Needs Analysis for the Development of a Culturally-Based Interactive Mathematics E-Module in Batang Regency

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Abstract

The purpose of this study is to conduct a needs analysis for developing instructional materials used in schools, namely an interactive mathematics e-module based on local culture by integrating the local culture of Batang Regency for vocational high school (SMK) students. The method used in this study is qualitative, oriented towards product development in the form of an e-module. Data collection techniques included interviews with grade XI mathematics teachers and students, as well as distributing questionnaires to grade XI students at SMK N 1 Kandeman. The object of this research is the development analysis of an interactive e-module based on the local culture of Batang Regency for the topic of composition and inverse functions. The subjects of this study are grade XI students and a grade XI mathematics teacher at SMK N 1 Kandeman. Data collection methods in this study include curriculum analysis, material analysis, and field condition analysis based on the background of the local culture. Based on the results of the analysis, it was found that students genuinely need instructional materials in the form of an electronic-based module to assist them in understanding the material, improve their problem-solving skills in the topics of composition and inverse functions, and help them relate the learning process to the local culture in their environment.

Keyword: needs analysis, interactive mathematics e-module, local culture, Batang Regency culture

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INTRODUCTION

In line with the rapid advancement of technology, the field of education can no longer be separated from the use of technology in teaching and learning activities. In this context, learning materials serve as essential instructional tools. One alternative learning resource that leverages current technological developments is the electronic module, commonly referred to as an e-module. Given that many students enjoy using mobile devices, interactive e-modules offer a potential solution for independent learning. These modules can be accessed anytime and anywhere, enabling students to use their gadgets positively for educational purposes (Novitasari & Pratiwi, 2023: 4). Improper use of gadgets or the internet can lead students to be swept away by the currents of globalization, making it difficult for them to distinguish between positive and negative influences. As a result, students may easily adopt foreign cultural values that are less constructive, which in turn contributes to the gradual erosion of local or national Indonesian culture. Therefore, it is essential for students to begin by understanding their own local cultural heritage. Integrating local cultural elements into learning not only makes the educational process more meaningful but also serves to introduce and preserve traditions that are recognized and valued by the local community (Andriono, 2021: 185). Interactive e-modules are instructional tools that deliver learning content in digital format by integrating text, images, audio, and video components (Qotimah & Mulyadi, 2021). In this context, interactive mathematics e-modules can be developed by incorporating local cultural elements, as culture-based learning plays a significant role in character development, particularly in the era of globalization. Through education, local cultural values can be instilled to strengthen students' character and reinforce national identity (Syarifuddin et al., 2022).

Based on observations conducted during the School Environment Orientation Program (PLP), the researcher found that many students, particularly those in grade XI, struggled to translate real-life problems into mathematical models. This difficulty impacted their ability to solve mathematical problems effectively. In classroom settings, students primarily relied on printed textbooks or, occasionally, PowerPoint presentations provided by the mathematics teacher. Such limited resources often led to student boredom and hindered independent learning, as well as their capacity to solve contextual problems.Integrating local culture into learning content is believed to help students better understand mathematical contexts. This approach is especially relevant for students at SMK Negeri 1 Kandeman, where interest in local cultural elements is notably high among grade XI students. One clear example is the strong student interest in extracurricular dance activities, which include traditional dances from Batang Regency and other regions in Java. These activities also introduce students to various traditional batik motifs specific to Batang. Therefore, incorporating local cultural elements into learning is believed to enhance students' comprehension of mathematics and their problem-solving abilities.

The e-module developed in this study utilizes Canva as the design platform and is formatted as a PDF integrated with flipping book hyperlinks, allowing students to access the material anytime and anywhere. This interactive e-module enables students to engage with mathematical concepts and problem-solving through contextual story problems. It is designed to improve students' problem-solving skills by embedding elements of local culture found in the Batang area, where SMK N 1 Kandeman is located. The purpose of this study is to analyze the need for developing a culture-based interactive mathematics e-module as an alternative instructional material for the composition and inverse function topics for grade XI students at SMK N 1 Kandeman.

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METHOD

This study employed a qualitative method with data collection techniques including interviews with one mathematics teacher who teaches grade XI students and four selected students from the same grade, as well as a questionnaire distributed to 35 grade XI students. The purpose of this study is to identify the needs for developing an interactive mathematics e-module based on the local culture of Batang Regency, specifically for the topics of composition and inverse functions. The object of the research is the development needs of a culture-based interactive mathematics e-module, while the subjects are the grade XI students of SMK N 1 Kandeman.

The research utilized a descriptive qualitative approach, which was chosen because the issue under investigation is ongoing and needs to be analyzed in terms of the phenomena occurring in the field. Data collection was conducted in May 2025, involving 35 students from class XI RPL 2 and one mathematics teacher at SMK N 1 Kandeman. The data collection methods, instruments used, and objectives for each stage of the needs analysis are presented in Table 1.

