking.*

INTRODUCTION

The purpose of education in Indonesia is to develop students' potential to speak, think critically, think creatively, and be innovative. The learning process included in the Curriculum of 2013 is performed in an interactive, inspiring, fun, and challenging way for students and teachers. The learning process is expected to motivate students to play an active role in providing opportunities for students to bring out the creativity and independence of students by adjusting the talents, interests, as well as physical and psychological development of students.

In the era of globalization, students need creative thinking skills to be able to solve mathematical problems in everyday life. So the demands in mathematics education can be achieved to generate new ideas and solutions in solving mathematical problems. In mathematics, problem-solving requires students' creativity. Through problem-solving, students can come up with new creative ideas.

Creative thinking is a characteristic of high-level thinking which is found in logical and divergent thinking methods. Someone with creative thinking skills can be competent with genius opinions, instincts and imagination, interesting ideas, and inspiring new ideas (Nasution et al., 2017; Puspitasari et al., 2018). Creative thinking is one of the high-level thinking skills (Nasution et al., 2017). That mater is in line with the research (Alzoubi et al., 2016; Badengo, n.d.; Wahyu Andriyani et al., 2021) which states that one of the skills of the 21st century is creative thinking. The ability to think creatively is expected to be able to provide a solution to every problem (Fatah et al., 2016). Moreover, creative thinking is included in the graduate competency standards of primary and secondary education. Indicators of creative thinking are fluency, flexibility, and novelty (Nasution et al., 2017). Therefore, creative thinking is very important for students because it is the basis for the responses to find solutions or problems encountered (SETIAWAN et al., 2020).

The result of previous research shows that the majority of teachers have several creative thinking skills (Panigrahi, 2017). Creative teachers can be seen from the creativity and originality when they are teaching. On the other hand, students' creative thinking skills fall into the low category. This matter can be seen from how the students solve problems where the students do not quite understand existing problems (Hendriana & Fadhillah, 2019).

Some literature shows that some students do not yet have the creative thinking ability (Panigrahi, 2017). As in research (Khoiriyah & Husamah, 2018) and (Widyastuti, 2018), the results show

that some students do not yet have creative thinking abilities. It requires a learning model that can improve the creative thinking ability to achieve creative thinking ability. Problem-based learning can be used as an alternative learning model. A problem-based learning model can be applied by teachers to improve creative thinking ability (Khoiriyah & Husamah, 2018).

Problem-based learning could develop and increase creative thinking ability (Birgili, 2015). According to (Wartono et al., 2018), problem-based learning is highly effective in training and increasing the creative thinking ability of students in learning. Problem-based learning is a form of learning that has the core of presenting a diverse and authentic problem situation that is meaningful to students (Riswari et al., 2018). In other words, problem-based learning tends to lead to an understanding of problem-solving in groups. The steps of a problem-based learning model are students' orientation toward problems, organizing students to learn, guiding individual and group investigation, developing and presenting work, and analyzing and evaluating problem-solving processes (Pratiwi, 2019). It requires supporting learning resources to implement the learning process by using problem-based learning. Learning resources are a set of materials that are arranged systematically to create an atmosphere that allows readers to learn (Raihan et al., 2018). The use of learning resources based on problem-based learning produces cognitive values that exceed the value of completeness criteria (Pujayanto et al., 2017). Based on the interview of teachers at school, learning resources have not used problem-based learning.

Based on the observation that has been done, the material used by students is limited to the Student Worksheet book issued by the government. Therefore, schools need supporting teaching materials. One of the teaching materials that can be developed by a teacher is an e-book. E-books are one type of teaching materials prepared by teachers given to students to support teaching and learning. A research that was conducted by Shurygin proves that a developed electronic education course can improve the efficiency of students in doing independent work (Shurygin & Krasnova, 2016). According to Hill, online resources designed to be used as a pre-instruction can make a difference in conceptual understanding and the smoothness of representational learners and make the students more aware that they are facing a learning process (Rahayu et al., 2023).

A recent study evaluated learning resources in the form of school textbooks. The evaluation revealed that the language aspect had the highest percentage at 76%. Several shortcomings were identified by the researchers, including: (1) a lack of examples, (2) less engaging presentation materials, and (3) the absence of a learning model. Based on validation from media experts, content eligibility had the highest percentage at 80%. Shortcomings noted by the researchers included: (1) absence of illustrations and (2) unattractive cover designs. These findings offer valuable insights for the development of more effective and engaging learning resources for students in educational settings.

