Development of Ethnomathematics E-Modules Based on Local Wisdom to Improve Students' Cultural and Civic Literacy

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ABSTRACT

This research aims to develop interactive mathematics teaching materials in the form of an ethnomathematical e-Module based on local wisdom of the Bugis-Makassar tribe that is valid, practical, and effectively used in learning to improve students' cultural and civic literacy in mathematics in Grade VII. This type of research is Research and Development using the Dick and Carey model consisting of stages of needs analysis, product design, validation, and evaluation. Data were collected during the e-Modul product trial using observation sheet instruments, interview formats, and questionnaires. To examine its validity, practicality, and effectiveness, language experts, media experts, material experts, teachers, and students were involved. The experimental data were analyzed using quantitative and qualitative descriptive data analysis techniques. The results of the evaluation of the validity of the e-Modules by experts indicate that the products that have been developed satisfy the very valid criteria with a score of 3.6, while the results of the practicality assessment of e-Modules by teachers indicate that the e-Modules are very practical to use with a score of 3.5, as well as the results of the assessment practicality by students shows that the e-Modul is practically used with a value of 3.3. The effectiveness of the e-Modul in improving the cultural and civic literacy of students, measured from the results of a large-scale field trial on 20 students, showed that there were 65% of students in the good category in the initial trial and there were 85% of students in the very good category in the final trial. Based on these results, it can be seen that the ethnomathematical e-Module based on local wisdom of the Bugis-Makassar tribe satisfy the valid, practical, and effective criteria to be applied as teaching materials for mathematics subjects, and at the same time can improve the cultural and civic literacy of students in grade VII.

Keywords: e-Modul, Ethnomathematics, Local Wisdom, Cultural and Civic Literacy.

1. INTRODUCTION

In the 21st century, students' literacy skills are an important element to understand information analytically, critically, and reflectively which is manifested in the School Literacy Movement (GLS) as an effort to create lifelong literacy conditions. Schools have a very important role in instilling a culture of literacy in students. The literacy skills developed in the GLS include the six basic literacy and are carried out through the practice of listening, speaking, reading, writing, viewing, and presenting/displaying ideas, feelings, and character behaviors. The characters developed to consist of: (1) religious, (2) nationalist, (3) independence, (4) cooperation, (5) integrity. The development of literacy skills is carried out through habituation, development, and learning activities [1].

One of the basic literacy skills is cultural and civic literacy, namely skills related to cultural understanding and obligations as citizens that need to be mastered by students. Specifically, cultural literacy is knowledge and skills in understanding and acting on Indonesian culture as a national identity, while civic literacy is knowledge and skills in understanding rights and obligations as citizens. Cultural literacy and nationalism save and develop national culture and

build the national identity in the middle of globalization [1].

Cultural and civic literacy achievements can be integrated into learning, habits, and development in all subjects, including mathematics. Mathematics as a subject aims to build the ability of students to identify, understand, and use the basics of mathematics that students need in dealing with everyday life obtained from the material of multiplication, division, and decimal fractions. Therefore, it is a challenge for teachers to be able to integrate cultural and civic literacy through teaching mathematics so that students can choose and sort out the noble cultural values of the nation that are relevant to be used as the basis for behaving, acting, and behaving in diversity [2]. In addition, teachers must integrate cultural literacy and citizenship in mathematics education so that students can take advantage of the cultural richness of their respective regions to produce works to preserve the nation's culture and inspire students to be motivated to work.

Cultural literacy competence and citizenship between religions, ethnicities, and groups in learning mathematics must be linked to media literacy to create a civilized society. This literacy concept can bring changes to students' understanding as literacy is applied in the teaching and learning process, namely: (1) Creating culturally literate citizens who are known from the ability of students to know, understand, and preserve the richness and diversity of Indonesian culture and (2) Identifying, appreciating, and preserving cultural values and local wisdom to be applied as a basis for acting and behaving, as well as in building social relations [3].

Local culture or local wisdom is often interpreted as a culture that develops in a certain place and a certain group of people to become a characteristic of the people in the area. So that many places or areas that are involved have the values of local wisdom. Still, one should know some of the characteristics that can be said to be local wisdom, including the following: being able to survive from outside cultures, being able to accommodate elements from outside cultures, being able to integrate aspects of foreign culture into the original culture, have the ability to control, have a clear direction on cultural development [4].

