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Innovation in Creative Writing Skills for Mathematics Textbooks Using the Design Thinking Method

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Abstract

The need for learning tools that can be mastered by prospective teacher students in the School Field Experience Program (PLP) 2 requires fifth-semester students to develop the ability to design appropriate and effective learning materials. Mathematics textbooks are among the essential tools that must be created for PLP 2, making it necessary to guide students in writing textbooks through a dedicated course. This has led to an innovation in creative writing skills for mathematics textbooks using the design thinking method, which consists of five stages: empathize, define, ideate, prototype, and test. The results of this research include the physical development of school mathematics textbooks for middle and high school levels. Testing of the resulting products has placed them in the "very good" category, indicating their suitability for use as learning materials to support PLP 2 activities.

Keywords: *writing skills; creative writing; design thinking; mathematics textbooks*

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INTRODUCTION

The field of education is inseparable from the role of teachers in maintaining the stability of the formal education process for students in schools. This requires teachers to continuously develop and enhance their potential as educators. The expectations for teachers are outlined in Law No. 20 of 2003 (Indonesia, 2003) and further regulated by the Minister of National Education of the Republic of Indonesia through Regulation No. 16 of 2007 (Ministry of National Education of the Republic of Indonesia, 2007), which sets academic qualification standards and teacher competency requirements.

The primary competency that teachers must possess is the ability to effectively manage learning (pedagogy). A teacher must have a thorough understanding of the subject matter they teach. Additionally, they must be able to select the most effective techniques and methods for delivering lessons to ensure students achieve the desired learning outcomes. The attainment of this competency is influenced by teaching experience, education, professional development training, and participation in internship programs during teacher preparation in education study programs (Nugroho, 2022).

Prospective student teachers must undergo an internship process in schools in accordance with the Regulation of the Minister of Research, Technology, and Higher

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Education of the Republic of Indonesia, Number 14 of 2005, Article 10, and Number 55 of 2017, Article 9, regarding the School Field Experience Program (PLP), commonly referred to as an internship (Mariasih, 2021). According to the decision of the Dean of FKIP at the University of Muhammadiyah Tangerang (UMT), the implementation of PLP in selected schools is carried out in stages, starting with PLP 1, followed by PLP 2, and PLP 3. In PLP 1, third-semester students conduct observation activities on the structure and bureaucracy of the school where the program takes place. In PLP 2, fifth-semester students engage in activities related to the development of learning tools. Finally, in PLP 3, seventh-semester students participate in teacher association activities within specific fields of study.

Fifth-semester students in the Mathematics Education Study Program at FKIP UMT are required to participate in PLP 2 activities after successfully completing PLP 1 in the third semester. Another prerequisite for PLP 2 is the ability to develop learning tools in accordance with the established guidelines for PLP 2 activities. One of the essential learning tools that fifth-semester students must master is the ability to write teaching materials, such as school textbooks or student worksheets. This mastery is facilitated through the Creative Writing Skills course, which students are required to take in the fourth semester.

The Creative Writing Skills course assigned to prospective teacher students is closely related to their ability to develop teaching materials that align with their field of expertise. Students in the Mathematics Education Study Program are required to produce school mathematics textbooks for junior high and high school levels in accordance with the applicable curriculum. Therefore, the Creative Writing Skills course serves as a platform for students to learn the process of writing school mathematics books following the guidelines for PLP 2 activities.

The book-writing process follows fundamental principles. Writing a book begins with defining its purpose and the competencies it aims to develop (Nielsen, 2013). Students must carefully and purposefully design their school textbooks to support the needs of PLP 2 activities. This necessity is reflected in the structure of the Creative Writing Skills course, as outlined in the Semester Learning Plan.

Creative writing is an activity that develops and expresses ideas creatively. It involves translating thoughts into written form (Dewi, 2023). The creative ideas expressed through writing reflect the concepts that the writer seeks to develop. Creative writing can be defined as a process-oriented form of writing (Arifin & Harida, 2022). Writing is a long and continuous process that requires patience and perseverance, both of which are key to fostering a strong writing tradition. To support this, lecturers responsible for the course must develop a systematic learning approach for each session. They need effective methods to guide students in designing and writing creatively, ensuring that their written work meets the required standards for school mathematics textbooks.