Therefore, e-books are considered appropriate if they are developed in accordance with the problem-based learning model and are used to enhance students' creativity. The purpose of this research is to describe the needs of teaching materials that are in accordance with the problem-based learning model and teaching materials that enhance students' creative thinking.

MATERIALS AND METHODS

In this research, the researchers develop an e-book design of mathematical learning based on the problem-based learning model. As in (Amirin, n.d.; Andrianingrum, n.d.; Durak & Ataizi, 2016; Widoarti & Suparman, 2021), the development of e-book designs using the ADDIE model, i.e.: analysis, design, development, implementation, and evaluation.

ADDIE model is the most popular learning design model because the phases are adjusted in detail (Nichols Hess & Greer, 2016). ADDIE model gives detailed specifications that are intended to create and measure practical and systematic learning (Wiphasith et al., 2016). ADDIE model consists of five stages, i.e.: analysis, design, development, implementation, and evaluation. Each stage has a learning goal so that students can achieve good results (Badengo, n.d.). This research is limited to the analysis, design, and development stages only. The produced product is a book design based on a problem-based learning model to improve creative thinking ability.

The subject of this research is the 8th-grade junior high school students of the school year

2019/2020. The data were collected using observation, interviews, questionnaires, and literature studies techniques. Data collection instruments used were observation guides, interview guidelines, questionnaire sheets, and literature studies. Observation guides were used to collect data about students' needs, to study the media, and to find out what learning models are used by the teachers. Interview guidelines were used to determine the use of learning media during the learning process and students' creative thinking ability. The literature study was conducted to determine the indicator of creative thinking ability and problem-based learning model. Data were analyzed by the reduction of data, presenting data, and drawing a conclusion.

RESULTS AND DISCUSSION

Analysis Phase

Researchers carry out the analysis. The analysis was performed on mathematics teachers and students. This stage of analysis included the curriculum used, difficulties in understanding the materials, things needed in the learning process, and problems that often occur in learning. In the curriculum, students must achieve basic competencies. The basic competencies can be seen in Table 1.

Table 1. Basic Competencies

Basic Competencies	Basic Competencies
3.3 Explain the linear equation system of two-variable and the problem-solving that are related to the contextual problems.	Explain the linear equation system of two-variable and problem-solving related to contextual problems.

The researchers gave questionnaires to the 8th-grade junior high school students to find out the materials that are difficult to learn. Those several students are divided into three groups i.e., the top group, the bottom group, and the lower group. Several students think that the linear equation system of two-variable is really difficult to learn, especially story problems. This is because students do not understand the purpose of the questions given by the teachers. According to several junior high school mathematics teachers, one of the materials that students find difficult to learn is the linear equation system of two variables. The linear equation system of two variables is considered difficult because students are still using their abstract abilities to solve those problems. The teachers also stated that students still have difficulties in understanding story problems. According to Polya, there are four stages in solving a mathematical problem, i.e., (a) understand the problem, (b) make a plan, (c) execute the plan that has been made, and (d) look back at of the process that has been done [26].

Aside from that, it is concluded from the interview results with several junior high school mathematics teachers that the learning process needs learning models of teaching materials based on problem-based learning. The linear equation system of two-variable material is considered as difficult. Electronic-based teaching materials are suitable to use. The observation during the learning process showed that the learning media used by students are less varied.

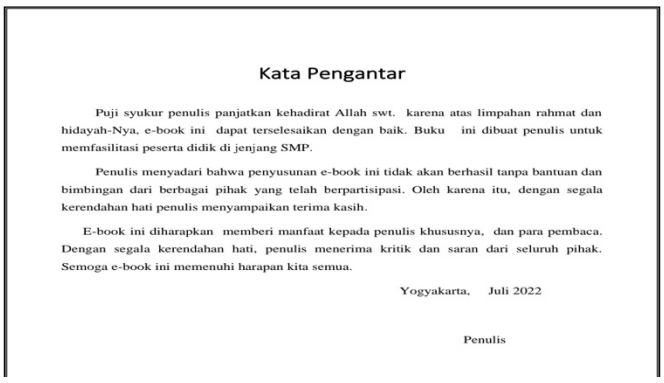
Furthermore, the researchers also conducted a literature study. The researchers conclude that both teachers and students need electronic-based teaching materials such as e-book-based learning models oriented to problem-based learning. Teaching materials are designed to enhance creative thinking ability in the linear equation system of two-variable material for 8th-grade junior high school students. The e-book is one of the teaching materials packaged in electronic form. The E-book functions as an independent learning tool so that students can learn at their own pace, be used, and be taken anywhere.