Table 1. Data Collection in the Needs Analysis

Data Collection Method	Data Collection Instrument	Objective	Number of Question Items
Interview	Instruments: Interview	To observe mathematics learning activities and the use of technology in the classroom; to gather opinions or responses regarding the development of a local culture-based interactive mathematics e-module in Batang Regency; and to identify students' interests in local arts or cultural heritage.	5 interview questions for the teacher and 6 interview questions for the students.
Curriculum Analysis	Instruments: Interview and Questionnaire Guidelines	To analyze the alignment between Learning Objectives (TP) and Learning Outcomes (CP) in accordance with the Independent Curriculum (Kurikulum Merdeka).	5 interview questions for the teacher, 6 interview questions for the students, and 6 questionnaire items for the students.
Material Analysis	Instruments: Interview and Questionnaire Guidelines	To examine the content and instructional materials required for e-module development.	5 interview questions for the teacher, 6 interview questions for the students, and 6 questionnaire items for the students.
Field Condition Analysis Based on Cultural	Instruments: Interview and Questionnaire	To analyze conditions related to the local cultural background of Batang	5 interview questions for the teacher, 6 interview questions for the

Background	Guidelines	Regency.	students, and 8 questionnaire items for the students.

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RESULTS AND DISCUSSION

This study aims to analyze the needs for developing an interactive mathematics e-module based on the local culture of Batang Regency to support mathematics learning on the topics of composition and inverse functions for grade XI students at SMK N 1 Kandeman. The data obtained through interviews and questionnaires were analyzed based on curriculum content, learning materials, and actual classroom conditions, taking into account the local cultural background. The following presents the results of the analysis conducted.

Curriculum and Material Analysis

Based on interviews with the mathematics teacher of grade XI, it was revealed that the school currently implements the Merdeka Curriculum (Independence Curriculum). In the learning process, the teacher stated that the primary instructional materials used are printed textbooks provided by the school, supplemented occasionally with digital modules. The teacher also explained that, during lessons, concrete teaching aids are often used to connect mathematical concepts with real-life contexts. This is because printed textbooks alone are often insufficient to fully engage students in learning, especially in mathematics, which is often perceived as abstract and challenging.

As a result, the teacher frequently seeks additional strategies and materials to attract students' interest and maintain their focus in class. According to the teacher, the use of e-modules is highly beneficial, as these materials can include engaging features such as introductory videos or images that help capture students' attention at the beginning of a lesson.

The questionnaire responses from students in class XI RPL 2 revealed the following results:

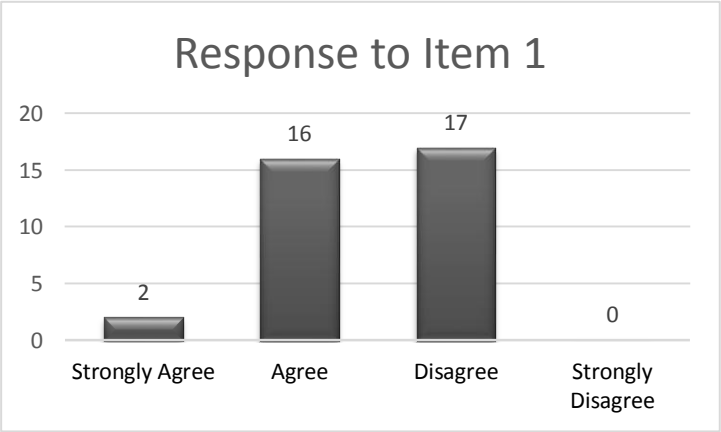

Figure 1. Responses of Grade XI Students to Statement 1

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Based on the results of the questionnaire given to the students of class XI RPL 2 regarding the first statement, which was: *"You have other learning resources besides those provided by the school to study mathematics."* Figure 1 shows that out of 35 respondents, 6% of students answered "Strongly Agree," meaning they are very active in seeking or using learning resources other than those provided by the school; 46% of students answered "Agree," meaning they use other learning resources besides those provided by the school; 49% of students answered "Disagree," indicating that they rarely use other learning resources besides those provided by the school; and 0% of

students answered "Strongly Disagree," meaning they only use the learning resources provided by the school.