The appropriate method should facilitate the learning process by gradually guiding students in designing and writing school mathematics textbooks. This method encourages students to work in teams, consider multiple perspectives, and address the challenges of developing effective learning tools, particularly school mathematics books. It follows a product development approach that begins with identifying and solving real-world problems. Currently, one of the most widely studied and practiced design development methods in educational institutions and research centers is the Design Thinking method.

Design Thinking is a problem-solving approach that involves understanding human needs, reframing problems with a user-oriented perspective, generating ideas through brainstorming, and implementing those ideas through prototyping and testing (Setyono & Mahardhika, 2022). The Design Thinking method has been proven effective in developing user interfaces based on experience, emotions, and situational awareness from

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user interactions (Wardhana & Fitriana, 2021). One of the key advantages of applying Design Thinking is that it enhances students' confidence and independence in learning. Additionally, it prepares them to contribute to the community, society, and industry (Suprobo, 2012).

Given this context, this study aims to examine the application of the Design Thinking method in the Creative Writing Skills course for fourth-semester students in the Faculty of Teacher Training and Education, Mathematics Education Study Program. By applying the Design Thinking method, the study seeks to enhance students' ability to write school mathematics books creatively while fostering confidence, independence, and problem-solving skills. The purpose of the study is to examine the application of the Design Thinking method in the Creative Writing Skills course for fourth-semester students in the Mathematics Education Study Program. Specifically, the study aims to: (1) introduce innovations in learning within the Creative Writing Skills course, (2) provide a framework for effectively implementing Design Thinking in the course, and (3) measure students' performance in writing school mathematics textbooks.

RESEARCH METHODOLOGY

This research resulted in the development of a product designed to support students in PLP 2 activities. The challenges in product development consist of two key aspects: identifying the problem that needs to be solved and defining the product specifications, such as the required features of the learning tools designed to address the problem. Therefore, product specifications must be based on problem identification in the field.

Researchers must carefully and thoroughly identify problems to ensure accuracy in analysis. Precision in analyzing and identifying issues leads to the development of effective and appropriate products. Design Thinking is a methodology used to solve problems by understanding the needs of individuals involved, redefining the requirements of potential users, generating ideas, and implementing solutions through prototyping and testing (Suprobo, 2012).

Figure 1. Design Thinking Process

There are five stages in the Design Thinking process: *Empathize, Define, Ideate, Prototype,* and *Test***,** as shown in Figure 1 (Cahyadi, 2019).

a. *Empathize*

The first phase of the *design thinking* process is to gain an empathetic understanding of the problem to be solved. This phase aims to learn more about problem areas by observing, engaging and empathizing with people to understand their experiences and motivations and try to investigate the problems that must be solved in order to gain a deeper personality to gain understanding. The principle of empathy in *design thinking* emphasizes the importance of listening to and observing the user involved in the problem to be solved.

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By understanding the needs, goals, and challenges that users face, we can design solutions that are appropriate and relevant.

a. *Define*

In the *define* stage, the team will analyze the information collected during the *empathize* stage to determine the core of the problem that has been identified so far. From this information, they will make a plan to address this issue. The *define* stage is important in helping to identify problems that need to be solved, and generate ideas for features, functions, and elements that will help users. Defining a problem well is a critical step in *design thinking*. It involves identifying the true root of the problem and formulating a clear and directed statement of the problem. By understanding the problem in depth, we can focus on finding effective solutions.

b. *Ideate*

The third stage of the *design thinking* process is to generate ideas. *Ideates* can be done by *brainstorming*, coming up with new concepts, or finding solutions to problems. After understanding the potential user and their needs at the empathy stage, then analysis and synthesis at the identification stage, and ending with a problem statement aimed at the potential user. There are many ways to generate ideas, including *brainstorming*, *brainwriting*, worst ideas, and scammers. The principle of ideation encourages the generation of ideas creatively and without obstacles. At this stage, there is no assessment of the ideas generated. The goal is to generate as many ideas as possible, even if they look unrealistic or unconventional. In this process, each idea is valued and used as fuel to develop innovative solutions.

