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Research Article

Development of E-Module for Mathematics Learning for Junior High School Students Based on Local Culture at the Van der Wijck Fort Complex to Improve Students' Mathematical Reasoning Ability and Learning Interest

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Abstract: This study aims to develop a junior high school mathematics e-module based on local culture at the Van der Wijck Fortress complex to enhance students' mathematical reasoning skills and learning interest. Specifically, the objectives are: (1) to describe the characteristics of the local culture-based e-module that can improve reasoning ability and learning motivation, and (2) to produce a high-quality e-module that meets the criteria of validity, practicality, and effectiveness. The research employed the ADDIE development model (Analysis, Design, Development, Implementation, and Evaluation). The participants consisted of one teacher, 31 students in the experimental class, and 32 students in the control class at a public junior high school in Kebumen Regency. The instruments used included validation sheets for media and material, competency tests, mathematical reasoning tests, learning interest questionnaires, and practicality assessment forms for teachers and students. The results showed that the e-module possesses characteristics of being self-instructional, self-contained, stand-alone, adaptive, and user-friendly. Product validity was confirmed through expert validation with average scores of 4.26 for media and 4.35 for material (very valid). The validation of instruments obtained average scores ranging from 4.5 to 4.92, categorized as very valid. Practicality was demonstrated through teacher assessments of 92%, student assessments of 85%, and learning implementation of 94% (all very practical). Effectiveness testing using the Multivariate Hotelling's T^2 test indicated significant differences between experimental and control classes in competency test scores, mathematical reasoning, and learning interest. Therefore, the local culture-based mathematics e-module is proven valid, practical, and effective in enhancing students' mathematical reasoning and learning motivation.

Keywords: E-Module; Junior High School; Learning Interest; Local Culture; Mathematical Reasoning

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1. Introduction

The world has now entered the 21st century, also known as the digital era. Science and Technology (IPTEK) is advancing rapidly. Everything now relies on digital technology for its use. IPTEK has not only penetrated the automotive world, which involves factory machinery for motor vehicle manufacturing, but the world of education has also been impacted by these advances. Stefaniak et al. (2021) explain that teaching in the current digital era presents both opportunities and challenges for educators. Therefore, teachers and prospective teachers must be prepared to face them. Davies et al. (2017) explain that the increasingly rapid development of technology brings convenience to learning. This digital learning environment allows for greater flexibility and easier access to learning materials from anywhere and at any time (Stefaniak et al., 2021). One example is learning media in the form of books or learning modules.

Mahadiraja & Syamsuarnis (2020) explain that a learning module is a form of teaching material that is packaged systematically and comprehensively, containing a set of planned learning experiences designed to help students master specific learning objectives. The distribution of printed books or learning modules takes a long time to reach teachers and students, resulting in learning delays and a lack of synchronization in Indonesia. Furthermore, distributing books to remote areas is certainly costly (Ruddamayanti, 2019). However, thanks to technological advances, learning is no longer limited to printed textbooks (Keast et al., 2018).

With the development of the times, this learning module has developed into an electronic learning module or what is usually called e-module. E-moduleor electronic modules are modules in digital form, which contain text, images or both which contain material suitable for use in learning (Herawati & Muhtadi, 2018). E-modulesystematic use of electronic devices gives students the opportunity to learn anywhere because e-module in file form, making it more practical to carry (Susilawati et al., 2020).

E-moduleGood learning has several characteristics as stated by Daryanto (2013: 9), namely; (a) *Self instruction. E-module* Contains clear instructions and objectives so that students can easily use it. Because it is used in the learning process, *e-module* must align with the curriculum objectives and additional objectives to be achieved. One example is introducing culture to users. (b) *Self contained. E-modul* contains complete material to be studied. (c) *Stand alone. E-module* does not require other teaching materials in its use. (d) Adaptive. *E-module* have the ability to adapt to developments in science and technology. (e) *User friendly. E-module* can help and be friendly to its users, one example is using language and terms that are easy to understand.