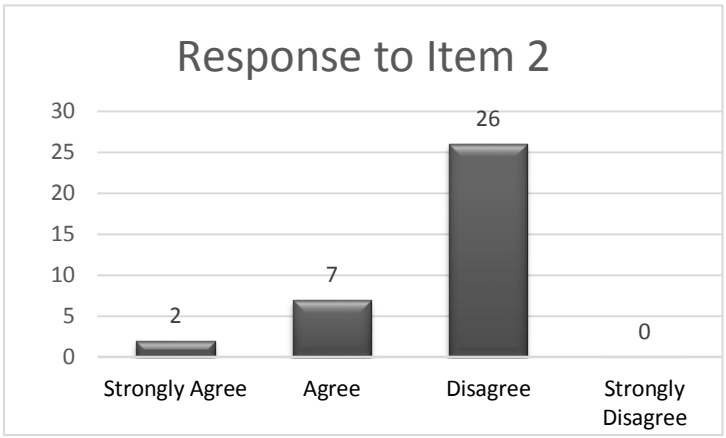

Figure 2. Responses of Grade XI Students to Statement 2

Based on the results of the questionnaire given to the students of class XI RPL 2 regarding the second statement, which was: *"You use those other learning resources to study mathematics."* Figure 2 shows that out of 35 respondents, 6% of students answered "Strongly Agree," meaning they very frequently use other learning resources to study mathematics; 20% of students answered "Agree," meaning they use other learning resources with a fairly good frequency; 74% of students answered "Disagree," indicating that they rarely use other learning resources to study mathematics; and 0% of students answered "Strongly Disagree," meaning none of the students completely avoid using other learning resources.

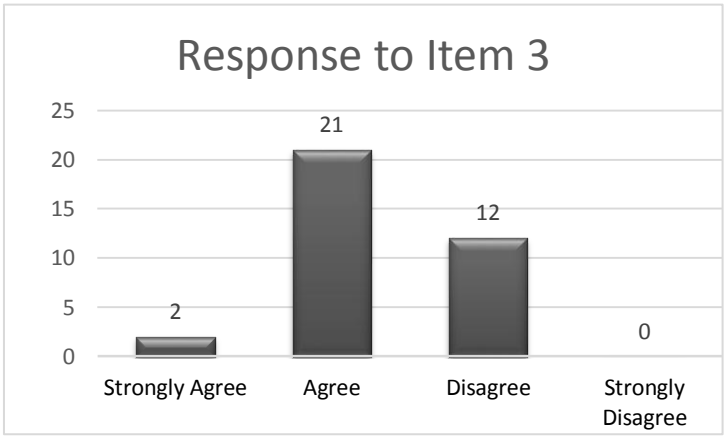

Figure 3. Responses of Grade XI Students to Statement 3

Based on the results of the questionnaire given to the students of class XI RPL 2 regarding the third statement, which was: *"Your teacher uses other teaching materials besides the books provided by the school."* Figure 3 shows that out of 35 respondents, 6% of students answered "Strongly Agree," meaning they feel the teacher very frequently uses additional teaching materials besides the school-provided books; 60% of students answered "Agree," meaning they feel the teacher uses additional teaching materials, although not always; 34% of students answered "Disagree," indicating that they feel the teacher rarely uses additional teaching materials and mostly relies on those

] led by the school; and 0% of students answered "Strongly Disagree," meaning they feel the teacher never uses any additional teaching materials.

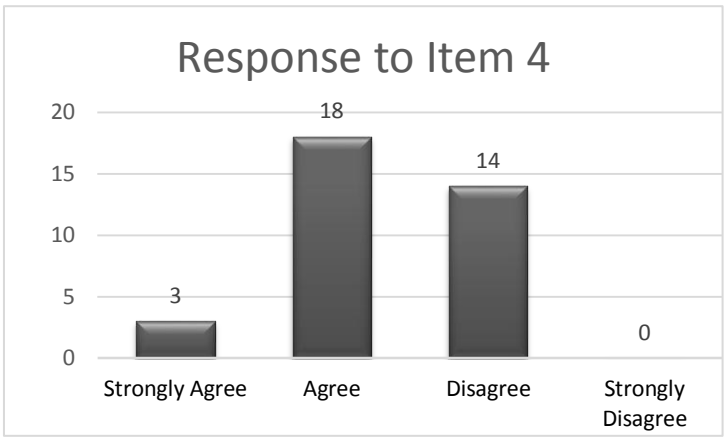

Figure 4. Responses of Grade XI Students to Statement 4

Based on the results of the questionnaire given to the students of class XI RPL 2 regarding the fourth statement, which was: *"The additional teaching materials help you understand the material being taught."* Figure 4 shows that out of 35 respondents, 9% of students answered "Strongly Agree," meaning they feel greatly helped by the additional teaching materials in understanding the subject matter; 51% of students answered "Agree," meaning they feel somewhat helped by the additional teaching materials, although not completely; 40% of students answered "Disagree," indicating they feel the additional teaching materials are not very helpful in understanding the subject matter; and 0% of students answered "Strongly Disagree," meaning they do not feel helped at all by the additional teaching materials in understanding the material.

