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Borneo ethnomathematics: Developing a mathematics test instrument based on local culture

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Abstract
This study aimed to develop a culturally contextualized mathematics assessment instrument for Grade XI students by integrating Borneo ethnomathematics into mathematics assessment practices. This study employed a research and development (R&D) method using a modified model proposed by Wilson, Oriondo, and Antonio, consisting of three stages, namely test design, pilot testing, and test assembly. The study involved Grade XI students at MA Raudhah Islamiyah, Mempawah Regency, who were selected using a non-probability sampling technique. Data were collected through test administration and analyzed using SPSS and ANATES to examine item validity, reliability, difficulty index, discrimination index, and distractor effectiveness. The results indicate that the developed instrument meets the criteria for a high-quality assessment tool. Most items demonstrated high validity, with only a few requiring minor revisions. The instrument showed good discrimination (0.67) and a moderate difficulty level (0.66), indicating its effectiveness in differentiating students' mathematical abilities. In addition, 49% of the distractors functioned effectively. These findings suggest that integrating local cultural contexts into assessment design can produce valid and reliable instruments while enhancing the relevance of mathematics assessment for students. Therefore, the developed instrument can serve as an alternative assessment tool that promotes both conceptual understanding and cultural awareness in mathematics learning.

Keywords: Cultural-based assessment, Ethnomathematics, Geometric transformation, Instrument development, Mathematics education

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Introduction

The educational process cannot be separated from the cultural background, as every learning activity always occurs within a specific cultural context that influences how students absorb and understand information (Chrissanti, 2018). Therefore, incorporating culture into learning materials is essential to ensure its continuity and existence (Maskar & Anderha, 2019). Integrating culture into the curriculum is thus a step toward creating a learning environment rich in cultural values. The integration of local culture in the learning process can foster students' critical thinking skills (Fitrianto & Farisi, 2025), which in turn supports students in solving HOTS-type problems. This integration also preserves local culture, such as communication in group work using local languages, and enhances students' participation in

the overall learning process. (Shih, 2024) further explains that culturally integrated learning offers several benefits, including fostering and strengthening students' confidence and identity, increasing participation and motivation in learning, improving critical thinking skills, reducing prejudice and bias, creating relevant connections between students' daily experiences and their education, and preparing them to engage with more heterogeneous communities in the future. Consequently, the integration of culture into student learning plays a significant role in determining the efficiency and effectiveness of the teaching and learning process.

Education that integrates local culture plays an important role in fostering students' cultural awareness from an early age. At the kindergarten level, for example, children can be introduced to local culture through various learning activities. This aims to cultivate appreciation for cultural diversity from a young age. At the elementary school level, the ethnomathematics approach can be applied to integrate culture into mathematics learning (Caskova & Chudy, 2021; Sutjipto, 2017). This approach enables students to understand mathematical concepts in a more contextual and relevant manner connected with everyday life.

Ethnomathematics is an approach that incorporates elements of local culture into mathematics instruction, allowing students not only to gain conceptual understanding of mathematics but also to recognize cultural values and local wisdom (Connor et al., 2019; Sarah & Batiibwe, 2024). By linking mathematical concepts to daily life, ethnomathematics makes learning more relevant and contextual for students. The following section illustrates the concept of ethnomathematics, which combines mathematics learning with cultural integration.