Rapid technological advancements have made the exchange of information between parts of the world limitless. Foreign cultures have become easily accessible and enjoyed by Indonesians. This has led to a decline in local culture. Many people are no longer interested in visiting cultural attractions. If left unchecked, these cultural and historical areas will gradually become neglected and forgotten. For example, the cultural heritage site used by the researchers, Fort Van der Wijck, which used to see a surge in visitors every holiday, has now seen fewer visitors. Yet, many things can be learned through culture, including mathematics. Integrating culture into mathematics, by utilizing local culture, will make learning more meaningful (Khayat, 2020). Therefore, *e-module* This is culturally based, one of which is to preserve local cultural heritage and to introduce local culture to the wider community.

One of the cultural heritage sites is Fort Van der Wijck. As the name suggests, Fort Van der Wijck is a historical relic in the form of a building. Fort Van der Wijck is the only octagonal fort in Indonesia. This Dutch colonial fort is expected to educate visitors, especially the younger generation, to appreciate historical relics, not just the objects themselves, but also the noble messages behind them and historical sites (Khayat, 2020).

Mathematics is one of the subjects in Indonesia. Many people still consider it a difficult subject (Kikas et al., 2020). Difficulties in learning mathematics may be due to the abstract nature of mathematics, making it difficult for students to understand concepts and reducing their interest in learning activities at subsequent levels (Meke et al., 2019). Furthermore, mathematics learning forces students to interpret by memorizing formulas and definitions, contributing to a decline in student interest in learning (Chao et al., 2018). Another reason that makes mathematics learning difficult is that educators do not or do not utilize the surrounding environment for the student's learning process (Abdullah, 2017). This results in low mathematical abilities among students in Indonesia, one of which is students' mathematical reasoning abilities (Fuadi et al., 2016).

One of the abilities that can be trained is reasoning ability (NCTM, 2020). Reasoning ability is one of the very important and useful abilities for human life. Through mathematics,

reasoning ability will be trained and developed. In accordance with the direction of*National Council of Teacher of Mathematics*Mathematical reasoning skills can be trained through mathematics (NCTM, 2020). Sumartini (2015) also explains that reasoning is an activity or thought process used to draw conclusions or create new statements based on previous statements whose truth has been proven. This opinion is reinforced by Lithner (2007: 257), who states that reasoning is a basic skill that must be optimized in school mathematics learning.

Based on previous research, namely research conducted by Khikmawati, which concluded that the use of *e-book* can help increase students' interest in learning (Khikmawati et al., 2021). Interest is the desire to intentionally engage with positive feelings in an activity or event (Tin, 2016: 40). Through interest in learning, a person's enthusiasm and enjoyment for learning will grow. This will result in maximally facilitating the process of transferring knowledge to students.

Through this research, a*e-module*Learning that is specifically designed for junior high school students can improve their mathematical reasoning skills and interest in learning mathematics. Developmen*e-module*This was done to preserve and introduce one of Indonesia's local cultures, namely Van der Wijck Fort. In addition, the development of*e-module*This is done so that teachers and students can use it in the learning process, both in the classroom and while studying from home. Therefore, it is necessary to develop learning media that can support the improvement of mathematical reasoning skills, student interest in learning, and the preservation of local culture.

*E-module*This local culture-based learning can be a solution to the problems outlined above. Several reasons for developing*e-module*This mathematics learning can create effective mathematics learning, can invite students to be actively involved in the learning process, improve students' mathematical reasoning skills, and increase students' interest in learning. The use of local culture in the Van der Wijck Fort complex can preserve and at the same time introduce local culture to the wider community, in addition, by using local culture, students' understanding of mathematics is deeper and students' interest in learning will increase.

Material on development*e-module*This mathematics lesson focuses on the surface area and volume of various curved-sided geometric shapes. This material falls under the geometry category. Through geometry learning, students will learn about geometric shapes and structures, as well as analyze their properties and relationships; as a natural place to develop reasoning; and geometry is not just about definitions but about describing relationships and reasoning (NCTM, 2000: 41). This material was also chosen because it aligns with the shape and structure of Fort Van der Wijck. Therefore, the surface area and volume of various curved-sided geometric shapes are materials that need to be well-packaged for easy understanding by students.