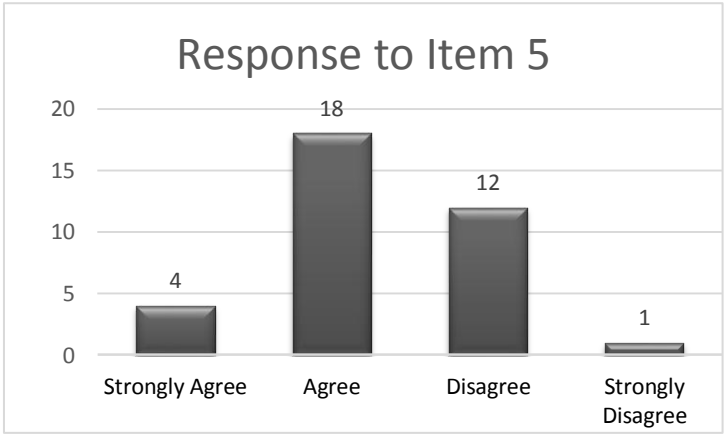

Figure 5. Responses of Grade XI Students to Statement 5

Based on the results of the questionnaire given to the students of class XI RPL 2 regarding the fifth statement, which was: *"The books provided by the school are difficult to understand in learning mathematics,"* this statement is a negative one. Figure 5 shows that out of 35 respondents, 11% of students answered "Strongly Agree," meaning they find it very difficult to understand the school-

provided books; 51% of students answered "Agree," meaning they find the books quite difficult to understand; 34% of students answered "Disagree," indicating they find the books fairly easy to understand; and 3% of students answered "Strongly Disagree," meaning they understand the school-provided books very well.

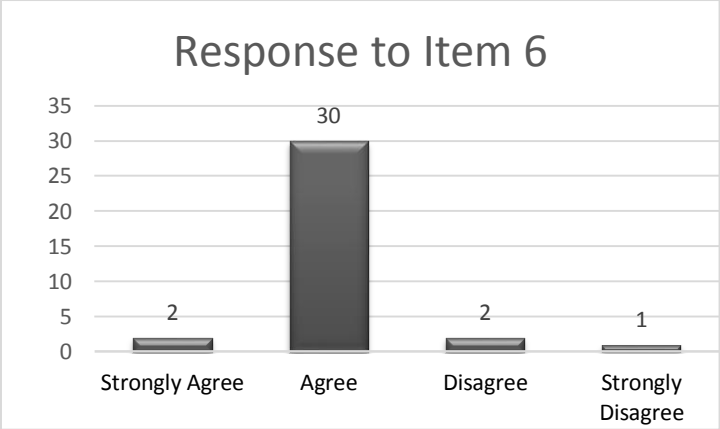

Figure 6. Responses of Grade XI Students to Statement 6

Based on the results of the questionnaire given to the students of class XI RPL 2 regarding the sixth statement, which was: *"Your teacher uses electronic teaching materials in learning."* Figure 6 shows that out of 35 respondents, 6% of students answered "Strongly Agree," meaning they feel the teacher very often and consistently uses electronic teaching materials; 86% of students answered "Agree," meaning they feel the teacher uses electronic materials but not always; 6% of students answered "Disagree," indicating they feel the teacher rarely uses electronic materials and more often uses conventional ones; and 3% of students answered "Strongly Disagree," meaning they feel the teacher does not use electronic teaching materials at all during the learning process.

This finding is supported by interviews with four students who stated that they prefer mathematics learning delivered in a systematic way starting from basic concepts, explanation of formulas, example problems, to similar practice exercises. Such a method can be more effective if supported by electronic teaching materials, where students are actively engaged in solving contextual problems before discussing them together with the teacher. The data show that although the use of electronic media is already present, its implementation has not yet been fully optimized. Students tend to expect more structured and varied digital learning materials to make learning more engaging, easier to understand, and to encourage active participation. In mathematics learning, students often face difficulties. Some of the challenges expressed by students include: insufficiently detailed material explanations that make it difficult for them to understand the topics, practice questions that are more difficult than the examples provided, making it hard for them to solve the problems, and a lack of accuracy when working on math problems, which affects their ability to arrive at the correct final answer.

Additionally, students reported that teachers often use the Problem-Based Learning (PBL) model in mathematics classes. However, some students feel that they do not fully understand the material when this learning model is applied. Students also shared their preferences regarding learning materials they like both physical and digital teaching materials, as each has its own advantages. For

example, physical materials make it easier for students to scribble while solving problems, while digital materials allow them to study anytime and anywhere, as they can access the content directly from their devices.

