International Journal of Innovative Research and Scientific Studies, 8(4) 2025, pages: 1347-1362

IJIRSS
International Journal of Innovative Research & Scientific Studies

ISSN: 2617-6548

URL: www.ijirss.com

Development of ethnomathematics-based e-modules to improve student learning outcomes on circle material

Aleksius Madu[1*], Imelda Hendriani Eku Rimo[2], Bakher Nenotaek[3], Alexandra Febriyanthy Agil[4]

[1,2,3,4]*Department of Mathematics Education, Universitas Nusa Cendana, Kupang, Indonesia*.

Corresponding author: Aleksius Madu (*Email: leksi_madu@staf.undana.ac.id*)

Abstract

This study aims to develop an e-module on grade XI circle material based on Sawah Lodok ethnomathematics as a representation of the local wisdom of the Manggarai community with the help of the Canva application. This e-module development uses the Research and Development (R&D) model with the ADDIE (Analysis, Design, Development, Implementation, Evaluation) approach. The findings showed that the developed e-module was declared valid and practical by expert validators and practitioners and received positive responses from students. The effectiveness test showed a significant increase in student learning outcomes after using the e-module. The ethnomathematics-based e-module on circle material developed is effective in improving student learning outcomes. This e-module successfully integrates the mathematical concept of circles with relevant local cultural contexts, thus making learning more meaningful and easier for students to understand. The practical implication of this research is the availability of alternative innovative teaching materials that can be used by teachers to create more engaging and interesting mathematics learning. This e-module can also be a reference for curriculum developers to develop similar teaching materials on other mathematics topics, while still paying attention to the potential of ethnomathematics in local culture.

Keywords: E-module, Ethnomathematics, Learning innovation, Learning mathematics, Local wisdom.

DOI: 10.53894/ijirss.v8i4.8069
Funding: This study received no specific financial support.
History: Received: 24 April 2025 / **Revised:** 30 May 2025 / **Accepted:** 3 June 2025 / **Published:** 24 June 2025

Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.
Transparency: The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.
Acknowledgments: We would like to express our gratitude to all those who have assisted in this research process. more specifically the validators, grade XI students, Mathematics Teachers and the Principal of State Senior High School 1 Kupang. We would also like to express our gratitude to the Head of the Mathematics Education Study Program, the Head of the Faculty and the Head of Nusa Cenda University who provided the opportunity for researchers to develop knowledge through the research conducted.
Publisher: Innovative Research Publishing

1. Introduction

In essence, every individual needs education because education is the key to life. It is the main key in life. education is a deliberate effort from the community and government that works together in providing direction, teaching, and training to prepare students to face [1] various challenges in the future in various life contexts [2, 3]. Education also has an important role because without its, humans will have difficulty in developing. Therefore, education must be provided with the right focus to produce individuals who are qualified, able to compete, and have high moral and ethical integrity [4, 5]. One of the fields of study that plays an important role in Zainuri, et al. [6] education and in solving various problems of everyday life is mathematics [7, 8].

Mathematics is one of the subjects studied Nabila, et al. [9] by students at the formal education level at the formal education level. Mathematics is taught at all levels of education, starting from elementary school [10] to develop students' abilities in thinking logically, analytically, systematically, critically [11] and creatively, as well as the ability to work together [12, 13]. Mathematics also functions as a basic science for students as a foundation for application in other fields of study.

Success in learning can be influenced by the utilization of learning resources or media used during the learning process [14]. Therefore, electronic modules are needed as teaching materials in the learning process [14]. E-Module is a learning tool designed to assist the learning process in achieving learning outcomes. In the E-Module, there is a series of learning experiences that are [15] arranged in a planned manner to help students achieve predetermined learning objectives. E-Modules at least include learning objectives, learning steps, materials, and additional references that support managing the learning process.

Based on preliminary observations at State Senior High School 1 Kupang, students only use textbooks and student worksheet teaching materials; no one has used electronic modules in learning mathematics, and there is also no mathematics learning that relates to the culture in the school [16-18]. Mathematics learning needs to present a view of mathematics that is related to the culture and customs of students, so that they can understand mathematics through their own local culture [19]. Mathematics is one of the subjects that is considered difficult [20] by many students. This difficulty is often caused by learning methods that are still abstract and do not relate the material to everyday life. To increase students' understanding and interest in mathematics, innovation is needed in the delivery of material that is more contextual and relevant to local culture [21]. In addition to linking to the local cultural context in mathematics learning [22] it can also bring students closer to mathematics itself.

Culture is a set of values and ideas based on beliefs shared by a group of people in an environment and passed down from generation to generation [23-25]. In everyday life, education and culture are inevitable because culture reflects a comprehensive unity in society [26] while education is a basic necessity for every individual. One approach that connects culture with mathematics is ethnomathematics, which focuses on teaching mathematics by incorporating cultural themes or linking to culture. Ethnomathematics is known as mathematics learning with a cultural theme or mathematics learning that connects with culture [27, 28].

Ethnomathematics as an approach to learning Hendriyanto, et al. [29] mathematics can be a solution in bringing mathematical concepts closer to students' lives [30, 31]. One example of the application of ethnomathematics is linking the concept of circles with the *sawah lodok* field system, which is the local wisdom of the community [32]. Manggarai people, East Nusa Tenggara. The *sawah lodok* field has a unique shape that resembles a circular pattern with a jurying-shaped land division, which is directly related to concepts in circular geometry such as radius, diameter, arc, sector, and central angle.

However, in reality, circle material in mathematics learning is still taught in a conventional way and has not been associated with local wisdom. This results in students having difficulty understanding the concept of circles in depth. Therefore, it is necessary to develop ethnomathematics-based teaching materials that not only improve student understanding but also introduce and preserve local culture.

Along with technological developments, the use of interactive e-modules Dewiyani et al. [33], is one of the innovations in learning that is more effective and interesting. E-modules allow a more dynamic presentation of material with visual displays, animations, and interactive features that can increase student engagement. In this study, the e-module was developed using Canva, a digital design platform that allows the creation of interesting and accessible learning media for students and teachers.

This research focuses on developing an ethnomathematics-based interactive e-module that Muzaki, et al. [33] integrates the concept of a circle with *sawah lodok*, the local wisdom of the Manggarai people, using the Canva application.

In addition, this research has high urgency for several reasons: (1) Improving the Quality of Mathematics Learning. Mathematics is often considered a difficult and abstract subject. With an ethnomathematics approach based on e-modules, students can more easily understand mathematical concepts through real examples from their own culture. (2) Preservation and Integration of Local Wisdom in Education. *Sawah lodok* is a cultural heritage of the Manggarai community that is rich in mathematical values. The use of local wisdom in learning not only improves students' understanding but also Purnama, et al. [34] helps preserve the culture. (3) Innovation in Digital Teaching Materials. The use of Canva in the development of e-modules allows for a more interesting, visual, and interactive presentation of materials compared to conventional Muzaki, et al. [33] textbooks. (4) Support for *Merdeka Curriculum*. The *Merdeka Curriculum* emphasizes contextual and project-based learning. This ethnomathematics-based e-module supports the concept of culture-based learning and innovative projects.

2. Literature Review

2.1. E- Module (Electronic Module)

The technology available today is highly influential in the development of education. One of the utilizations of technology is in the form of e-modules that can support the learning process [26]. E-modules are the result of modifying printed modules into electronic modules that are presented in the form of text, images and can be accessed via smartphones [35, 36]. E-modules are small and practical, so they can be accessed anytime and anywhere. The benefits of using e-modules in learning [37] include improving the quality of learning in an interactive and interesting way [38]. Interactive e-modules are compiled from media elements into a unity in the application on the Android system [39]. Android is an operating system developed from the Linux operating system, which is mobile and used on mobile devices, namely smartphones [40, 41]. The use of Android-based e-modules can increase students' interest in learning [42] mathematics.

To develop an e-module, it is necessary to pay attention to several characteristics that an e-module must have. These characteristics are the same as those of a module, among others [43]: (1) Self-instruction, meaning that the e-module developed must have a clear and easy-to-use instruction system. (2) Self-contained, the material presented in the e-module must be able to Azriyanti [44] answer the achievement of the expected learning objectives. (3) Standalone means that the teaching materials developed must stand alone without any dependence on other teaching materials. (4) Adaptive, meaning that e-modules are developed according to the times. (5) User-friendly, the use of language and terms in e-modules must be easy to understand and practical. (6) Consistency, meaning that the preparation of e-modules should be consistent in the use of fonts [15], spaces, and layouts.

E-Modules also have functions and purposes that can be utilized by teachers and students in Sulistiyoningsih and Surachmi [45], carrying out learning in the classroom. These functions include [45-47]: (1) Independent teaching materials, this means that using e-modules in the learning process [48] serves to increase student independence in learning; (2) substitute for the function of educators, meaning that e-modules function as a medium that can assist in delivering subject matter to students so that it is easier to understand according to the level of knowledge each student has; (3) as an evaluation tool, it can be interpreted that e-modules have a function as a measuring tool and assessment of students' cognitive levels and students' mastery of the material that has been taught [49]; and (4) As a reference material for students, because e-modules contain various materials that will be studied by students, in this case e-modules can be used as a reference for students in the learning process [50].

While the objectives of e-modules include [51, 52]; (1) To further clarify and simplify the presentation and messages so that they are not too verbal [48]; (2) to overcome the limitations of space, time, and sensory power of both students and teachers; (3) used as an appropriate innovation and variation to increase student motivation and enthusiasm for learning; (4) to develop students' abilities to interact directly with the environment and other learning resources that enable them to learn independently according to their abilities [50].

