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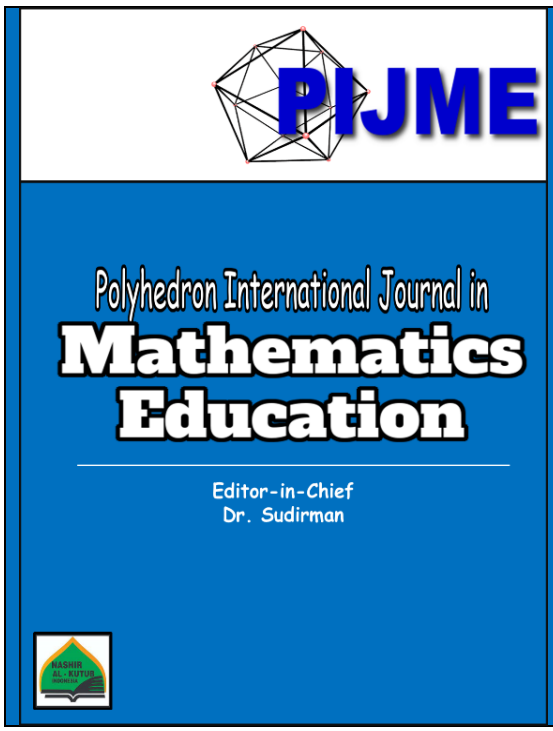

Development and validation of ethnomathematics-based worksheets integrating Sundanese Pupuh for enhancing number pattern learning in indonesian secondary schools

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Development and validation of ethnomathematics-based worksheets integrating Sundanese Pupuh for enhancing number pattern learning in indonesian secondary schools

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Abstract
This study addresses the persistent challenge of low mathematical performance among Indonesian secondary students, particularly in learning number patterns, by developing culturally responsive teaching materials. Although Indonesia's PISA performance has improved, students remain below the OECD average, with prior studies highlighting difficulties in pattern recognition, symbolic representation, and generalization. To address this issue, the study bridges abstract mathematical concepts with students' cultural contexts through the development of ethnomathematics-based student worksheets integrating Sundanese Pupuh, a traditional literary art form characterized by structured numerical patterns in syllable counts and line arrangements. The research employed a Research and Development approach using the 4D model (Define, Design, Develop, Disseminate). The worksheets were designed to explicitly connect the inherent mathematical structures of Pupuh—guru wilangan and guru lagu—with formal number pattern concepts in the eighth-grade mathematics curriculum. The development process included needs analysis, alignment with Indonesia's Merdeka Curriculum, and analysis of student characteristics. Expert validation conducted by mathematics education lecturers and prospective teachers resulted in a combined validity score of 90%, categorized as very valid. Practicality testing with eighth-grade students yielded a score of 92.6%, indicating high usability. This study contributes to mathematics education in three key ways: (1) introducing a novel pedagogical use of indigenous cultural heritage to support abstract mathematical learning, (2) providing empirically validated culturally responsive worksheets that address specific difficulties in number pattern learning, and (3) offering a replicable framework for integrating ethnomathematics into formal curricula. The findings suggest that culturally grounded instruction can enhance student engagement and conceptual understanding, with potential application to other cultural contexts.

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1. Introduction

Mathematics is one of the compulsory subjects for students, as mentioned by Sumandya & Widana (2022) that mathematics plays a very important role and is used in the development of science and technology (Sudirman et al., 2025). In general, mathematics is used as the basis for science and technology. In addition, mathematics also contributes greatly to humans in their daily lives, for example when shopping, planning activities, and so on (Asma, 2023; Prasetya et al., 2025). Mathematical activities are often carried out by society without being realised (Dhiki & Bantas, 2021; Khairunnisa et al., 2025; Sudirman et al., 2025). In education, mathematics is a subject that can foster creativity and emphasise critical thinking skills.

