Ethnomatematics-Based Learning Media for Junior High School Mathematics using Rejang Lebong as Bengkulu Traditional House

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Abstract: The purpose of this research is to develop the mathematics learning media with ethnomathematics base for SMP (Junior High School) students at traditional house of Rejang Lebong and the media must valid, practice and effective. The research which used is research which developed by using ADDIE model with 5 steps, they are: (1) Analysis, (2) Design, (3) Development, (4) Implementation, and (5) evaluation. The subjects in this research are 24 students of class VIII of SMP Negeri 36 Rejang Lebong. The data instrument which collected in this research consist of validity sheet, practical sheet and a sheet of concept understanding capability test. Data are analyzed by using descriptive statistics to describe the average from students' concept understanding. Validity is analyzed by using Aiken Index. The result shows that mathematics learning media with ethnomathematics base at Rumah Adat Rejang Lebong is Valid with average Aiken Index score on material aspect is 0,81 and media aspect is 0,92 with valid criteria. Learning media has practical criteria from the teacher and students'' point of view. Interactive learning media product with ethnomathematics has followed the effective criteria according to students' capability in understanding the concept. It is showed from the percentage of students' completeness achievement is 82,68% with average score is 83,33.

Keywords: development research, ethnomathematics, rumah adat, concept understanding

Abstrak: *Penelitian ini bertujuan untuk mengembangkan media pembelajaran matematika berbasis etnomatematika pada rumah adat Rejang Lebong untuk siswa SMP yang valid, praktis, dan efektif. Penelitian yang digunakan adalah penelitian pengembangan dengan model ADDIE (Branch, 2009) dengan lima tahapan, yaitu: (1) analysis, (2) design, (3) development, (4) implementation, dan (5) evaluation. Subjek penelitian ini adalah peserta didik kelas VIII SMP Negeri 36 Rejang Lebong sebanyak 24 orang peserta didik. Instrumen pengumpulan data terdiri dari lembar validitas, lembar kepraktisan, dan lembar tes kemampuan pemahaman konsep. Data dianalisis secara statistik deskriptif untuk mendeskripsikan rata-rata pemahaman konsep peserta didik. Validitas dianalisis menggunakan indeks Aiken. Hasil penelitian menunjukkan bahwa media pembelajaran matematika berbasis etnomatematika pada rumah adat Rejang Lebong valid dengan rata-rata skor indek Aiken pada aspek materi sebesar 0,81 dan aspek media 0,92 dengan kriteria valid. Media pembelajaran memiliki kriteria praktis ditinjau dari penilaian guru dan peserta didik. Produk media pembelajaran interaktif berbasis etnomatika memenuhi kriteria efektif ditinjau dari kemampuan pemahaman konsep siswa. Hal ini ditunjukkan persentase ketercapai ketuntasan belajar peserta didik 82,68% dengan nilai rata-rata 83,33.*

Kata kunci: *penelitian pengembangan, etnomatematika, rumah adat, pemahaman konsep*

▪ INTRODUCTION

Mathematics learning in schools has an important role in preparing students to face the increasingly rapid development of science and technology. Through learning mathematics, students are able to think logically, rationally, mathematically, and think critically. This is in accordance with the objectives of learning mathematics in

Permendikbud No. 58, namely: (1) improving intellectual abilities, especially high-level abilities of students, (2) shaping students' abilities in solving problems systematically, (3) obtaining high learning outcomes, (4) training students in communicating ideas, especially in writing scientific papers, and (5) developing students' character (Kemendikbud, 2014). Mathematics also has an important role as a communication tool that is needed both by all sciences and in everyday life (Haji, 2012). Based on this, mathematical ability is an important aspect to be mastered by students.