2.2. Ethnomatematika

Ethnomathematics is a field of study that explores the relationship between mathematics and culture Waiswa, et al. [53]. It involves understanding and analyzing how mathematical concepts are reflected in Muhaimin, et al. [54] in different aspects of human life, including in cultures, traditions, and everyday practices [55]. Ethnomathematics also studies the ways in which people from different ethnic and cultural groups use mathematics in their own contexts, as well as how this mathematical knowledge is passed on and maintained through generations [29, 56]. One important aspect of ethnomathematics is the recognition that mathematics not only exists in textbooks or in the classroom but also in people's everyday activities and practices. For example, in the traditional cultures of indigenous tribes in different parts of the world [57], we can find examples of the use of mathematics in activities such as determining animal migration patterns, measuring time based on seasonal changes, or planning the layout of houses and villages.

Ethnomathematics involves understanding how mathematics is practiced, understood and internalized in a particular cultural context [58, 59]. This means recognizing that mathematics is not only limited to the concepts and applications taught in schools but also involves the mathematical knowledge and practices that people have and use in their daily lives. Ethnomathematics has paved the way for the development of Amelia et al. [61], a more inclusive and context-based approach to mathematics learning [29]. Rather than just focusing on abstract mathematical concepts and formulas, the ethnomathematics approach allows students to see how math is related to their daily lives, their culture, and the world around them. This can help increase students' interest and motivation towards math, as well as help them understand mathematical concepts better. However, while ethnomathematics has made valuable contributions to our understanding of the relationship between mathematics and culture [54], the field also faces certain challenges. One of the main challenges is the difficulty [60] in integrating ethnomathematics concepts into the existing mathematics curriculum [61]. Many mathematics curricula are still based on conventional approaches that focus on abstract mathematical concepts and formulas, without considering the cultural context or daily lives of students.

Thus, ethnomathematics leads to a broader understanding of mathematical concepts within their cultural and historical contexts. The study of ethnomathematics not only allows us to see the different ways people use mathematics in their daily lives but also provides valuable insights into the Iannone, et al. [62] diversity of mathematical knowledge and skills around the world.

There are several domains or mathematical activities in everyday life, including grouping activities, counting, measuring, designing buildings or tools, making patterns, counting, determining [63] locations, games, explaining, and so on. Some of these domains (activities) are explained as follows [64, 65]: (1) Counting activities are related to the question "how many."

The forming elements of counting activities can use traditional media such as stones, leaves, or other natural materials. Additionally, counting activities can also be formed with movements or strokes. Counting activities generally demonstrate the activity of using and understanding odd and even numbers, among others. (2) Measuring activity [66]. Measuring activity is related to the Hermanto and Nurlaelah [66] form of the question "how much". In ethnomathematics, traditional measuring tools are often found in the form of bamboo pieces and tree branches. In addition, traditional people also use their hands as the most practical and effective measuring tool. Apart from using your hands, you can also use a ruler as a standard measuring tool. To measure time, liquid objects, and weight, different methods and tools are used in each culture. This measuring activity is also related to numbers [67]. Thus, it also includes the activities of comparing, ranking, and qualifying the characteristics of an object. (3) Activity of Determining Location, some basic concepts of geometry begin with determining the location used to determine changes in movement, or determining the displacement from one point to another. Where later between the displacements can form a pattern in the form of a geometric field. Determining location is related to finding a path, placing an object, determining direction, and determining the relationship of objects to one another. This relates to spatial ability, how spatial conceptualization and how an object is positioned in the spatial environment [67]. Mapping, navigation, and organization of spatial objects are found in all cultures and form important mathematical knowledge. (4) Building Design Activities: Building design activities have been applied by all types of cultures. If locating activities are related to position and orientation, then building design activities are related to all tools used for the purpose of designing a building or designing a tool. Building design is also concerned with large-scale structures such as houses, villages, roads, gardens, fields, and cities. All of these become sources and parts of the formation of mathematical knowledge among members of cultural groups. (5) Playing Activities: Playing activities are related to various traditional games in society that involve types of mathematical reasoning, probability, and strategic thinking. Games contain rules, procedures, materials used, and standardized criteria. (6) Explaining Activities: making explanations is an activity that hones human understanding related to experiences gained from their environment, with regard to one's sensitivity in reading natural situations. In mathematics, making explanations relates to questions like "why" geometric shapes are the same or symmetric, why the success of one is the key to the success of the other, and other matters related to mathematical laws. In answering these questions, symbolization in the form of real evidence is used.

The role of ethnomathematics in understanding culture and society is significant. The field provides deep insights into how mathematical concepts are reflected, used, and internalized in different aspects of human life. Here are some of the key roles of ethnomathematics in understanding culture and society [68, 69]: (1) Revealing diverse cultural perspectives. Mathematical etymology allows us to see the diversity of cultural perspectives on mathematics. Every culture has a unique way of viewing and using mathematics, and ethnomathematics helps us understand this variation through cultural studies and ethnographic analysis. (2) Valuing local wisdom. Through ethnomathematics research, we can appreciate and recognize the local wisdom that exists in a particular society. Traditional mathematical practices, such as the systems of addition, measurement, and calculation used by a particular society, reflect knowledge and skills that have been passed down from generation to generation [70]. (3) Understanding the relationship between man and nature. Mathematics also helps us understand the relationship between humans and nature [71]. For example, mathematical practices in navigation, agriculture, and astronomy reflect the ways in which humans interact with their natural environment and use mathematical knowledge to understand and manage that nature. (4) Supporting cultural preservation. Ethnomathematics can help in cultural preservation by maintaining and documenting the inherited mathematical knowledge within a particular society. This can help communities to maintain their cultural identity and promote the sustainability of their cultural heritage. (5) Providing alternatives in mathematics learning. Mathematics can provide alternatives in learning mathematics in schools. The integration of ethnomathematics concepts in the mathematics curriculum can help students to see the relevance and application of mathematics in their daily lives [53] and increase their interest and motivation in the subject [72]. (6) Valuing diversity of knowledge. Mathematics helps us to appreciate the diversity of mathematical knowledge and skills across cultures. It shows that there is no single definition of what "math" is, and that mathematical concepts can vary significantly between different cultures and societies.

Thus, the role of ethnomathematics in understanding culture and society is very important. Through this approach, we gain a deeper insight into the relationship between mathematics and culture, as well as Lubis and Yusnita [20] understand the values, practices and mathematical knowledge held by a particular society.

2.3. Canva

Canva is a design development tool that can be used by everyone without the need for special skills in the field of design. Accessing Canva can be done through the website or application, so an internet connection is required. Canva offers a variety of templates and elements that can be used for free or paid. Canva is easy to use and very practical because it integrates other applications that have collaborated, which can facilitate the design process.

Canva can be one of the applications for making e-modules. Canva has several advantages, namely [73, 74]: (1) Ease of use that allows educators, even those with limited design skills, to create visually appealing e-modules without requiring extensive training or experience in graphic design; (2) Canva provides a variety of multimedia options, including animations, images, videos, and templates. This variety allows developers to create engaging and interactive content that can capture students' attention and cater to different learning styles [42]. The use of Canva allows the upload of high-quality images and offers many design elements that can enhance the visual appeal of e-modules. (3) Canva can be accessed both as a web app and a mobile app, making it easy for educators to work on their e-modules from various devices. (4) Canva supports collaborative work, allowing multiple users to contribute to the e-module design simultaneously. This feature is especially beneficial for teams of educators working together to develop thorough learning materials. (5) Canva has features available

for free, and additional features are accessible through paid subscriptions. Canva's paid subscription is affordable enough to produce high-quality e-modules.

Besides having advantages, Canva also has disadvantages, namely (1) cannot be used while offline [73, 74] (2) requires premium account access for some features and templates, (3) Long video download, (4) not yet equipped with table features.

2.4. Canva-assisted Ethnomathematics-Based E-Module

The application of ethnomathematics in e-modules will be made in the form of material culture, namely in the form of physical or concrete objects as a result of human work [75]. The material object in East Nusa Tenggara, which is the main target of this research, is *Sawah Lodok*. Because *Sawah Lodok* is easier to explore and is related to the learning material discussed, namely, the Circle.

Canva-assisted ethnomathematics-based e-modules are e-modules containing material, sample questions, and practice questions and accompanied by instructions and activity steps in them that contain culture [76]. The e-module can be made with the help of Canva. Creating e-modules that can be accessed online can be done using the Canva software. Canva is not only useful for e-modules, but also for creating e-books, digital magazines [44], catalogues and more [77, 78]. Like presentation materials, advertising designs, and others, Canva allows users to switch to the next or previous page smoothly. The purpose of creating this E-module is to improve students' understanding of circle material and to develop analytical thinking skills in solving problems related to circles.

The following is an explanation of the parts in the Kurniawan [79] ethnomathematics-based e-module with the help of Canva in this study, namely: (1) Cover section. The display on the cover will include elements of *Sawah Lodok* related to the material to be taught. The components in this cover include: a) Title of the e-module, adjusted to the topic discussed, namely "Circle"; b) Learning Outcomes and Learning Objectives; and c) Learning instructions (student instructions) [32]. **(2)** The content section of the e-module [10] contains: a) Introductory material, containing brief information about the material to be studied, which is of course related to ethnomathematics; b) Supporting information, containing additional information that serves as a reference in problem formulation, for example, information about Ethnomathematics objects that exist in the discussed topic. c) Core material, namely Canva, which presents reading material on Circles, equipped with culture according to the abilities of students who wish to improve.

3. Materials and Methods

3.1. Type of Research

This type of research uses a research Madona, et al. [80] and development (R&D) design [75]. Development research is a way to develop products and test the effectiveness of these products [42]. This type of research was chosen because it can produce new products with high validity. The developed product is an ethnomathematics-based E-module created with the help of Canva for class XI mathematics subjects at State Senior High School 1, Kupang.

