EKSPLORING JAMBI CULTURAL ELEMENTS IN DEVELOPING MATHEMATICS QUESTIONS THAT MEASURE THE COGNITIVE PSYCHOLOGY OF JUNIOR HIGH SCHOOL STUDENTS

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Abstract

This study was motivated by the importance of integrating local culture into mathematics learning and developing assessment instruments that can measure students' cognitive psychology, particularly critical thinking skills. The objective of this study was to develop mathematics problems based on Jambi cultural elements and to analyze junior high school students' critical thinking skills as part of cognitive psychology. This study employed a Research and Development (R&D) method using the ADDIE model, which consists of analysis, design, development, implementation, and evaluation stages. The subjects of this study were ninth-grade students of Junior High School 4 Jambi City. Data were collected through interviews, tests, and questionnaires. The developed instrument consisted of ten mathematics problems based on Jambi cultural contexts and six indicators of critical thinking, namely interpretation, analysis, inference, evaluation, explanation, and self-regulation. The results showed that the developed instrument met the validity and reliability criteria. The validation results indicated that the material aspect obtained a score of 86.4% and the design aspect obtained 89.8%, both categorized as very valid. The reliability test using Cronbach's Alpha showed a value of 0.743, indicating that the instrument had sufficient reliability. The field test results showed that students' critical thinking skills reached an average score of 70.1%, which is categorized as high. These findings indicate that mathematics problems based on Jambi cultural elements are feasible and effective to be used as an instrument to measure students' critical thinking skills in mathematics learning.

Keywords: Cognitve Psychology; Critical Thinking; Jambi Culture; ADDIE; SPLDV

INTRODUCTION

Learning mathematics is an important subject to be taught to students. Therefore, mathematics education is made one of the subjects that must be taught in schools (Mulyaningsih et al., 2020). In daily life, mathematics plays an important role in helping students solve various problems, both simple and complex.

However, in reality, students often experience difficulties in understanding mathematical problems or when solving mathematical questions (Firdaus et al., 2021). One of the reasons is that learning that does not involve real-life contexts makes mathematics less meaningful (Khusna & Ulfah, 2021). This makes it difficult for students to relate the material to concrete situations, limiting their ability to understand problems and solve word problems.

According to research conducted by Mubarok et al. (2020), it was stated that students' ability to analyze SPLDV material is still considered low. This can be seen from the many students who experience difficulties in solving story problems related to SPLDV.

The achievement of students' answers varies, ranging from a lack of understanding of the questions, difficulties in converting story problems into mathematical models, being formula-oriented, not understanding the concepts, to not finding the right method. Therefore, in this case, to solve mathematical story problems, students can choose to convert them into another form, which involves the ability to create mathematical

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models and problem-solving (Muntaha et al., 2020).

Based on the results of initial interviews with the ninth-grade mathematics teacher at SMP Negeri 4 Kota Jambi, it was found that students still experience difficulties in solving word problems on the topic of Two-Variable Linear Equation Systems (SPLDV). The mathematics teacher at SMP 4 stated that most students often make mistakes when converting word problems into mathematical models. This aligns with the statement from a student identified as Z, who admitted that it is easier for him to understand problems when presented in real-life contexts close to everyday life.

In school learning practice, the potential of local culture has not been utilized optimally, especially in mathematics learning. Involving culture in education is important because it is an instrument of local wisdom born from understanding nature and humans (Pramudita & Muslihati, 2024). According to Safitri et al. (2022), integrating culture into mathematics learning is expected to increase students' interest in learning mathematics.

Culture is a whole and comprehensive unity that exists within a society, whereas education is an essential need that must be obtained by every individual, as education plays an important role in human life (Aprillianti & Yudianto, 2019). Additionally, using culture as a context in mathematics learning at school can be an appropriate approach (Kamid et al., 2025).