However, the reality shows that students' mastery of mathematics is still low, especially at the junior high school level. For example, the mathematics mastery of junior high school students in Bengkulu City is still in the low category. Description of the ability of SMP/MTs students in Bengkulu City in solving math problems based on Trend International Mathematics and Science (TIMSS), the results show that mastery is based on material criteria with completeness in the number material by 59.18%, geometry by 36.39% and at data material and student mastery opportunities of 50.39% (Susanta et al., 2021). The results of research conducted by Haji, Yumiati and Zamzaili (2017) showed that students' ability to solve PISA questions at Bengkulu City Junior High School was at a moderate level with an average score of 43.75.

Based on observations at SMP Negeri 36 Rejang Lebong, several findings were obtained, including: (1) students perceive mathematics as a difficult subject. (2) students are accustomed to memorizing concepts, (3) learning is still teacher center. The results of the initial observation also showed that the mastery of students in the mid-semester exams for class VIII was obtained that the average student mastery was below the school's drinking completeness criteria. The test results show that the average student learning outcomes are 56.37, this is far from the school set, which is 75.

important to increase the ability of students in learning mathematics, especially in understanding mathematical concepts. According to Haji (2017) the principle of learning mathematics means prioritizing understanding or understanding concepts. So that in learning students need an intermediary that makes it easier for them to carry out the mathematization process. Intermediaries in learning can use media that can bridge students in understanding mathematical concepts. Teachers as learning facilitators should be able to be creative in designing and using media in learning. According to Susanta, & Susanto (2020) mathematics teachers should be able to develop problem solving skills and critical thinking skills so that they are able to link the means of all mathematical concepts in solving problems in each lesson. In addition, teachers should support students' mathematical connection skills so that students can use them in connecting various problems related to mathematics (Haji, Abdullah, Maizora, & Yumiati, 2017).

One of the efforts made by teachers is to develop the potential of students by using the right media (Andiny & Lestari, 2016). Teachers as facilitators in developing students' abilities need to carry out innovative learning (Susanta, Koto, & Susanto, 2022) Teachers can increase students' potential through independent learning without limiting students in learning both in understanding concepts and solving problems (Haji & Abdullah, 2015). In the increasingly rapid development of technology, teachers can use technology-based media in learning to make it easier for students to use. This is in accordance with NCTM (2000) which states that the incorporation of technology in mathematics learning has a positive impact, namely it can increase mathematics

learning achievement, increase learning effectiveness, and influence what and how mathematics should be studied and taught.

In addition, the use of the cultural context needs to be linked to the presentation of mathematical material so that it is easily understood by students. According to Muslimin, et al (2019), local wisdom is very important to support the learning process, so it is necessary to explore further about Indonesian culture in supporting mathematics learning. According to Prihastari (2015) culture-based learning in mathematics learning is one of the innovations that can eliminate the notion that mathematics is rigid and also through culture-based learning can introduce a culture that is not yet widely known by students. The relationship between culture and mathematics can be known as ethnomathematics. Ethnomathematics is a bridge between education and culture and mathematics can be interpreted as a cultural product (Wahyuni, Trias, & Sani, 2018; Lisnani, Zulkardi, & Ratu, 2020). Ethnomathematics focuses on the relationship between mathematics and culture (Albanese & Perales, 2015), Ethnomathematics on how to combine ideas, developed by socio-cultural or members of different cultures (D'Ambrosio, 2016; Rosa & Orey, 2016).

Several previous research studies related to ethnomathematics-based learning have been carried out, including Haji, Nirwana and Yulfitri (2019) showing that there is an effect of Rejang Lebong's ethnomathematical achievement learning model on mathematical problem-solving abilities. Other research on ethnomathematics is the research of Rahmawati & Muchlian (2019) conducting ethnomathematical exploration of the Minangkabau Tower House, West Sumatra; Ethnomathematics on archaeological wells in Kaliwadas Village, Cirebon (Noto, Firmasari, & Fatchurrohman, 2018); ethnomathematics: exploration of Borobudur temple (Utami, et al., 2020) ethnomathematics in the game of dengklaq (Fauzi & Lu'luilmaknun, 2019), ethnomathematics in Sundanese culture (Abdullah, 2017), the concept of geometric transformation in Yogyakarta batik (Prahmana & D'Ambrosio , 2021), traditional games on numeracy (Zulkardi & Nasrullah, 2011), mathematical modeling on the system of seasons and birth dates (Prahmana, et. al, 2021), ethno mathematics of the traditional "tanean-lanjang" Madura house (Sari, Budiarto, & Ekawati, 2022)