3.2. Research Subjects

The subjects used in this study were students of class XI of State Senior High School 1 Kupang, and mathematics teachers in class XI.

3.3. Research Design

The development model in this study Erniwati, et al. [26] is the *ADDIE* development model (Analysis, Design, Development, Implementation, and Evaluation) [81, 82]. The *ADDIE* development model is still very relevant to use because this model can adapt well to various conditions [83]. There are several reasons why the *ADDIE* model remains relevant and should be applied today. The *ADDIE* model can adapt well to various conditions [83] so the model is still possible to implement at this time. The *ADDIE* model offers great flexibility in dealing with problems and is known to be effective for learning. In addition, the model provides systematic steps for product development, including revision and evaluation at each stage.

Table 1.
ADDIE Branch Development Model and ADDIE E-Module Development Model Based on Ethnomathematics.

No	Stages	Research Steps
1.	Analysis	1. Literature review analysis
		2. Student, teacher, and school analysis
		3. Needs analysis
2.	Design	1. Media Design: Collect references and design materials, create concept maps
		2. Material Design: Developing materials with ethnomathematics elements
		3. Instrument design: Developing supporting instruments
		4. Storyboard
		5. Design stage evaluation
3.	Development	1. Product creation
		2. Media and material validation
		3. Validation of test instrument feasibility test (content, construct, reliability, difficulty level, and distinguishing power) of students' numeracy literacy skills
		4. Limited class trial
		5. Evaluation of the development stage
4.	Implementation	1. Implementation of products that have been developed into learning
		2. Giving pre-test and post-test questions, as well as teacher and student response questionnaires
		3. Evaluation at the implementation stage
5.	Evaluation	Evaluation based on the results of teacher and student responses

3.4. Research Data

Data collection techniques in this study used questionnaires and tests [75]. Questionnaires were used to obtain data on the level of validity and practicality of the ethnomathematics-based e-module assisted [75] by Canva. The test technique was used to obtain data on the effectiveness of the e-module. The test was conducted once in the form of a descriptive question. The data in this study include the validity test, e-module practicality test, and test results on the circle material to evaluate the effectiveness of the e-modules.

3.5. Data Analysis

Data analysis techniques in this research [49] and development are adjusted to the type of data, namely qualitative data and quantitative data [11]. For qualitative data, the data analysis technique is conducted descriptively. In this case, researchers collected written and oral information through interviews and input or suggestions from class XI teachers, as well as suggestions from material validators, media validators, and test instrument validators to be analyzed and formulate conclusions as a basis for taking action on development. As for quantitative data analysis, data analysis techniques were obtained from the scores on the validation sheets of material experts, media experts, as well as feasibility questionnaires and responses given to teachers and students of class XI of the State Senior High School I Kupang. The value obtained from each expert validator is calculated using a formula to determine the validity and feasibility of the learning media. Learning media can be categorized as valid or feasible if the validation value reaches the aspects of the four rating scales in the validation questionnaire and response questionnaire as in Table 2 of the learning media validity criteria below.

Table 2.
Valid Criteria.

No	Criteria	Average
1	Very Valid	4≤ KV < 5
2	Valid	3≤KV<4
3	Less Valid	2≤KV<3
4	Not Valid	1≤KV<2

Source: Sudarmanto, et al. [49]

To calculate the practicality of the Toshpulatov [84] e-module, the research results were obtained through questionnaires and ethnomathematics-based electronic learning media assisted by the Canva application. Students and teachers were asked to determine the practicality of the e-module being studied. The practicality value is calculated using the following formula [44]:

$$NA = \frac{S}{N} x100\%$$

Description:
NA: Final Grade
S: Score obtained
N: Maximum Score
The assessment results are grouped based on their level of practicality as shown in Table 3.

Table 3.
Categories of Practicality of Ethnomathematics-Based Mathematics Learning e-Modules with Canva Assistance.

No	Achievement Level (%)	Category
1	81 – 100	Very Practical
2	61 – 80	Practical
3	41 – 60	Moderately Practical
4	21 – 40	Less Practical
5	0 – 20	Not Practical

Source: Saputra, et al. [85].

For the effectiveness of the e-module, the researchers conducted a learning outcome test related to the circle material. The results of the residual processing value can be expressed in Table 4, to determine the effectiveness of the product developed.

Table 4.
Criteria for Assessing the Effectiveness of Ethnomathematics-Based E-Modules Assisted with Canva Application.

No	Final Grade	Criteria
1	76 – 100	Very Effective
2	56 – 75	Effective
3	40 – 55	Moderately Effective
4	0 – 39	Less Effective

Source: Sari Maulina Harahap [86].

4. Result and Discussion

4.1. Result

E-Modules are the result of this research that can help students learn flexibly and independently. The ADDIE development model in this study can be explained as follows. (1) Analyze. The analysis was conducted based on the circle material, which students did not understand because the teacher had difficulty delivering the material. The lecture method is not suitable because it is difficult for teachers to observe students' learning progress. Limited face-to-face meetings (lesson hours at school) make students need flexible and simple learning media. The resulting media is expected to help students understand the material, one of which is an e-module that can be accessed via a smartphone. (2) Design. This stage begins with creating a concept design, instructions for use, logo, material display, and e-module evaluation display. a) E-Module Concept. The E-Module is adapted to the material at the Senior High School level and is packaged flexibly so that students can easily access and understand the circle material associated with the ethnomathematics of *sawah lodok* fields. The initial display of the E-Module contains class identity, material topic, and a picture of *sawah lodok* fields can be seen in Figure 1.

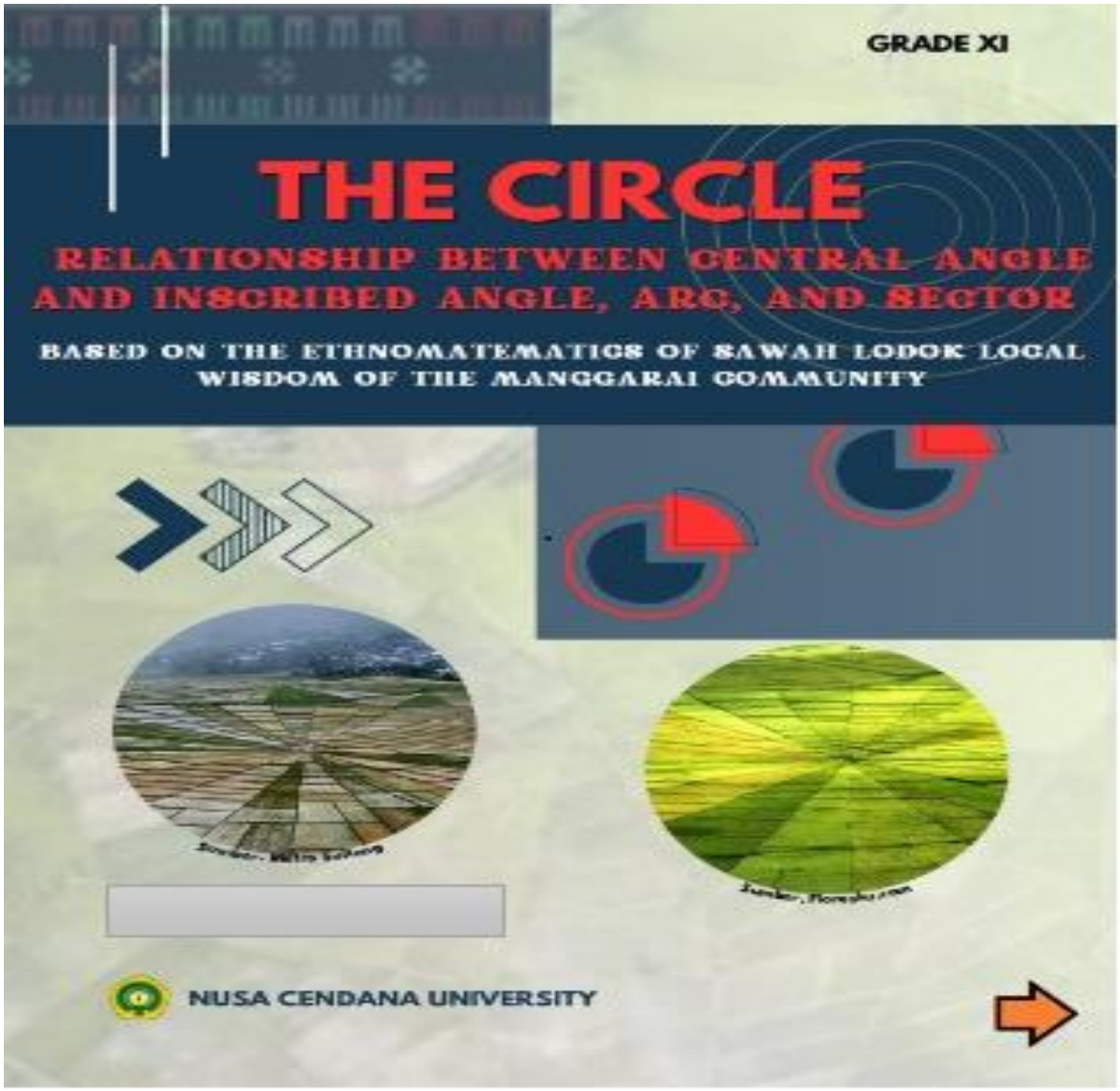

Figure 1.
Initial view of the e-module.

b). Introduction. E-Module media is designed to support students in understanding circles and practicing questions independently. In the introduction section of the E-Module as presented in Figure 2 which contains instructions for using the e-module, learning outcomes, and learning objectives.

