



Increasing the Motivation of Prospective Teachers: Exploration of the Use of ChatGPT in Developing Mathematics Teaching Materials Independent Learning Curriculum in Indonesia

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Increasing the Motivation of Prospective Teachers: Exploration of the Use of ChatGPT in Developing Mathematics Teaching Materials Independent Learning Curriculum in Indonesia

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Abstract

Teachers in Indonesia have limitations in developing teaching materials. The aim of this research is to explore the use of ChatGPT in developing mathematics teaching materials for the independent learning curriculum in Indonesia. This type of research is quantitative descriptive with a sample of 15 students. The instruments used in this research were motivation questionnaires, observation sheets, documentation, and interviews. The results of this research are steps for using ChatGPT in developing teaching materials, including developing needs analysis instruments, searching for teaching material materials, and searching for teaching material designs with the help of ChatGPT. The use of ChatGPT in developing teaching materials is very helpful and easy, providing time and energy efficiency as well as extensive information for prospective teacher students. However, the use of ChatGPT in developing teaching materials also has disadvantages, including not always being able to understand more specific learning contexts, resulting in errors in understanding or being irrelevant. Another thing that is felt is the limitations of the images displayed by ChatGPT. The motivation of prospective teacher students in developing teaching materials using ChatGPT was obtained by 13 people who had medium and high motivation, while 2 people had low motivation.

Introduction

Mathematics education is a field of study related to the process of learning and teaching mathematical concepts, theories, and applications to students at various levels of education (Bossé et al., 2011). The main focus is to help students understand basic mathematical concepts, develop problem-solving skills, and apply mathematics (Gagatsis et al., 2022). According to interviews with teachers around the world, it is unanimously found that mathematics is applicable to real-life problems and others (Cai et al., 2009).

Mathematics education is one of the main pillars in the education system, and teachers have an important role in implementing mathematics learning (Dawadi, 2020). In the context of mathematics teaching, the challenges faced by mathematics education teachers in Indonesia are very large. They need to ensure that the material they develop is in accordance with the applicable curriculum, stimulates students' creativity and critical thinking, and remains

relevant to current developments (Hendayana et al., 2010). The current curriculum in Indonesia is the Independent Learning Curriculum.

The independent learning curriculum is an educational approach introduced by the Indonesian government to provide freedom and independence to schools, teachers, and students in designing and managing the learning process (Utami & Suswanto, 2022). This concept aims to increase the relevance, creativity, and effectiveness of learning by accommodating individual needs and potential. The Merdeka Belajar curriculum encourages competency-based learning, the use of information technology, and the development of character and abilities for the 21st century (Batubara & Davala, 2023). Thus, this approach allows for local curriculum adjustments and is responsive to student development and community dynamics. This independent learning curriculum produces students who are creative, think critically, independently, and encourage teachers to participate in learning progress (Mahatika et al., 2022). The independent learning curriculum provides teachers and students with greater freedom to explore various learning methods and develop teaching materials (Suyanto, 2017). Therefore, one important part of the independent curriculum is the development of teaching materials.

Teaching material development is the process of designing, creating, and compiling learning materials aimed at facilitating the teaching and learning process. Teaching materials can take the form of various media such as textbooks, modules, presentations, videos, games, and other resources used by teachers or students. An important part of developing teaching materials is the interaction between teachers and learning resources related to the curriculum (Trouche et al., 2019).

Various studies reveal problems regarding the development of independent learning curriculum teaching materials in Indonesia. Teachers experience difficulties in developing learning tools such as lesson plans and teaching materials because they do not understand the terms and objectives expected from the independent learning curriculum (Tanjung & Amalia, 2023). Another problem that is seen is that teachers have difficulty developing the skills needed to face the challenges of 21st-century learning (Akib et al., 2020). Teachers also experience problems, namely difficulties in developing teaching modules and evaluating assessments according to predetermined standards (Mahatika et al., 2022).

Therefore, teachers must have sufficient provisions to be able to develop teaching materials in accordance with the independent curriculum (Batubara & Davala, 2023). Before becoming a teacher, a person must first undergo training and acquire skills related to the role and responsibilities of a teacher (Oliveira & Hannula, 2008). Prospective teachers are also students majoring in education at the college level (Bartell et al., 2013). Teachers or prospective teachers are required to be able to balance mathematical objectives, students' reasoning and thinking, and classroom management (Potari, 2012). It is important for teachers to have a teacher education qualification as a teaching requirement because teachers who have a bachelor's degree qualification are assumed to have the experience and knowledge required for their profession (Novikasari, 2021). One important part that must be prepared is to provide prospective teachers with the knowledge and skills to develop teaching materials that are in line with current developments, so that teachers are more accustomed to using technology before they teach.