c. *Prototype*

At this stage, *Design Thinking* generates multiple products in the form of minimal versions of an idea or a complete solution, allowing potential users to understand the proposed solution to the problem identified in the previous stage. This marks the fourth and final phase of project creation, where experiments are conducted to determine the best solution for each identified problem. *Prototyping* is a crucial step in *Design Thinking* that involves creating a model or simplified representation of a proposed solution. These prototypes can take various forms, such as sketches, physical models, or digital simulations. The primary goal is to test ideas and gather user feedback early in the process. Prototypes can be refined and improved iteratively to develop more effective solutions.

d. *Testing*

The final stage of this testing process is designed to determine how users understand and interact with the product, as well as how they feel and empathize with the product. This information will be used to make changes to the product being developed and improve it. Testing and iteration are important principles in *Design Thinking*. Through testing solutions developed at the prototyping stage, we can collect feedback from users and use it to improve and improve the solution. This feedback cycle can be repeated until a solution that optimally meets user needs can be achieved (Herfandi et al., 2022).

RESULTS AND DISCUSSION

Learning Planning is outlined in the RPS of the Creative Writing Skills course for each session. Classroom activities begin with students being divided into six groups, each consisting of 4–5 members. In every session, students within their groups are given the opportunity to present material relevant to their needs in creative writing, specifically in producing a school mathematics book.

The first lecture session provides guidance on student activities for future meetings. Therefore, an introductory session is necessary, including a lecture contract and an overview of the course. This introduction covers topics such as the benefits and

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objectives of writing, writing profiles and skills, and the fundamentals of book writing. Students are expected to prepare themselves to adhere to the agreements outlined in the lecture contract, from presentation materials to planned activities. Classroom activities are conducted in accordance with the subject matter being studied. Table 1 below presents an overview of student group activities for each session.

Table 1. Student Activities for Each Session

Session	Presentation Groups	Math TextBook	Material	Activities of Each Group	Phase
2	I	Junior High School Grade 7	Topic and Title of the book	Formulate the topic and title of the book according to the group	*Empathize*
3	II	Junior High School Grade 8	Target Reader	Determine the process of understanding of a reader and the factors that affect the reader's interest	*Define*
4	III	Junior High School Grade 9	Book Framework	Write down the outline of the book according to the group	*Ideate*
5	IV	Grade 10 High School	Chapter Development	Develop content for each chapter, including sub-chapter titles	*Prototype*
6	V	Grade 11 High School	Sub-Chapter Development	Write material in accordance with the subject matter of each sub-chapter.	
7	VI	Grade 12 High School	How to Cite and Write a Biblio-graphy	Follow proper citation and bibliography guidelines based on referenced literature.	

Student activities (Sessions 2–7), as outlined in Table 1, require several preparations that must be completed by students. During the first session, the lecturer provides guidance on the necessary requirements and expectations. According to Table 1, students must gather information from users—specifically teachers and students—to determine materials that align with the applicable school curriculum. The following is a description of each phase of the *Design Thinking* method implemented in this study:

a. Fase *Empathize–Define*

Students gather data on the identity of the readers (students) who will be the end users of the product developed by their respective groups. This data may include interests, talents, hobbies, and learning outcomes. Since students are the primary users of the books being created, they serve as the benchmark for how the school book should be written.

Understanding user identity involves adopting the perspective of the reader. For instance, 7th-grade junior high school students have different needs and comprehension levels compared to 12th-grade high school students. Additionally, school books may vary in content and structure across different educational institutions. The books should contain lesson topics aligned with the appropriate grade level and student age (Soesilo & Munthe, 2020). Data for this study was obtained through various methods, including teacher and student interviews, as well as research on the development of school books and learning resources for high school students.

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The type of user, determined by the lecturer, is categorized into three competency levels: low, medium, and high. This classification provides more detailed insights into user needs. Students with lower competency levels require more elaborate explanations compared to those with higher proficiency. This activity also helps students refine their data collection skills, such as conducting interviews and observations. Each group formulates and presents the collected user data as the foundation of the *Empathize–Define phase*. Students are given a full week (between Session 1 and Session 2) to complete this process. During Session 2, students use the gathered user identity data to support activities in Sessions 2 and 3.

In Session 2, groups discuss and decide on the topic and title of the book, ensuring they align with the target readers' interests and comprehension levels. They also begin designing the cover and content structure of the book. By Session 3, students have created a rough draft of the book's cover and content layout. The outcomes of the *Empathize–Define phase* are finalized and presented in Session 3. An example of these results is shown in Figure 2. Each group presents their findings in a class discussion, where they receive constructive feedback to refine their book topic, title, and cover design to better suit student users.