Field Condition Analysis Based on Local Cultural Background

Through interviews, the teacher revealed that the use of an interactive mathematics e-module based on the local culture specifically Batang Regency's batik is highly beneficial. Previously, the teacher had already incorporated elements of Batang's local culture, such as traditional foods like *serabi Kalibeluk* and *nasi megono*, to help explain certain topics, such as the concept of circles. This approach made it easier for students to visualize everyday objects and connect them with the lesson material.

Considering that the cultural element chosen by the researcher is batik, students are expected to show enthusiasm, as some of them may not yet be familiar with the distinctive batik of Batang Regency. The teacher also explained students' interest in local culture, stating that they are fairly interested, especially in areas related to local tourism. Students can be encouraged to explore their local culture not only to support their understanding of the learning material but also to increase their awareness of their own culture so that it can be preserved together.

In addition, as students learning in the digital era, they are naturally inseparable from technology. According to the mathematics teacher for class XI, today's students easily adapt to technological advancements, particularly in the class selected by the researcher XI RPL 2 whose vocational focus is Software Engineering. These students are already accustomed to using technology in their vocational practice. However, one of the challenges mentioned by the teacher is the need for enhanced skills in developing e-modules, as well as the extended time required to create them.

Below is the field condition analysis based on the local cultural background, which is derived from the questionnaire data distributed to students and elaborated as follows.

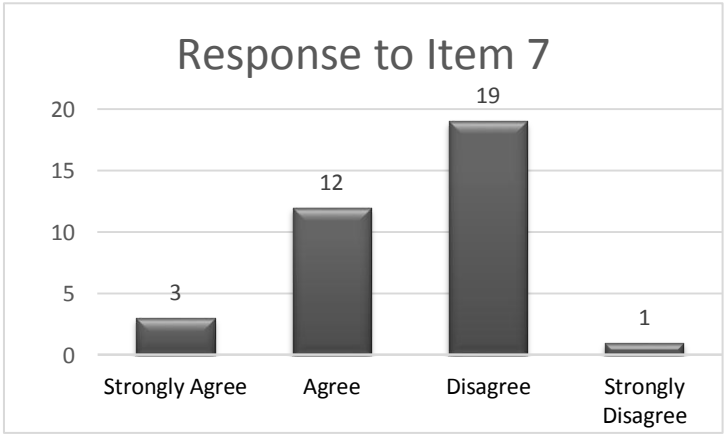

Figure 7. Responses of Grade XI Students to Statement 7

Based on the results of the questionnaire given to the students of class XI RPL 2 regarding the seventh statement, which was: *"You are enthusiastic about learning the topic of composition and inverse functions in mathematics."* Figure 7 shows that out of 35 respondents, 3% of students answered "Strongly Agree," meaning they are excited and interested in participating in the learning process; 12% of students answered "Agree," meaning they are fairly enthusiastic and show a good level of interest, though not very strong; 19% of students answered "Disagree," indicating that they are less enthusiastic about the learning; and 1% of students answered "Strongly Disagree," meaning they feel bored or dislike the lesson.

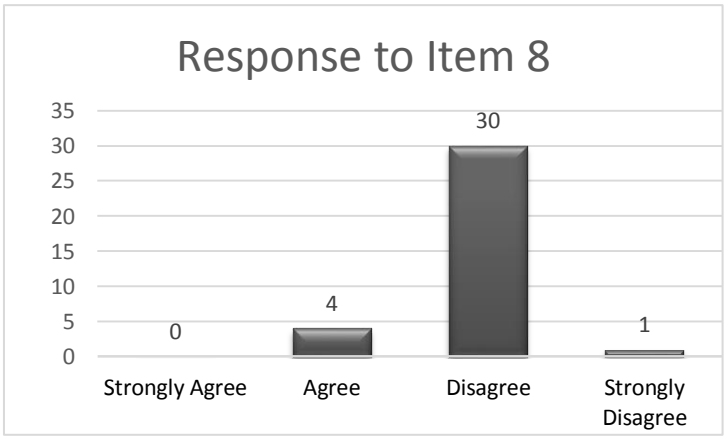

Figure 8. Responses of Grade XI Students to Statement 8

Based on the results of the questionnaire given to the students of class XI RPL 2 regarding the eighth statement, which was: *"Your teacher has an interactive e-module that helps you better understand the topic of composition and inverse functions."* Figure 8 shows that out of 35 respondents, 0% of students answered "Strongly Agree," meaning they feel the teacher truly possesses and uses an interactive e-module that is very helpful; 11% of students answered "Agree," meaning they feel the teacher has an e-module that helps them understand the material fairly well; 86% of students answered "Disagree," indicating that they rarely see the teacher use an interactive e-module; and 3% of students answered "Strongly Disagree," meaning they feel the teacher does not have an interactive e-module and that it is not helpful at all.