Under development*e-module*In this mathematics curriculum, teachers are required to be technologically literate and familiar with the local culture of their respective communities. A willingness to continuously learn and keep up with developments must also be cultivated. This is solely for the benefit of students and to maximize the achievement of mathematics learning goals. Considering that we are now entering the digital era, an era in which human life is constantly connected to technology and information, the increasingly rapid advancement of technology and information must go hand in hand with our culture. Therefore, as a cultured society, we are obligated to preserve our culture, as it is a regional heritage and fosters a sense of nationalism.

Based on the description above which explains the facts that require a*e-module* local culture-based mathematics learning, researchers are interested in developing*e-module* local culture-based junior high school mathematics learning at the Van der Wijck Fort complex to improve students' mathematical reasoning abilities and learning interest.

2. Materials and Method

This section explains the research methods used in stages to develop a local culture-based mathematics learning e-module at the Van der Wijck Fortress Complex in Gombong, Kebumen. A systematic approach is necessary to validate and test the effectiveness of the product development process.

Research Stages

This section systematically explains the stages of research into the development of a local culture-based mathematics learning e-module at the Van der Wijck Fortress Complex, which aims to improve the mathematical reasoning skills and learning interests of junior high school students. The research was conducted following the scientific procedures of the model.ADDIE (Analysis, Design, Development, Implementation, and Evaluation)as stated by Branch (2010). This type of research isresearch and development. The focus of the research is directed to producelocal culture-based mathematics learning e-module productvalid, practical, and effective. Model ADDIE chosen because it provides a systematic development flow and can be implemented in stages, including:

a. Analysis (Analisis)
b. Design
c. Development
d. Implementation
e. Evaluation

E-modules are developed with materials surface area and volume of curved-sided geometric shapes, using the real context of Van der Wijck Fort complex to instill a connection between mathematical concepts and local culture.

ADDIE Model Development Stages

a. Analysis Level

This stage aims to identify learning needs, context, and characteristics. Activities include:

The curriculum analysis was conducted by examining the core competencies and learning indicators for the curved-sided geometric shapes material to ensure the e-module aligns with national standards. A needs analysis conducted through teacher interviews revealed that learning is still textbook-centered and has not yet integrated into the local cultural context; therefore, Van der Wijck Fortress was chosen as an example of relevant geometry. An analysis of the school environment indicated that most students have personal devices, thus making the use of digital e-modules feasible.

b. Design Stage

Based on the analysis results, this stage produces a conceptual design for a local culture-based e-module. The design process includes: The e-module design phase begins with determining learning objectives and indicators focused on improving students' mathematical reasoning and learning interest. Afterward, a Learning Implementation Plan is developed using the Discovery Learning model, which encourages students to actively discover concepts through direct learning experiences. The e-module structure is then designed, including an introduction, objectives, main material, contextual examples from Van der Wijck Fortress, exercises, and evaluation. To strengthen the connection between mathematical concepts and the local cultural context, learning videos and cultural

illustrations from Van der Wijck Fortress are also added. This design produces an initial e-module prototype that is further developed using Flipbook Creator software.

c. Development Stage

This stage realizes the design plan into an e-module product that is ready to be tested. The steps taken are: The e-module development phase involved several main steps. First, a Learning Implementation Plan (and e-module content were developed, including materials, sample questions, exercises, and discussions related to the architectural features of Fort Van der Wijck. This approach aimed to strengthen students' mathematical reasoning skills through a realistic local cultural context.

Next, the e-module product was validated by two expert lecturers, a material expert and a media expert. This validation process included assessing aspects of appearance, language, presentation strategies, and content alignment with the applicable curriculum. Based on the validation results, the e-module was then revised according to input and suggestions from the validators to meet the expected feasibility and validity criteria.

After going through the revision stage, the e-module that has been declared valid is declared ready to be implemented in the trial stage for students as the next step in the research and development process.

d. Implementation Stage

The implementation phase aims to test the practicality and effectiveness of the local culture-based mathematics learning e-module. The trial was conducted at a public junior high school in Kebumen Regency, involving two classes: an experimental class (IX A) consisting of 31 students using the local culture-based e-module, and a control class (IX B) consisting of 32 students using conventional learning methods.

The trial began with a pre-test to assess students' initial abilities. Next, learning activities were conducted using the Discovery Learning model, where students actively discovered mathematical concepts through a pre-designed e-module guide. After the learning process was completed, a post-test and a learning interest questionnaire were administered to assess improvements in mathematical reasoning skills and changes in students' motivation for learning.