Mathematical ability in 15-year-olds is measured in a programme called the Programme for International Student Assessment (PISA), organised by the Organisation for Economic Co-operation and Development (OECD). In 2018, the PISA results in the mathematics category showed that Indonesia's mathematical literacy skills ranked 72nd out of 78 countries, with a score of 379 out of an average score of 489 (Sugiarni et al., 2023). According to the OECD (2023), Indonesian students' mathematics skills in the 2022 PISA results showed an improvement in ranking, but their scores decreased and remained far below the OECD average, with the majority of students at Level 1 or below (18% reached Level 2, compared to the OECD average of 69%). In Sugiarni et al. (2023) study, Indonesia has a Minimum Competency Assessment (AKM), which is one of the instruments for analysing the minimum competencies of students who have two basic skills, namely reading literacy and numeracy, based on the PISA measurement concept. The results show that the numeracy skills of general junior high school students are at 65% or in the moderate category (Kemdikbud, 2024). This indicates that mathematical skills at the junior high school level are still insufficient. This statement aligns with Sugiarni et al. (2023), who noted low numeracy scores among junior high school students, as well as Gunawan et al. (2023), whose research showed that Indonesia's mathematics scores remain below average.

Several studies also show that students have difficulty understanding mathematics, including number patterns, as found by Iskandar et al. (2025), who found that students had difficulty understanding and observing patterns and regularities, Maula et al. (2024) found errors in students' representation of mathematical symbols and expressions, reliance on manual calculations without generalising patterns, and Chrisnawati & Pratama (2023) found that students struggled to construct and evaluate mathematical arguments, as well as limitations in learning activities that encompassed teaching methods or a lack of teaching materials that supported the understanding of number patterns. This aligns with Dinta et al. (2023), who noted that there is a perception that mathematics is abstract, leading students to struggle with mathematical tasks, which in turn reduces their motivation and interest in learning mathematics. Suwito et al. (2023) also added that challenges in mathematics learning include students' difficulties in understanding the material, accompanied by feelings of boredom experienced by students. Problems with number pattern material cause students to experience difficulties due to limitations in recognising patterns, symbolic representations, and pattern generalisation. Unvaried teaching methods, limited teaching materials, and the perception that mathematics is abstract are the causes of difficulties for students.

To address this issue, educators are advised to use more symbolic and interactive reasoning activities to strengthen students' understanding and generalisation skills in number patterns (Maula et al., 2024). Sugiarni et al. (2023) also added that one of the efforts to help students understand the material in learning is through the use of appropriate media. Several studies have developed media and teaching materials on number patterns, including (Setiyaningrum & Sari, 2023), who developed a Problem-Based Learning-based worksheet, similar to Setyorini et al., (2020), who developed a scientific-based worksheet for number patterns, and Prasetyo & Atsila (2022), who produced a valid and practical electronic worksheet for students on number patterns.

The results of developing worksheets by adding cultural context also determine how students understand something, including mathematics. When a subject matter is very far from the cultural framework of students, it becomes difficult to understand (Putri et al., 2024). According to Sugiarni et al. (2023), mathematical concepts found in culture can be used as teaching materials in schools to be

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preserved for future generations. Learning that integrates local cultural elements into education is known as ethnomathematics. According to D'Ambrosio (2001), ethnomathematics is the study of how a particular community understands, represents, and uses mathematical concepts within its cultural context. Ethnomathematics is the practice of mathematics among identifiable cultural groups such as ethnic communities, worker groups, children of a certain age group, and professional classes (Bantaika et al., 2025; Sugiarni et al., 2023; Sudirman et al., 2025).

The ethnomathematics approach can be used to develop students' motivation and interest in learning, as shown in the research by Ardiyanti et al. (2024) that learning with ethnomathematics can significantly increase students' interest and creativity. Zaslavsky (1991) also demonstrated that ethnomathematics can bridge the gap between formal mathematics and students' daily experiences, thereby enhancing their interest and understanding of mathematics. The ethnomathematics approach provides students with the opportunity to understand mathematics through cultural contexts they are familiar with, leading to more meaningful learning.

Many studies have produced Student Worksheets that integrate ethnomathematics into number pattern material, including the results of research by Dahoklory et al. (2023), who developed lesson plans, teaching materials, and student worksheets based on ethnomathematics in the woven fabrics of the Meher tribe (Kisar Island) using the Realistic Mathematics Education (RME) approach in number pattern material. Setiyadi et al. (2022) developed ethnomathematics-based teaching materials using non-standard counting units characteristic of Banyumas in primary schools, Faqih et al. (2021) also developed interactive multimedia learning media based on ethnomathematics in the subject of two-dimensional and three-dimensional shapes, and Mursalina et al. (2021) produced worksheets using the CTL approach based on ethnomathematics for system of linear equations in three variables material, while Fairuz et al. (2020) produced valid, practical, and effective worksheets for number pattern material based on Sasirangan ethnomathematics.