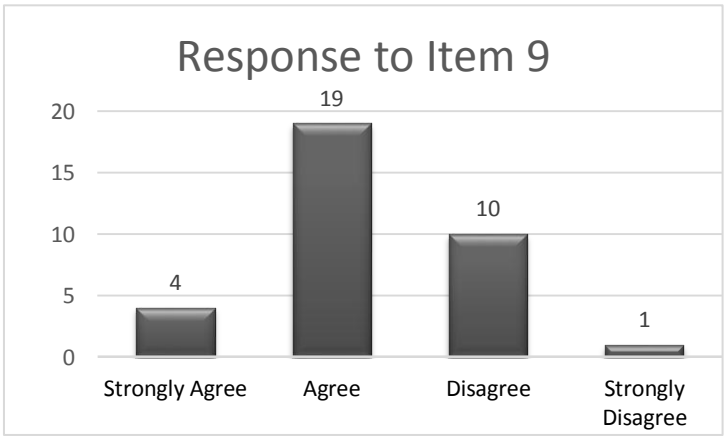

Figure 9. Responses of Grade XI Students to Statement 9

Based on the results of the questionnaire given to the students of class XI RPL 2 regarding the ninth statement, which was: *"You have difficulty relating mathematics learning to real-life contexts."* This statement is a negative one. Figure 9 shows that out of 35 respondents, 11% of students answered "Strongly Agree," meaning they find it very difficult to relate mathematics material to real-life contexts; 54% of students answered "Agree," meaning they find it quite difficult to make such connections; 29% of students answered "Disagree," indicating they are fairly capable of relating mathematical concepts to everyday life; and 3% of students answered "Strongly Disagree," meaning they do not experience any difficulty in relating mathematics material to real-life situations.

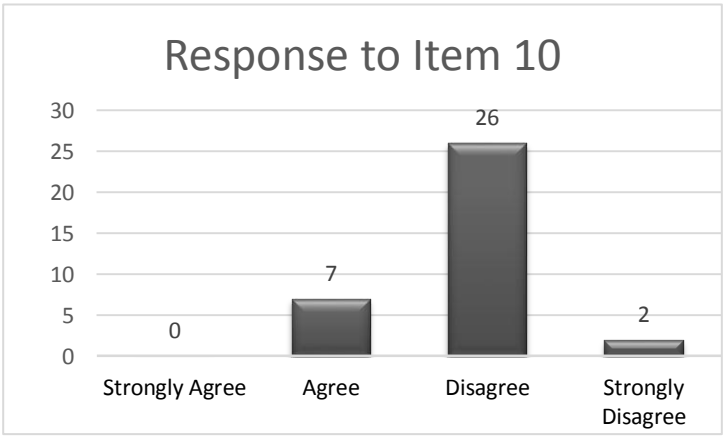

Figure 10. Responses of Grade XI Students to Statement 10

Based on the results of the questionnaire given to the students of class XI RPL 2 regarding the tenth statement, which was: *"You are active during mathematics lessons."* Figure 10 shows that out of 35 respondents, 0% of students answered "Strongly Agree," meaning they are very active during mathematics learning; 20% of students answered "Agree," meaning they are fairly active, occasionally asking or answering questions; 74% of students answered "Disagree," indicating they are not very active during learning activities; and 6% of students answered "Strongly Disagree," meaning they are not active at all in the learning process.

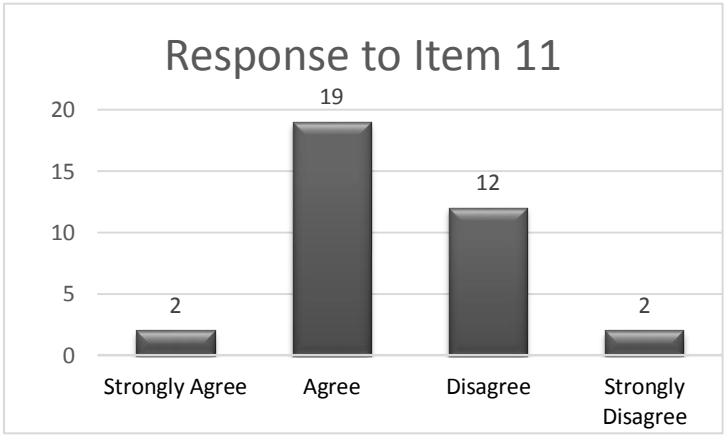

Figure 11. Responses of Grade XI Students to Statement 11

Based on the results of the questionnaire given to the students of class XI RPL 2 regarding the eleventh statement, which was: *"Some of your mathematics learning outcomes have not met the Minimum Mastery Criteria (KKTP)."* This statement is a negative one. Figure 11 shows that out of 35 respondents, 6% of students answered "Strongly Agree," meaning they often do not meet the KKTP; 54% of students answered "Agree," meaning they occasionally do not meet the KKTP; 34% of students answered "Disagree," indicating they often meet the KKTP; and 6% of students answered "Strongly Disagree," meaning they always meet the KKTP.