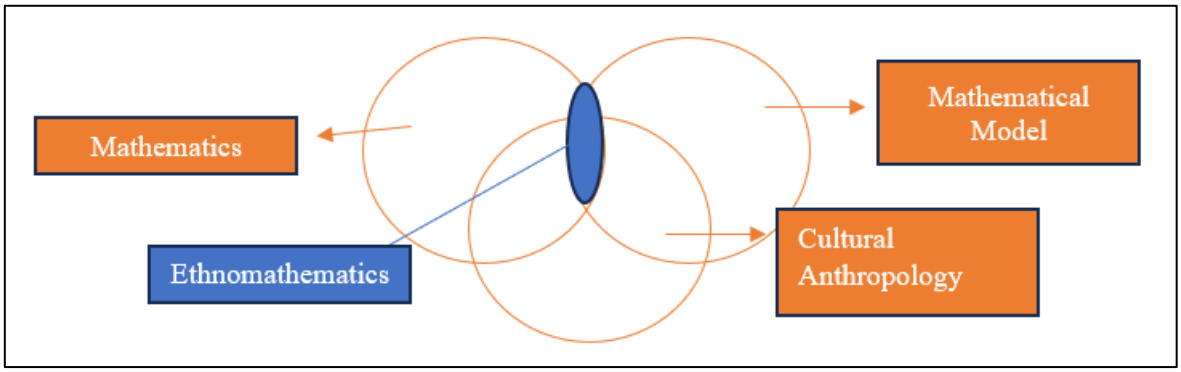

Figure 1. Ethnomathematics Concept

The concept of ethnomathematics, according to (Rosa & Orey, 2011), as illustrated in Figure 1, describes the relationship between mathematics, cultural anthropology, and mathematical models. Ethnomathematics, shown in blue, is a field that connects mathematical concepts with cultural aspects of society. Mathematics is a discipline that develops formally, with rules and concepts organized systematically. Cultural anthropology, shown in orange, relates to the study of culture and how communities use mathematics in daily life, such as in weaving patterns, traditional numeral systems, and calculations in traditional architecture. Meanwhile, mathematical models represent the outcome of the relationship between mathematics and culture, namely mathematical concepts contextualized within community life.

According to Chrissanti (Chrissanti, 2018), ethnomathematics plays an important role in mathematics education because it combines two interconnected aspects: mathematics as a core subject and culture as a support for the development and preservation of Indonesian heritage.

(Rosa & Orey, 2011) developed the concept of ethnomathematics in education, derived from the words "ethno" (culture) and "mathematics" (science and models). Therefore, the concept of ethnomathematics in education can be explained through three main groups: culture, school mathematics, and mathematical models.

Several previous studies have examined the application of ethnomathematics in mathematics learning. For example, (Supriadi et al., 2018) demonstrated that mathematical concepts can be linked to the structure of traditional houses in the context of geometry. Building on this idea, the following assessment item illustrates how cultural artifacts can be integrated into mathematics problems by using the geometric features of the tobacco house as the context. One example is presented below.

> Problem: As shown in Figure 2 below, there are two triangles of different sizes in the tobacco house. The larger triangle is the original, while the smaller triangle is the result of a dilation of the larger one. If the larger triangle is transformed using the matrix $\begin{pmatrix} 2 & 1 \\ 4 & 3 \end{pmatrix}$ and then dilated with the center at (0,0) and a scale factor of 3, the area of the smaller triangle becomes ___ times the area of the larger triangle.

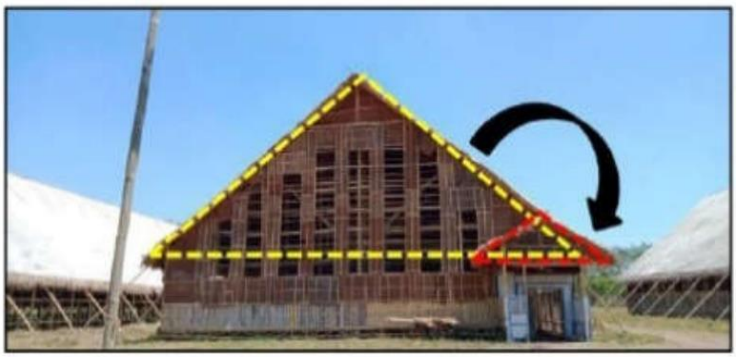

Figure 1. Tobacco House (Fatoni & Septiadi, 2021)

Furthermore, research by (Mardhiyah et al., 2021) developed mathematics problems based on local cultural contexts, such as batik motifs, to enhance understanding of geometric transformation concepts. One example from their study, Development of PISA Model Mathematics Problems on Geometry Transformation for Grade XI, demonstrates how cultural contexts can be incorporated into mathematics assessment tasks.

> Problem: Lumajang banana batik is one of the finest products of Lumajang and a source of pride for the district. Its distinctive feature lies in motifs based on bananas, which differ from batik designs in other regions. One method of producing this batik is through stamping. If one stamp produces 4 banana images and 4 leaf images, then on a cloth measuring 100 cm × 40 cm, how many banana and leaf images will be produced? Present the solution using the concept of translation.