In addition, practicality questionnaires were collected from teachers and students to assess the e-module's ease of use, appearance, and usefulness in supporting the learning process. The results of this implementation phase serve as the basis for assessing the e-module's effectiveness in improving the quality of mathematics learning in schools.

e. Evaluation Stage

The evaluation phase was conducted to assess the quality of the developed e-module based on three main aspects: validity, practicality, and effectiveness. Validity was determined by expert assessments of the media components, materials, and research instruments used. Practicality was evaluated through teacher and student questionnaires, as well as observation sheets on the implementation of learning, which showed the extent to which the e-module was easy to use and implement in the teaching and learning process. Effectiveness was measured based on pre- and post-test results of mathematical reasoning skills, as well as increased student learning interest after using the e-module.

The evaluation process is carried out formatively during the development stage to improve and perfect the product, as well as summatively after field trials to assess the overall effectiveness of the e-module as a local culture-based learning medium.

Trial Design and Subjects

This study used a pretest-posttest control group design to compare learning outcomes between the control and experimental classes. The subjects consisted of 63 junior high school students: 31 in the experimental class using local culture-based e-modules and 32 in the control class using conventional learning.

The variables tested in this study encompass three main aspects: mathematical reasoning ability, student learning interest, and the practicality and effectiveness of the e-module. This design provides comprehensive data to assess the extent to which the e-module positively impacts students' cognitive and affective abilities in mathematics learning.

Research Instruments and Data Collection Techniques

This study uses three main types of instruments, namely validity, practicality, and effectiveness instruments.

The validity instruments consisted of an e-module validation sheet (material and media aspects), a competency test validation sheet, a mathematical reasoning test validation sheet, and a teacher and student learning interest and practicality questionnaire validation sheet. Assessments were conducted using a Likert scale with a score range of 1 to 5, ranging from very poor to excellent.

The practicality instruments included a teacher practicality questionnaire that assessed the e-module's ease of use, appearance, and contribution to learning, as well as a student practicality questionnaire that assessed the e-module's level of interest, ease of use, and usefulness in aiding understanding of the material. In addition, a learning implementation observation sheet filled out by observers was used to assess the suitability of the learning implementation with the Learning Implementation Plan.

The effectiveness instruments consisted of a competency test, a mathematical reasoning ability test, and a student interest questionnaire. The interest questionnaire covered four main aspects: student interest, attention, engagement, and enjoyment during the learning process. These three types of instruments were used in an integrated manner to assess the quality, feasibility, and impact of the e-module on improving student learning outcomes and motivation.

Data Analysis Techniques

The data analysis in this study aims to assess the quality of the local culture-based mathematics learning e-module at the Van der Wijck Fortress Complex, using valid, practical, and effective criteria. The data analyzed consisted of quantitative (test and questionnaire results) and qualitative (observation and response results).

First, a validity analysis was conducted based on expert validation sheets for the media, materials, test instruments, and questionnaires. Assessment scores were calculated using averages and categorized according to specific intervals. An e-module was declared valid if it achieved an average score of at least 3.39 (the valid category).

Second, practicality analysis was obtained from teacher and student questionnaires and observations of learning implementation. The practicality percentage was calculated using a formula comparing the obtained score to the maximum score. An e-module was considered practical if the results achieved a minimum of 60% and the learning implementation reached 80%.

Third, an effectiveness analysis was conducted by comparing the pretest and posttest results between the experimental and control classes. An e-module was declared effective if there was an increase in learning outcomes, mathematical reasoning, and learning interest, with a minimum completion rate of 75%.

The analysis was conducted using descriptive statistics to describe the improvement in learning outcomes and inferential statistics (normality test, homogeneity test, Hotelling's T^2, and paired sample t-test) to test for significant differences between the two classes. The test was conducted using SPSS 26, with a significance level of 0.05. The results showing significant differences between the experimental and control classes provide the basis for this e-module being valid, practical, and effective for use in local culture-based mathematics learning.

