

# Development of Ethnomathematics-Based Module to Improve Students' Critical Thinking Skills

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## ABSTRACT

Critical thinking skills are crucial for students as they are closely tied to their problem-solving capabilities. This study aims to develop a teaching module integrated with the ethnomathematics of the *Jam Gadang* architecture to enhance students' critical thinking skills on the topic of flat shapes. This research adopts a Research and Development (R&D) approach using the Plomp model. The study involves fifth-grade students from a state elementary school in Sungai Jariang in a one-to-one and small-group method trial class, and a state elementary school in Pahambatan Balingka as a field trial class. Data analysis employs validity analysis techniques, practicality analysis techniques utilizing a Likert scale, and effectiveness analysis techniques using a one-group pretest-posttest design. The research instruments include a questionnaire and a critical thinking test. Validation of the teaching module instrument scored 3.6, and student worksheets (LKPD) scored 3.83, both falling into the highly valid category. The practicality of the teaching module reached 92.86%, while the practicality of student worksheets (LKPD) reported 91.18% from the students' perspective and 95.85% from the teacher's perspective, all categorized as highly practical. The *Jam Gadang* integrated learning modules for ethnomathematics were declared effective in the medium category based on the calculated N-Gain value in field trials of 0.51. Thus, this learning module is suitable for use in improving students' critical thinking skills.

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## 1. INTRODUCTION

The current learning modules have not achieved optimal ability in conveying concepts and learning objectives, resulting in students' critical thinking abilities being still low (Zagoto & Dakhi, 2018). The ability to think critically is not an innate skill in humans but rather must be cultivated through the learning process (Gistituati et al., 2018). Utilizing a learning module incorporating local wisdom and cultural elements is expected to enhance the effectiveness of facilitating students' understanding. One relevant approach in this context is "ethnomathematics," which establishes connections between mathematical

concepts and students' culture and daily experiences (A. A. L. Dewi & Agustika, 2022). Integrating learning approaches with culture can commence with the design of learning modules. Educators are crucial in crafting engaging and meaningful learning content within the designed learning framework (Prihatinia & Zainil, 2020). The current learning module falls short of fully addressing the student's needs, resulting in a monotonous appearance of mathematics learning (Choirudin et al., 2020). Learning modules have yet to succeed in motivating students by delivering compelling and engaging educational content (Mulyanti & Sesrita, 2023). Furthermore, the learning modules utilized are not contextualized according to the specific environment in each student's area (Purwanti & Rismaningtyas, 2019). This implies that the integration of ethnomathematics, which establishes connections between mathematical concepts and students' cultural contexts and daily experiences, is a pertinent and promising approach to mathematics learning. The emphasis on incorporating learning approaches with culture, beginning with the design of learning modules, is underscored as a strategy to render learning both interesting and meaningful.

An ethnomathematics approach can offer students mathematics in a more authentic and relevant context in everyday life. By using ethnomathematics, an understanding of mathematical concepts related to geometric objects can be presented concretely. This approach facilitates deeper understanding among students, making the material more accessible and understandable (Sari, 2022). Additionally, ethnomathematics aids students in comprehending mathematical concepts by encouraging exploration and understanding of the culture within their surrounding environment (Febrina et al., 2022; Mulyatna et al., 2022). Incorporating culture into the learning process can facilitate the development of students' critical thinking skills more easily. The importance of adapting mathematics teaching to each individual should reflect aspects of their culture (Prahmana & D'Ambrosio, 2020). Culture is one aspect of students' daily environment that can be interconnected with mathematics subjects (Febriyanti & Ain, 2021; Putri & Agustika, 2022). In the process of learning mathematics, teachers require instructional media that can assist students in comprehending mathematical concepts more easily, incorporating cultural elements present in their surroundings. Several aspects of Indonesia's cultural richness that can be incorporated into ethnomathematics learning include historical buildings. Historical buildings are one of the objects that are very relevant to observe in the context of ethnomathematics (Faturrahman & Soro, 2021). This implies that the integration of ethnomathematics in mathematics learning can open the door to a deeper and more applicable understanding for students, fostering an appreciation for and exploration of the rich culture around them.