Other studies by (Connor et al., 2019; Sarah & Batiibwe, 2024) affirm that integrating culture into mathematics learning can significantly enhance student engagement and understanding. Nevertheless, most of these studies have focused on the development of

teaching materials or contextual problems, with relatively few addressing the development of standardized and validated test instruments based on local culture.

Geometry transformation is one of the key topics in mathematics learning, as it plays an important role in developing students' spatial abilities and reasoning skills (Setyowati et al., 2021). This topic includes concepts of changing the position and shape of objects through translation, reflection, rotation, and dilation (Subekhi et al., 2021). However, in practice, students often struggle to understand transformation concepts due to their abstract and symbolic nature. This highlights the need for more contextual approaches to teaching and assessment so that students can grasp these concepts more deeply.

Based on pre-research observations with mathematics teachers at MA Raudhah Islamiyah Anjungan, it was found that students were not accustomed to solving non-routine mathematics problems, particularly in geometry. Students tended to memorize formulas without understanding the underlying concepts. Additionally, the abundance of symbols and formal operations in geometry transformation posed challenges for students who were still at the concrete operational stage. This finding highlights the need for assessment instruments that not only measure students' mathematical abilities but also relate mathematical concepts to contexts that are familiar in students' daily lives.

Although various studies have examined ethnomathematics in learning, there remains a research gap in the development of culturally based test instruments. Most research has focused on teaching materials or contextual problems rather than standardized and validated test instruments. Furthermore, studies specifically integrating Bornean culture into the development of mathematics test instruments, particularly in geometry transformation, are still limited. Therefore, this study offers novelty by developing a Borneo ethnomathematics-based mathematics test instrument that is not only contextual but also meets the criteria of a high-quality assessment tool.

Based on this rationale, the purpose of this study is to develop a Borneo ethnomathematics-based mathematics test instrument on geometry transformation that meets the criteria of validity, reliability, difficulty level, and discriminating power.

Methods

This study employed a quantitative approach with a research and development (R&D) design. According to (Sugiyono, 2019), research and development is a method used to design, develop, and evaluate a product. This model was chosen because its steps, test design, pilot testing, and test assembly, were considered appropriate for the needs of the study. The quantitative approach was used to systematically test and analyze relationships among variables through numerical data (Qauliyah & Shodiqin, 2022). Moreover, this approach aims to formulate and test models or theories related to the phenomenon under investigation (Siregar, 2023). The development model applied was a modification of the model proposed by Wilson, Oriondo, and Antonio (Alfarisa et al., 2021) which was deemed suitable for the development of a mathematics test instrument.

The study was conducted at Madrasah Aliyah (MA) Raudhah Islamiyah Anjungan, Mempawah Regency, West Kalimantan. The research subjects were all Grade XI students, totaling 30 participants. The sampling technique used was non-probability sampling with a

saturated sample method, given the limited population size, so that all members of the population were included as research samples.

Instrument development followed the modified Wilson–Oriondo–Antonio model which consisted of three main stages, namely test design, pilot testing, and test assembly. The test design stage included determining learning objectives, preparing test blueprints, writing Borneo ethnomathematics-based items, and conducting expert validation. The pilot testing stage involved administering the instrument to the research subjects to obtain empirical data regarding item quality. Finally, the test assembly stage was carried out by selecting and organizing items that met the quality criteria based on the analysis results.

Data collection was conducted through the administration of the test instrument to students. The instrument developed consisted of 25 items in both multiple-choice and essay formats, contextualized with Borneo local culture in the topic of geometry transformation. Prior to use, the instrument underwent validation, including content and construct validity by experts. The test was administered directly to students to obtain response data used in the analysis of instrument quality.

Data analysis was conducted quantitatively with the assistance of software such as SPSS, Anates, and Microsoft Excel. The analysis focused on testing validity, reliability, difficulty level, discriminating power, and distractor effectiveness for each item. The results of this analysis were used to determine the quality of the developed instrument, thereby producing a test instrument suitable for measuring students' abilities in geometry transformation within the context of Borneo ethnomathematics.