Design

Researchers designed a book with cover, forewords, table of contents, and bibliography. The design of the book is based on practicality and validity. In addition, the formulation of the book design is based on the results of the needs analysis that has been done. The cover design can be seen in Figure 1.

Figure 1. Cover with the title *"SISTEM PERSAMAAN LINIER DUA VARIABEL"*

The cover contains the author's profile. Then, the author also gives a foreword. The foreword in the e-book is presented in Figure 2.



Kata Pengantar

Puji syukur penulis panjatkan kehadirat Allah swt. karena atas limpahan rahmat dan hidayah-Nya, e-book ini dapat terselesaikan dengan baik. Buku ini dibuat penulis untuk memfasilitasi peserta didik di jenjang SMP.

Penulis menyadari bahwa penyusunan e-book ini tidak akan berhasil tanpa bantuan dan bimbingan dari berbagai pihak yang telah berpartisipasi. Oleh karena itu, dengan segala kerendahan hati penulis menyampaikan terima kasih.

E-book ini diharapkan memberi manfaat kepada penulis khususnya, dan para pembaca. Dengan segala kerendahan hati, penulis menerima kritik dan saran dari seluruh pihak. Semoga e-book ini memenuhi harapan kita semua.

Yogyakarta, Juli 2022

Penulis

Figure 2. Foreword

The forewords contain the author's thank-you note to the parties that are involved in the design preparation. The table of content can be seen in Figure 3.

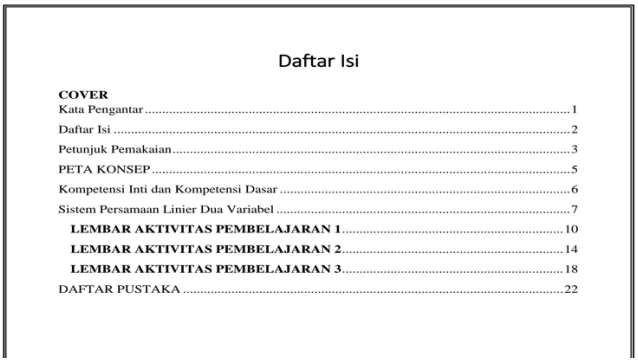
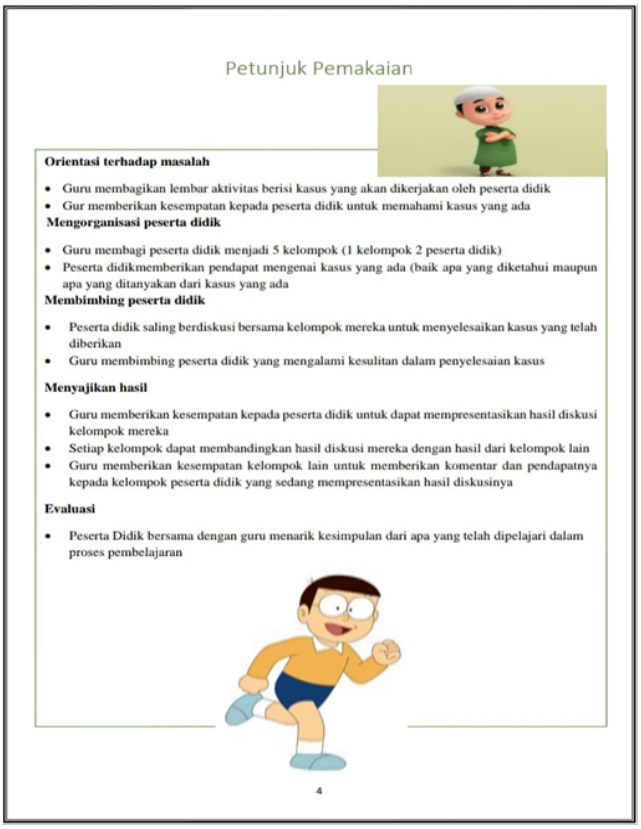

Daftar Isi

Figure 3. Table of Content

The table of content contains information about the page layout of all sections in the e-book design to make it easier for readers to find materials they are looking for. The user's guide can be seen in Figure 4.