To help students learn mathematics effectively, local culture provides a golden opportunity to integrate the richness of Jambi culture into the teaching and learning process. For example, Jambi Batik, Rumah Kajang Lako, Muaro Jambi Temple, Al-Falah Grand Mosque, and the Sekapur Sirih Dance can be used as contexts in the preparation of math problems, making the material closer to students' experiences. This aligns with the focus of this research, which is to utilize elements of Jambi culture, such as Jambi Batik and other local wisdom, as contexts in the preparation of math problems. Thus, integrating local culture into learning is expected to both assess and develop students' cognitive psychological abilities.

Solso, et al. (2008) stated that cognitive psychology is the science that investigates human thought patterns. In fact, cognitive psychology encompasses everything we do. According to Ramadanti & Patda Sary (2021), cognitive psychology studies how information received by the senses, such as sight and hearing, then enters the human mind. After that, the information is processed in the mind before it is finally realized by a person or manifested in the form of actions and behavior.

Research that connects the local culture of Jambi with students' cognitive psychology abilities in mathematics is very important. According to Novianti (2020), good critical thinking skills need to be possessed by students. Students who have critical thinking skills can become proficient in providing logical explanations, developing basic skills, drawing conclusions, and actively participating in academic activities as well as social interactions in the school environment. Therefore, having critical thinking skills will help students solve both simple and complex problems (Setiana & Purwoko, 2020).

METHOD

This study employed a Research and Development (R&D) approach to address the research problems and objectives. The R&D method focuses on the process of producing and testing educational products. According to Sugiyono (2023), Research and Development is used to design, validate, and improve products so that they become more effective and useful in practice. Product development may involve refining existing products to enhance their practicality and efficiency or creating new products that have not previously been developed. In this research, the product developed is a set of mathematics problems based on elements of Jambi culture. The development process aims to explain how these culturally based mathematics questions are designed to measure students' cognitive psychology, particularly their critical thinking indicators. Furthermore, this study also examines the quality of the developed questions by analyzing their validity and reliability.

This research adopted the ADDIE development model as the framework for conducting the study. ADDIE stands for

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Analyze, Design, Develop, Implement, and Evaluate. This model is commonly used in instructional design to guide the systematic development of learning products. The ADDIE approach emphasizes the creation of effective learning designs by considering both short-term and long-term learning processes. It also focuses on learner-centered instruction and applies a systematic approach to understanding human learning and knowledge development (Hidayat & Nizar, 2021).

The participants in this development study were ninth-grade students of Junior High School 4 Jambi City. The testing process was carried out through several stages. First, a one-to-one trial was conducted involving three students representing low, medium, and high levels of thinking ability. These students were selected by the mathematics teacher based on their daily academic performance. Second, a small-group trial involved six students with varying levels of thinking ability who were also chosen by the mathematics teacher according to their daily scores. Finally, a field test trial was conducted with 32 students from class IX-H who had diverse thinking abilities. This stage aimed to observe the potential effect of the developed mathematics questions on students' thinking skills.

The data collection methods used in this study included interviews, tests, and questionnaires. These three data sources were used in a complementary manner to ensure that the data obtained met the research requirements. Test scoring was conducted after all students had taken the written test; student responses were reviewed and scored on a scale of up to 4 points for each indicator. Percentage calculations were based on the formula and classification of critical thinking ability levels proposed by Zakaria & Silalahi (2021).

Validity analysis consists of content validity and item validity. Content validity was conducted after data collection, followed by calculating the percentage for each assessment by the validators. The calculation utilized the formula and questionnaire validity categories from Akbar (2016). Meanwhile, item validity employed Pearson's Product-Moment correlation analysis, developed by Karl Pearson.

Reliability analysis was conducted to determine the level of consistency of the test items in the developed instrument. Data were obtained from the results of the instrument pilot test administered to students. The scores obtained were then analyzed using Cronbach's Alpha coefficient to assess the internal consistency of the instrument, employing the formula and reliability criteria for Cronbach's Alpha from Arikunto (2013).