However, the development of worksheet teaching materials on number patterns using an ethnomathematical approach with a pupuh context is still rare. Pupuh is a cultural heritage with great potential for development. Pupuh is a traditional literary and musical art form with specific rules regarding vowel sounds and the number of syllables in each line, as well as the number of lines in each stanza. According to Haerudin et al. (2023), in pupuh, the sound of each line is usually called guru lagu, while the number of syllables in each line and the number of lines in each stanza is called guru wilangan, which has its own rules or patterns. This indicates that pupuh is related to number patterns. Therefore, the purpose of this study is to develop a Student Worksheet based on ethnomathematics using pupuh in mathematics learning for eighth-grade junior high school students on the topic of number patterns.

2. Method

The method used in this study was the Research and Development (R&D) method. The research method used was the Research and Development (R&D) method with a 4D model in the Define, Design, and Develop stages. However, this research was conducted up to the Develop stage, as the focus was on validating and testing the practicality of the developed worksheet, not on large-scale implementation. The participants in this study included 1 lecturer, 1 teacher, and 3 eighth-grade students from a private junior high school (SMP) in Cianjur Regency. The instruments used in this study were validation sheets by subject matter experts, media experts, and education practitioners to ensure feasibility, and practicality assessment sheets by students through questionnaires. This study is limited to testing the validity, effectiveness, and practicality of the produced product. Based on Faqih et al. (2021), Mania et al. (2024), dan Setiyadi et al. (2022), the procedure to be used is the 4D model (Define, Design, Develop, and Disseminate), but in this study, only 3 stages were used, as shown in Figure 1.

Figure 1
Stages of 4D model development

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The first stage is Define, in which the background of the main problem, student needs, review of tasks and materials used, and learning objectives based on the Merdeka Curriculum Learning Outcomes are analysed. This phase included multiple analyses:

a) Analysis of Needs

Students struggled to comprehend number pattern concepts, especially when it came to identifying relationships, generalizing patterns, and deciphering symbolic representations, according to preliminary observations and literature reviews. Learning resources that were abstract and disconnected from students' cultural contexts made these problems worse. Contextual learning resources that could connect mathematical ideas to students' real-world experiences were therefore necessary.

b) Analysis of Curriculum

The Merdeka Curriculum, specifically the Grade VIII mathematics learning outcomes, which prioritize conceptual comprehension, reasoning, and contextual problem-solving, were cited in the analysis. Because of its intrinsic regularity and structure, the number pattern topic was found to be appropriate for contextualization through cultural artifacts.

c) Analysis of Student Characteristics

Students in the eighth grade at a private junior high school in Cianjur were the intended audience. When learning materials were linked to well-known cultural elements, students demonstrated greater engagement, according to observations. The integration of local culture, particularly pupuh, as a meaningful context for learning number patterns is supported by this finding. Analysis of Concepts Conceptual alignment between mathematical concepts and cultural elements was made possible by mapping mathematical concepts related to number patterns to the structural features of pupuh, such as the number of syllables (guru wilangan) and rhyme patterns (guru lagu).

The second stage is Design, in which the media to be used is designed based on what was obtained from the Define stage, with the aim of designing Student Worksheets that will be developed from design to content. Next, data collection instruments are designed, consisting of validation sheets and practicality test questionnaires. Building the worksheet prototype based on the findings of the define stage was the main goal of the design stage. The structure of the worksheet was identity page and cover curriculum outcomes and learning objectives an overview of pupuh as a cultural setting activities for recognizing, evaluating, and extrapolating numerical patterns under guidance sections for reflection and assessment selection and arrangement of content from contextual observation to abstraction, the mathematical content was arranged in a progressive manner. Pupuh's cultural components were incorporated as conceptual anchors to facilitate pattern recognition and generalization rather than as ornaments. Students examined syllabic patterns and rhyme structures to find numerical regularities using integration of Pupuh Pupuh as a contextual medium. Ethnomathematical principles, which see mathematics as culturally embedded knowledge, are consistent with this integration. Design of validation or instruments validation tools were created to evaluate instructional viability, presentation quality, language clarity, and content accuracy. Additionally, practicality tools were created to assess cultural relevance, clarity, ease of use, and engagement.