Figure 2. Result Fase *Empathize–Define*

b. Fase *Ideate–Prototype-Testing*

In Session 4, students formulate ideas for the subject matter in their books, ensuring that the content aligns with the secondary school education level. The subject matter will define the identity of each chapter, serving as the framework of the book. A book outline is a structured overview or roadmap of the book's content, designed to guide the writing process (Trim, 2017). Before developing the outline, authors need to brainstorm to gather ideas and address potential challenges in structuring the content. According to Leonard (2012), there are three commonly used brainstorming mehods for outlining a book: (1) random method, (2) sporadic networking method, (3) format method (Trim, 2017). Students generally prefer the format method, as it provides a structured approach for determining chapter titles and subheadings. Additionally, this method aligns with the applicable curriculum, making it easier to formulate a well-organized book framework. The result of this process is a book outline, as shown in Figure 3 as an example.

Kerangka Buku SMA Kelas 12

KATA PENGANTAR
DAFTAR ISI
1. TRANSFORMASI FUNGSI
   a) Translasi
   b) Refleksi
   c) Dilatasi
   d) Rotasi
   e) Kombinasi Transformasi Fungsi
   Latihan Soal
2. BUSUR DAN JURING LINGKARAN
   a) Busur Lingkaran
   b) Juring Lingkaran
   c) Hubungan Panjang Busur dan Luas Juring
   Latihan Soal
3. KOMBINATORIK
   a) Aturan Pengisian Tempat
   b) Permutasi
   c) Kombinasi
   d) Peluang Suatu Kejadian
   e) Peluang Kejadian Majemuk
   f) Peluang Kejadian Majemuk Saling Bebas Bersyarat
   Latihan Soal
DAFTAR PUSTAKA
GLOSARIUM

Figure 3. Example of a Book Outline

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In Sessions 5–7, students begin developing prototypes of school mathematics books in their respective groups. Figure 4 shows the student group presentation activities in this phase. In Session 5, each group works on writing content for each chapter, including subchapter titles. The chapter development process requires determining both the format and model of the content.

Figure 4. Group Presentation in the Ideate–Prototype Phase

The chapter format can take different forms, such as narrative, description, reflection, or argumentation. The chapter model follows a structured approach, consisting of four key components: *Starter*, *Main Course*, *Dessert*, and *Garnish.* The *Starter* is the introductory section at the beginning of each chapter, designed to engage the reader and stimulate their interest. Examples of effective starters include thought-provoking questions, relevant images, photos, or illustrations that align with the chapter title, as shown in Figure 5. The goal is to capture the reader's attention and set the stage for the topic covered in the chapter.

Figure 5. Examples of Chapter Starter

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The *Main Course* contains content and examples. The content includes theories, concepts, formulas, descriptions, explanations, regulations, and similar elements, while the examples illustrate real-world cases, exercises, and solutions. Specifically for textbooks, the *Dessert* section primarily consists of tests or practice questions designed to assess the competence of readers/users (students) in mastering the material or chapter content. The *Garnish* section of the book provides a summary and contributes to the book's overall physical presentation. Just as journal articles follow a standardized template, the garnish serves as the template for each chapter in the book.

In Sessions 6–7, students begin focusing on developing the main course content in each chapter. This involves writing material for each subchapter, explaining concepts that include rules, formulas, examples, and solutions, as shown in Figure 6.The writing process consists of several paragraphs categorized into three types: opening, core, and closing paragraphs.