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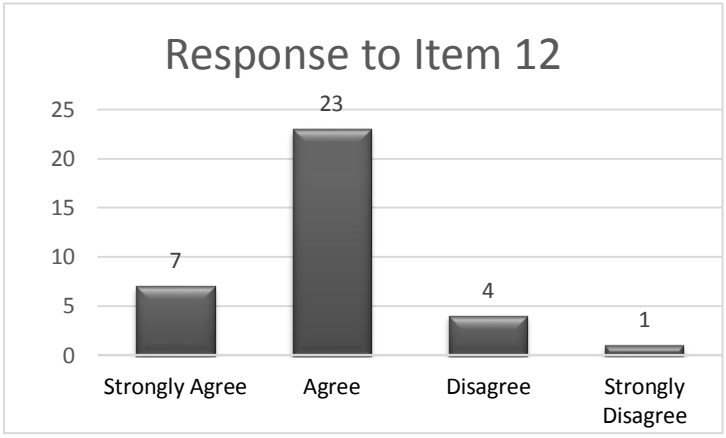

Figure 12. Responses of Grade XI Students to Statement 12

Based on the results of the questionnaire given to the students of class XI RPL 2 regarding the twelfth statement, which was: *"You have an interest in local culture."* Figure 12 shows that out of 35 respondents, 20% of students answered "Strongly Agree," meaning they have a high level of interest and are familiar with local culture; 66% of students answered "Agree," meaning they have a fair interest in local culture but are not actively engaged; 11% of students answered "Disagree," indicating a low level of interest and little enthusiasm for local culture; and 3% of students answered "Strongly Disagree," meaning they have no interest at all in local culture.

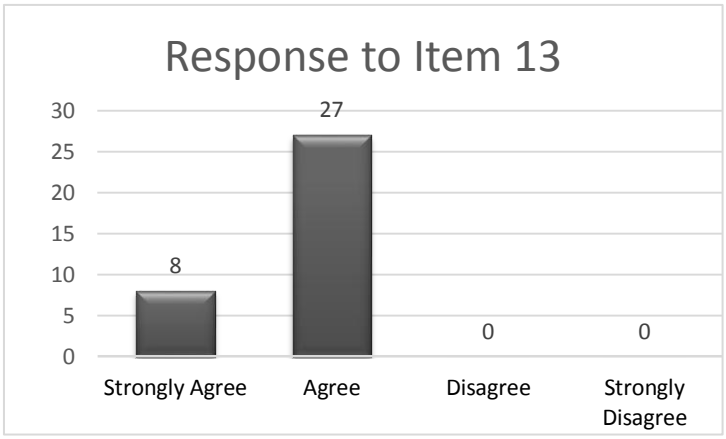

Figure 13. Responses of Grade XI Students to Statement 13

Based on the results of the questionnaire given to the students of class XI RPL 2 regarding the thirteenth statement, which was: *"You are more interested in learning mathematics when using an interactive mathematics e-module based on local culture."* Figure 13 shows that out of 35 respondents, 23% of students answered "Strongly Agree," meaning they are very interested in learning mathematics when using an interactive e-module based on local culture; 77% of students answered "Agree," meaning they are quite interested and feel more motivated to learn mathematics when using such an e-module; 0% of students answered "Disagree," meaning they are less interested and feel the use of the e-module does not significantly affect their interest in learning; and 0% of students answered "Strongly Disagree," meaning they are not interested at all in the interactive e-module based on local culture.

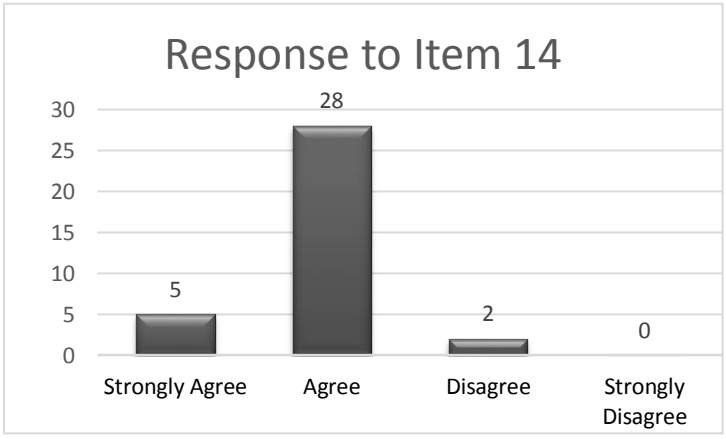

Figure 14. Responses of Grade XI Students to Statement 14

Based on the results of the questionnaire given to the students of class XI RPL 2 regarding the fourteenth statement, which was: *"You study using an interactive mathematics e-module based on local culture."* Figure 13 shows that out of 35 respondents, 14% of students answered "Strongly Agree," meaning they strongly agree with learning using an interactive mathematics e-module based on local culture; 80% of students answered "Agree," meaning they agree to learn using the module; 6% of students answered "Disagree," meaning they are less supportive of learning with the interactive e-module based on local culture; and 0% of students answered "Strongly Disagree," meaning they strongly disagree with using such a module.