The final stage is Develop, where the worksheets that have been designed are validated by experts to obtain input, suggestions, and criticism to improve the developed worksheets. Data collection for this research uses validation questionnaires and student response questionnaires related to the practicality of the worksheets. Data analysis techniques use validation tests and practicality tests of the worksheet. Data analysis to measure the level of validity obtained from the validation sheet uses the following formula:

$$NP_{r_n} = \frac{TS_{-e}}{TS_{-max}} \times 100\% \qquad (1)$$

After obtaining the validation results from each validator, then the combined validation of the analysis results is calculated into the formula, namely:

$$V = \frac{NP_{r_1} + NP_{r_2}}{2} = \cdots \% \qquad (2)$$

Description:
V = Validasi (gabungan)
NP_{r_1} = First validator process score

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NP_{r_2} = Second validator process score
TS_{-e} = Total empirical score (obtained from validators)
TS_{-max} = Total expected maximum score

After obtaining the validation analysis results, the next step is to determine the validity level of the developed worksheet in terms of presentation feasibility by adjusting it to the validity criteria presented in Table 1.

Table 1
Categorisation of the validity of ethnomathematics-based worksheets using the Guttman scale

No	Validity Criteria	Validity Level
1	80.01% - 100%	Very valid, used without revision
2	60.01% - 80,00%	Valid, can be used but need minor revisions
3	40.01% - 60,00%	Less valid, recommended not to be used because it needs major revisions
4	20.01% - 40,00%	Not valid, should not be used
5	00.00% - 20,00%	Very invalid, should not be used

Assessment data on all aspects obtained from the learner response questionnaire sheet were analyzed to obtain a percentage of the worksheet practicality criteria with the formula, namely:

$$P = \frac{\sum f}{(N \times I \times R)} \times 100\% \qquad (3)$$

Description:
P = Persentage number
$\sum F$ = Total score of all respondents
N = Number of respondents
I = Maximum score
R = Number of indicator

Then, the provisions to determine the level of practicality of the worksheet based on the analysis of student response questionnaire data, the categorization is used in Table 2 below.
Table 2
Categorization of the Practicality of Ethnomathematics-based Worksheets with Guttman scale

No	Validity Criteria	Validity Level
1	80.01% - 100%	Very practical
2	60.01% - 80,00%	Practical
3	40.01% - 60,00%	Less practical
4	20.01% - 40,00%	Not practical
5	00.00% - 20,00%	Very impractical

3. Results and Discussion

3.1 Results

The result of this research is a math worksheet developed with an ethnomathematics approach to number pattern material for junior high school students. This media has been prepared to be validated from the aspects of design, quality, visual appearance, and effectiveness of media communication. The stages of development carried out by researchers are described as follows:
Define

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The implementation of the define stage through curriculum analysis aims to identify learning outcomes, and appropriate learning objectives for the topic of number patterns in junior high school mathematics. This analysis ensures that the worksheets is in accordance with the characteristics of the Merdeka Curriculum which prioritizes learning to improve soft skills and character, focuses on essential material, and differentiated learning and adjustment to context and local content (Pakabu et al., 2024; Wiguna & Tristaningrat, 2022). In addition, it is also in accordance with the deep learning approach which emphasizes in-depth, contextually appropriate and meaningful learning (Kemendikdasmen, 2025).

The next stage is learner analysis, which involves identifying learners' characteristics, learning needs and cultural background. As the target users are learners in one of the private junior high schools in the district in Cianjur, it was found that learners are more engaged when learning is contextual and culturally relevant. Integrating local culture into mathematical problems can improve learners' concept understanding, higher order thinking skills, confidence and interest in learning (Ardiyanti et al., 2024; Bela & Wewe, 2024; Hartindya et al., 2022; Putri et al., 2024). D'Ambrosio (2001) emphasizes that ethnomathematics connects mathematical ideas with the cultural practices of a community, thus making learning more relevant and authentic for learners. The integration of ethnomathematics, particularly Sundanese pupuh, can be used as a meaningful context for learning number patterns. Furthermore, mathematical concepts related to number patterns are examined and mapped to the Sundanese pupuh context. In this case, the structure of the number of syllables of each line as well as the final rhyme of vowels found in Sundanese pupuh.