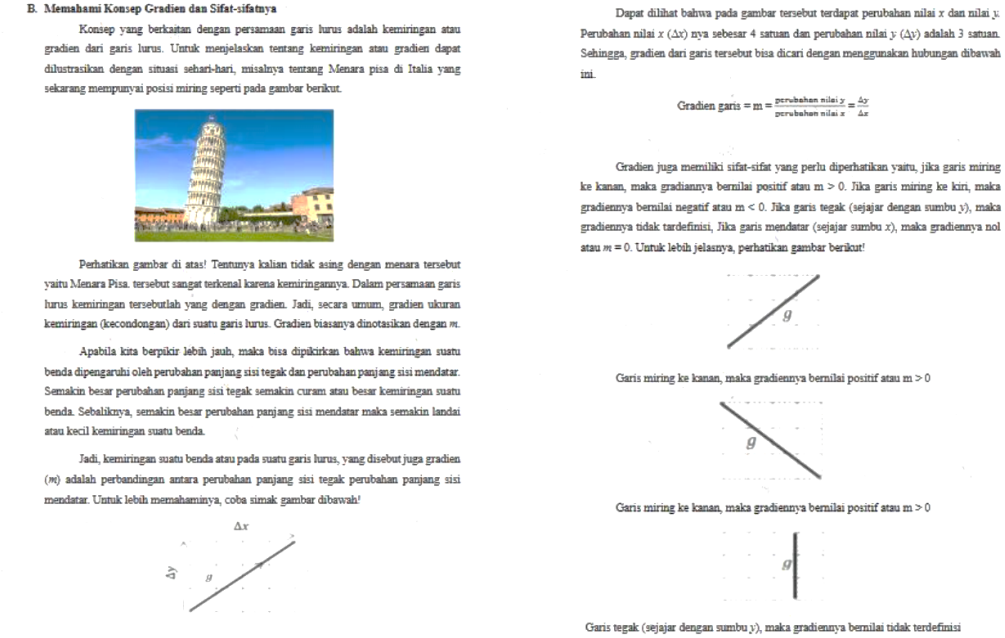

Figure 6. Example of Sub-Chapter

From Sessions 8–14, students present their book-writing results in class discussions. The creative writing works of students are shown in Figure 7. Each group provides feedback and suggestions to refine the school mathematics books further.

Figure 7. Creative Writing Works of Students

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Additionally, both peer assessment and lecturer evaluation are conducted to ensure quality and effectiveness. The summary of the assessment results for each group's school mathematics book writing is presented in Table 2.

Table 2. Writing *Test Results* Score for Each Group

	Math TextBook Grade					
Group	**7**	**8**	**9**	**10**	**11**	**12**
1	78	82	82	82	82	78
2	79	86	83	85	81	80
3	78	84	83	83	79	80
4	79	85	84	84	81	78
5	78	83	82	85	82	79
6	77	85	83	82	81	79
Lecturer	78	84	83	84	80	81
Average	**78**	**84**	**83**	**84**	**81**	**79**

The results of this testing phase were obtained by analyzing the scores of each student to assess their ability to write creatively in school mathematics books. The average student score was 81.5, which falls into the very strong classification (Purbaningrum & Safitri, 2022). This indicates that students' creative writing abilities in school mathematics books are categorized as very good.

With these results, students can effectively support teachers during Internship Process 2 at school. Books serve as essential learning media that enhance students' literacy skills. Therefore, special attention is needed to encourage the community, especially teachers, to contribute at a global level (Sripatmi et al., 2023).

The innovations in creative writing skills demonstrated by students—resulting in school mathematics books for junior high to high school levels—are highly valuable. Given the limited availability of quality mathematics books, these student-created resources are essential. They also empower mathematics teachers to develop learning materials independently, ultimately enriching the educational landscape.

CONCLUSION AND SUGGESTIONS

The creative writing ability demonstrated in school mathematics books by prospective teacher students represents an innovation in producing written works relevant to the needs of mathematics teachers. This writing process is carried out using the Design Thinking method, which follows two major stages: the *Empathize–Define* phase and the *Ideate–Prototype–Testing* phase.

The process begins with the *Empathize* stage, where students identify the needs, goals, and challenges faced by users—both teachers and, more importantly, students—to design appropriate and relevant solutions. At this stage, the author gathers information, which is then analyzed in the *Define* stage to detect existing problems. By deeply understanding these issues, more effective solutions can be developed.

Writing begins in the Ideate stage of the *Ideate–Prototype–Testing* phase. Students present their ideas by outlining the framework of the book (*Ideate*) and then developing structured paragraphs for each sub-chapter (*Prototype*). The final stage involves *Testing*, where the written school mathematics books are assessed by prospective teacher students who interact with the product, evaluate its effectiveness, and reflect on their experience. Through this testing process, authors receive user feedback, allowing for improvements in the quality of the book.

The calculated average score for creative writing ability in school mathematics books is 81.5, which falls into the "very good" category. These results highlight the

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importance of prospective teacher students following structured procedures in learning tool innovation to make meaningful contributions and fulfill their responsibilities as professional educators.

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