One of the historical buildings in Bukittinggi is the *Jam Gadang*. In ethnomathematics studies, the observation of historical buildings can assist students in comprehending various mathematical concepts employed in building design, serving as an alternative medium for learning mathematics (Salsabila & Soebagy, 2023). Additionally, *Jam Gadang* holds cultural and historical significance in society, evident through symbolism, patterns, and geometry embedded in its architecture. The cultural value inherent in observing historical buildings provides an intriguing avenue to intertwine mathematics with culture and history in the learning process (Setiawan et al., 2023). This suggests that the presence of cultural values in *Jam Gadang* is an intriguing means to bridge the gap between mathematics and culture.

Based on initial observations carried out in several elementary schools in West Sumatra, especially in the class fifth of SD Negeri 20 Pahambatan Balingka on Wednesday 2 August 2023; SD Negeri 01 Sungai Jariang on Thursday 3 August 2023; and SD Negeri 03 Koto Tuo on Friday 4 August 2023 it was discovered that the teaching modules used were not fully in line with students' needs in the learning process. The teaching module used was proven to be less effective in motivating student learning, because it followed procedures that were too general and sometimes too abstract, causing students to become bored while studying. Likewise, when working on student worksheets (LKPD), students are not enthusiastic about working because the presentation is less interesting. In addition, the approach or method outlined in the module does not quite match the steps presented. Apart from that, there is a lack of providing clear steps for students to think critically, especially through indicators and problems presented by educators in teaching modules.

In an attempt to analyze the necessity for learning modules, a questionnaire was employed and distributed to educators. The analysis of the questionnaire results led to the conclusion that there is a distinct need to develop a teaching module that can enhance students' critical thinking abilities. The development of ethnomathematics teaching module emerges as a solution to improve culturally integrated students' critical thinking skills. This has been proven through previous research that ethnomathematics can improve students' critical thinking skills (K. S. Dewi et al., 2022; Nelawati et al., 2019; Novitasari et al., 2022; Suhartini & Martyanti, 2019). In research (Dewi et al., 2022), it was found that the focus of the research was producing student worksheets (LKPD) on geometry based on ethnomathematics, which were viewed from the perspective of critical thinking skills with the research subject of grade 7 students at SMP Negeri 4 Abung Timur. Furthermore, the research (Nelawati et al., 2019), focus of the research was to develop a teaching module characterized by ethnomathematics of the Komering ethnic group and material for flat shapes for class IV of SD Negeri 1 Terpadu Karang Kemiri and SD Negeri 2 Karang Kemiri. The next research (Novitasari et al., 2022) has a focus on developing ethnomathematics-based student worksheets (LKS) with a science, technology, engineering, and mathematics (STEM) approach to improve the critical thinking abilities of class IX junior high school students. Subsequent research (Suhartini & Martyanti, 2019) focused on improving critical thinking skills in ethnomathematics-based geometry learning.

Learning mathematics in phase C measurement elements, "students can determine the perimeter and area of various flat shapes (triangles, quadrilaterals and polygons) as well as their combinations" (Kemendikbud, 2022), namely using the *Jam Gadang* architecture because there are many mathematical elements. Through the application of real-world integrated learning using *Jam Gadang* architecture learning resources, it is hoped that students can develop their critical thinking skills.

This research has a different focus from previous research in that it focuses on developing an integrated learning module for *Jam Gadang* ethnomathematics on the topic of flat shapes for use with fifth-grade elementary school students. To obtain the results of this research, this research question was divided into two:

- a. How to develop a valid and practical integrated learning tool for ethnomathematics jam gadang to improve the critical thinking skills of fifth grade elementary school students?
- b. How to develop an effective integrated learning tool for ethnomathematics jam gadang to improve the critical thinking skills of fifth grade elementary school students?

This research aims to develop an integrated learning module for *Jam Gadang* ethnomathematics that is valid and practical. In addition, this research aims to evaluate the effectiveness of this learning module in the teaching process. The use of the *Jam Gadang* integrated learning module in ethnomathematics subjects is expected to improve students' critical thinking skills.

## 2. METHODS

### 2.1 Research Design

This research uses the Research and Development (R&D) method. The Research and Development (R&D) method is a needs analysis research method used to create a product, which will then be tested for the effectiveness of the product (Sugiyono, 2019). The development model used refers to the model proposed by Tjeerd Plomp. This model consists of three phases (Plomp & Nieveen, 2013), namely the initial investigation phase, the prototyping phase, and the assessment phase, which will be explained in the development procedure.