The last step in this stage involves literature review and problem formulation, a review of previous studies on contextual learning and ethnomathematics reinforces the importance of designing learning materials that integrate local culture or wisdom. The objectives of this mathematics-based number pattern learning are to recognize patterns, state rules and predict sequences of patterns, generalize patterns into the form of an object or number. These objectives are aligned with the curriculum, especially for the topic of number patterns at the junior high school level. The expected learning outcomes emphasize the learners' ability to identify, analyze, and apply number patterns in mathematical problems, while fostering mathematical connections through cultural contexts.

3.1.1. Design

This stage includes preparing the initial prototype of the worksheets to facilitate students' understanding of the material presented. Content selection and organization was done by mapping mathematical concepts to relevant elements of Sundanese culture, particularly pupuh. The structure of the number of syllables in each line of pupuh and the final vowel rhyme in each line have rules or patterns that are used as entry points to explore number patterns. The components contained in the worksheets are on the cover page including the worksheets title and student identity section, learning objectives and instructions for use to guide students in each activity. The content integrates contextual information about Sundanese Pupuh to bridge cultural knowledge with mathematical understanding. The activities in the worksheets are designed to encourage inquiry, group discussion and pattern recognition, which are aligned with the characteristics of effective mathematics learning. There is also a student reflection presented in Figure 2 until figure 6.

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Figure 2
Cover page

Figure 3
Contents page

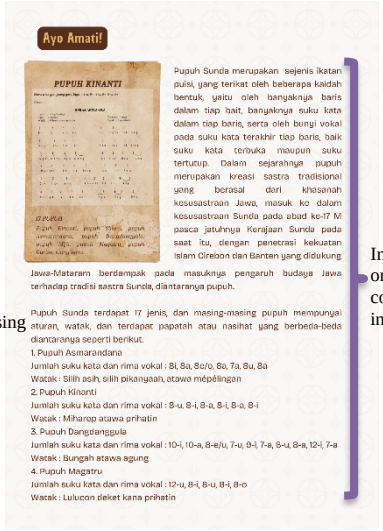

Figure 4
Contents page

Figure 5
Contents page

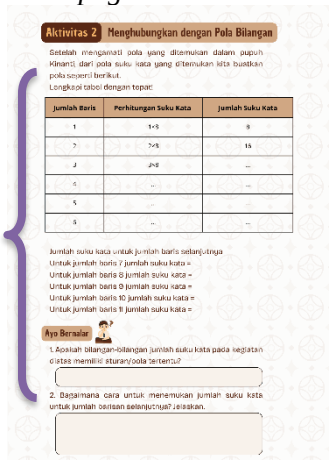

Figure 6
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3.1.2 Develop

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At this stage, the initial product design is refined through expert validation and limited trials to assess its feasibility and practicality. This stage includes expert validation of the product, improvements based on feedback, and a field test to determine its practicality in a real learning environment.

a) Validity Test Results

At this stage, the first draft of the worksheets was evaluated by two validators, namely mathematics education lecturers and prospective mathematics teachers. Validation aims to assess the feasibility of worksheets in terms of content accuracy, language clarity, presentation design, and alignment with learning objectives. The results of the Worksheets Validation of each Validator on the Presentation Feasibility Aspect Using the Guttman Scale presented in Table 3.

Table 3
Result of Validation

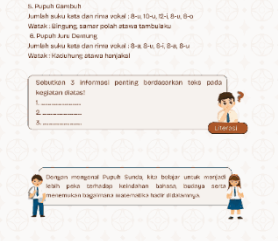
Validator	Empirical Score	Maximum Score	Average Validity of Percentage	Kriteria Validitas
First Validator	52	55	94,5%	Very Valid
Second Validator	47	55	85,4%	Very Valid
Average Combined Percentage			90%	Very Valid

The development of the Student Worksheet was validated by two validators, one mathematics education lecturer and one prospective mathematics teacher. Validator 1 gave an empirical score of 52 out of a maximum score of 55, resulting in a validity percentage of 94.55%. Validator 2 gave an empirical score of 47 out of a maximum score of 55, resulting in a validity percentage of 85.45%. Based on the validation of the two validators, the average validity percentage is 90%, so that the worksheets based on ethnomathematics with Sundanese Pupuh on Number Pattern material is “very valid” for use in learning. Qualitative feedback from validators included adding visual representations related to pupuh to strengthen contextual understanding, including character education values within learning activities and improving motivational statements to increase student engagement. All suggestions were accommodated in the revised worksheet.

b) Worksheets Improvement

In addition to validation, feedback from the validators resulted in some improvements in the product which are presented in Table 4.