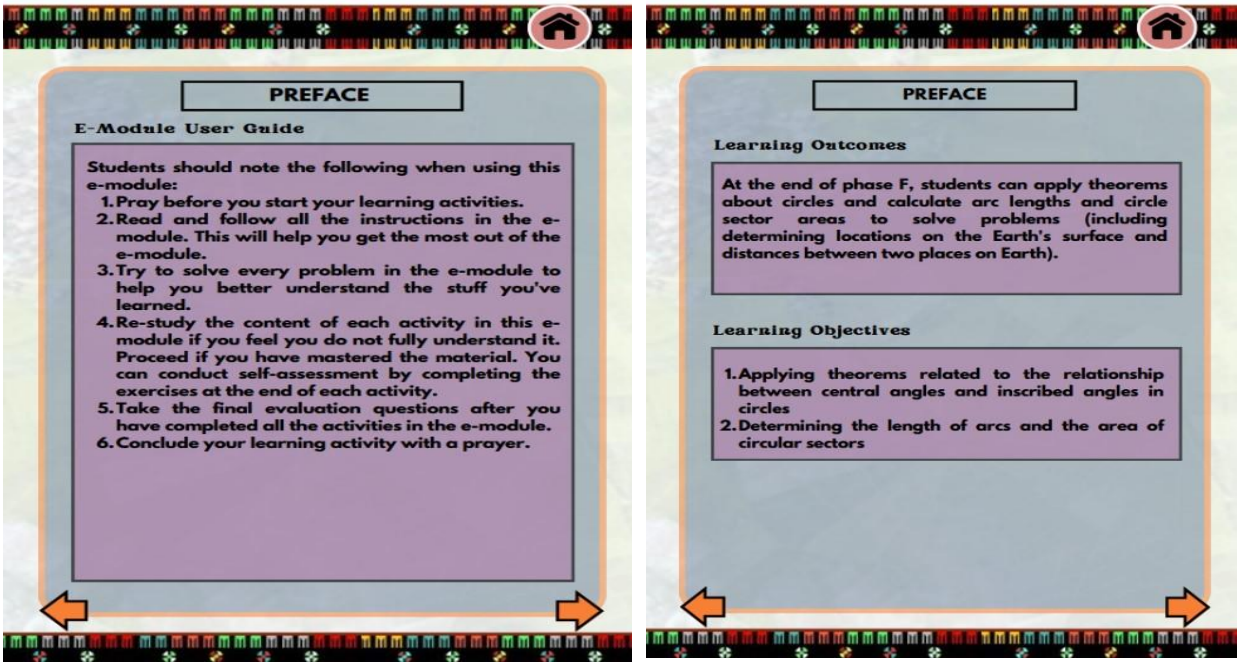

Figure 2.
e-Module Introduction

c). E-Module Material Display. The design of this material is clear and easy to understand, so students are more enthusiastic about learning. On the material menu, there are back and next buttons, so students who do not understand the previous material can look back. Each sub-material has examples and practice questions; when students answer the sample questions, the discussion will automatically appear. Learners who answer the exercise questions correctly will return to the material display, while learners who answer incorrectly will return to the sub-material. Figure 3 shows the display of E-Module learning media materials based on the Ethnomathematics of *sawah lodok* fields.

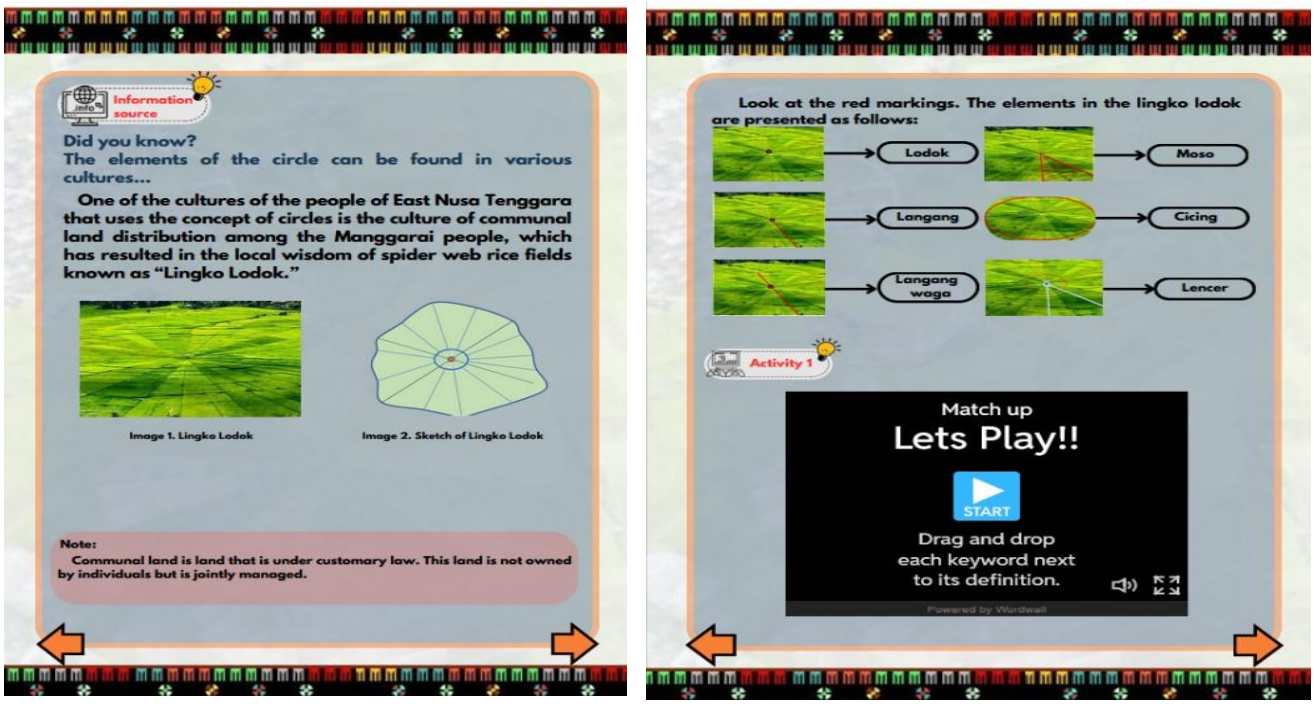

Figure 3.
Material display on e-Module.

d). E-Module Evaluation Display. This evaluation contains questions related to circle material; these questions are included in the ethnomathematics of *sawah lodok* fields. Questions are made to test students' abilities after using ethnomathematics-based e-module learning media. Students who have completed the evaluation, consisting of 10 questions, will then see the score obtained. The finished design is then executed or assembled using the Canva application. The evaluation display is presented in Figure 4.

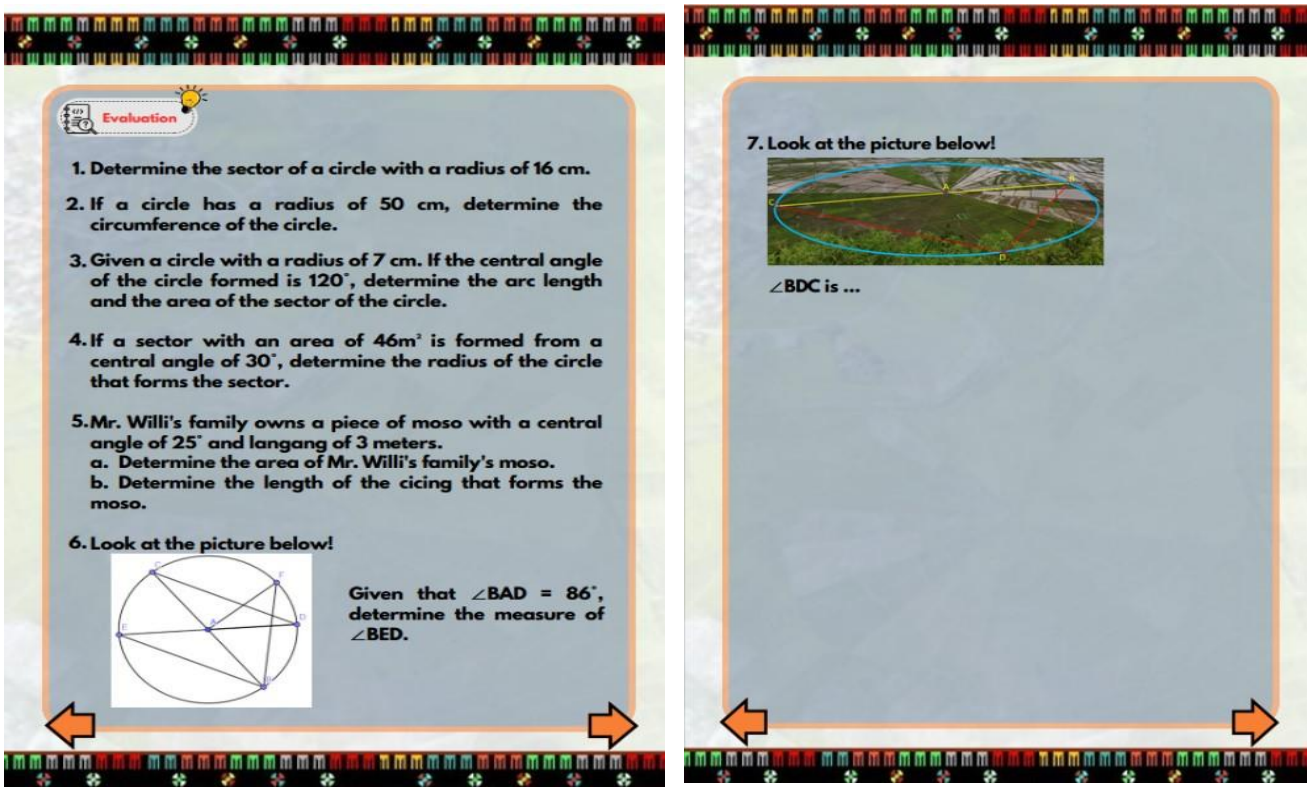

Figure 4.
Evaluation Display on E-Module.