### 2.2 Participant

The parties involved in this development research include: 1) instrument validators consisting of 2 mathematicians; 2) expert validators (material experts consisting of 2 mathematicians and 1 practitioner, 1 language expert, and 1 media expert); 3) class V students in three elementary schools, namely SD Negeri 03 Koto Tuo as a critical thinking test subject, 18 students; SD Negeri 01 Sungai Jariang as a subject in one-on-one groups of 3 people and small groups of 12 people; and SD Negeri 20 Pahambatan Balingka as

subjects in a large group (field test) of 17 people. The sample selection process involved utilizing a random sampling technique.

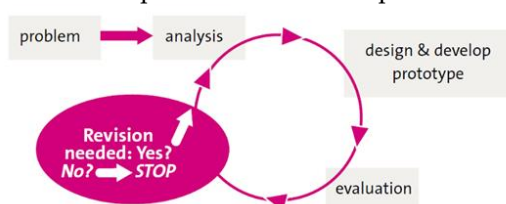
### 2.3 Instrument

The instruments used in this research are by the research objectives, namely to produce valid, practical and effective products. So the instruments used generally consist of three things validation instruments, practicality instruments, and effectiveness instruments. Validation instruments help determine the validity of the designed teaching modules and student worksheets (LKPD). The validation sheet contains assessment aspects which include content validity, construct validity, language, and appearance of teaching modules and student worksheets (LKPD). The practicality instrument is used to collect practicality data from teaching modules and student worksheets (LKPD). This instrument consists of a teacher response questionnaire and a student response questionnaire to obtain responses to the practicality of using the teaching modules and student worksheets (LKPD) that were developed. Teaching module indicators: ease of use, time efficiency, benefits, and teaching module structure, with a total of 14 questions in this teaching module. Indicators for the student worksheet (LKPD) questionnaire: ease of use, benefits of the student worksheet (LKPD), readability, and time efficiency, with a total of 12 questions. The questionnaire used in this research was adapted from previous studies to align with the specific requirements of the current research. Teachers and students fill out this questionnaire after learning using teaching modules and student worksheets (LKPD). These instruments collectively contribute to the evaluation of the validity, practicality, and effectiveness of the teaching modules and student worksheets developed in the research.

The instrument used to obtain data on the pretest and posttest uses test questions. The critical thinking test questions are in the form of a description of six items. This test is used to see the effectiveness of using the module during learning. The questions given in the pretest and posttest have different aims to assess students' critical thinking abilities. The critical thinking test questions in the pretest use material before the research was carried out, while the critical thinking test questions in the posttest use material when the research was carried out.

### 2.4 Procedure

This research and development follows a pilot model comprising three phases: the initial investigation phase, the prototyping phase, and the assessment phase. The development procedure is illustrated in Figure 1 and will be further explained in the subsequent sections:



**Figure 1:** Systematic Design and Development Cycle Iteration

In the initial stage, the researcher conducted a preliminary analysis to prepare the initial design of the teaching module and LKPD. Moving on to the second stage, the development phase resulted in the creation of prototype 1 in the form of teaching modules and LKPD. The generated teaching modules and LKPD underwent multiple evaluation stages. The first evaluation stage involved self-evaluation, followed by an expert review. During the expert review stage, validation by experts occurred, where experts provided suggestions. The validation results served as guidelines for revisions, leading to the production of prototype 2. Prototype 2 underwent testing in a one-to-one evaluation, resulting in the creation of prototype 3. Subsequently, Prototype 3 was tested in a small group evaluation, leading to the development of Prototype 4. In the third stage, an evaluation was carried out to assess the practicality and effectiveness of prototype 4. A field test was conducted at SD Negeri 20 Pahambatan Balingka to gauge the module's practicality and effectiveness.

### 2.5 Data Analysis

The average percentage value was calculated by analyzing data from all instruments using descriptive statistics. Validity data analysis and practical data analysis are two types of data analysis approaches. This information is derived from the outcomes of completing out the instrument, which is collated using a Likert scale to produce a score for each item (Purwanto, 2020). To process and analyze the data obtained from the questionnaire, it is essential to ensure that all questionnaires have been filled in correctly and completely.