This makes the basis for conducting research by developing ethnomathematical-based learning media using the Rejang Lebong traditional house as a learning context. The Rejang Lebong traditional house is better known by students in the area so that the use of context is expected to make it easier for students to understand the concept of the material provided. The focus of the research objectives carried out was to produce a prototype of Rejang Lebong ethnomathematics-based junior high school mathematics learning media based on the exploration of mathematical concepts in the Rejang Lebong culture that met the criteria of validity, practicality, and effectiveness.

▪ **METHOD**
Research Subjects

The targets of this development research are eighth grade students of SMP Negeri 36 Rejang Lebong Lebong for the 2021/2022 academic year. The trial subjects in this study were selected for class VIIIA with 24 people consisting of 15 women and 9 men.

Research Design and Procedures

The research design used is development research which aims to develop ethnomathematical learning media based on the Rejang Lebong Traditional House which is valid, practical and effective. The development procedure in this study adopted the ADDIE model (Branch, 2009) with five stages, namely: (1) analysis, (2) design, (3) development (4) implementation and (5) evaluation. The analysis phase is carried out to analyze product development needs which consists of: needs analysis, curriculum analysis, student analysis. The design stage aims to design a learning media prototype consisting of: format and media selection. The development stage consists of product assessment by experts, teachers, and students.

Research Instruments

The instruments used for data collection in this study consisted of three, namely: validity instruments, practicality instruments, and concept understanding tests. The instrument to measure the validity consists of a material expert and media expert validity sheet. The validation instrument in the form of a statement refers to the Ministry of National Education (2008) which consists of: (a) the suitability of the content/material, (b) the suitability of the linguistic component, (c) the suitability of the presentation component, and (d) conformity with the ethnomathematical context of the Rejang Lebong traditional house. The assessment criteria in the developed validation instrument sheet consist of five rating scales, namely: very good (5), good (4), sufficient (3), less (2), and very poor (1).

Practical instruments consist of teacher and student assessment sheets. The instrument consists of 10 statement items. The assessment refers to the Linkert consisting of five assessment criteria, namely: (5) strongly agree, (4) agree, (3) undecided, (2) disagree, (1) strongly disagree. The concept understanding ability test instrument consists of 7 questions in the form of descriptions that measure the material of rectangles and triangles.

Data Analysis

The data analysis technique used was descriptive qualitative. The validity data were analyzed using the Aiken Index with the following equation.

$$V = \sum_{n=1}^{c-1} \frac{in_i}{[N(c-1)]}$$

Keterangan:
in_i = skor penilai tiap aspek dikurangi kategori penilaian terendah
c = kategori tertinggi
N = jumlah penilai (Aiken, 1980)

The criteria for assessing validity in this study are that the media is said to be valid if the Aiken index value ≥ 0.5 . Practical data analysis is based on data obtained from teacher assessment sheets and student assessment sheets. The reference for the practical analysis of the teacher and student assessments refers to the assessment interval with a score range of 1-5. The following is a reference based on the equation given by Widyoko (2009) with the number of statement items on the teacher's assessment as many as 17 items and 15 items for students.