(4) Development. E-Modules that have been produced according to the design are then entered into the development stage to measure their feasibility through validation tests. The validator's criticism and suggestions greatly support the improvement of the e-module. The validation test of the ethnomathematics-based e-module of *sawah lodok* obtained very good results and was feasible to use as shown in Table 5.

Table 5.
Results of E-Module Validation by Experts.

No	Assessment Aspect	Average	Criteria
1	Presentation of e-module components		
	a. The suitability of the material in the e-module with the Learning Outcomes.	4.33	Very Valid
	b. Clarity of learning objectives on each Learner Worksheet (LKPD) presented using LKPD.	4.33	Very Valid
	c. The activities in the LKPD Live begin with a real problem (featuring the culture of *sawah lodok*) and are challenging for students, followed by activities that lead students to draw conclusions.	5	Very Valid
	d. The activities in the Live worksheet are organized based on the level of thinking presented in the iceberg, namely situation, model of, model for, and formal knowledge.	3,66	Valid
	e. Video illustrations in the e-module keep students captivated, interested, and challenged to learn and reason.	4,33	Very Valid
	f. The activities in the LKPD require students to reason.	3,33	Valid
	g. The suitability of image illustrations in the LKPD with student characteristics.	5	Very Valid
2	Suitability of the material	4.33	Very Valid
3	Suitability of material: Video content and display	3.66	Valid
4	Video display	4	Valid
5	Presentation of direct worksheets	4.33	Very Valid

(5) Implementation. After the e-module media was declared valid from all aspects that had been determined, the media was tested on the subjects, namely 18 students of class IX of State Senior High School 1 Kupang. This activity was carried out twice. at the first meeting students took a pretest to determine their initial abilities and researchers distributed applications to study. Then at the second meeting students took a post-test to measure their abilities after using the e-module media. The practicality test was conducted by validators with the results that can be seen in Table 6.

Table 6.
Practicality Test Results of E-Module Based on Ethnomathematics of *Sawah Lodok* Assisted by Canva.

No	Aspect	Percentage (%)
1	Preparation for Media Use	85
2	Media Usage	90
3	Media Maintenance and Storage	86
Average		87

Based on the practicality test results in Table 6, it shows the percentage of 87%, with a very good category. Validators assessed the preparation for media use, media use, and media maintenance and storage as very practical. The results of the validators' assessments indicate that the e-module media based on the ethnomathematics of *sawah lodok* fields, assisted by Canva media, can be used in learning.

(6) Evaluation. The last stage in ADDIE is evaluation; the media is tested on subjects, namely students who have not received circle material. Effectiveness is measured based on the level of students' learning success using the media, specifically through a pre-test to determine initial ability before using the e-module media. Learners were provided with e-modules via smartphones after completing the pre-test to study both in and out of class and to work on the evaluation questions. The final test or post-test was administered after students studied circles with the help of e-module media. The test consisted of four essay questions covering the circle material. Figure 5 presents the average data of pre-test and post-test scores of students.

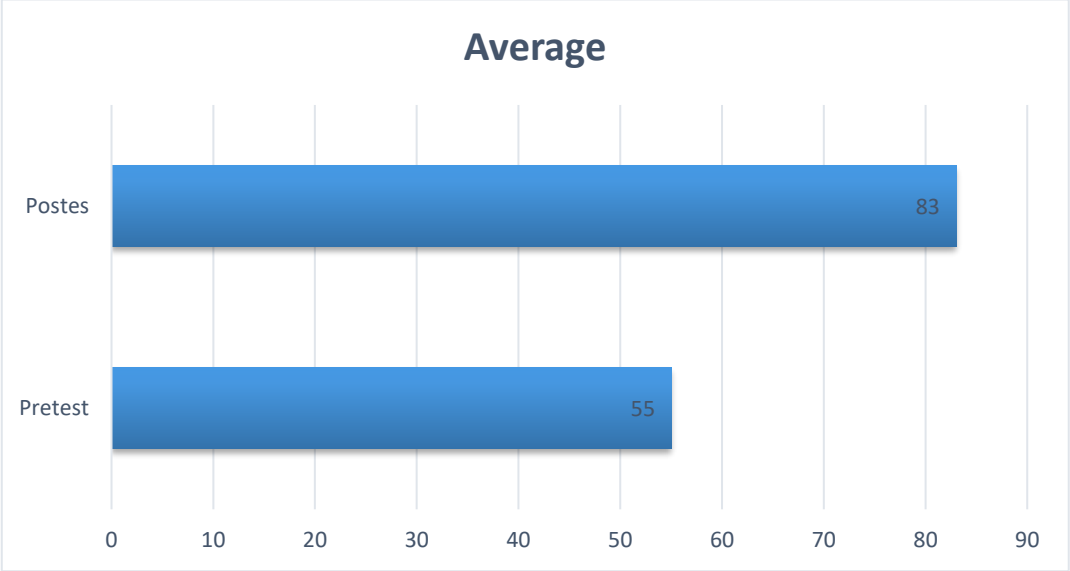

Figure 5.
Graph of average pre-test and post-test scores.

The results of the effectiveness test of the ethnomathematics-based e-module media assisted by Canva media obtained very good results (as seen from the post-test results), so the e-module produced was effectively applied to learning circle material. Students gave positive responses, indicating that the e-module was very interesting and could help facilitate independent learning.

4.2. Discussion

The developed learning e-module focuses on the circle material, incorporating the cultural context of *sawah lodok*. This approach links the e-module with the culture of *sawah lodok*, tailored to students' abilities [87]. *Sawah lodok* is the local wisdom of the Manggarai people resulting from the culture of customary land division *(lingko).* The exact year of the start of this division system is unknown.

This customary land division system was originally carried out based on the agreement of the ancestors of the Manggarai community by dividing it according to the shape of the traditional house *(mbaru gendang)* of the Manggarai community, which has a circular floor with a conical roof and a main pillar in the middle serving as the center of the traditional house [88, 89]. So that the process of dividing customary land is carried out by sticking *teno* wood *(haju teno)* at the center of customary land *(lodok)*.

The concept of land division is considered a form of fair distribution to all residents and contains the values of intimacy and unity within the Manggarai community [90]. This land division is carried out by a *tu'a teno*. The term *tu'a* in the Manggarai language itself means an elder and leader. Meanwhile, *teno* is taken from a type of wood (tree) that grows in the Manggarai area, namely *teno* wood (*haju teno*) [91]. *Teno* wood is used in the division of community land, so the term *tu'a teno* can be interpreted as a customary elder who is authorized in the division of land [92]. *Sawah lodok* is also an example of a culture that has ethnomathematics value. Students are more involved in learning mathematics when there is an ethnomathematics component, and this also makes it easier for students to understand mathematical concepts.

With direct experience through the presence of cultural elements, it is expected that students will be able to explore the surrounding culture and relate it to mathematics [93]. In each learning activity, the learning e-module contains instructions and interesting pictures or illustrations related to the material being taught. E-modules equipped with clear instructions for presenting the material make it easier for students to understand learning concepts. The e-module display is designed to attract students' interest by including images and illustrations in addition to text, making it easier for them to comprehend the material [94, 95].

This learning e-module uses material about circles based on the culture of *sawah lodok*. Ethnomathematics-based learning e-modules produce valid results and can be used for learning. E-module development based on *sawah lodok* ethnomathematics or others is often encountered in students' daily lives, making it easier to understand and increasing students' interest in learning [96]. E-modules are interactive learning materials, and various forms of questions are created using the live worksheet feature, suitable for online or offline learning [97]. E-Modules developed based on Manggarai culture on circular material can expand the development of mathematical problems.

Creative learning that allows students to learn meaningfully, more interestingly and enjoyably leads to culture and the learning that surrounds it [98, 99]. According to [100, 101]. Students' daily experiences related to mathematics learning can encourage better understanding and strategies to create learning experiences for students that integrate with culture, called culture-based learning. D'Ambrosio [102] states that the learning process of applying local cultural knowledge to mathematics is called ethnomathematics [102, 103]. Ethnomathematics is a science that applies community culture and is used to understand what mathematics is like and is very useful in learning mathematics [104, 105]. The culture that exists in society, including mathematical concepts, is referred to as ethnomathematics objects [106-108]. The ethnomathematics objects include traditional games, artifacts, traditional crafts, and cultural activities. One of the cultures from East Nusa Tenggara is *Sawah Lodok*. *Sawah Lodok* culture can be related to mathematics learning because it contains many mathematical concepts, especially circle material.

The learning module on circle material based on *sawah lodok* field ethnomathematics has the advantage that it can be used as a reference for learning and to facilitate students in gaining new experiences and making it easier for students to understand concepts in circle material using *sawah lodok* field-based ethnomathematics.

5. Conclusion

The results of the research on the development of e-modules for learning mathematics based on *Sawah Lodok* ethnomathematics on flat building material for class XI of State Senior High School 1 Kupang show that the development of e-modules for learning mathematics based on the ethnomathematics of *Sawah Lodok*, which is carried out with the 4-D development model Define, Design, Develop, and Disseminate, results in an e-module that meets the valid, practical, and effective requirements based on the assessment of material experts and media experts, teacher assessments, and student respondents. Thus, the e-module for learning mathematics based on the ethnomathematics of *Sawah Lodok* fields on circle material, with the help of the Canva application, meets the eligibility criteria and can be used by teachers and students at school.