The data obtained from the validation sheets was presented in tabular form, with scores assigned to each response. To determine the average score provided by the validator, the formula was utilized (Walpole, 2017):

$$\mu = \sum_{i=1}^n \frac{X_i}{n}$$

Description:

$\mu$  = average item score

$X_i$  = score given by the  $i$ -th validator for the item

$n$  = number of validators

The average obtained was evaluated using the criteria outlined (Fernandes & Syarifuddin, 2020) as presented in Table 1 below:

**Table 1. Criteria for the Validity of the Learning Tool**

Average Assessment Results	Interpretation
$\bar{X} \geq 3,50$	Highly Valid
$3,00 \leq \bar{X} \leq 3,49$	Valid
$2,00 \leq \bar{X} \leq 2,99$	Less Valid
$1,00 \leq \bar{X} \leq 1,99$	Not Valid

The technique used in analyzing the practicality data involves calculating scores and percentages for each respondent's answer. Subsequently, a simple statistical analysis is performed by calculating the mean using Microsoft Excel with the formula (Purwanto, 2020) below:

$$NA = \frac{R}{SM} \times 100$$

Description:

NA = Total score

R = Sum of obtained scores

SM = Total maximum score

Criteria for determining the practicality level of the teaching materials (Purwanto, 2020) such as Table 2 below:

**Table 2. Criteria for Practicality of the Learning Tool**

Practicality Score	Interpretation
$85 \leq P \leq 100$	Highly Practical
$75 \leq P < 85$	Practical
$60 \leq P < 75$	Fairly Practical
$55 \leq P < 60$	Less Practical
$0 \leq P < 55$	Not Practical

After obtaining the calculation results, data interpretation is carried out based on the findings. Finally, conclusions for each analysis will be derived based on the average value of the percentage. For pretest and posttest data, the analysis technique is based on critical thinking indicators. The indicators used are based on Polya's method, including 'what if' and 'what's wrong'(Stiff, 1999). The data analysis

involves examining the results for each indicator within the range of values 1-4. Subsequently, statistical analysis is performed using the formula (Purwanto, 2020) below:

$$P = \frac{\sum \text{Sum of students who scored } \geq 75}{\sum \text{total number of students}} \times 100 \%$$

Description :

P = Completion Percentage

The next step is to analyze the pretest and posttest using the N-Gain Score formula:

$$N - \text{gain} = \frac{S_{\text{post}} - S_{\text{pre}}}{S_{\text{max}} - S_{\text{pre}}}$$

Description:

N-Gain = Score Gain Score

Spre = Score dari Pretest

Spost = Score dari Posttest

The total scores of students during the pretest and posttest were compared using N-Gain Scores to assess the effectiveness of the developed teaching module .

### 3. FINDINGS AND DISCUSSION

#### 3.1 Teaching Module Development

The results of the development of *Jam Gadang's* ethnomathematics integrated teaching module are as follows:

##### a. Teaching Module Cover

The cover of this teaching module was designed using the Canva program, with the basic color selection being green and blue gradations, and the title type used was Fredoka One. On the cover of this teaching module, there are several components, such as the title of the module, a picture of the *Jam Gadang*, the title of the material used, class, and phase. The cover of the teaching module being developed can be seen, as shown in Figure 2 below:

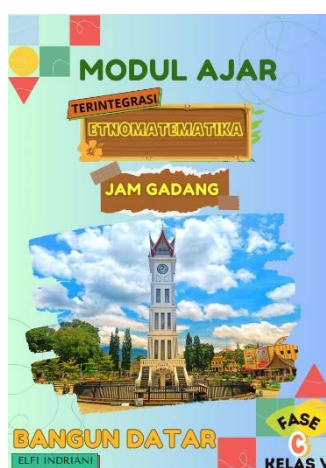


Figure 2. Cover of the Teaching Module

b. Meeting Title

The title of the meeting in this teaching module uses the Canva application with Quicksand writing type, size 22. The title of the meeting in this teaching module can be seen, as shown in Figure 3 below:



Figure 3. Teaching Module Meeting Title

c. General information

General information in this teaching module uses Microsoft Word with Cambria writing type and writing size 12. The background is edited using the Canva application, as shown in Figure 4 below:

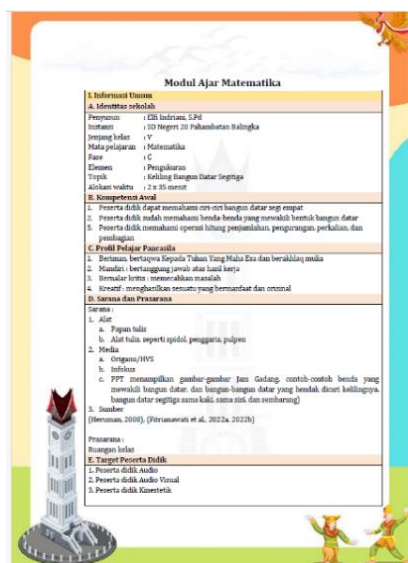


Figure 4. General Information

Figure 4 above contains general information consisting of the identity of the teaching module, initial competencies, Pancasila student profile, infrastructure, target students, and the learning model used.

d. Core Components

The core components of this teaching module use Microsoft Word with Cambria writing type and writing size 12. The background is edited using the Canva application, as shown in Figure 5 below:

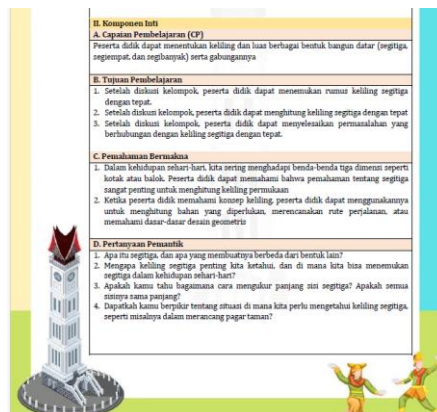


Figure 5. Core Components

In this component section, there are six teaching module sections consisting of learning objectives, meaningful understanding, trigger questions, learning activities, assessment, enrichment, and remedial.

e. Teaching Module Attachment

The attachments to this teaching module use Microsoft Word with Cambria writing type and writing size 12. The background is edited using the Canva application, as shown in Figure 6 below:

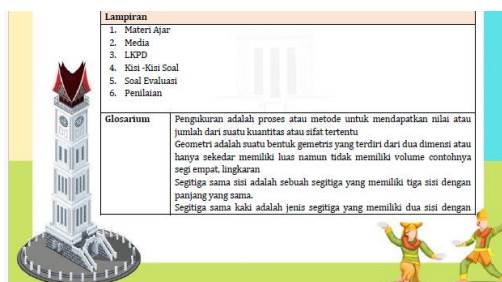


Figure 6. Attachment To The Teaching Module

The attachment section of this teaching module consists of student worksheets (LKPD), reading materials, a glossary, and a bibliography.

Based on the results of the development of the *Jam Gadang* ethnomathematics integrated module on data presentation material starting from designing the teaching module, validating the presentation and appropriateness of the contents of the teaching module, the language of the teaching module, and the graphics of the teaching module that validated by the experts in mathematics, Indonesian language, and arts material, the results obtained can be seen in Table 3 below:

Table 3. Recapitulation Results of Teaching Module Validation by Experts

Assessment Aspects	Average	Category
Subject Identity	4	Highly Valid
Lesson objectives	4	Highly Valid
Formulation of learning indicators	3,5	Highly Valid
Formulation of learning objectives	3,38	Valid
Selection of learning materials	3,83	Highly Valid
Selection of learning strategies	3,5	Highly Valid
Selection of learning resources	3,5	Highly Valid
Selection of learning media	3,5	Highly Valid
Learning activity steps	3,25	Valid
Evaluation	3,75	Highly Valid
Language	3,63	Highly Valid
<b>Average</b>	<b>3,60</b>	<b>Highly Valid</b>

Validation was carried out using a validation sheet on the presentation, appropriateness of the content, and language of the teaching modules given to mathematics, language, and arts material experts. Based on Table 3, the results of the evaluation carried out by experts on the *Jam Gadang* ethnomathematics integrated teaching module meet Highly Valid criteria.

The valid teaching module was then evaluated using a questionnaire sheet focusing on teacher practicality and student practicality to derive a practical teaching module. Following its implementation in the classroom, the results of the *Jam Gadang* integrated ethnomathematics teaching module were obtained as follows:

**Table 4.** Results of the Teaching Module Practicality Analysis

Aspects	Practical Results	Category
Teacher Practicality Questionnaire	92,86	Highly Practical

Based on Table 4, the results of the analysis of the practicality questionnaire sheet for the teaching module show that the *Jam Gadang's* ethnomathematics integrated teaching module has a score of 92.86 in the Highly Practical category.