Results

Test Design

This summative test was designed to measure students' understanding of geometry transformations while simultaneously integrating elements of Bornean culture, particularly for students of Madrasah Aliyah Raudhah Islamiyah in Mempawah. The test was structured to assess the ability to analyze and compare transformations as well as compositions of transformations using matrices among Grade XI students. In addition, the test incorporated elements of Bornean culture found in communities in Pontianak. The content assessed included translation, reflection, rotation, and dilation.

The instrument was developed with four material indicators, referring to Bloom's taxonomy, with the following distribution: C2 (40%), C3 (24%), C4 (28%), and C5 (8%). From the four indicators of geometry transformation learning, this study connected them with seven cultural contexts. The test instrument, as shown in Table 1, contains information on instrument construction, descriptions of Bornean culture, ethnomathematics-based geometry transformation problems, and answer choices. To ensure the accuracy of the instrument in measuring student learning outcomes, the researchers conducted test validation. Content validity was analyzed using CVR and CVI, while construct validity was examined through additional analysis.

Table 1. Types of Traditional Cultural Contexts in Borneo

No.	Type of Culture	Description	Number (in Items)
1	Batik Motifs	*Kangkung Kaombakan*, *Parang Rusak*, *Tampuk Manggis*, *Sadulur*, *Sasaringan*, *Leuit Salisung*	7
2	Beach Tourism	Angsana Beach (*Pantai Angsana*), Samber Gelap Beach	2
3	Traditional Arts	*Kuntau* (traditional martial art), *Enggang* Dance, *Mangkuk Merah* Tradition, *Sape'* (traditional stringed musical instrument)	4
4	Traditional Transportation	*Kapal Bandong* (traditional wooden boat)	2
5	Traditional Buildings and Landmarks	Dayak Traditional House (*Rumah Adat Dayak*), Sultan Syarif Abdurrahman Mosque, Sultan Suriansyah Mosque, Sharpened Bamboo Roundabout (*Bundaran Bambu Runcing*)	6
6	Traditional Clothing	Dayak Traditional Hat, Traditional Headband	2
7	Traditional Foods	*Leumeung*, *Kokoleh*	2

The validation process was carried out by several experts in mathematics education and secondary school teaching. Each validator received a validation sheet containing multiple-choice questions with five answer options along with their explanations. The evaluation of items was grouped into three categories: essential (highly relevant to Borneo ethnomathematics), less essential (necessary but less relevant), and non-essential (not required). Validators were also provided with a comment section to give critiques and suggestions. After completing the validation, they were asked to provide a conclusion regarding the feasibility of the instrument, whether it was feasible without revision, feasible with revision, or not feasible for trial use.

The validity calculation was conducted using the Content Validity Ratio (CVR), based on the assessments of Subject Matter Experts (SMEs) who evaluated the essentiality of each item. In this study, validation was performed by Mr. Sumin, S.E., M.Si., and Ms. Hidayu Sulisti, M.Pd. The results of the content validity are presented in Table 2.

Table 2. Results of Multiple-Choice Item Validity Test Using SPSS

Item No.	CVR Coefficient	Description	Item No.	CVR Coefficient	Description
1	0,6	Valid with Revision	11	1	Valid
2	1	Valid	12	1	Valid
3	1	Valid	13	1	Valid
4	1	Valid	14	0,6	Valid with Revision
5	1	Valid	15	1	Valid
6	1	Valid	16	0,6	Valid with Revision
7	1	Valid	17	1	Valid
8	1	Valid	18	1	Valid
9	1	Valid	19	1	Valid
10	1	Valid	20	1	Valid

Table 2 above shows the results of the validity test for multiple-choice items using SPSS. Most items (numbers 2–10 and 12–20) obtained a CVR value of 1, indicating high validity. However, items 1, 14, and 16 had a CVR value of 0.6, suggesting the need for minor revisions to improve their validity.

Table 3. Results of Essay Item Validity Test Using SPSS

Item No.	CVR Coefficient	Description
1	1	Valid
2	1	Valid
3	1	Valid
4	1	Valid
5	1	Valid

Table 3 presents the results of the validity test for essay items. All essay questions (numbers 1–5) obtained a CVR value of 1, indicating that the items are valid and suitable for use in learning evaluation.