Since the product to be developed by the researcher is an interactive mathematics e-module based on local culture, the researcher aimed to assess students' knowledge of local culture in Batang Regency through interviews. The results showed that the four interviewed students gave almost similar responses regarding cultural knowledge some only recognized Batang's traditional culinary dishes, while others knew about a specific traditional dance. However, three of them were not yet familiar with Batang's traditional batik. As a result, the students expressed interest and enthusiasm in learning about Batang's culture, specifically batik, through the e-module to be developed.

From the students' responses, it can be concluded that mathematics learning using an interactive e-module based on local culture particularly on the topic of composition functions has the

potential to increase student interest in learning mathematics. In line with the field conditions, there is a need to design an interactive mathematics e-module based on local culture that can facilitate student learning. The implementation of e-modules in learning provides convenience for students to study independently according to their individual abilities and can also enhance their motivation and learning outcomes (Sholeh et al., 2023). An interactive e-module designed with a combination of text, images, videos, and animations can enhance students' conceptual understanding and critical thinking skills, especially in distance learning (Wulandari et al., 2021). In addition, the development of e-modules based on local wisdom has been proven to not only improve learning outcomes but also foster a sense of love and appreciation for students' regional culture (Suantara et al., 202 13

In his research Suanto (2024) it is stated that assimilating mathematics learning with local culture in the form of batik can make students feel more enthusiastic. Therefore, developing an interactive e-module based on local culture specifically Batang Regency's traditional batik can increase students' enthusiasm for learning mathematics. This aligns with the results of the student response questionnaires and interview answers.

This condition is also in line with the theory of ethnomathematics developed by D'Ambrosio (1985), which views mathematics not only as a formal science but also as a cultural construct that lives within society. The ethnomathematics approach emphasizes the importance of connecting mathematical concepts to local cultural realities, so that students are not only able to understand abstract concepts but also apply them in their real lives (Shannon, 2021). The batik that will be used in the e-module is *Batik Batangan*, which includes various types such as *Batik Gringsing*, *Batik Seno*, *Batik Gelaran*, and others.

Figure 14. Batik Batangan Motifs: Seno, Gelaran, Gringsing

By incorporating cultural elements such as batik, it is expected that students' knowledge and appreciation of their local culture will increase through interactive, technology-based learning using e-modules. This is also in line with research conducted by Purwoko et al. (2020), which stated that students often struggle to understand abstract problems in printed textbooks provided by the school and expect that a local culture-based e-module will help both students and teachers in the mathematics learning process. The questionnaire results showed that 77% of students are interested in learning using an interactive e-module based on local culture, and 80% agree that such a module should be implemented in learning. Additionally, 65% of students admitted having difficulty relating mathematics to real-life situations. In-depth interviews revealed that students are more enthusiastic when the material is presented within a cultural context they are familiar with, such as batik

Gringsing motifs or traditional dances. Teachers stated that this approach helps students grasp abstract concepts more easily.

CONCLUSION

Based on interviews with the mathematics teacher of grade XI, it can be concluded that students often experience difficulties when using printed teaching materials, leading the teacher to use additional supports such as teaching aids and e-modules. Interactive e-modules are considered more engaging, especially when incorporating videos or images at the beginning of lessons. Integrating local culture also helps students better understand the material while encouraging them to recognize and preserve their regional culture. The results of the needs analysis questionnaire distributed to grade XI students indicate that there is a need for an interactive mathematics e-module based on local culture. Electronic modules are seen as more helpful in understanding material and solving problems, particularly in the topic of function composition, which can be linked to students' surroundings—such as Batang Regency's traditional batik. A total of 77% of students agreed they were interested and more motivated to learn mathematics using this kind of module, and 80% agreed to use it in learning.

This research is expected to be beneficial for teachers by supporting interactive and creative technology-based learning, for students by improving contextual problem-solving skills and cultural knowledge, for researchers by providing strong data to design effective e-modules, and for schools by encouraging the use of technology as an interactive learning resource. After the needs analysis, the next step is to design an interactive mathematics e-module based on local culture tailored to students' characteristics and field findings. The development may follow the ADDIE or 4D model, followed by expert validation and a limited trial to evaluate its practicality and effectiveness in improving students' problem-solving abilities.

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