### 3.2 Development of LKPD

The results of the *Jam Gadang's* ethnomathematics-integrated LKPD development product are as follows:

#### a. LKPD Cover

This LKPD cover was designed using the Canva application program, with the basic color selection being green and blue gradations, and the type of writing used being Fredoka One. On the cover of this LKPD, there are several components, such as the title of the teaching module, a picture of the *Jam Gadang*, the title of the material used, class, and phase. The cover of the teaching module being developed can be seen, as shown in Figure 7 below:



**Figure 7.** LKPD Module Cover

#### b. LKPD Topic Title

The topic title on the LKPD was created using the Canva application with Alegreya type 18, as shown in Figure 8 below:

##### I. Judul Topik

Konsep keliling bangun datar

**Figure 8.** LKPD Topic Title

#### c. LKPD Purpose

The purpose of the LKPD is to be created using the Canva application using Alegreya size 18 writing type, as shown in Figure 9 below:

##### II. Tujuan LKPD

Menemukan konsep keliling bangun datar

**Figure 9.** LKPD Purpose

d. LKPD Instructions

Instructions for using LKPD are useful for students in working on LKPD and as a guide in working on LKPD. These LKPD instructions were created using the Canva application with Alegreya writing type size 18, as shown in Figure 10 below:

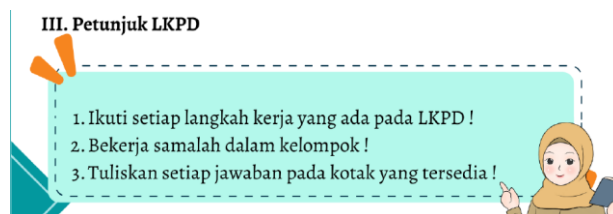


Figure 10. LKPD Instructions

e. Introduction to LKPD

The LKPD introduction contains supporting information before carrying out the activity steps on the LKPD, which is written in Alegreya size 18, as shown in Figure 11 below:

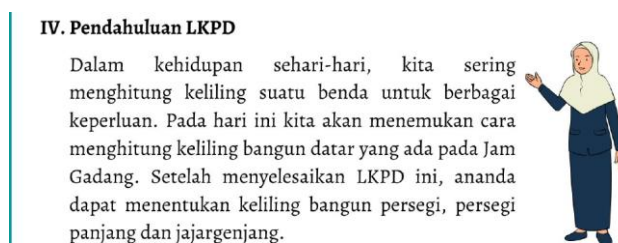


Figure 11. Introduction to LKPD

f. Activity Steps

The activity steps contained in the LKPD are designed so that students are active in group activities. The activity begins with observing activities in accordance with the scientific approach and the ethnomathematics approach. The steps for this activity were created using the Canva application with Alegreya size 18, as shown in Figure 12 below:

**VI. Langkah-Langkah Kegiatan**

1. Perhatikan foto atap Jam Gadang di bawah ini !  
Atap Jam Gadang desainnya berbentuk bangun datar segitiga.  
Gambarkan bentuk segitiga sesuai atap Jam Gadang di bawah ini !

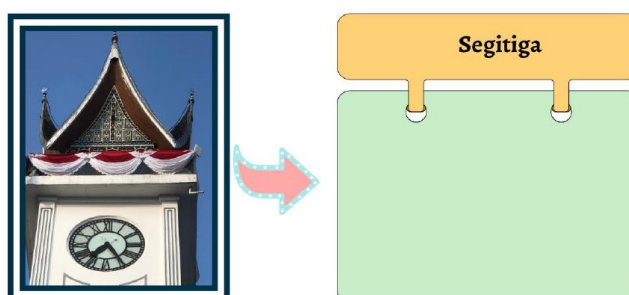


Figure 12. Activity Steps

g. Practice Every Meeting

The exercises at each meeting presented in the LKPD consist of 1 or 2 questions to improve students' understanding and critical thinking skills. The exercises at each meeting were created using the Canva application with Alegreya size 18, as shown in Figure 13 below:

2. Berdasarkan gambar yang ananda buat pada lembar kerja, jawablah pertanyaan ini !

- Apakah sisi-sisinya sama panjang? Jawab:
- Bangun datar apakah itu? Jawab:
- Ukurlah panjang ketiga sisinya menggunakan penggaris !  
Jawab:

3. Hitunglah keliling segitiga tersebut sesuai dengan pemahaman materi keliling sebelumnya ! Tuliskan berapa cara yang bisa ananda gunakan !  
Jawab:

**VII. Pertanyaan**

Jika ada sebuah segitiga dengan panjang sisi masing-masing 3 cm, 4 cm, dan 5 cm. Bagaimana cara kita menentukan kelilingnya?