Table 1. Guidelines for product practicality test

Score range for teacher	Score range for students	Category
$x > 58$	$x > 51$	Very practical
$48 < x \leq 58$	$42 < x \leq 51$	Practical
$37 < x \leq 48$	$33 < x \leq 42$	Neutral
$27 < x \leq 37$	$24 < x \leq 33$	Less practical
$x \leq 27$	$x \leq 24$	Not practical

Effectiveness data analysis was carried out statistically descriptively by describing the average understanding of students' concepts, learning completeness, and product effectiveness criteria. Data analysis to determine the effectiveness of learning ethnomathematics-based junior high school mathematics. The criteria for the effectiveness of the developed learning media are said to be effectively used in the learning process in the classroom if classically at least 80% of students reach the minimum completeness criteria set, namely 75.

▪ **RESULT AND DISSCUSSION**
Product development

The results of development research produce development products in the form of ethnomathematical learning media based on the Rejang Lebong traditional house that is valid, practical, and effective. The product developed consists of four learning media for triangle and quadrilateral material. In compiling learning products, an initial analysis is carried out, namely needs, students, and curriculum.stage analysis carried out by needs analysis showed that based on the results of the distribution of questionnaires to 24 students of class VIII, it can be concluded that 15 people (80.00%) answered that the teaching materials used by teachers were only textbooks and worksheets purchased from publishers which contained a collection of questions. exercise. In addition, about 75% (12 people) of students commented that learning mathematics in class was less attractive to students. Data on student ability is also still low based on students' semester test scores with an average of 44.89 which is still far from the KKM. Curriculum analysis obtained results under the focus of development carried out on geometry material, namely triangles and quadrilaterals with basic competencies of 3.11 and 4.11. The results of the context analysis used in the development of the media are the Rejang Lebong traditional house. Some of the results of the initial analysis carried out in the context of traditional houses can be used as learning resources such as: the shape of the roof of a traditional house, walls, rooms, and other parts that are related to geometric material.

Analysis of student background information obtained that all students came from the same environment, namely Rejang Lebong. So that in developing learning media or teaching materials, you can use contexts that are close to students. The use of this context can make it easier for students to learn because each student knows the context in their environment, one of which is the Rejang Lebong traditional house. At the design carried out by compiling an ethnomathematics-based learning media product design at the Rejang Lebong Traditional house for class VIII junior high school students. The product design of teaching materials is based on the results of the analysis that has been carried out, namely curriculum analysis, needs analysis, and analysis of prospective

students. studied in chapter 2. The format of the teaching materials developed consists of: (1) title page, (2) user manual, and (3) menu page. On the menu page is the main component or main dashboard of the developed media which consists of: (a) core competencies, basic competencies, and indicators, (b) materials, (3) exercises or quizzes, (4) references, and (e) information.

The product developed consists of four initial products consisting of materials: square and rectangle, trapezoid, rhombus, and triangle. Learning media is arranged based on ethnomathematics at the Rejang Lebong traditional house which interactively presents material and is equipped with quizzes or exercises to strengthen the subject matter. In designing ethnomathematical-based mathematics learning media at the Rejang Lebong traditional house by paying attention to several aspects, namely: material aspects, construction, language, traditional house context, and media presentation. The material aspect is designed based on the suitability of the selected material which refers to the basic competence of the material. The construction aspect is designed to be related to the systematic presentation of the media. While the language is designed by taking into account the use of appropriate language, such as: legibility, clarity of information, conformity with good and correct Indonesian rules, and conformity with the development of students. Learning media also pays attention to aspects of presentation and graphics, such as the use of attractive colors and presenting various images to make it easier for students to understand the material. The following is an example display of the results of product development
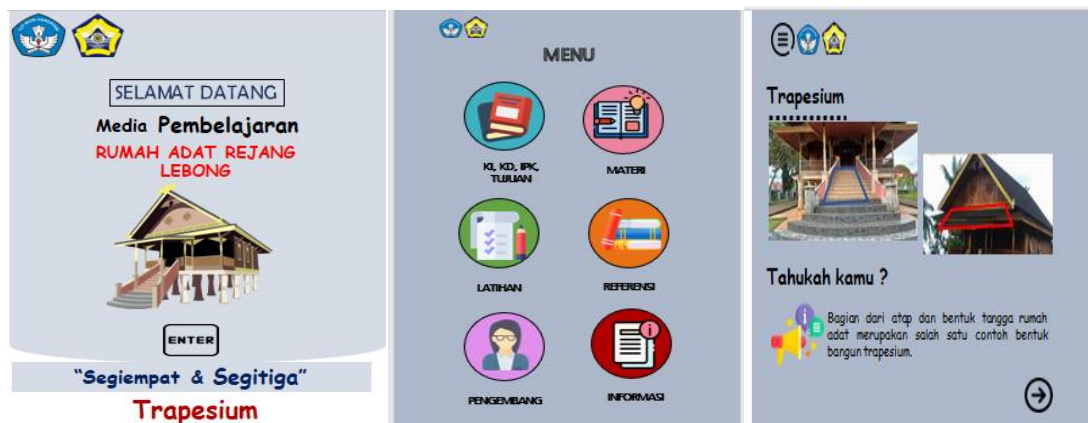