Petunjuk Pemakaian

Orientasi terhadap masalah

- Guru membagikan lembar aktivitas berisi kasus yang akan dikerjakan oleh peserta didik
- Gur memberikan kesempatan kepada peserta didik untuk memahami kasus yang ada

Mengorganisasi peserta didik

- Guru membagi peserta didik menjadi 5 kelompok (1 kelompok 2 peserta didik)
- Peserta didikmemberikan pendapat mengenai kasus yang ada (baik apa yang diketahui maupun apa yang ditanyakan dari kasus yang ada

Membimbing peserta didik

- Peserta didik saling berdiskusi bersama kelompok mereka untuk menyelesaikan kasus yang telah diberikan
- Guru membimbing peserta didik yang mengalami kesulitan dalam penyelesaian kasus

Menyajikan hasil

- Guru memberikan kesempatan kepada peserta didik untuk dapat mempresentasikan hasil diskusi kelompok mereka
- Setiap kelompok dapat membandingkan hasil diskusi mereka dengan hasil dari kelompok lain
- Guru memberikan kesempatan kelompok lain untuk memberikan komentar dan pendapatnya kepada kelompok peserta didik yang sedang mempresentasikan hasil diskusinya

Evaluasi

- Peserta Didik bersama dengan guru menarik kesimpulan dari apa yang telah dipelajari dalam proses pembelajaran

4

Figure 4. User's Guide

There is also a concept map in the e-book. The concept map can be seen in Figure 5.

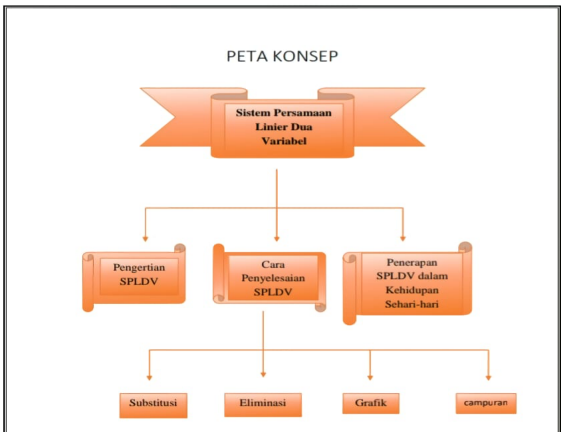


Figure 5. Concept map

Aside from the general user's guide, the instructions for use of the e-book also provided in an e-book. The learning model used in the e-book is problem-based learning (PBL).

Appendix

The e-book design was evaluated by two experts or validators. The validators stated that the e-book design could be developed as an e-book. The assessment done by the validators can be seen in Table 2.

Table 2. Validator Data and Conclusio n of Design Evaluation

No	Name	Instution	Conclusion
1.	Herli Munira	SMP N 2 Simpang Pesak	Very Good
2.	Aisyah Nur Istiqomah	MA Jamiurrahman	Very Good

Based on the validation result, researchers concluded that the e-book design could be developed to be an e-book with several revisions. Researchers followed up on the validators' suggestions. Validators' suggestions and the follow-up can be seen in Table 3.

Table 3. Suggestions from Experts

No	Suggestions and Comments	Follow Up
1.	The indicator of creative thinking needs to be added	Creative thinking indicator is added
2.	Needs to add creative thinking and problem-based learning icons	Added creative thinking and Problem-Based Learning icons
3.	Needs to add problem-based learning steps	Added problem-based learning steps
4.	Indicators of creative thinking in the problems of the product have not yet appeared	Added the indicators of creative thinking in the problems
5.	The icons are too large	Icons are scaled down

The revision results in accordance with the validators' suggestions can be seen as follows:

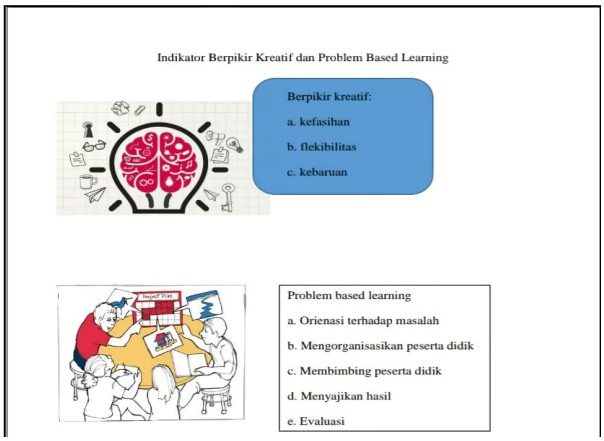


Figure 6. Indicators and icons of creative thinking and problem-based learning

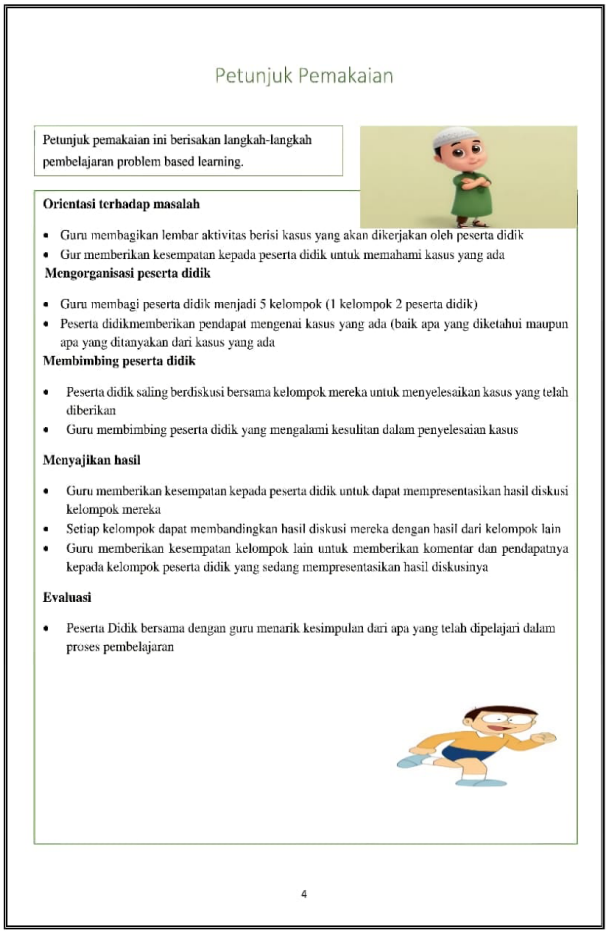


Figure 7. Steps of problem-based learning

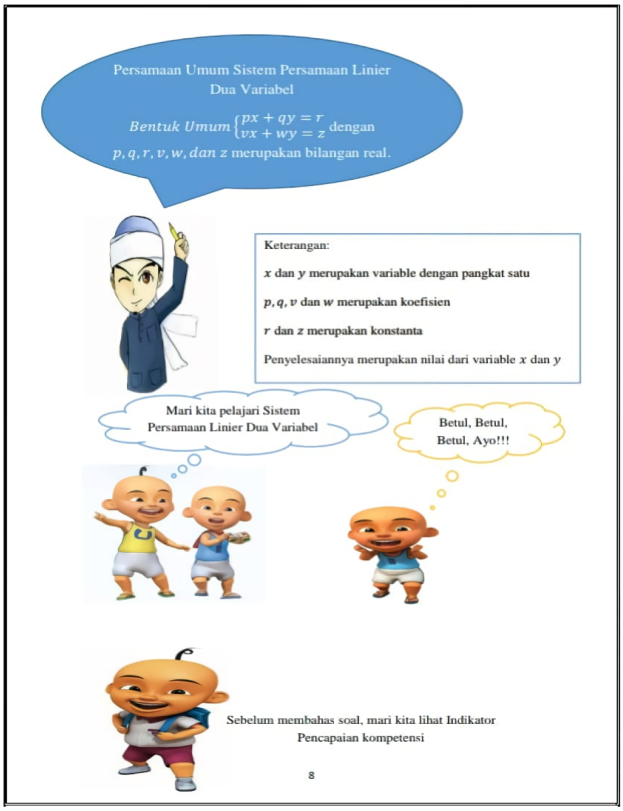


Figure 8. Minimized icon

Figure 9. Questions Creative thinking

Validation results from media and material experts can be seen on table 4.

Table 4. Validation Results

Expert	Score	Category
Material Expert	110	Excellent
Media Expert	80	Excellent

From the table above, researchers concluded that the e-book is in the excellent category. Further research can be conducted on the implementation stage and evaluation to produce a practical and effective e-book in enhancing creative thinking ability.

CONCLUSION

This research shows several results. The creative thinking ability of students still needs to be enhanced. The 8th-grade students consider that the linear equation system of two-variable material is difficult. The learning media used is not yet designed to develop the creative thinking ability of students. Teachers and students need a problem-based learning e-book model. The e-book design is in accordance with the problem-based learning model. The e-book designed that was made by researchers obtained excellent and very decent scores to be developed as an e-book.

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