**Figure 13.** Exercise in LKPD

#### h. Conclusion

The conclusion on this LKPD is provided to make it easier for students to conclude the activities carried out when working on the LKPD. This aims to measure students' abilities and understanding of working on LKPD. This conclusion was made with the Canva application, as seen in Figure 14 below:



**Figure 14.** Conclusion

Based on the results of the development of *Jam Gadang's* ethnomathematics integrated LKPD on data presentation material, starting from designing the LKPD, validating the presentation and appropriateness of the LKPD content, LKPD language, and LKPD graphics to mathematics, Indonesian language and arts material experts, the results obtained are as shown in Table 5.

**Table 5.** Recapitulation Results of LKPD Validation by Experts

Aspect of Assessment	Average	Category
Presentation	3,5	Highly Valid
Content Eligibility	3,7	Highly Valid
Language	3,75	Highly Valid
Graphics	3,83	Valid
<b>Average</b>	<b>3,83</b>	<b>Highly Valid</b>

Based on Table 5, validation was carried out using a validation sheet on the presentation, appropriateness of the content, and language of the student worksheet (LKPD) given to mathematics, language, and arts material experts. The results of evaluation by experts on the *Jam Gadang* integrated ethnomathematics student worksheet (LKPD), which are listed in Table 5, found Highly Valid criteria.

The validity of the student worksheet (LKPD) was assessed through a questionnaire sheet on teacher practicality and student practicality, resulting in a practical student worksheet (LKPD). After trying it in class, the results of the *Jam Gadang* integrated ethnomathematics student worksheet (LKPD) were obtained, as shown in Table 6 below:

**Table 6.** Results of Practicality Analysis of LKPD by Teachers and Students

Aspects	Practical Results	Category
Teacher Practicality Questionnaire	95,83	Highly Practical
Student Practicality Questionnaire	91,18	Highly Practical

Based on Table 6, the results of the analysis of the teacher and student practicality questionnaire sheets showed that the *Jam Gadang* integrated student worksheet (LKPD) on ethnomathematics for teachers scored 95.83 in the highly practical category and for the student aspect with a score of 91.18 in the highly practical category.

After the completion of the learning series, the subsequent stage involved testing the effectiveness of students' critical thinking abilities using a test comprising six descriptive questions that had undergone a validation process. The purpose of this effectiveness test was to evaluate the functionality of the learning device created, determining whether it enhanced students' critical thinking skills in relation to the subject matter. This test was subsequently employed to assess the performance of the *Jam Gadang* ethnomathematics integrated learning device that had been implemented in the classroom.

The effectiveness of learning module is determined by looking at the achievement of the Learning Goal Achievement Criteria (KKTP) using ethnomathematics-integrated flat-shape learning topics during research. The Learning Goal Achievement Criteria (KKTP) used has intervals that require guidance 0–65, sufficient 65-75, good 75–90, and very good 90–100 (Anggraena et al., 2022). This interval is used in analysis related to evaluating critical thinking abilities through the tests provided. The results of the Learning Goal Achievement Criteria (KKTP) achievements can be seen in Table 7 below:

**Table 7.** Results of the Analysis of the Effectiveness of KKTP Achievements

No	Students	Pretest			Posttest		
		Correct	Mark	Number of students completed	Correct	Mark	Number of students completed
1	Student 1	11	46	NC	20	83	C
2	Student 2	12	50	NC	17	71	NC
3	Student 3	21	88	C	22	92	C
4	Student 4	14	58	NC	18	75	C
5	Student 5	15	63	NC	19	79	C
6	Student 6	16	67	NC	20	83	C
7	Student 7	14	58	NC	18	75	C
8	Student 8	16	67	NC	19	83	C
9	Student 9	19	79	C	21	88	C
10	Student 10	16	67	NC	20	83	C
11	Student 11	17	71	NC	20	83	C
12	Student 12	20	83	C	23	100	C
13	Student 13	15	63	NC	20	83	C
14	Student 14	18	75	C	18	88	C
15	Student 15	20	83	C	23	100	C
16	Student 16	18	75	C	20	83	C
17	Student 17	11	46	NC	15	63	NC
Total			1138	6		1413	15
Average			67			83	
Completion percentage (%)			35,29			88,24	