Table 4. Test Item Validity

Item No.	Expert 1	Expert 2	Item No.	Expert 1	Expert 2
1	4	4	11	4	4
2	4	4	12	4	4
3	3	3	13	3	3
4	4	4	14	4	4
5	4	4	15	4	4
6	4	4	16	4	3
7	3	3	17	4	3
8	4	4	18	4	4
9	3	4	19	4	4
10	3	3	20	4	4

Table 4 presents the validity assessment of test items by two experts (AHL11 and AHL12). Most items received a score of 4 from both experts, indicating a high level of validity. However, several items such as numbers 3, 7, 10, 16, and 17 received a score of 3 from one of the experts, suggesting that minor revisions may be necessary.

Table 5. CVI Validity of Multiple-Choice Items

Item	Expert 1	Expert 2	Expert In Agreement	I-Cvi	Category	UA
1	1	1	2	1,0	Relevant	1,0
2	1	1	2	1,0	Relevant	1,0
3	1	1	2	1,0	Relevant	1,0
4	1	1	2	1,0	Relevant	1,0
5	1	1	2	1,0	Relevant	1,0
6	1	1	2	1,0	Relevant	1,0
7	1	1	2	1,0	Relevant	1,0
8	1	1	2	1,0	Relevant	1,0
9	1	1	2	1,0	Relevant	1,0
10	1	1	2	1,0	Relevant	1,0
11	1	1	2	1,0	Relevant	1,0
12	1	1	2	1,0	Relevant	1,0
13	1	1	2	1,0	Relevant	1,0
14	1	1	2	1,0	Relevant	1,0
15	1	1	2	1,0	Relevant	1,0
16	1	1	2	1,0	Relevant	1,0
17	1	1	2	1,0	Relevant	1,0
18	1	1	2	1,0	Relevant	1,0
19	1	1	2	1,0	Relevant	1,0
20	1	1	2	1,0	Relevant	1,0

Table 5 presents the results of the Content Validity Index (CVI) calculation for multiple-choice items. All items obtained an I-CVI value of 1.0, indicating that they were judged by experts to be highly relevant and valid. No items required revision based on this evaluation.

Table 6 shows the results of the CVI calculation for essay items. All essay questions received a score of 4 from both experts, indicating that the items are highly valid and suitable for use in learning evaluation. In Table 7, the relevance (CVI) of the essay items that have been calculated is also presented.

Table 6. CVI Validity of Essay Items

Item	Expert 1	Expert 2	Expert In Agreement	I-CVI	Category	UA
1	1	1	2	1,0	Relevant	1,0
2	1	1	2	1,0	Relevant	1,0
3	1	1	2	1,0	Relevant	1,0
4	1	1	2	1,0	Relevant	1,0
5	1	1	2	1,0	Relevant	1,0

Table 7. Validity and Relevance of Essay CVI

Item	Expert 1	Expert 2
1	4	4
2	4	4
3	4	4
4	4	4
5	4	4

The researcher prepared a scoring guide to ensure consistency in student scores on the completed test, as shown in Formula 1 below. The scoring method chosen did not include correction for guessing; correct answers received a score of 1, while incorrect or unanswered items received a score of 0. Weighting was assigned to multiple-choice and essay items, with a maximum total score of 100. Multiple-choice items carried a weight of 60, and essay items a weight of 40. Each multiple-choice item was worth 3 points (20 items in total), and each essay item was worth 8 points (5 items in total). The final student score was calculated by summing the scores from multiple-choice and essay items using Formula 1 as follows.

$$\text{Total Multiple} - \text{Choice Score } (60) + \text{ Total Essay Score } (40) = \text{ Final Score } (100) \quad (1)$$

Test Trial

The trial was conducted on July 28, 2022, involving 30 grade XI students. During the mathematics lesson, the trial was carried out in the classroom, as shown in Figure 3 below. The results indicated that the test instrument was valid and highly reliable, thus meeting the requirements as a suitable measurement tool for this study, which focuses on Borneo ethnomathematics.

Figure 3. Implementation of the Test Trial

Difficulty Level

The items were analyzed based on the mean value of each item. Of the 20 multiple-choice questions, 14 items fell into the medium category (numbers 1–9, 12–16), while the remaining 5 items (numbers 10, 11, 17–20) were classified as easy. All five essay questions also fell into the medium category. The calculated index shown in Table 8 for the difficulty level was 0.66, indicating that the items were in the medium category.