Developments in the 21st century cannot be separated from technological advancements. The presence of technology has permeated various aspects of life, including education (Rathod, 2023). With the progress of technology, there are significant opportunities to utilize it in creating more dynamic and relevant teaching materials. One prominent technological advancement in the field of education is the utilization of artificial intelligence (AI) (Mohamed et al., 2022). A particular technology that is garnering attention is ChatGPT, an artificial intelligence model capable of generating text based on provided input (Ratnam et al., 2023). In the realm of mathematics education, ChatGPT is recommended as an artificial intelligence tool to acquire information about the subject matter and receive various other forms of assistance in learning development (Guler, 2024). This is where the importance of utilizing technologies like ChatGPT comes into play in the process of creating learning materials.

ChatGPT can be used to generate varied and interesting examples of mathematical problems (Zafrullah et al., 2021). By entering the topic or concept that you want to teach students, ChatGPT can produce various kinds of questions that can be used to train students' problem-solving skills (Wardat et al., 2023). This helps in enriching the learning material presented to students so that it is not limited to cliché or ordinary questions. Apart from that, ChatGPT can also be used to produce explanations of mathematical concepts that are easy for students to understand. Prospective teachers can provide input about the concept they want to explain, and ChatGPT will produce text that explains the concept clearly and systematically (Dasari et al., 2023). In this way, prospective teachers can use the explanations produced by ChatGPT as a reference or even as additional material presented to students (Supriyadi & Kuncoro, 2023).

Apart from helping in developing learning materials, using ChatGPT can also broaden the horizons of prospective mathematics education teachers. By interacting with ChatGPT and seeing how the model generates text based on the input provided, prospective teachers can gain a better understanding of certain mathematical concepts (Zafrullah et al., 2021). They can see various ways to explain the concept, as well as concrete examples that can be used in learning. Of course, using ChatGPT in developing teaching materials also has some challenges and limitations. One challenge is the model's limitations in understanding the local cultural and environmental context (Wardat et al., 2023). Therefore, prospective teachers need to make adjustments to the material produced by ChatGPT so that it fits the educational context in Indonesia.

Overall, the use of ChatGPT in developing teaching materials for prospective mathematics education teachers in Indonesia promises many benefits. By utilizing artificial intelligence, prospective teachers can create learning materials that are more varied, interesting, and relevant to students' needs. In this way, it is hoped that mathematics learning in Indonesia can be more effective and enjoyable for students. However, although the potential for using ChatGPT in developing mathematics teaching materials is very interesting, there is still a need to learn more about how this technology can be integrated effectively in the educational context in Indonesia. Therefore, this article aims to investigate the potential and challenges of using ChatGPT in developing teaching materials for the Merdeka Belajar curriculum for prospective mathematics education teachers in Indonesia. In this way, it is hoped that it can provide valuable insight for educational practitioners and policymakers about how technology can be an effective tool in improving the quality of mathematics learning in Indonesia.

Method

This type of research is quantitative descriptive research. This type of research is quantitative descriptive research. Sugiyono defines quantitative descriptive research as a type of research that aims to systematically, factually, and accurately describe the facts and characteristics of a particular population or describe phenomena in detail (Rukajat, 2018). The sample in this research was 15 students who were prospective mathematics education teachers teaching teaching materials development courses. The instruments used in this research were motivation questionnaires, documentation, observation sheets, and interview sheets. The motivation questionnaire consists of 20 items, consisting of 10 positive items and 10 negative items. The motivation questionnaire has undergone instrument analysis in the form of a validity test and a questionnaire reliability test.

The results of testing the questionnaire with the product moment correlation test stated that the questionnaire was valid with a calculated r value of 0.542 and r table 0.349, because the calculated r value $>$ r table then the questionnaire was declared valid. Meanwhile, for reliability testing with Cronbach's Alpha, the calculated r value was 0.75, because the calculated r value was 0.6 then the questionnaire is declared reliable. Data analysis in this research is by percentage of respondents' achievement level. The way to carry out this analysis is to calculate the average score and respondent achievement level (TCR) and interpret it. This analysis does not relate one variable to another variable and does not compare one variable to another variable. To find the Respondent Achievement Rate (RAR), the following formula is used:

$$RAR = \frac{As}{n} \times 100\% \dots\dots\dots$$

Information:

RAR = Respondent Achievement Level

As = Average Score (mean)

n = Maximum Score Value

After calculating the total achievements of respondents, the motivation percentage will be obtained, which is then classified in Table 1 as follows:

Table 1. Motivation Categories

Value	Criteria
$X \leq 40$	Low
$40 \leq X \leq 80$	Middle
$X \geq 80$	High

Results and Discussion

Steps to Explain Teaching Materials Using ChatGPT Assistance

Based on the results of interviews and observations with student teacher candidates developing mathematics

teaching materials, the stages of developing teaching materials using ChatGPT were obtained. These stages include:

Delivering a Needs Analysis Instrument with the help of ChatGPT

Before developing teaching materials, a needs analysis is first carried out. This analysis includes the analysis of materials, teaching materials, and student characteristics using a questionnaire instrument. The development of this questionnaire instrument can be assisted by ChatGPT. If the selected instrument is inadequate, a new search is conducted in ChatGPT because it provides various information and suggestions related to learning, including different types of evaluation tools and instruments that can be used in the learning process (Huang et al., 2023). Some search results for needs analysis questionnaires using ChatGPT can be seen in Figure 1:

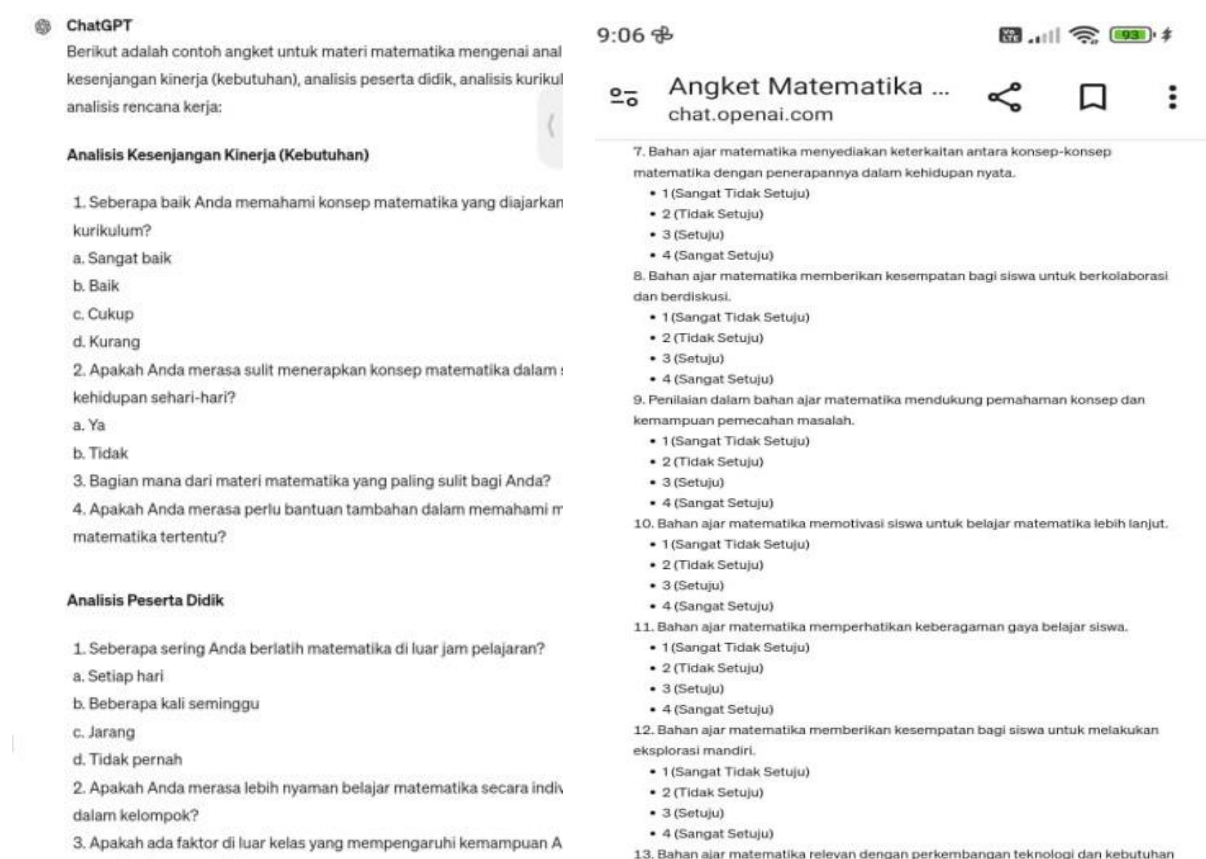


Figure 1. Search Results for Needs Analysis Questionnaire with the Help of ChatGPT