### Discussion

After obtaining the pretest and posttest results, the pretest and posttest results was analyzed using SPSS version 18 to calculate the N-Gain Score. If the Gain Score value is at least in the medium category, this learning module is considered effective. The categorization of N-Gain score values (Ramdhani et al., 2020) can be found in Table 8 below :

**Table 8.** Gain Score Category

No	Gain Score	Category
1	$N\text{-Gain} > 70$	High
2	$30 \leq N\text{-Gain} \leq 70$	Medium
3	$N\text{-Gain} < 30$	Low

The effectiveness of increasing critical thinking skills can be seen from the difference in pretest results and posttest results using the n-gain score, which can be seen from SPSS in table 9 below :

**Tabel 9.** N-Gain Score Test Results

	N	Minimum	Maximum	Mean	Std. Deviation
N-Gain	17	.31	1.00	.5102	.20484
Valid N (listwise)	17				

Based on Table 9 above, the results of the N-Gain Score test at SD Negeri 20 Pahambatan Balingka obtained a mean of 0.5102, so the category obtained is medium, which means the development of integrated learning device for Jam Gadang ethnomathematics on the topic of flat shapes to improve students' critical thinking skills has been used effectively.

Referring to the validity, practicality, and effectiveness data in Tables 3, 4, 5, 6, and 9 above, the development of the *Jam Gadang* ethnomathematics integrated learning module shows highly valid, highly practical, and effective results for use in fifth-grade elementary school.

The results of this research are in line with previous research. Research conducted (Setiana, 2018) entitled "Development of Mathematics Teaching module Based on Ethnomathematics of Yogyakarta Palace". The focus of this research is to describe the stages of developing a mathematics teaching module based on the Yogyakarta Palace's ethnomathematics. The results of this research show that the teaching module developed have met the criteria of being valid, practical, and effective. What this research has in common with previous research is the development of an integrated ethnomathematics teaching module. It's just that the object of ethnomathematics is the Yogyakarta Palace, while this research uses the ethnomathematics of the *Jam Gadang*. The next research was conducted (K. S. Dewi et al., 2022) entitled "Development of Ethnomathematics-Based Geometry LKPD Based on Critical Thinking Ability". The focus of this research is to produce ethnomathematics-based geometry student worksheets in terms of critical thinking skills based on validity, practicality, and effectiveness on triangle and quadrilateral material. The findings from the research above show that the student worksheet (LKPD) developed meets the criteria of being valid, practical, and effective. What this research has in common with previous research is the development of an integrated ethnomathematics teaching module. It's just that in the research above, the teaching module were only student worksheets (LKPD) and ethnomathematics objects with batik filter motifs, whereas this research used *Jam Gadang* ethnomathematics.

The research implications are that applying and utilizing the *Jam Gadang* ethnomathematics integrated learning module on the topic of flat shapes can improve students' critical thinking skills. Students are helped to discover concepts independently so that they are able to apply the knowledge gained to solve problems on the topic of flat shapes using various methods. This happens because students have first become familiar with the culture taught through these teaching modules, so the learning process in class produces a significant positive impact on mathematics learning.

#### 4. CONCLUSION

The conclusion from the research on the development of the *Jam Gadang* ethnomathematics integrated learning tool that has been carried out is that the *Jam Gadang* ethnomathematics integrated learning tool is suitable for use and application in the learning process as one of the innovative learning activities for improving students' critical thinking skills. The *Jam Gadang*'s ethnomathematics integrated learning tool was declared valid with a validity percentage of teaching modules of 3.6 and student worksheets (LKPD) of 3.83. The *Jam Gadang* ethnomathematics integrated learning tool developed has a Highly Practical category based on the results of calculating student response questionnaires and teacher responses. The practicality of the teaching module based on teacher responses was 92.86%. Meanwhile, the practicality of student worksheets (LKPD) from student responses was 91.18%, and teacher responses were 95.85%. The *Jam Gadang* ethnomathematics integrated learning device developed is effective in the medium category based on the calculation of the N-Gain value on the pretest and posttest results, with a score of 0.5102. This research is limited to the topic of flat shapes. Recommendations for further research include the development of teaching module using other topics.

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