The strategy to integrate cultural literacy and citizenship for mathematics teachers is to link mathematics material with cultural elements, especially the local ones. From its theoretical perspective, ethnomathematics is an option in learning mathematics. Ethnomathematics builds a relationship between mathematics learning and the socio-cultural community [5]. This relationship can be seen from two perspectives: what mathematics is contained in cultural symbols or how mathematics is the basis for producing cultural symbols in society [6]. These two perspectives are the main tools for instilling cultural values in mathematics lessons by using cultural symbols of the surrounding community with mathematical material.

Improving cultural literacy skills and citizenship through ethnomathematics is one of the models of learning with culture by introducing culture to students as a way or method to learn certain subjects [7]. Learning with culture includes using various forms of cultural embodiment (ethnomatics) both as a medium in the learning process, as a context for examples of mathematical concepts or principles, and as a context for applying principles or procedures in mathematics. Ethnomathematics will help develop students' intellectual, social, emotional, and political learning by using their own cultural references to impart their knowledge, skills, and attitudes [8]. Through ethnomathematics, students can increase their motivation and facilitate students to maintain their cultural identity and citizenship and academically achieve learning goals.

Improving cultural literacy skills and citizenship in mathematics subjects with ethnomathematics is certainly not an easy thing. Especially if mathematics learning is carried out online, for this reason, a new approach is needed with new digital-based media and learning resources to achieve the goals of learning mathematics. Instilling and growing cultural literacy and citizenship of students requires e-Modules integrated with ethnomathematics, which includes new sources of knowledge related to culture and citizenship and mathematics material. The use of the ethnomathematical e-Module can make it easier for teachers to deliver material while improving students' cultural literacy and citizenship skills as well as helping students to be able to recognize the character of culture and citizenship through the ethnomathematics e-Module.

e-Modul is an electronic-based module that has interactive properties because of the ease of navigation, attractive display of images, audio, video, and moving animations that provide variety, as well as feedback through certain formative tests or quizzes [9][10] e-Module will help students recognize the

culture and its diversity because it can be presented more attractively through learning videos, Audio, Visual Aid and includes attractive designs. Therefore e-Modules must be designed so that both from the aspect of display design and ease of access also need to be considered so that students have interest and motivation to learn [11].

Teachers' development of e-Modules can help students learn independently, which is more complete than just giving assignments and LKPD as an independent learning guide [12]. The use of e-Modules is innovative because it can display teaching materials that are complete, interesting, interactive, and develop good cognitive functions with a presentation structure according to the learning model and design. One of the advantages of other e-Modules is that it can improve students' critical thinking skills and get a positive response from students [13].

Learning with modules allows students to have a high speed in learning and more quickly complete one or more basic competence (KD). Learning design will be more effective if more attention is paid to individual students than the group, and modules can be designed to achieve these goals [14]. Modules with these advantages are more effective in terms of knowledge acquisition to be useful tools for teaching and learning [15]. Modules can even contain learning sequences with a certain design that students can follow in stages. Research shows that e-Modules are easier to use and can motivate students to study longer [16].

The development of e-Modules in its presentation can be collaborated with specific learning designs and models while still using the curriculum as a reference in its development which includes main competence, basic competence, and indicators that students will achieve, and is presented using good, interesting language, and is equipped with illustrations.

This research was carried out in the form of development research using the Dick and Carey development model as a development model that is simpler but more structured in stages to obtain products in the form of electronic modules. The e-Modul product developed in the form of an ethnomathematical e-Modul is a supplement with technical specifications consisting of (1) development using the Open Sources application program http://bookcreator.com, (2) file format in the form of ePub (electronic publication) and pdf files, (3) ePub reader software using Redium Google PlayBook, Moon + Reader, ReadEra, Cool Reader, Ebook Reader, and other applications on desktops and Smartphones, (4) in the form of electronic Modules (e-

Modules) containing text, Audio, Videos, Pictures, Illustrations and Animations (5) The contents of the e-Module material Lines and Angles consist of initial preliminaries, contents, and final preliminaries, as well as non-technical specifications, which are equipped with e-Module usage guidelines as well as lesson plans and syllabus.

The development of the Dick and Carey e-Module model is carried out on ethnomathematical nuances, namely line and angle material. Line and angle materials are often found in cultural symbols and local wisdom that can be used as learning resources for students. Through cultural symbols, it is expected to improve students' cultural literacy skills and citizenship obtained from a series of new experiences through a series of activities according to the syntax designed and compiled by the teacher in the ethnomathematics e-Module. By using cultural elements in mathematics learning, it is expected to increase students' knowledge and understanding of mathematics subject matter, as well as to improve students' cultural literacy skills. Thus, this research is intended to determine the level of validity, effectiveness, and practicality of e-Module ethnomathematics based on local wisdom to improve students' cultural and civic literacy.