Figure 1. Example worksheet display

Product validity analysis

The results of expert validation assessment were analyzed using Aiken's formula. The results of the validation analysis are presented in the following table.

Table 2. The result of product content validation

Aspects	Aiken V index	Critetia
Contents	0.91	Valid
Constructions	0.82	Valid
Language	0.71	Valid
Contextual use	0.80	Valid

The results of the validity analysis in the table above show the average Aiken index value in all the aspect of content validity assessment is 0.81 with valid criteria. Based on the assessment of the material, construction, language, and contextual aspects, the Aiken index value is more than 0.70 with the material aspect having the highest Aiken index value of 0.91. Revision based on the results of suggestions or comments from the content validity assessment. The following is an example of notes from validators related to this validation who tend to comment on the relationship between core competencies, basic competencies, indicators in learning media.
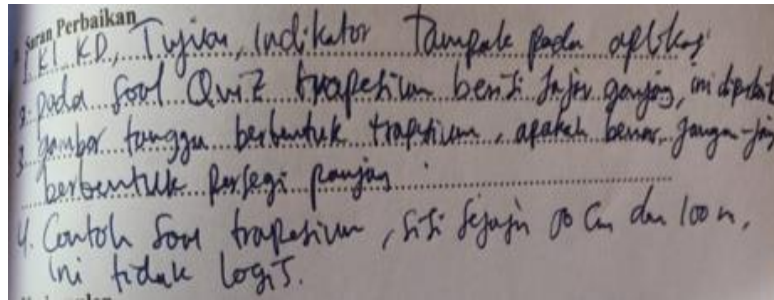

Figure 2. Notes for content validation revision

After an expert assessment of the content aspect is carried out, a media expert is then assessed. In the media aspect, the assessment is based on three aspects, namely: (1) user friendly, (2) design description, (3) usage interaction, and (4) usability. Assessment of media aspects is carried out by a master lecturer in educational technology with a summary of the results of the analysis based on the Aiken index as shown in the following table.

Tabel 3. The result of media validation

Dimension	Aiken V index	Criteria
User Friendly	0.96	Valid
Design	0.89	Valid
User interaction	0.93	Valid
Usefulness	0.89	Valid
Average	0.92	Valid

Based on the data from the analysis of the Aiken index on the assessment of media aspects, an average score of 0.93 was obtained with valid criteria because it was more than 0.5. Based on the analysis of each dimension of the media aspect, the average Aiken index value with very valid criteria. In the media analysis, there are several revisions from experts based on revision notes from two evaluators. The following is a revised note from a media expert.
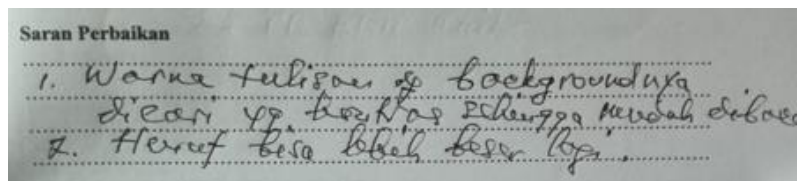