3. Research and Development Result

Initial Product Development Result

Level of analysis

The analysis stage is carried out as a basis for designing e-modules to suit the needs of students, teachers, and school conditions. This analysis includes an analysis of the curriculum, needs, and the school environment. Based on the analysis results, it is known that the school is still using the 2013 Curriculum with the developed material in the form of surface area and volume of various curved-sided geometric shapes, including cylinders, cones, and spheres. The basic competencies that students must master include the ability to generalize surface area and volume and solve contextual problems related to curved-sided geometric shapes.

Interviews with teachers revealed that several obstacles remain in the learning process. Students struggle to grasp math concepts due to nearly two years of online learning. Teachers also have to review incomplete material, making learning time inefficient. Facilities such as projectors and laptops are not being utilized optimally, while violations of the rules regarding cell phone use during lessons persist. Furthermore, online learning during the pandemic has led to a decline in nationalism, as the flag ceremony, traditionally held every Monday, has been discontinued.

On the other hand, many students are not yet familiar with Van der Wijck Fortress, even though the location is quite close to the school and has a building shape that is relevant to the geometry concepts being studied. Based on this, the needs analysis indicates the need for innovative digital-based learning media that can link learning to the local cultural context. The Van der Wijck Fortress-based e-module was chosen because it is considered to empower students to achieve the necessary mathematical competencies, improve reasoning skills and learning interest, assist teachers in conveying mathematical concepts effectively, foster a sense of nationalism through the introduction of local culture, and contribute to the preservation of Indonesian culture through modern learning media.

Stage design

The design phase involved developing an e-module based on the results of the needs analysis. The e-module was designed based on the local culture of the Van der Wijck Fortress Complex with the aim of improving students' mathematical reasoning skills and learning interests. The e-module design was created using Canva and Heyzine Flipbook, resulting in an interactive flipbook that resembles a printed book but can be accessed digitally.

This e-module includes a short video about Van der Wijck Fort as a cultural context to engage students, as well as a math explanation video created by the researcher and some taken from YouTube. Learning materials were adapted from the teacher's handbook, student's textbook, and relevant online sources to align with the curriculum. Furthermore, the researcher developed pre- and post-test questions to measure students' reasoning skills.

Other research instruments prepared at this stage include a Lesson Implementation Plan (RPP), a student interest questionnaire, observation sheets, and a practicality questionnaire for teachers and students. The learning design in the e-module follows a contextual flow involving the stages of real-world problem identification, concept exploration, practice, reflection, and evaluation. This pattern adheres to the principle of Realistic Mathematics Education (RME), which emphasizes that students must understand mathematical concepts through real-world experiences and situations relevant to their lives.

Development stage

The development phase is the process of transforming the design into a complete e-module. This phase involves the creation of visual content, videos, and interactive activities that incorporate local cultural elements into mathematics learning. The e-module was developed by combining elements of Van der Wijck Fortress culture with concepts of curved-sided geometry, presenting the material in a step-by-step and contextual manner, helping students understand the relationship between mathematical concepts and everyday life.

The e-module structure consists of three main sections. The first section is the introduction, containing an introduction, concept map, and learning objectives. The second section is the learning activities, which include exploration of concepts through cultural context, exercises, and reflection. The third section is the conclusion, containing a summary, glossary, and final test. Each learning activity is designed to actively engage students in understanding concepts through observation and discussion based on the local cultural context.

To enhance interactivity and learning motivation, the e-module also includes supporting media such as instructional videos, interactive quizzes, and a student reflection space. After the e-module was developed, a validation process was conducted by subject matter and media experts to assess its suitability in terms of content, presentation, language, and compliance with applicable core competencies. The validation results indicated that the e-module was suitable for field testing after minor revisions were made based on the validators' suggestions.

Implementation stage

The implementation phase was conducted to test the e-module's feasibility and effectiveness, which had been declared valid by experts. The trial was conducted at SMP Negeri 3 Gombong with ninth-grade students over several learning sessions. The activities were implemented using a Realistic Mathematics Education (RME) approach based on the local cultural context, in this case the Van der Wijck Fortress Complex.

Before the lesson began, students were given a pretest to measure their initial mathematical reasoning abilities and a questionnaire to assess their interest in learning mathematics. The lesson was then implemented using an interactive e-module developed by the researcher. The teacher acted as a facilitator and director throughout the learning process. Each session began with an apperception activity through the screening of a short video featuring Fort Van der Wijck as the learning context. This activity aimed to foster students' curiosity about the relationship between mathematical concepts and the shapes and structures of buildings in their environment.