2. RESEARCH METHODS

The type of research is Research and Development, which is used to produce products in the form of an e-Module Ethnomathematics model based on local wisdom. To determine the level of validity, practicality, and effectiveness, content testing from experts and field testing for user candidates were carried out. The R&D development model used was the Dick & Carey Model consisting of ten stages, namely, (1) Identity Instructional Goals, (2) Conduct Instructional Analysis (3) Analyze Learners and Contexts, (4) Write Performance Objectives, (5) Develop Assessment Instruments, (6) Develop Instructional Strategy, (7) Develop and Select Instructional Materials, (8) Design and Conduct Formative Evaluation of Instruction, (9) Revise Instruction, (10) Design and Conduct Summative Evaluation [17].
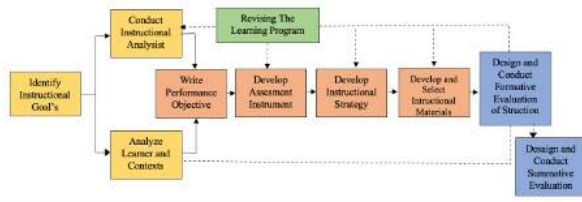
Figure 1. Procedure for Development of Ethnomathematical e-Module Based on Local Wisdom (Model Adoption Dick & Carey)

This research was conducted at the junior high school level by setting the research subject to the subject of needs analysis, namely the 2017 revised edition of the curriculum 2013 document in the seventh-grade mathematics subject at the SMP/MTs level. The measurement of the feasibility of the e-Module was carried out on three components, namely the validity, practicality, and effectiveness of the product. The validity of aspects of the material, language and images, presentation, and display/graphics was examined by experts. Meanwhile, junior high school mathematics teachers assessed the practicality of e-modules, and students evaluated all aspects of e-modules, including ethnomathematical aspects and the achievement of cultural and civic literacy.
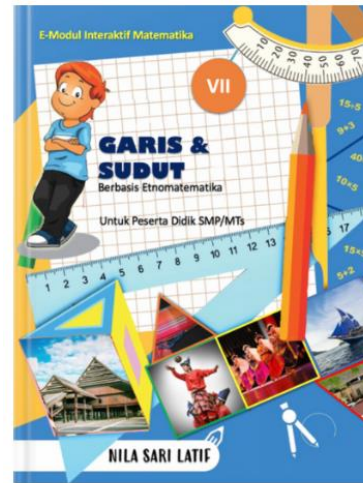
The trial was carried out after going through an expert validation process to determine the level of validity of the e-Module for students to use to master cultural and civic literacy. The first trial, namely a small group trial, was conducted by selecting 9 students who were asked to use the e-Module in learning in assessing clarity, impact, and feasibility. The second trial was a field test evaluation (Field Trial) tested on a large group consisting of 20 students who were randomly selected to determine the effectiveness of the e-Module. The main data collection instruments and techniques were questionnaires, observations, tests, and interviews to obtain data on the quality of teaching material products in the form of e-Modules.

The data analysis techniques used were quantitative and qualitative data analyses. The quantitative analysis was applied to analyze the assessment results, input, feedback, critics, and suggestions for improvement through questionnaires and test results of learning outcomes, while qualitative analysis was used to analyze data obtained from observations and interviews on the use of wisdom-based ethnomathematical e-Module.

3. RESEARCH RESULTS AND DISCUSSION

3.1. Development Results

The results of product development of ethnomathematical e-Module teaching materials based on local wisdom to improve students' cultural and civic literacy are presented as follows:

Cover E-Modul

Figure 2 Cover e-Modul

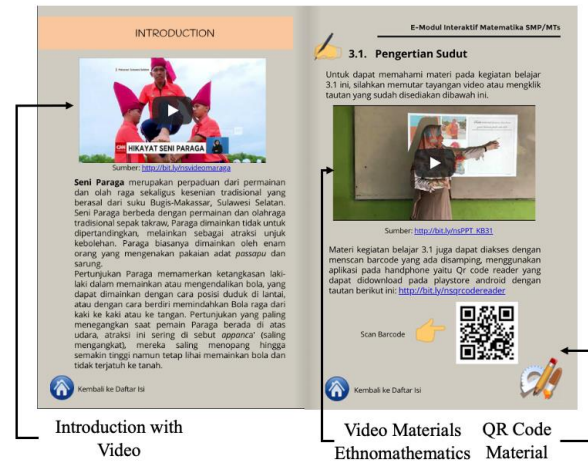Concept Map presented in Video Form   Basic Materials and Competence