Figure 3. Notes for media validation revision

Based on the results of the validity test, it can be concluded from the aspect of product validity that meets the valid criteria. The results showed that the learning media met the valid criteria. The results of this study indicate that there is a strong relationship between learning media and the theory of the material presented. This is in accordance with Nieveen's (1999) opinion that teaching materials are said to be valid in accordance with strong theoretical rationale and there is internal consistency between the components of the device. According to Risnawati, et.al (2019), every educational product development must pay attention to the validation process because it is very important to get the best quality educational products. Valid learning media is the best way to get information about students' abilities according to learning objectives (Rezeki, et.al. 2022; Yunus, et.al. 2021).

Product practicality analysis

Data on teacher assessment results were obtained using a teacher assessment sheet on learning media. The components assessed from this sheet include aspects of content, presentation and graphics and language. The data from the practical analysis based on the practicality assessment by two teachers are presented in the following table.

Table 4. Practicality assessment by teachers

Product	Average	Category
Media 1	57.5	Practical
Media 2	60	Very Practical
Media 3	60.5	Very Practical
Media 4	59.5	Very Practical
Average	59.37	Very Practical

The data from the teacher's assessment on the practicality of the media from the assessment by two teachers obtained an average score with very practical criteria. Based on this, the learning media as a development product meets the practical quality. That is, the product is easy for teachers to use in learning. The results of the analysis of the teacher's assessment also found several suggestions, one of which was on graphics where some background colors interfered with the delivery of writing so that improvements were made.

The selection of the test subject students is done by selecting each of four students at low, medium, and high academic levels. Based on the assessment of 12 students in terms of the use of learning media, it can be summarized the average student assessment score.

Tabel 5. Practicality assessment by students

Product	Average	Category
Media 1	64.5	Very practical
Media 2	60.5	Very practical
Media 3	68.0	Very practical
Media 4	65.0	Very practical
Rata-rata	64.5	Very practical

Based on the table, the average results of the analysis of the practicality of learning media in the very practical category with an average score of 64.50. Based on this, it is concluded that the development product in the form of an ethnomathematical learning media based on the Rejang Lebong Traditional House meets the practical criteria both based on the teacher and in terms of students.

Product effectivity analysis

In the research class, the learning treatment was given using a learning model based on the ethnomathematics of the Rejang Lebong traditional house. At the end of the meeting, a concept understanding ability test (posttest) was conducted. The results of the concept understanding ability test are as follows:
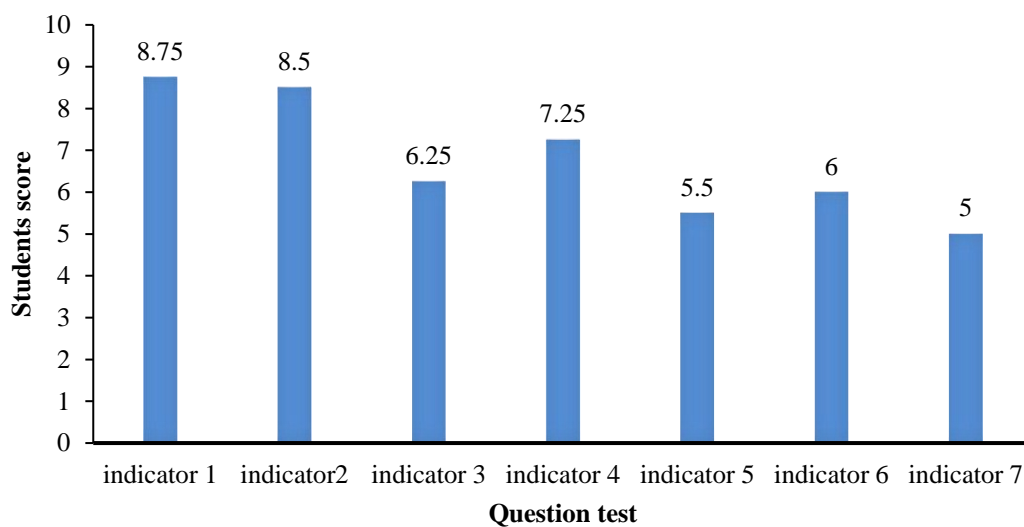