Table 8. Analysis of Difficulty Level for Multiple-Choice Items

Item No.	Mean Value	Description	Item No.	Mean Value	Description
1	0,63	Medium	11	0,76	Easy
2	0,63	Medium	12	0,50	Medium
3	0,66	Medium	13	0,70	Medium
4	0,50	Medium	14	0,66	Medium
5	0,66	Medium	15	0,70	Medium
6	0,50	Medium	16	0,66	Medium
7	0,60	Medium	17	0,76	Easy
8	0,50	Medium	18	0,83	Easy
9	0,56	Medium	19	0,86	Easy
10	0,73	Easy	20	0,80	Easy

The results of the index calculation shown in Table 9, namely the difficulty level of essay items, indicate a value of 2.3, which classifies the items in the medium category.

Table 9. Analysis of Difficulty Level for Essay Items

Item	Mean Value	Description
1	2,30	Medium
2	2,30	Medium
3	2,27	Medium
4	2,30	Medium
5	2,57	Medium

Discriminating Power

Discriminating power functions to distinguish students who have mastered the material from those who have not. The evaluation was conducted through the item discrimination index, analyzed using SPSS with the Pearson product-moment correlation method. The analysis results, as shown in Table 10 below, indicate a total discrimination index of 0.67, which is considered good. This also means that almost all multiple-choice items could be answered well

by Grade XI students of MA Raudhah Islamiyah, reflecting good mastery of the material. Meanwhile, the essay items were also answered well by students, although some were not completed thoroughly.

Table 10. Analysis of Discriminating Power for Multiple-Choice Items

Item No.	Discrimination Value	Quality	Item No.	Discrimination Value	Quality
1	0,559	Good	11	0,483	Good
2	0,873	Good	12	0,561	Good
3	0,924	Good	13	0,818	Good
4	0,605	Good	14	0,763	Good
5	0,924	Good	15	0,876	Good
6	0,605	Good	16	0,924	Good
7	0,674	Good	17	0,688	Good
8	0,605	Good	18	0,529	Good
9	0,441	Good	19	0,493	Good
10	0,392	Fair	20	0,683	Good

Meanwhile, the essay items were also answered well by students, although some were not completed thoroughly. Table 11 below shows the discrimination values of essay items, with an average score of 0.7, which indicates a fairly good level.

Table 11. Analysis of Discriminating Power for Essay Items

Item No.	Discrimination Value	Quality
1	0,776	Good
2	0,797	Good
3	0,749	Good
4	0,763	Good
5	0,474	Good

Effectiveness of Distractors

The analysis of distractor factors in multiple-choice items aimed to evaluate the effectiveness of answer options in confusing students. The researcher added distractors to five items (numbers 4, 6, 8, 9, and 12) to encourage students' critical thinking and increase item difficulty. The analysis results, as shown in Table 12 below, indicate that the distractors embedded in the multiple-choice items functioned effectively, with an overall percentage of 49%. In general, distractor quality is considered good if it falls within the range of 20–50%.

Table 12. Percentage of Distractor Effectiveness

Answer	No 4	No 6	No 8	No 9	No 12
A	50%	13%	20%	56%	50%
B	17%	50%	10%	17%	17%
C	13%	10%	50%	10%	13%
D	10%	10%	13%	7%	10%
E	10%	17%	7%	10%	10%

Test Assembly

After being evaluated with several measurement tools and corrected by experts, the test was declared ready for use. The process began with exam questions created by the researcher, which were then sent to validators (teachers or lecturers) for review. To assess students' understanding of the questions, the researcher subsequently revised the exam based on the

feedback received and calculated all student responses in both multiple-choice and essay formats. The analysis results showed that the test was valid and met the applicable standards. Once validators assessed the relevance of each item, the test assembly was finalized. Furthermore, applications such as Microsoft Excel, SPSS, and ANATES were used to calculate the validity and reliability of the instrument. The final test consisted of 25 items, comprising 20 multiple-choice questions and 5 essay questions, designed to evaluate students' ability in geometric transformations.