Figure 3 Concept Map and Basic Competencies

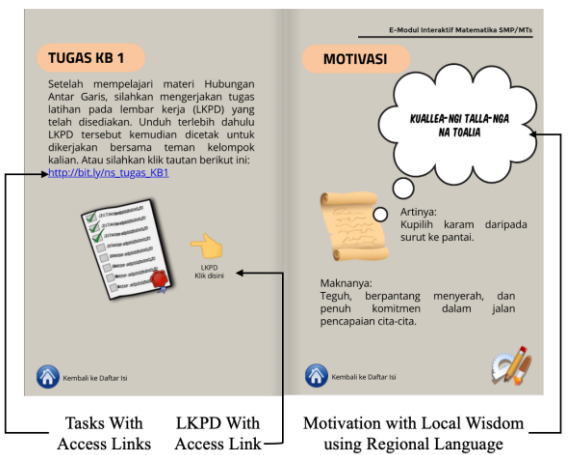Learning Objectives are presented in the form of Sound

Learning Steps with Links

Figure 4 Learning Objectives and Steps

Introduction with Video

Video Materials Ethnomathematics

QR Code Material

Figure 5 Introduction based on local wisdom of the Bugis-Makassar tribe, ethnomathematical material in the form of videos and QR Code materials

Tasks With Access Links

LKPD With Access Link

Motivation with Local Wisdom using Regional Language
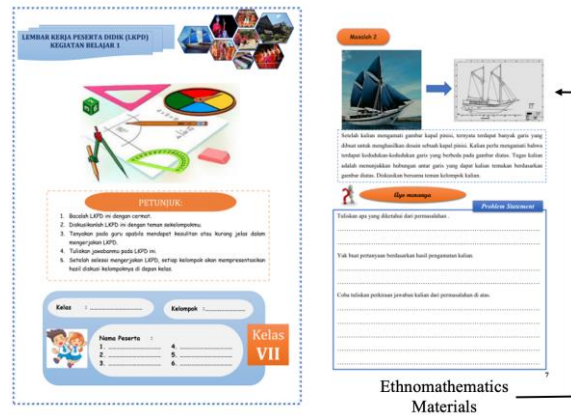
Figure 6 Assignment and Motivation

Ethnomathematics Materials

Figure 7 LKPD Ethnomathematics

3.2. *Product Development Test Results*

From the implementation of product trials of teaching materials in the form of e-Modules, the feasibility of products as a source of learning for improving students' cultural and civic literacy in mathematics subjects was tested by measuring the validity, practicality, and effectiveness of e-Modules.

3.2.1. *e-Module Expert Validation Results*

The level of validity of the developed e-Module was measured through expert assessment. the data obtained from the assessment are given as follows:

Table 1. Expert Validation Results for e-Modules

No	Assessment Component	Average	Test Decision
1	Content eligibility	3.63	No Revision Needed
2	Language Accuracy	3.58	No Revision Needed
3	Graphics	3.67	No Revision Needed
	Total Average	3.6	No Revision Needed
	Category 3.5 ≤ M ≤ 4 2.5 ≤ M < 3.5 1.5 ≤ M < 2.5 M < 1.5	Very Valid	No Revision Needed

Table 1 shows that the average score of the expert validation results on the three components, namely content feasibility, language accuracy, and graphics, is 3.6, which means that the e-Module is very valid. It indicates that the e-Modul product feasibility test components are in the very valid category, where the highest average graphics and content feasibility scores are 3.67 and 3.63, respectively. The data also shows

that the development of e-Modules from feasibility, language, and graphics do not require revision. From all inputs and assessments from the validator, it can be concluded that this e-Module is suitable for use as teaching material in mathematics learning.

3.2.2. e-Module Practicality Test Results

The practicality of the e-Module can be seen from the determination of the product results from a limited trial in the field regarding the practicality and implementation of the product developed. The results of the trial data analysis were obtained from the practicality assessment of the e-Modul on the suitability of the content with the material, the suitability for the development of cultural literacy, language and graphics, and the conformity with the learning syntax of the teacher and students. The result of Data Analysis of the practicality of e-modules from teachers can be seen in Table 2 and Table 3.