Search for Teaching Materials with the help of ChatGPT

After finding the tool, the next step is to search for materials, questions, and exercises to gather relevant teaching materials. These materials should be suitable for the students' needs and characteristics, and should help them achieve the learning objectives that have been established. Students simply need to use a question sentence with keywords to search for the desired material, and ChatGPT will provide a display of the requested materials. The search results for teaching materials can be seen in Figure 2:

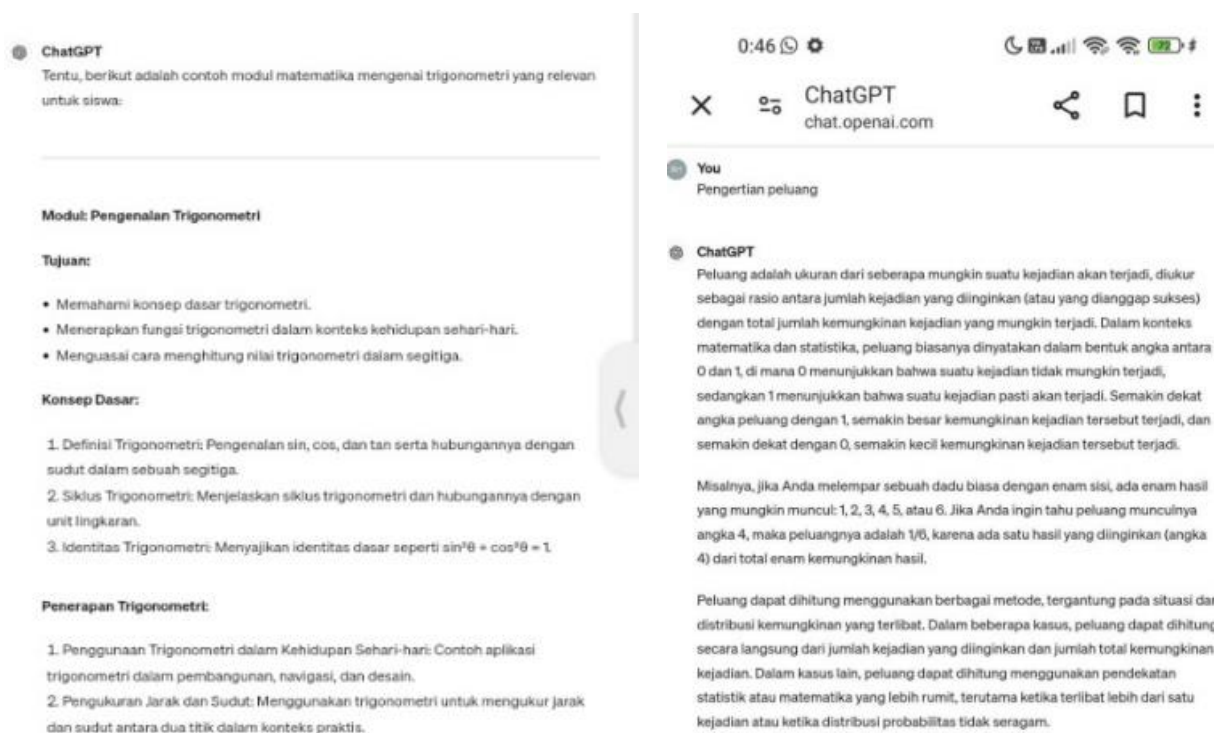


Figure 2. Search Results for Teaching Materials with the help of ChatGPT

Search for Teaching Material Design with the Help of ChatGPT

After all the materials, example questions, and exercises have been collected, the next step is for students to arrange the teaching materials according to the layout and elements of the teaching materials. ChatGPT's assistance in preparing the design of this teaching material includes choosing a cover that includes the elements of color, image, and title in the teaching material. The results of the development of teaching material designs developed by prospective mathematics teacher students using the help of ChatGPT can be seen in Figure 3.

Advantages of Developing Teaching Materials Using ChatGPT Assistance

After developing teaching materials with the help of ChatGPT, the authors conducted an interview regarding the advantages of using ChatGPT in developing teaching materials. The advantages they feel are that ChatGPT is able to provide information for their needs as well as extensive access to information, providing an easy-to-understand understanding of the topics discussed. Apart from that, ChatGPT can quickly help them in designing the framework and content of teaching materials and can speed up the process of developing teaching materials so that they can provide time and energy efficiency. The development of ideas and inspiration generated by ChatGPT can provide inspiration and new ideas for developing teaching materials in order to produce the best ideas for creative teaching materials.