References

[1] D. O. Hasibuan, H. Kurniawan, and H. P. Sari, "Perennialism education: Building critical thinking in the digital age," *Journal of Creative Student Research*, vol. 2, no. 6, pp. 145-157, 2024.

[2] C. Spiel *et al.*, "The contribution of education to social progress," *Rethink. Soc*, vol. 21, no. 3, pp. 753–778, 2018. https://doi.org/10.1017/9781108399661.006

[3] D. Fajarwati, T. J. Raharjo, and S. Samsudi, "The implementation of multiple intelligence-based school management," *The Journal of Educational Development*, vol. 4, no. 1, pp. 31-36, 2016.

[4] M. P. W. Mukti, A. Cahyono, and S. Suwardi, "Quality education plays a central role in shaping a superior and competitive generation," presented at the In International Conference on Science, Education, and Technology (Vol. 9, pp. 447-451), 2023.

[5] UNESCO, "SDG 4 data digest: How to produce and use the global and thematic education indicators," Retrieved: http://uis.unesco.org/sites/default/files/documents/sdg4-data-digest-2019-en_0.pdf, 2019.

[6] A. Zainuri, I. Wiryokusumo, and I. P. Leksono, "Development of interactive e-modules for engineering aspect workshop lessons household electrical installation material," *Budapest International Research and Critics Institute-Journal*, vol. 5, no. 2, pp. 11701-11711, 2022.

[7] Y. D. Arthur, E. K. Owusu, S. Asiedu-Addo, and A. K. Arhin, "Connecting mathematics to real life problems: A teaching quality that improves students' mathematics interest," *IOSR Journal of Research & Method in Education*, vol. 8, no. 4, pp. 65-71, 2018. https://doi.org/10.9790/7388-0804026571

[8] U. D'Ambrosio, "The role of mathematics in educational systems," *Zdm*, vol. 39, pp. 173-181, 2007. https://doi.org/10.1007/s11858-006-0012-1

[9] P. W. Nabila, T. Widhiyanti, and S. Mulyani, "Review of chemistry learning modules on the impact of students' literacy," *KnE Social Sciences*, pp. 188–199, 2024. https://doi.org/10.18502/kss.v9i8.15506

[10] S. M. Tayebi *et al.*, "Technological innovation in increasing sport access and participation for people with disabilities and inactivit," presented at the A Report on 1st Conference USCI (University Sport Consortium International) _November 5-6, 2024. Annals of Applied Sport Science, 13, 0-0, 2025.

[11] S. Sofiyan, R. Amalia, and A. B. Suwardi, "Development of mathematical teaching materials based on project-based learning to improve students' HOTS and character," presented at the In Journal of Physics: Conference Series (Vol. 1460, No. 1, p. 012006). IOP Publishing, 2020.

[12] D. Manurung, P. Siagian, and A. Minarni, "The development of realistic mathematics education based learning tools to improve mathematical problem solving ability and self-efficacy on students in junior high school 1 lubuk Pakam," *Budapest International Research and Critics in Linguistics and Education (BirLE) Journal*, vol. 3, no. 1, pp. 107-118, 2020.

[13] M. Cotič, D. Doz, M. Jenko, and A. Žakelj, "Mathematics education: What was it, what is it, and what will it be?," *International Electronic Journal of Mathematics Education*, vol. 19, no. 3, p. em0783, 2024. https://doi.org/10.29333/iejme/14663

[14] P. M. Anggraini, Y. Gusmania, F. Amelia, and B. N. Kusuma, "Development of an exe-learning-based mathematics e-module on sequences and series," *Hipotenusa: Journal of Mathematical Society*, vol. 5, no. 1, pp. 44-58, 2023. https://doi.org/10.18326/hipotenusa.v5i1.9023

[15] G. S. Sakinah, J. Indrawadi, S. Suryanef, and E. Ernawati, "The development of e-modules of pancasila education learning with the flipbook application," *Scaffolding: Jurnal Pendidikan Islam dan Multikulturalisme*, vol. 5, no. 3, pp. 601-631, 2023. https://doi.org/10.37680/scaffolding.v5i3.3815

[16] C. Lutching, "Self-learning modules (slm): Its effect on the academic self-learning modules (slm): Its effect on the academic performance in mathematics in the new normal a completed basic research presented to the policy," *Planning and Research Division Misamis Oc*, 2024.

[17] S. Erita, "Development of an e-modules for learning mathematics based on a scientific approach to help the online learning process," *International Journal of Trends in Mathematics Education Research*, vol. 5, no. 4, pp. 411-416, 2022. https://doi.org/10.33122/ijtmer.v5i4.170

[18] O. Asrowiah, I. Sujadi, and I. Slamet, "Needs analysis of mathematics modules as learning materials in distance learning during covid-19 pandemic," presented at the In International Conference of Mathematics and Mathematics Education (I-CMME 2021) (pp. 217-223). Atlantis Press, 2021.

[19] D. Apriandi and A. D. Ayuningtyas, "Mathematics teaching materials based on the ethnomathematics of Shiva Temple by applying the" Tri-N" Teaching," *Al-Ishlah: Jurnal Pendidikan*, vol. 14, no. 2, pp. 1597-1606, 2022. https://doi.org/10.35445/alishlah.v14i2.1180

[20] R. R. Lubis and N. C. Yusnita, "Development of media puzzle using game based learning approach to improve learning outcomes student mathematics in elementary school," *Journal of Elementary School Education*, pp. 188-194, 2023. https://doi.org/10.62966/joese.v1i3.338

[21] A. Azmidar, D. Darhim, and J. Dahlan, "Enhancing students' interest through mathematics learning," in *Journal of Physics: Conference Series*, 2017, vol. 895, no. 1: IOP Publishing, p. 012072.

[22] A. Imswatama and I. Zultiar, "Traditional house architecture in geopark ciletuh sukabumi as mathematical learning materials in basic education," in *Proceedings of the 2nd International Conference on Education*, 2020, pp. 47-54.

[23] S. U. Y. Kim and V. Y. Wong, "Asian American mental health: Assessment theories and methods," *Psychiatric Services*, vol. 54, no. 8, pp. 1175-1176, 2003. https://doi.org/10.1007/978-1-4615-0735-2

[24] M. Taneo, A. Madu, and F. A. Ndoen, "The cultural heritage of Ume Kbubu: Strengthening atoin meto identity through school learning," *Journal of Intercultural Communication*, vol. 24, no. 3, pp. 88-103, 2024. https://doi.org/10.36923/jicc.v24i3.881

[25] R. Socialization, L. P. Juang, H. C. Yoo, and A. Atkin, "Asian American parenting," *Asian Am. Parent*, 2017. https://doi.org/10.1007/978-3-319-63136-3

[26] E. Erniwati, H. Hunaidah, R. Nurhidayat, and S. Fayanto, "The testing of e-module flip-pdf corporate to support learning: study of interests and learning outcomes," *Journal of Education Technology*, vol. 6, no. 4, pp. 586-597, 2022. https://doi.org/10.23887/jet.v6i4.43857

[27] M. Rosa and D. C. Orey, "Ethnomathematics: The cultural aspects of mathematics," *Revista Latinoamericana de Etnomatemática Perspectivas Socioculturales de La Educación Matemática*, vol. 4, no. 2, pp. 32-54, 2011.

[28] W. S. Dominikus, A. Madu, I. K. S. Blegur, and M. U. Jemamun, "Ethnomathematics in caci dance of manggarai community and its integration in mathematics learning," *Journal of Law and Sustainable Development*, vol. 12, no. 2, pp. e3035-e3035, 2024.

[29] A. Hendriyanto *et al.*, "Learning mathematics using an ethnomathematics approach: A systematic literature review," *Journal of Higher Education Theory & Practice*, vol. 23, no. 7, pp. 59-74, 2023.

[30] M. Rosa, L. Shirley, M. E. Gavarrete, and W. V. Alangui, "Topic study group no. 35: Role of ethnomathematics in mathematics education," in *Proceedings of the 13th International Congress on Mathematical Education: ICME-13*, 2017: Springer International Publishing, pp. 543-548.

[31] R. Simbolon, "Literature study: Integration of ethnomathematics in mathematics learning in schools," *JMEA: Journal of Mathematics Education and Application*, vol. 3, no. 2, pp. 70-76, 2024.

[32] L. A. Prasetya, H. W. Herwanto, and Y. Yoto, "Development of learning modules for electric power plant machinery for class xi phase f of electric power plant engineering expertise program in vocational schools," *IJECA (International Journal of Education and Curriculum Application)*, vol. 7, no. 3, pp. 279-291], 2024.

[33] A. Muzaki, I. D. Hastuti, S. Fujiaturrahman, and Z. Untu, "Development of an Ethnomathematics-Based e-Module to Improve Students' Metacognitive Ability in 3D Geometry Topic," *International Journal of Interactive Mobile Technologies*, vol. 16, no. 3, pp. 32-46, 2022. https://doi.org/10.3991/IJIM.V16I03.24949

[34] W. R. Purnama, A. Hadinata, M. Misrowati, R. Afdian, and T. M. Wijayanti, "Pancasila as an identity that forms national character: Analysis of the philosophy of Indonesian education," *Journal of Basic Education Research*, vol. 5, no. 2, pp. 54-60, 2024.

[35] A. Asrial, S. Syahrial, D. A. Kurniawan, and Q. Luthfiah, "Character likes to read in elementary school students electronic module and print module," *Journal of Education Technology*, vol. 5, no. 2, pp. 246-253, 2021.