Table 2. Results of data analysis of the practicality of e-modules from teachers

No	Assessment Component	Average	Test Decision
1	Conformity of content with material	4	No Revision Needed
2	Compatibility with the development of Cultural Literacy	3	No Revision Needed
3	The suitability of the material with KD, IPK, and TP	3.5	No Revision Needed
4	Compatibility with learning syntax	3.5	No Revision Needed
	Total Average	3.5	No Revision Needed
	Category 3.5 ≤ M ≤ 4 2.5 ≤ M < 3.5 1.5 ≤ M < 2.5 M < 1.5	Very Practical	No Revision Needed

The test results on the level of practicality of e-Modules conducted by teachers are in the Very Practical category with a score of 3.5. This means that the e-Module made is considered very practical for use in learning. There is no need to revise the material's content, develop cultural literacy, language, and graphics, and conform to the learning syntax.

The test results on the practicality of e-Modules by students are presented in table 3 below:

Table 3. Results of Data Analysis of the Practicality of e-Modules from Students

No	Assessment Component	Average	Test Decision
1	Completeness of Material Content	3	No Revision Needed
2	Kejelasan uraian Materi	3	No Revision Needed
3	Clarity of material description	3.5	No Revision Needed
4	Ease of Use	3.5	No Revision Needed
	Total Average	3.3	No Revision Needed
	Category 3.5 ≤ M ≤ 4 2.5 ≤ M < 3.5 1.5 ≤ M < 2.5 M < 1.5	Practical	No Revision Needed

Based on table 3 above, the results of the practicality assessment of students are in the Practical category with a value of 3,3, which means that e-Modules are practically used in learning activities, and there is no need to revise the e-Modules.

3.2.3. e-Module Effectiveness Test Results

The effectiveness of the e-Modul is determined by how far the students understand the material. This can be seen from the results of the posttest of students and the achievement of Cultural and Civic Literacy. The test in question is structured based on subject matter indicators. The pretest was carried out before the field trial to determine the initial condition of the students, while the post-test was carried out after the field trial and an assessment to determine the competence and mastery of the students' e-Module achievement. Furthermore, e-Modules are effective if at least 80% of the percentage of students with a minimum completeness criterion of 70 is achieved.

Table 4. Pretest and Posttest Descriptive Analysis Results

No	description	Pre-test	Post-test
1	Average Completeness Score	68.75	77.25
2	The highest score	80	90
3	Lowest value	60	65
4	Many students have completed	12	17
5	Many students do not complete	8	3
6	Percentage of students who completed	60%	85%

Based on table 4 above, the percentage of students who completed the post-test was 85% or as many as 17 people, an increase from the pre-test score of 60% or 12 students. Thus, in terms of mastery of the material, the teaching materials developed have met the effective criteria because the percentage of students who achieve mastery is above 80%, with a standard value of completeness of 70.

Table 5. Measurement Results of Cultural and Civic Literacy

Category	Score Interval	Frequency		Percentage	
		Beginning	End	Beginning	End
Very good	81 -100	3	17	15	85
Good	61 - 80	13	3	65	15
Pretty good	41 - 60	4	0	20	0
Not good	21 - 40	0	0	5	0
Very Not Good	0 - 20	0	0	0	0
Total		20	20	100	100

The effectiveness of the e-Modul for the achievement of the Cultural and Civic Literacy of students can be seen in table 5. In the initial measurement, as many as 13 students were in a good category or 65% who achieved 61-80. Then, it experienced an increase in the final measurement of 17 students in the Very Good category or 85%, achieving a score between 81-100 on mastery of Cultural and Civic Literacy. Thus, it can be said that the developed e-Module is also effective in improving the Cultural and Civic Literacy abilities of students from good to the very good category after using ethnomathematical e-Module based on local wisdom.

3.3. Discussion

The results of testing on the development of e-Modules on validity, practicality, and effectiveness indicate that e-Modules based on local wisdom ethnomathematics are feasible to use for learning mathematics. The e-Modul product is developed according to the technical and non-technical specifications that have been set, namely (1) using the http://bookcreator.com application, (2) The file format is in the form of ePub and pdf files, (3) can be accessed with the Redium Google Play application Book, Moon + Reader, ReadEra, Cool Reader, Ebook Reader, on desktop and Smartphone, (4) contains text, Audio, Video, Picture, Illustration and Animation (5) structure consists of Preliminaries, Contents and final preliminaries, as well as specifications non-technical containing guidelines for the use of e-Modules, lesson plans, and syllabus.