The advantages of ChatGPT in developing teaching materials are in line with research which states that ChatGPT can provide more benefits of emotional and interactive support for teachers and students. ChatGPT participation can improve diverse learning and have evaluations that show a positive attitude towards the use of ChatGPT at a

higher level (An et al., 2023). Another thing that is in accordance with the results of this research is that ChatGPT has the potential to increase learning efficiency and have an impact on educational assessment and evaluation. It can also facilitate the advancement of academic creativity and critical thinking in education (Ye, 2023).



Figure 3. Results of Teaching Material Design with the Help of ChatGPT

Disadvantages of Developing Teaching Materials Using ChatGPT Assistance

Apart from having advantages, ChatGPT also has disadvantages in developing teaching materials. The shortcomings of ChatGPT in developing teaching materials include the lack of accuracy in reading the questions given. If the question asked is incorrect, ChatGPT does not produce answers or other alternative answers. ChatGPT has extensive knowledge but cannot always understand more specific learning contexts, resulting in errors in understanding or being irrelevant. Another limitation in developing teaching materials using ChatGPT is the limited appearance of images that are relevant to the material or questions asked. Additionally, prospective teacher students using ChatGPT in developing academic materials have concerns about plagiarism of the content or materials presented in ChatGPT. The shortcomings of using Chat GPT in developing teaching materials are in line with several studies. This is because ChatGPT uses generative AI, which is not always accurate and may produce incorrect or illogical information. Therefore, it is very important to use this technology carefully (Rathod, 2023). There are still many limitations for students in using ChatGPT for independent learning, because they have to face changes in the quality of knowledge, reduced social interaction, and dependency problems (Ma, 2023).

Motivation of Prospective Teacher Students Who Develop Teaching Materials Using ChatGPT Assistance

The percentage of motivation questionnaire results given to student teachers who have developed teaching materials using Chat GPT can be seen in Table 2 as follows:

Table 2. Percentage of Motivation Results for Each Indicator

No	Indicator	Percentage
1	The existence of desires and desires	73%
2	There is encouragement and need	80%
3	There are hopes and aspirations	79%
4	There are interesting activities	86%
5	There is a conducive environment	64%

Meanwhile, the results of student teacher motivation in using ChatGPT in developing teaching materials can be seen in Table 3:

Table 2. Motivation Results

Value	Students	Criteria
$X \leq 40$	2	Low
$40 \leq X \leq 80$	5	Middle
$X \geq 80$	8	High

Based on Table 3, there are 2 prospective teacher students whose motivation category is low. This is also revealed by their failure to complete the development of ChatGPT-assisted teaching materials. Their limitations in using the internet and other tools, such as laptops or computers, hinder their ability to support the development of

teaching materials. Consequently, they lack the desire to complete the teaching materials they are working on. On the other hand, the remaining 13 prospective teacher students exhibit moderate to high motivation. This is evident from the complete teaching materials they have developed, which align with the chosen material, as well as their positive interest and enthusiasm in developing teaching materials. The findings of this research align with previous studies that highlight the role of motivation in driving students to achieve their learning goals (Lao et al., 2021). Highly motivated students will likely learn with ease and make any class a pleasure to teach, while unmotivated students will likely learn very little and be generally frustrated (Filgona et al., 2020). In addition, motivation correlates more strongly with teaching materials and main aspects of assessment compared to others (Elshareif & Mohamed, 2021).

Conclusion

Based on the research results above, steps for using ChatGPT in developing teaching materials can be obtained, including developing needs analysis instruments, searching for teaching material materials, and searching for teaching material designs with the help of ChatGPT. The use of ChatGPT in developing teaching materials is very helpful and easy, providing time and energy efficiency as well as extensive information for prospective teacher students. However, the use of ChatGPT in developing teaching materials also has disadvantages, including not always being able to understand more specific learning contexts, resulting in errors in understanding or being irrelevant. Another thing that is felt is the limitations of the images displayed by ChatGPT. The motivation of prospective teacher students in developing teaching materials using ChatGPT was obtained by 13 people who had medium and high motivation, while 2 people had low motivation.

Recommendations

This research recommends that the use of ChatGPT in developing teaching materials can be carried out by teachers or prospective teachers in mathematics or other subjects. This research only examines the motivation of prospective teachers in developing teaching materials using ChatGPT, while other variables have not been studied. Therefore, researchers recommend conducting further research on other variables that have not been examined in this research.

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