RESEARCH RESULTS AND DISCUSSION

The test was administered by the researcher during the field test stage to students according to the predetermined schedule. The test instruments used consisted of 10 questions. After the entire series of tests was conducted, the researcher corrected each student's answers based on the scoring guidelines that had been prepared, referring to six critical thinking indicators, namely interpretation, analysis, inference, evaluation, explanation, and reflection. The scoring results were used to describe students' critical thinking abilities. Furthermore, students' critical thinking abilities were classified into high, medium, and low categories.

The field test results show that the total score obtained by the students was 2,244.1. After converting this to a percentage of the maximum score, the average score was 70.1%. There were 20 high-ability students, 11 students in the moderate category, and 1 low-ability student. These percentages indicate that the students' critical thinking skills fall into the high category. These results indicate that the majority of students fall into the high and moderate categories, although there are still a number of students in the low category.

The data collected during the field test was analyzed for item validity using the Pearson product-moment correlation. The data was then analyzed using SPSS software.

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Tabel 1. Results of the item validity test

Item	R-count	R-table	Conclusion	Criteria
1	.353*	0,349	Valid	Low
2	.600**	0,349	Valid	High
3	.596**	0,349	Valid	Medium
4	.366*	0,349	Valid	Low
5	.630**	0,349	Valid	High
6	.728***	0,349	Valid	High
7	.744**	0,349	Valid	High
8	.742**	0,349	Valid	High
9	.478**	0,349	Valid	Medium
10	.535**	0,349	Valid	Medium

The reliability of the instrument was tested using Cronbach's Alpha, a common method for assessing the consistency of an instrument. The collected data was then analyzed using SPSS. The results of the data analysis using SPSS showed that the Cronbach's Alpha value was 0.743 for the 10 items. This value is above the minimum reliability threshold of 0.70; therefore, it can be concluded that the Jambi-culture-based test instrument developed has "reliability that meets the standard for reliability."

In the high category, students were able to identify the information provided and asked for completely and organize the solution steps systematically. Conversely, in the low category, students were not yet able to explain the solution steps and did not double-check the results obtained.
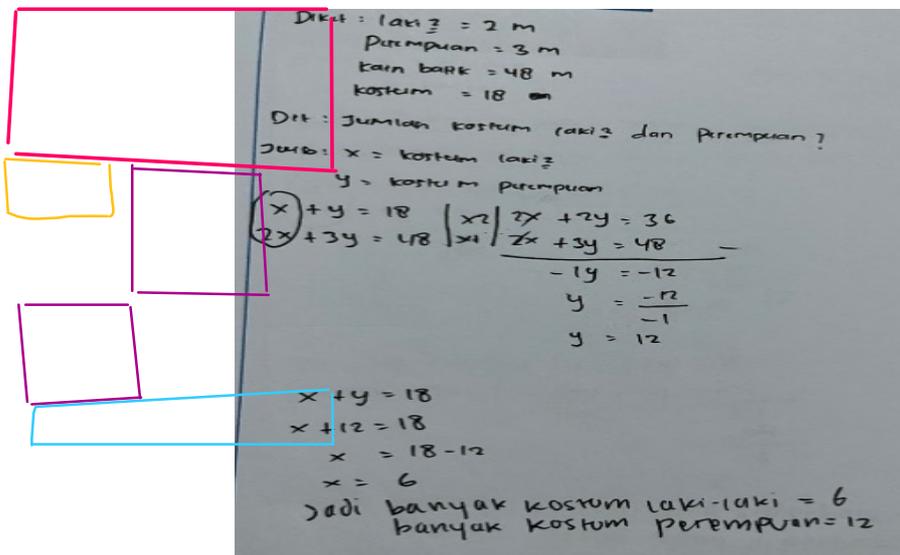

Figure 1. Student's answer to question number 1

Figure 1 presents an example of a student's response categorized as demonstrating high critical thinking ability. The response was examined using six critical thinking indicators, namely interpretation, analysis, inference, evaluation, explanation, and self-regulation. These indicators were used to identify and understand the student's thinking process while solving the given problem.