The e-Module validation by material experts, language experts, and media experts obtained an average score of 3.6 which means that the level of validity of the e-Module product is in the very valid category. This indicates that all aspects of the assessment meet the required criteria so that the product does not need to be revised. From the validation of language experts, it is known that several components need to be improved, such as the directness of language, both in sentences and in learning videos, so that they are more dialogical when students use the product. Although, in general, the graphic aspect has met the valid criteria, several graphic components from media experts still have notes of improvement, such as the size of the module that needs to be adjusted, including the font size and typeface that still needs to be varied so that it improves to the attractiveness of the e-Modul. The results of the material expert validation also have several important notes for the perfection of the e-Modul related to the up-to-date material presented. It is still necessary to upgrade material so that students can connect the material with their environment. Notes from material experts include that in choosing examples, especially ethnomathematics, which is richer and more varied, in the local wisdom of the Bugis-Makassar tribe.

Comments and suggestions obtained from product validity tests by language experts, material experts, and media experts include selecting very precise images with proportional color and background combinations so that the display does not tire the eyes. The selection of font types is quite good, although the font pair still needs to be considered when juxtaposing two different font types on one page. Some of the video presentations are interesting and interactive, making it easier for students to follow the explanation of the material. Meanwhile, the use of language is quite good, short, and clear, but it still needs to be more direct in its delivery in verbal form through learning videos.

The results of the practicality level test of e-Modules conducted by teachers 3.5 means that the e-Modules are in the category of very practical use, and students obtained an average score of 3.3, which means that the e-Modules are in the category of practical use. Even though it is in the practical and very practical category, some inputs for improving the e-Module include notes from teachers to pay close attention to the suitability of the material with the development of cultural and civic literacy. In addition, in the presentation of e-modules, it is also necessary to pay attention to conformity with the specified learning syntax to learn sequentially and coherently. Meanwhile, the results of the evaluation of students require that the e-Module developed to pay attention to the completeness of learning resources and the clarity of the description of each material presented in the e-Module, both in the form of documents and in the form of learning videos.

Comments and suggestions obtained from the practicality test include the suitability of the material with ethnomathematics and the relationship between the material and efforts to improve students' cultural and civic literacy, which must also be included in the student worksheet (LKPD). Regarding the LKPD, the selection of images has been adjusted to the image presentation on the e-Module so that it is easier for students to find learning resources in the e-Modul when completing assignments on the LKPD. The most important suggestion from this stage is that it needs to determine the learning syntax included in the e-Modul so that students can carry out learning in a coherent manner. Some of the students' comments include the composition and layout presented sheet in the e-Modul. It is pretty exciting and easy to use because it has straightforward navigation, links, and QR codes. In general, students find it helpful to learn by using the E-Module ethnomathematics based on the local wisdom of the Bugis-Makassar tribe because, in addition-coherent lye context of the subject matter of lines and angles, they can also identify cultural objects and local wisdom that exists in their tribe. So that they can more easily complete tasks through LKPD, and their cultural and civic literacy skills are increasing.

The pretest and posttest results show that 80% of all students achieve the minimum score of completeness, namely a score of 70. Some important notes from the large group test are that the ethnomathematical nuances in the subject matter still need to display pop cultures that are very familiar to students so that they can be easier to understand and add insight and knowledge about culture civic literacy.

4. CONCLUSION

The teaching materials developed in e-Modules have met technical and non-technical specifications and contain materials adapted to basic competencies (KD), GPA, and learning objectives. In addition, the presentation is accurate and equipped with supporting materials, including materials with ethnomathematical nuances based on local wisdom. The presentation of the material pays attention to the use of communicative, dialogical, and interactive language and is adjusted to students' level of development. To make it easier for students to understand, the e-Module is equipped with illustrations, interesting pictures, symbols and icons as navigation while maintaining the composition of the typeface, font size, and color composition so that the appearance of the e-Module is attractive and easy to use. To improve students' cultural and civic literacy skills, the e-Module presents the material with ethnomathematical nuances based on Bugis-Makassar local wisdom, both in the form of videos, animations, and illustrations, interesting sentences, and pictures so that students can easily recognize them associated with mathematics subject matter. Thus, the ethnomathematical e-Modul product of the Bugis-Makassar tribe meets the valid, practical, and effective criteria to be used as teaching materials in the mathematics of lines and angles, and at the same time, can improve the cultural and civic literacy of students in class VII.

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