Students were then guided to observe, discuss, and solve contextual problems presented in the e-module. The Student Worksheets (LKPD) included in the e-module helped students discover concepts through exploration and group collaboration. The teacher monitored the discussion, provided feedback, and ensured all students were actively involved. Despite technical challenges such as internet connection disruptions and limited electronic devices, the learning process continued smoothly because students demonstrated high enthusiasm and were able to adapt to the e-module-based learning system.

At the end of each session, students were asked to reflect on the learning activities they had completed. This reflection aimed to enable students to recognize their own thought processes, understand potential errors, and improve their learning strategies. After completing the entire learning process, students were given a posttest to measure improvements in mathematical reasoning skills and completed a media practicality questionnaire to assess the ease and attractiveness of the e-module during use. Based on observations during the implementation process, students appeared more active, enthusiastic, and able to work well together. Teachers also stated that the use of local culture-based e-modules helped deliver material in a more engaging, efficient, and contextual manner.

Evaluation stage

The evaluation phase was conducted to assess the overall quality of the e-module based on three main aspects: validity, practicality, and effectiveness. This evaluation aimed to determine the extent to which the e-module achieved learning objectives and positively impacted students' mathematical reasoning skills and learning interest.

Validation results by material and media experts indicate that the local culture-based e-module of the Van der Wijck Fortress Complex is highly valid. In terms of content, the e-module is deemed to align with the core competencies and learning indicators established in the 2013 Curriculum, and to align the material with the cultural context used. In terms of appearance and language, the e-module is deemed engaging, communicative, and easy for students to understand.

The practicality aspect was measured through observations of the learning process and responses from teachers and students. The results showed that the e-module was highly practical for use in the teaching and learning process. Teachers found this tool helpful because it facilitated material delivery, while students felt more motivated and found it easier to understand mathematical concepts through engaging visual displays and real-world context-based activities.

The effectiveness aspect was assessed from the results of the pretest and posttest of mathematical reasoning ability and the student learning interest questionnaire. Analysis of the test results showed a significant increase in mathematical reasoning ability after using the e-module. The average student score increased significantly compared to before the learning, indicating that the e-module was effective in helping students understand mathematical concepts through the context of local culture. Furthermore, the learning interest questionnaire showed an increase in positive attitudes toward mathematics, where students became more enthusiastic, confident, and interested in learning the material more deeply.

Overall, the evaluation results demonstrate that the local culture-based mathematics learning e-module from the Van der Wijck Fortress Complex meets three main criteria: validity, practicality, and effectiveness. This e-module is suitable for use as an innovative learning medium that not only improves reasoning skills and interest in mathematics but also fosters a love of local culture and nationalism among students.

Product Trial Result

The product trial results showed an increase in students' mathematical reasoning abilities and learning interest after using the e-module based on the local culture of Benteng Van Der Wijck. Based on the results of the N-Gain calculation, a value of 0.46 was obtained, which is included in the medium-high category according to Hake's (1999) classification. This indicates that the use of the e-module has a positive influence on improving students' mathematical reasoning abilities. Students who initially had difficulty understanding the concept of the System of Linear Equations in Two Variables (SPLDV) showed an increase in understanding after using the e-module designed with a contextual approach and local cultural integration.

Table 1. Results of Values *Cronbach Alpha* Questionnaire *Mathematical Growth Mindset.*

Stage	*Average Score*	*Improvement*
Before (Pre-test)	70.12	-
After (Post-test)	86.92	24%

In addition to improvements in mathematical reasoning, there was also a significant increase in student interest in learning. Based on questionnaire data, the average interest score before using the e-module was 70.12, while after the learning process, it increased to 86.92, a 24% increase. This increase indicates that the developed e-module is effective in motivating and engaging students in mathematics learning.

Practical Data Analysis

The practicality of the e-module was assessed through observations of the learning implementation conducted by mathematics teachers during the e-module implementation process in the experimental class. Observations were conducted at each meeting to assess the extent to which teacher and student activities were carried out in accordance with the e-module-based Learning Implementation Plan (RPP) developed. The results of the summary of the learning implementation observations are shown in Table 2 below.