[36] E. Febriani, S. Zulaihati, and M. A. Adha, "Creation of google sites-based e-modules for digital document elements at high vocational schools," *Jurnal Pendidikan Ekonomi, Perkantoran, dan Akuntansi*, vol. 5, no. 1, pp. 63-75, 2024.

[37] L. Dewiyani, A. Marini, S. Khairunnisa, A. Maksum, and D. Safitri, "Interactive module based on qr code to increase learning interest in entrepreneurship course for college students," *J. High. Educ. Theory Pract*, vol. 24, no. 2, pp. 229–243, 2024. https://doi.org/10.33423/jhetp.v24i2.6928

[38] F. Delita and N. Berutu, "Online learning: The effects of using e-modules on self-efficacy, motivation and learning outcomes," *Turkish Online Journal of Distance Education*, vol. 23, no. 4, pp. 93-107, 2022.

[39] S. Yulando, S. Sutopo, and T. Franklin Chi, "Electronic module design and development: An interactive learning," *American Journal of Educational Research*, vol. 7, no. 10, pp. 694-698, 2019.

[40] P. S. Uttarwar, R. P. Tidke, D. S. Dandwate, and U. J. Tupe, "A literature review on android-a mobile operating system," *International Research Journal of Engineering and Technology*, vol. 8, no. 1, pp. 1-6, 2021.

[41] M. Jaiswal, "Android the mobile operating system and architecture," *Manishaben Jaiswal," ANDROID THE MOBILE OPERATING SYSTEM AND ARCHITECTURE", International Journal of Creative Research Thoughts*, vol. 6, pp. 2320-2882, 2018.
[42] A. Widodo *et al.*, "The personalized system of e-modul instructions in physical education online learning," *Retos: Nuevas tendencias en educación física, deporte y recreación*, vol. 56, pp. 319-327, 2024. https://doi.org/10.47197/retos.v56.103515
[43] E. Herlina and Z. Abidin, "Development of interactive e-modules to improve students' scientific literacy abilities: A literature review," *Jurnal Mangifera Edu*, vol. 8, no. 2, pp. 74-87, 2024.
[44] R. Azriyanti, "Validation of the physics e-module based on problem based learning as independent teaching material to improve critical thinking skills of class xi high school students," *Jurnal Penelitian Pendidikan IPA*, vol. 9, no. 11, pp. 10223-10229, 2023. https://doi.org/10.29303/jppipa.v9i11.5809
[45] D. F. E. Talan and A. Widayati, "Effectiveness of implementing E-module based on contextual teaching and learning to improve learning outcomes and class XI IPS in SMA Negeri 1 Soe," *Asian Journal of Social and Humanities*, vol. 1, no. 06, pp. 279-287, 2023.
[46] K. Trilestari and N. F. Almunawaroh, "E-Module as a solution for young learners to study at home," in *4th Sriwijaya University Learning and Education International Conference (SULE-IC 2020)*, 2021: Atlantis Press, pp. 364-369.
[47] A. Holisoh, N. Nurhalimah, and N. Hamda, "Analysis of the benefits of using e-modules as distance learning media: can it help students improve cognitive and affective aspects of students?," *Gema Wiralodra*, vol. 14, no. 2, pp. 592-597, 2023.
[48] I. Irdawati, M. Chatri, K. Wulansari, A. Razak, and S. Fajrina, "Development of stem-based biology e-module to improve student learning outcomes," *Jurnal Penelitian Pendidikan IPA*, vol. 9, no. 8, pp. 6694-6700, 2023.
[49] B. A. Sudarmanto, E. S. Wajidi, T. Wahyuni, D. Susilastri, A. Zalmansyah, and Z. Abidin, "The vernacular sauna batimung: Local wisdom of the banjar community in South Kalimantan, Indonesia," *ISVS e-journal*, vol. 11, no. 1, pp. 120–133, 2024. https://doi.org/10.61275/ISVSej-2024-11-01-08
[50] N. P. Sintawati and I. G. Margunayasa, "Interactive e-module for science learning content: validity and feasibility," *International Journal of Elementary Education*, vol. 5, no. 1, pp. 19-29, 2021.
[51] S. Bachri, L. Y. Irawan, and M. Aliman, "E-module in blended learning: Its impact on students' disaster preparedness and innovation in developing learning media," *International Journal of Instruction*, vol. 14, no. 4, pp. 187-208, 2021.
[52] Y. Rosiana, W. Syafii, R. A. Putra, and D. Futra, "Validition of circulation systems e-modules based learning cycle 8e," *Journal of Biology Education*, vol. 6, no. 1, pp. 65-66, 2023.
[53] R. Waiswa, A. Nabakiibi, J. Nabbira, and C. B. Mugimu, "Relationships between children's literacy comprehension and their achievement in numeracy and ethno-math at lower primary schools in Uganda," *European Journal of Education and Pedagogy*, vol. 5, no. 1, pp. 54-60, 2024. https://doi.org/10.24018/ejedu.2024.5.1.783
[54] L. H. Muhaimin, Y. S. Kusumah, D. Juandi, A. Hendriyanto, and S. Sahara, "Mathematical framework for accurate prayer times: Insights from the bencet tradition," *Indonesian Journal of Science and Mathematics Education*, vol. 6, no. 3, pp. 416-429, 2023.
[55] K. Bhatt, "Culture and indigenous knowledge reflected on Ethnomathematics," in *Mathematics Education Forum*, 2020, vol. 1, no. 40, pp. 30-33.
[56] U. D'Ambrosio, "Literacy, matheracy, and technocracy: A trivium for today," *Mathematical thinking and learning*, vol. 1, no. 2, pp. 131-153, 1999. https://doi.org/10.1207/s15327833mtl0102_3
[57] Z. Wu and L. Ye, "Mathematical modeling in connecting concepts to real world application," in *The Proceedings of the 12th International Congress on Mathematical Education: Intellectual and attitudinal challenges*, 2015: Springer, pp. 639-640.
[58] K. L. Anderson-Pence, "Ethnomathematics: The role of culture in the teaching and learning of mathematics techno-mathematical discourse view project captivated view project," utah math. teach. fall/winter 2013-2014," Retrieved: https://www.researchgate.net/publication/280865220, 2013.
[59] J. B. Pradhan, T. Sharma, and T. Sharma, "Ethnomathematics research practices and its pedagogical implications: A Nepalese perspective," *Journal of Mathematics and Culture*, vol. 15, no. 1, pp. 110-126, 2021.
[60] J. Beno, A. Silen, and M. Yanti, "A mobile teacher professional development course on digital game-enhanced language learning," Doctoral Dissertation, Middle East Technical University (Turkey), 2022.
[61] G. Sunzuma and A. Maharaj, "Teacher-related challenges affecting the integration of ethnomathematics approaches into the teaching of geometry," *Eurasia Journal of Mathematics, Science and Technology Education*, vol. 15, no. 9, p. em1744, 2019.
[62] P. Iannone *et al.*, "Proceedings of FAME 1–feedback & assessment in mathematics education (ETC 14), 5-7 June 2024, Utrecht (The Netherlands)," in *FAME-Feedback & Assessment in Mathematics Education*, 2024: Utrecht University & ERME.
[63] F. I. S. Sinaga, "Hypothetical learning trajectory based on ethnomathematics," *NUSRA: Jurnal Penelitian dan Ilmu Pendidikan*, vol. 5, no. 1, pp. 333-341, 2024. https://doi.org/10.55681/nusra.v5i1.2230
[64] W. S. Dominikus, A. Madu, and D. V. L. Bale, "Ethnomathematical study of traditional Hole rituals in the Sabu community in Sabu Liae Sub-District Sabu Raijua District," *Edelweiss Applied Science and Technology*, vol. 9, no. 3, pp. 2249-2267, 2025.
[65] D. Muhtadi and R. C. I. Prahmana, "Sundanese Ethnomathematics: Mathematical Activities in Estimating, Measuring, and Making Patterns," *Journal on mathematics education*, vol. 8, no. 2, pp. 185-198, 2017.
[66] R. Hermanto and E. Nurlaelah, "Exploration of ethnomathematics on the kampung naga indigenous peoples," in *Journal of Physics: Conference Series*, 2019, vol. 1315, no. 1: IOP Publishing, p. 012072.
[67] Z. H. Putra, V. Safni, Z. Antosa, D. Dahnilsyah, and H. Tjoe, "Ethnomathematics exploration of traditional games played by primary school students in west sumatra," in Cases on Informal Learning for Science and Mathematics Education: IGI Global Scientific Publishing, 2025, pp. 303-336.
[68] D. S. Setiana, "The role of ethnomathematics in welcoming the society 5.0," in *SEMANTIK Conference of Mathematics Education (SEMANTIK 2019)*, 2020: Atlantis Press, pp. 130-134.
[69] U. Umbara, S. Prabawanto, and M. G. Jatisunda, "Combination of mathematical literacy with ethnomathematics: How to perspective sundanese culture," *Infinity Journal*, vol. 12, no. 2, pp. 393-414, 2023.
[70] E. Wiyanarti, M. Holilah, T. F. Zahra, and S. C. Dahalan, "Development of an e-module based on local wisdom ethnoastronomy in the digital era to strengthen the pedagogical competence of social studies teachers," *Journal of Engineering Science and Technology*, vol. 19, no. 4, pp. 1280-1301, 2024.