Discussion

This study produced a geometry transformation test instrument based on Borneo ethnomathematics, developed through three main stages: test design, test trial, and test assembly. In the design stage, the integration of seven cultural contexts into the test items demonstrated that mathematics learning can be systematically contextualized without diminishing the essence of the mathematical concepts themselves. This aligns with the concept of ethnomathematics proposed by (Rosa & Orey, 2011), which emphasizes that mathematics is not independent of cultural practices as an abstract science but is connected to cultural practices in community life. Thus, the design results reinforce that local cultural contexts function not merely as illustrations but as meaningful tools for building students' conceptual understanding.

From the perspective of instrument quality, the validation results showed that most items had high CVR and CVI values, indicating strong content alignment with the constructs being measured. These findings suggest that the integration of Borneo culture into the instrument did not reduce content validity and still met the standards of learning evaluation. This is consistent with the findings of (Connor et al., 2019; Sarah & Batiibwe, 2024) who stated that culture-based approaches can enhance the quality of learning without compromising conceptual accuracy. Nevertheless, the presence of several items requiring minor revisions indicates that the development of instruments based on local contexts still demands careful attention to editorial and visual aspects to avoid potential bias in interpretation.

In the trial stage, the analysis of difficulty levels showed that most items were in the medium category, with some items classified as easy, and none in the difficult category. Theoretically, a distribution dominated by medium-level difficulty suggests that the instrument can optimally measure students' abilities (Arikunto, in the context of educational evaluation). However, the absence of items with high difficulty levels may indicate that the instrument is not yet fully capable of discriminating among students with higher abilities. This result is consistent with the study by (Mardhiyah et al., 2021) which also found that context-based items tend to fall into the medium difficulty category because they are more easily understood by students.

From the aspect of discriminating power, most items were in the good category, indicating that the instrument was able to distinguish students based on their mastery of the material. This suggests that the integration of cultural contexts did not obscure the primary function of the instrument as an evaluation tool. These findings reinforce the results of studies by (Isnaniah & Imamuddin, 2023; Muzni & Rafianti, 2024), which stated that the quality of test items can be maintained even when developed within cultural contexts. Additionally, the effectiveness of distractors, which fell within the good range, shows that the answer options were functionally

designed to encourage students' critical thinking, although some variation in effectiveness was observed across items.

The test assembly stage was an important process to ensure that the resulting instrument was truly suitable for use. The findings showed that after undergoing validation, trial, and revision, the final instrument, consisting of 20 multiple-choice items and 5 essay items, met the criteria of validity, reliability, difficulty level, and discriminating power. This assembly process also involved refining technical aspects such as item wording, clarity of illustrations, and appropriateness of answer options. Conceptually, this stage emphasizes that instrument development does not end at the design phase but requires an iterative process to produce an accurate and representative measurement tool. This is consistent with the principles of research and development (R&D), which stress continuous improvement cycles until an optimal product is achieved.

Compared with previous studies (Isnaniah & Imamuddin, 2023; Mardhiyah et al., 2021; Muzni & Rafianti, 2024), this research has the advantage of integrating a more comprehensive analysis of item quality, covering validity, reliability, difficulty level, discriminating power, and distractor effectiveness. Furthermore, this study specifically linked each test item to Borneo cultural contexts, thereby producing an instrument that not only meets evaluation standards but also carries high contextual value. Thus, the developed instrument functions not only as a tool for measuring mathematical ability but also as a medium for introducing and preserving local culture within the learning process.

Conclusion

This study shows that the development of the test was carried out in stages, with input and review from validators confirming that the items prepared were relevant. Validity and reliability testing demonstrated that the items met the desired standards, with most of the 20 multiple-choice questions falling into the medium difficulty category, and all essay questions also classified in the same category. The discriminating power and effectiveness of distractors in the multiple-choice items were rated good, and overall, the test was declared valid and ready for use.

Based on these findings, several recommendations for further development are proposed, such as preparing items with more varied levels of difficulty. Follow-up research on the effectiveness of ethnomathematics-based test instruments in different cultural contexts and other areas of mathematics is also considered essential. It is recommended that schools apply the results of this study in daily teaching by incorporating real examples from local culture as part of the instructional material.

Declarations

Author Contribution : ANW: Conceptualization, Methodology, Visualization, Writing- Review & Editing, Supervision.
YS: Conceptualization, Validation, Investigation, Data Curation.
PKW: Conceptualization, Resources, Writing- Original Draft.
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