Figure 4. Average students' scores for each question

Based on Figure 4, it is known that student mastery in the 0-10 range is highest in the first and second indicators, namely restating a concept and classifying objects. While the lowest is in indicator 5 and indicator 7, namely developing the necessary requirements and applying the concept. Based on descriptive statistical data, the average overall score in the score range 0-100 obtained students' understanding of the concept of 83.33. This shows a significant increase compared to the average pretest of students. The data also shows that the percentage of classical student learning completeness that reaches the minimum completeness criteria is more than 75%, which is 82.68%. This shows that the learning tools developed have met the effective criteria.

Learning media is developed systematically in terms of presentation, where the media starts from introductory information about the context, material, and evaluation of material reinforcement. The learning media developed also relates to the environment around students, especially in the realm of culture, especially in Rejang Lebong. The advantage of the learning media developed in this study is that it can stimulate students in increasing their understanding of concepts through emphasizing material in the ethnomathematical context of traditional houses. The results of this study are supported by research conducted by Fajriyah (2018), the role of ethnomathematics also supports

mathematical literacy by facilitating students to be able to construct mathematical concepts as part of mathematical literacy based on students' knowledge of their socio-cultural environment. The use of cultural context is important, research by Susanta, Sumardi, & Zulkardi (2022) states that learning with an emphasis on context issues can support students to improve students' abilities.

The product is also effective in improving the ability to understand concepts. The effectiveness is shown by the achievement of student learning outcomes, especially the ability to understand concepts more than the minimum completeness criteria with a completeness level of more than 80%. This is in accordance with the effectiveness criteria (Nieven, 1999) which means that there is consistency between the learning tools that are set and those that are implemented as well as the learning tools that are set and the goals to be achieved.

This research is supported by several studies, namely research conducted by Yulfitir, Haji, & Nirwana (2019); Kurumeh, Onah, and Mohammed (2012) who showed that the achievement of mathematical concepts with ethnomathematical-based learning was greater than conventional learning. The use of realistic traditional house contexts for students helps students communicate the problems they find. In developing problems with cultural contexts, attention should be paid to contextual and content-relevant issues (Susanta, Sumardi, & Zulkardi, 2022). Haji and Abdullah (2016) that realistic context learning can support student communication. Risdiyanti and Prahmana (2017) who mention the relationship of mathematical concepts in batik design can be done by making learning designs and learning starting points.

Several other research studies that support the results found, Ishartono and Ningtyas (2021) state that the mathematical concepts in Batik can be applied to mathematics learning at the school level from primary to secondary levels.

▪ **CONCLUSION**

Based on the research and development results that have been described, it can be concluded that the ethnomathematics-based junior high school mathematics learning media product at the Rejang Lebong traditional house meets the valid, practical, and effective criteria with the characteristics: (a) oriented to the context of the Rejang Lebong traditional house, (b) arranged systematically in the form of a flip pdf, (c) facilitating students in developing the ability to understand concepts. The learning media is valid with the Aiken index in the material aspect of 0.81 and the media aspect of 0.92. The practicality of the product from the student assessment has an average score of 64.50 with very practical criteria and the teacher's assessment of 59.37 with practical criteria. While the effectiveness aspect is shown by the percentage of students' learning mastery achievement of 82.68% with an average value of 83.33.

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