[71] M. D. Rahiem, *Religion, education, science and technology towards a more inclusive and sustainable future: Proceedings of the 5th international colloquium on interdisciplinary Islamic Studies (ICIIS 2022), Lombok, Indonesia, 19-20 October 2022*. Taylor & Francis, 2024.
[72] M. R. D. Saputra, M. Niethammer, and H. N. A. Putra, "From hombo batu to the realm of physics: implementation of ethnophysics-based mobile learning to increase learning independence and learning outcomes," *Tarbiyah: Jurnal Ilmiah Kependidikan*, vol. 13, no. 2, pp. 245-257, 2024.
[73] Y. K. Dwivedi *et al.*, "Setting the future of digital and social media marketing research: Perspectives and research propositions," *International journal of information management*, vol. 59, p. 102168, 2021.
[74] J. E. Pedroso, R. S. Sulleza, K. H. M. C. Francisco, A. J. O. Noman, and C. A. V. Martinez, "Unlocking the power of Canva: Students' views on using the all-in-one tool for creativity and collaboration," *Journal of Digital Learning and Distance Education*, vol. 2, no. 2, pp. 443-461, 2023.
[75] M. Putri and I. Junaedi, "Development of ethnomathematics-based E-module using the inquiry learning model to improve mathematical problem solving ability," *Unnes Journal of Mathematics Education*, vol. 11, no. 2, pp. 174-182, 2022.
[76] L. A. Purwasi, N. Fitriyana, R. D. Jayati, L. Fitriani, and B. P. Irawan, "Developing interactive e-modules through canva app," in *Online Conference of Education Research International (OCERI 2023)*, 2023: Atlantis Press, pp. 326-338.
[77] T. N. Fitria, "Using Canva in creating and designing e-Module for english language teaching," *SAGA: Journal of English Language Teaching and Applied Linguistics*, vol. 5, no. 2, pp. 111-122, 2024. https://doi.org/10.21460/saga.2024.52.194
[78] I. N. Suputra, A. Basuki, and A. Septiana, "Improve students' critical thinking and skills through canva-based e-modules," in *BISTIC Business Innovation Sustainability and Technology International Conference (BISTIC 2022)*, 2023: Atlantis Press, pp. 167-178.
[79] R. Kurniawan, "The validity of e-module based on guided inquiry integrated ethnoscience in high school physics learning to improve students' critical thinking," in *Journal of Physics: Conference Series*, 2021, vol. 1876, no. 1: IOP Publishing, p. 012067.
[80] A. S. Madona, G. Gusnetti, and S. Syofiani, "Desain multimedia game tembak huruf untuk meningkatkan pemahaman bahasa siswa Kelas 1 SD dalam pengenalan huruf abjad," *Jelisa (Jurnal Edukasi dan Literasi Bahasa)*, vol. 2, no. 1, pp. 160-167, 2021.
[81] R. K. Almomen, D. Kaufman, H. Alotaibi, N. A. Al-Rowais, M. Albeik, and S. M. Albattal, "Applying the ADDIE—analysis, design, development, implementation and evaluation—instructional design model to continuing professional development for primary care physicians in Saudi Arabia," *International Journal of Clinical Medicine*, vol. 7, no. 08, p. 538, 2016.
[82] S. R. Patel, P. J. Margolies, N. H. Covell, C. Lipscomb, and L. B. Dixon, "Using instructional design, analyze, design, develop, implement, and evaluate, to develop e-learning modules to disseminate supported employment for community behavioral health treatment programs in New York State," *Frontiers in public health*, vol. 6, p. 113, 2018.
[83] A. Hamidah, D. S. Ayunasari, and E. Sanjaya, "Development of E-LKPD in motion system materials for High School class using pageflip 3D software," *Jurnal Penelitian Pendidikan IPA*, vol. 9, no. 3, pp. 1233-1241, 2023.
[84] R. I. Toshpulatov, "Dulang penamat in socio-religious practice: integration of islamic religious education, multicultural and local democracy in the sasak community," *International Journal of Pedagogics International Journal of Pedagogics*, vol. 3, no. 9, pp. 43–47, 2022.
[85] E. A. Saputra, S. Wakhinuddin, and F. Rizal, "Validity and practicality of problem-based electronic learning media," in *Progress in Social Science, Humanities and Education Research Symposium*, 2020: Redwhite Press, pp. 88-92.
[86] R. M. Sari Maulina Harahap, "Efendi napitupulu," *Differentiated E-Module Based on Problem-Based Learning : Natural Science Subject*, vol. 5, no. 4, pp. 1284–1301, 2024. https://doi.org/10.47175/rielsj.v5i4.1090
[87] J. S. Eviota and M. M. Liangco, "Jurnal pendidikan MIPA," *Jurnal Pendidikan*, vol. 21, no. 2, pp. 109-119, 2020.
[88] M. Meleisea and P. Schoeffel, "Land, custom and history in Samoa," vol. 5, pp. 22–34, 2015.
[89] E. Iswandono, E. A. Zuhud, A. Hikmat, and N. Kosmaryandi, "Traditional land practice and forest conservation: Case study of the Manggarai tribe in Ruteng Mountains, Indonesia," *Komunitas*, vol. 8, no. 2, pp. 256-266, 2016.
[90] D. W. T. Andari, D. A. Mujiburohman, R. Junarto, R. Riyadi, N. Aisiyah, and A. H. Farid, "Local wisdom in the land system of Manggarai's indigenous people, Indonesia," *ISVS e-Journal*, vol. 10, no. 9, pp. 223-243, 2023.
[91] C. H. Karjo, "Phonetic and phonotactic analysis of Manggarai language," in *International Congress of Indonesian Linguistics Society (KIMLI 2021)*, 2021: Atlantis Press, pp. 79-83.
[92] H. K. Dinata, O. J. Nubatonis, Y. M. Y. Jacob, and C. M. D. Bire, "The existence of tu'a golo in the distribution of customary land in golo mori village, komodo district, west manggarai regency," *Journal of Lifestyle and SDGs Review*, vol. 5, no. 2, pp. e03570-e03570, 2025. https://doi.org/10.47172/2965-730X.SDGsReview.v5.n02.pe03570
[93] M. Ayu, "Evaluation of cultural content on English textbook used by efl students in Indonesia," *Journal of English Teaching*, vol. 6, no. 3, pp. 183-192, 2020. https://doi.org/10.33541/jet.v6i3.1925
[94] T. Z. Adha, A. Asrizal, and F. R. Rahim, "Development of E-module integrated stem approach to improve students' critical and creative thinking skills," *Physics Learning and Education*, vol. 1, no. 2, pp. 62-70, 2023. https://doi.org/10.24036/ple.v1i2.27
[95] B. A. Hutomo, S. Saptono, and B. Subali, "Development of e-module based on science, technology, engineering, and mathematics (stem) to improve science literacy of junior high school students," *Journal of Innovative Science Education*, vol. 11, no. 2, pp. 241-249, 2022.
[96] J. Hamid and N. I. Rahmawati, "Developing ethnomathematics-based e-modules to support students' problem solving skills," *Edumatika J. Ris. Pendidik. Mat*, vol. 7, no. 1, pp. 1–13, 2024. https://doi.org/10.32939/ejrpm.v7i1.3427
[97] Y. I. Putra, R. Fadli, and S. Dahry, "Meta analyzing the ease of use of e-modules in learning," *Jurnal Inovasi Teknologi Pendidikan*, vol. 10, no. 4, pp. 338-343, 2023.
[98] T. Kettler, K. N. Lamb, and D. R. Mullet, *Developing creativity in the classroom: Learning and innovation for 21st-century schools*. Routledge. https://doi.org/10.4324/9781003234104, 2021.
[99] B. Lucas and M. Anderson, "the importance and impact of developing creativity in schools creative learning in schools: What it is and why it matters a rapid evidence scan," Retrieved: http://www.creativityculture education.org/research-reports, 2015.
[100] I. Vale and A. Barbosa, "Active learning strategies for an effective mathematics teaching and learning," *Eur. J. Sci. Math. Educ*, vol. 11, no. 3, pp. 573–588, 2023. https://doi.org/10.30935/scimath/13135
[101] M. D. Tañola and L. S. Lomibao, "Understanding how students learn mathematics: A systematic literature review of contemporary learning strategies in mathematics education post-2020," *Journal of Innovations in Teaching and Learning*, vol. 4, no. 1, pp. 66-75, 2024. https://doi.org/10.12691/jitl-4-1-11

[102] U. D'Ambrosio, "The program ethnomathematics: a theoretical basis of the dynamics of intra–cultural encounters," *Learning*, vol. 1, no. 2, pp. 131-153, 1999.
[103] U. D'Ambrosio, "The ethnomathematics program and a culture of peace," *Journal of Mathematics and Culture*, vol. 10, no. 2, pp. 1-11, 2016.
[104] I. P. Wahyuningtyas and D. Lutfiana, "The effect of Islamic corporate governance, Islamic corporate social responsibility, and islamicity performance index on the financial performance of sharia commercial banks in Indonesia," *Al-Mal: Jurnal Akuntansi Dan Keuangan Islam*, vol. 3, no. 2, pp. 135-156, 2022. https://doi.org/10.24042/al-mal.v3i2.12096
[105] F. G. Karaoglan Yilmaz and R. Yilmaz, "Learning analytics as a metacognitive tool to influence learner transactional distance and motivation in online learning environments," *Innovations in Education and Teaching International*, vol. 58, no. 5, pp. 575-585, 2021. https://doi.org/10.1080/14703297.2020.1794928
[106] O. A. Cimen, "Discussing ethnomathematics: Is mathematics culturally dependent?," *Procedia-Social and Behavioral Sciences*, vol. 152, pp. 523-528, 2014. https://doi.org/10.1016/j.sbspro.2014.09.215
[107] I. Bloch, "Mathematical concepts , objects , and symbols : Where do they come from ?," 2015.
[108] N. Faiziyah, N. N. Azizah, M. Nurrois, and H. J. Prayitno, "Ethnomathematics: Mathematics in Batik Solo," in *Journal of Physics: Conference Series*, 2021, vol. 1720, no. 1: IOP Publishing, p. 012013.