Table 2. Learning Implementation Percentage.

Meeting	Teacher's Activity	Student's Activity	Teacher's Activity	Student's Activity
1st Meeting	90%	90%	93%	93%
2nd Meeting	90%	90%	90%	97%
3rd Meeting	93%	93%	93%	93%
4th Meeting	90%	90%	97%	97%
5th Meeting	90%	90%	93%	93%
6th Meeting	93%	93%	93%	93%
7th Meeting	90%	90%	97%	97%
8th Meeting	90%	90%	93%	97%
Average Percentage	91%	91%	94%	94%
Average of Learning Implementation	91%		94%	

Based on the results in Table 2, the learning implementation in the experimental class reached an average of 94% for both teacher and student activities, while in the control class the average was 91%. This value indicates that the local culture-based mathematics learning e-module is highly practical for use in teaching and learning activities. Teacher and student activities were carried out well according to the stages of discovery learning, indicating that the e-module is easy to implement without requiring complex technical adjustments.

These observations reinforce the findings of practicality questionnaires conducted by teachers and students, which found the e-module to be easy to use, visually appealing, and helpful in increasing student engagement in mathematics learning. Therefore, this e-module is suitable for use as an innovative learning medium in junior high schools.

Product Revisions

The product revision process was conducted once after the validation stage, involving two validators: a material expert and a media expert. This revision aimed to refine the Local Culture-Based Junior High School Mathematics Learning E-Module at the Van der Wijck Fortress Complex before its implementation in the field trial phase. Revisions were not conducted more than once because no significant obstacles or errors were encountered during the e-module's implementation.

Revisions were made based on input provided by the validators regarding the material, media, and research instruments. Based on the validation results, several sections of the e-module needed to be revised to improve content clarity and cultural contextual suitability. Regarding the material, the validators recommended revising the operational verbs in the

learning indicators to make them more specific and measurable objectively. Furthermore, the material presented should also reflect the relevant cultural context and demonstrate how students can learn it independently within the local cultural environment. The validators also emphasized the importance of adding the name of the supervising lecturer to the author section of the e-module and adjusting the cover design to include important information regarding the target audience and the context of the e-module.

Regarding the instrument aspect, the validator provided several notes to correct ambiguous sentences in the mathematical competency and reasoning ability tests to make the questions easier for students to understand. A similar issue was found in the mathematics learning interest questionnaire, where some sentences needed to be simplified to avoid multiple interpretations. Furthermore, in the practicality assessment instrument for teachers and students, the validator suggested improvements to the grammar, filling instructions, and clarity of sentence wording to make the instrument easier to use during the practicality testing process.

After all input was analyzed and implemented, improvements were made to the e-module and all research instruments. The revised results showed that the product met the validity criteria in terms of content, presentation, and language, and was ready to be implemented in the learning process. During the field trial in the experimental class, no issues requiring additional revisions were found, so the e-module was declared suitable for use as an effective local culture-based learning medium in improving students' mathematical reasoning skills and learning interest.

Final Product Review

The quality of a product can be determined by examining its validity, practicality, and effectiveness (Nieveen & Folmer, 2013). The next step is the evaluation phase, which evaluates the developed product based on data obtained from both the validator and the results of the trials. The following explains each aspect of product quality.

Validity of E-Modules

Based on the validation results conducted by two validators, namely material experts and media experts, the Local Culture-Based Junior High School Mathematics Learning E-Module at the Van der Wijck Fort Complex was declared valid and suitable for use in the learning process. The assessment of the material aspect showed that the e-module content was in accordance with the curriculum, learning indicators, and the objectives to be achieved. The material was presented in a communicative, systematic, and contextual language with the students' local cultural environment. The validators also assessed that the e-module had met the principle of construct validity because each learning component, from objectives, activities, to evaluation, had a logical and consistent integration.