Based on the student's answer in the interpretation section (shown in the pink box),

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the student is able to identify the information known and asked in the question completely and accurately. The student writes down the given data, such as the amount of fabric and the requirements for each type of costume, and establishes variable representations to represent the number of male and female costumes. This demonstrates that the student has a good understanding of the problem and is capable of converting the information from the word problem into an appropriate mathematical model.

In the analysis stage (shown in the yellow box), students are able to construct a mathematical model in the form of a system of linear equations with two variables based on the information that has been interpreted. Students write two equations that correctly represent the relationships between the data in the problem. This indicates that students are able to connect the known information with relevant mathematical concepts and choose an appropriate solution strategy.

In the inference section (shown in the purple box), students solve the system of equations that has been created with logical and systematic steps. Students perform elimination and substitution operations to obtain the values of each variable. From this process, students are able to draw conclusions in the form of variable values that correspond to the problem, which shows that they have used mathematical reasoning appropriately to obtain a solution.

Based on the students' answer sheets, no specific steps were found that indicate a process of evaluation or rechecking of the obtained results. Students did not explicitly write down a re-examination or verification of the correctness of the answers. Therefore, the evaluation indicator is not visibly present in the students' written answers.

At the explanation stage (shown in the blue-colored box), students write the final results in clear sentences that are appropriate to the context of the problem, namely stating the quantity of each type of costume obtained. This final answer writing shows that students are able to communicate the results of problem-solving in writing effectively and can relate the calculations back to the situation in the problem.

Although it does not appear in writing on the answer sheet, based on interview results, it was found that the student checked back on the steps and the results obtained. This indicates that the student is aware of reviewing their thought process and ensuring the correctness of the answers, thus the self-regulation indicator is still fulfilled through the interview data.

CONCLUSION

Based on the findings and discussion of the study, it can be concluded that the developed product in the form of mathematics questions based on Jambi cultural elements can be used to measure students' cognitive psychological aspects, particularly their critical thinking indicators in the topic of Systems of Linear Equations with Two Variables (SPLDV). The developed instrument has fulfilled the criteria of validity and is appropriate to be used both as a learning instrument and as a tool for assessing students' critical thinking skills.

The development of the mathematics questions was conducted using the ADDIE model, which consists of the stages of analysis, design, development, implementation, and evaluation. The analysis stage revealed that students' critical thinking abilities still require support through contextual learning instruments. Therefore, the questions were designed by incorporating several elements of Jambi's local culture, such as Jambi Batik, Kajang Lako House, Muaro Jambi Temple, the Al-Falah Grand Mosque, and the Sekapur Sirih Dance into mathematical contexts. The development of these questions also referred to six indicators of critical thinking proposed by Facione, namely interpretation, analysis, inference, evaluation, explanation, and reflection.

The developed mathematics questions based on Jambi cultural contexts demonstrate satisfactory levels of validity and reliability. The validation results indicate that the content aspect obtained a score of 86.4%, categorized as "highly valid," while the design aspect reached 89.8%, also classified as "highly valid." These results suggest that the instrument is consistent with the intended learning competencies and appropriate to be implemented in the learning process.

Furthermore, the results of the field test

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showed an average percentage of 70.1%, which falls into the "high" category. This finding indicates that students' critical thinking abilities are generally at a good level based on the applied indicators. The analysis of item validity using Pearson's product-moment correlation revealed that the developed questions were valid. Subsequently, the reliability analysis confirmed that the instrument satisfied the acceptable reliability standards.

Therefore, it can be concluded that the mathematics questions developed using Jambi cultural elements fulfill the required criteria of validity and reliability. These questions are considered appropriate to be used as an assessment instrument in junior high school mathematics learning, particularly for measuring students' cognitive psychological aspects related to critical thinking skills.

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