In terms of media, the validator gave a positive assessment of the visual appearance, navigation, and interactivity of the e-module. The design created using the Canva application and developed into an interactive flipbook with Heyzine was deemed capable of increasing the attractiveness and comfort of student learning. The colors, layout, and illustrations used have been adjusted to the characteristics of junior high school students. Based on the overall validation results, the e-module obtained an average score above the minimum eligibility criteria so that it is categorized as a "very valid" learning medium. This indicates that the developed product meets the standards of content and media validity as stated by Nieveen (1999) that a valid product is a product developed based on a strong theoretical foundation and has consistency between learning components.

Practicality of E-Modules

The practicality aspect was evaluated based on observations of the implementation of learning and responses from teachers and students after using the e-module in the learning

process. Observations showed that teacher activity during the learning process reached an average of 98.6%, while student activity reached 95%, with an overall average of 96.8%, which is categorized as very practical. This indicates that the e-module can be used well without requiring intensive guidance from the developer and is easily integrated into classroom learning. Teachers responded positively to the structure and clarity of the e-module content, as the learning guides, materials, and student activities were presented in detail and were easy to follow. Students also stated that the e-module was engaging, interactive, and helped them understand the concepts of surface area and volume of curved-sided solids. Furthermore, the e-module, based on the local culture of Benteng Van der Wijck, made the learning process more meaningful because the material was linked to students' real-life contexts. This finding aligns with Sutisna et al.'s (2021) findings that the use of electronic learning media can increase students' motivation, understanding, and active engagement in learning activities. Thus, the results of the practicality test prove that the developed e-module is included in the very practical category, because it can be used effectively by teachers and students and supports an active, contextual, and efficient learning process.

Effectiveness of E-Modules

The effectiveness of the e-module was evaluated based on the improvement in students' mathematical reasoning ability and learning interest before and after learning using the e-module. Based on the analysis results, the N-Gain value was 0.46, which is included in the medium-high category according to Hake's (1999) classification. This value indicates a significant improvement in students' mathematical reasoning ability after using the e-module based on the local culture of Benteng Van der Wijck.

Furthermore, students' interest in learning also increased significantly. The average interest score before using the e-module was 70.12, while after the learning process, it increased to 86.92, a 24% increase. This data indicates that the e-module is not only effective in improving students' cognitive abilities but also their affective aspects, such as motivation and interest in learning mathematics.

These findings support the research of Moreno-Guerrero et al. (2020), which states that the use of digital-based learning media can significantly improve student learning outcomes and interest. Similarly, Sumarwati et al. (2020) emphasized that technology integration in learning media can encourage active student engagement and strengthen higher-order thinking skills. Thus, the local culture-based e-module of Benteng Van der Wijck was declared effective in improving students' mathematical reasoning skills and learning interest through contextual and interactive learning.

4. Conclusion

Based on the results of the research and development that has been carried out, it can be concluded that the Local Culture-Based Junior High School Mathematics Learning E-Module at the Van der Wijck Fort Complex has fulfilled three main aspects, namely validity, practicality, and effectiveness.

In terms of validity, expert assessments indicated that the e-module was highly valid, both in terms of content and media. The material presented aligned with the curriculum, learning objectives, and the local cultural context. The engaging media presentation and use of interactive flipbook technology made the e-module easy to use and suited to the characteristics of junior high school students.

From a practical perspective, observations of learning implementation showed that teachers and students were able to use the e-module very well. Teacher and student activities during the learning process achieved an average implementation rate of 96.8%, which is considered very practical. This demonstrates that the e-module is easy to implement in

teaching and learning activities without requiring complex technical assistance, while also encouraging active student engagement throughout the learning process.

In terms of effectiveness, the trial results showed a significant increase in students' mathematical reasoning abilities and learning interest. The N-Gain value of 0.46 indicates an increase in mathematical reasoning abilities in the medium-high category, while the average student learning interest increased by 24% after using the e-module. These findings indicate that e-module-based learning with a local cultural approach can strengthen students' motivation, engagement, and understanding of the material being taught.

Overall, the development of this local culture-based e-module contributes to improving the quality of mathematics learning through the integration of cultural values, digital technology, and a contextual approach. This product not only supports students' academic achievement but also plays a role in cultural preservation and fostering a sense of nationalism among students.

However, this study still has limitations in the accessibility of the e-module, which relies on an internet connection and digital devices. Therefore, further research is recommended to develop an offline version of the e-module and expand its implementation to other levels and subjects to achieve broader benefits.

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