Table 4
Suggestions and improvements for the worksheet

Image		Suggestions and Improvements
Before Revision	**After Revision**	
		In the history section, add pictures related to pupuh, then add questions that train students literacy.
		

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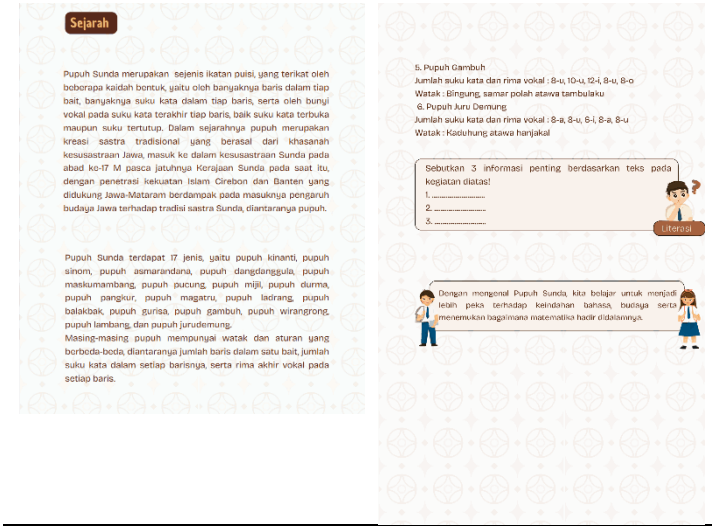
	In pupuh, there is a trait or character component for each pupuh, add the character.
	Added motivational words in the content section so that it contains positive character values for students.

3.1.3 Practicality Test

After the revisions were made, the worksheet was tested for practicality by three students in one of the private junior high schools in Cianjur Regency. This practicality test aims to assess whether the worksheet is easy to understand, interesting, and effective in supporting number pattern learning.

Tabel 5
Data on the practicality results of the worksheets

No.	Respondents	Total Score
1.	S1	92
2.	S2	85
3.	SS	87
Total Combined Score		264
Total Maximum Score		285
Average (%)		92.63%
Practicality Criteria		Very Practical

In the practicality questionnaire, the worksheets were assessed by three students in one of the private junior high schools in Cianjur Regency. The results of the practicality questionnaire assessed by three students scored 264 out of a maximum score of 285. So that the average score of the practicality of the worksheets 92.63% with the criteria “very practical”. Students stated that the worksheet was easy to understand, engaging, and helpful in learning number patterns.. The worksheets is also considered to be able to increase the knowledge of students, support in the process of understanding mathematics.

3.2 Discussion

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Learning media that is interesting and based on culture that is close to students can increase understanding in learning mathematics. In this case, research was conducted to produce ethnomathematics-based student Worksheets with Pupuh in learning grade VIII junior high school mathematics on Number Pattern material. The intrinsic rules of Pupuh, specifically guru wilangan (the fixed number of syllables per line) and guru lagu (rhyme patterns), provide a natural and concrete numerical dataset that aligns perfectly with the mathematical definition of a sequence. This development is based on the low mathematical ability of students, especially on number pattern material and limitations in learning such as the lack of approaches that integrate culture. By using Pupuh, the learning process acknowledges and utilizes the students cultural heritage (Sundanese) as a vehicle for learning, making the material less abstract and more meaningful. Supported by the statement that ethnomathematics can improve student abilities so that it becomes one of the studies that can be applied to worksheets in learning mathematics (Susanti et al., 2024). The method used in this research is the 4D model at the Define, Design and Develop stages. This stage was chosen because the flow is systematic and appropriate for developing learning media. Pupuh becomes the context in bridging the concept of number patterns with culture to produce worksheets that are relevant and interesting for students. In accordance with Putri et al. (2024), that the results of concepts in ethnomathematics can be utilized as an alternative mathematics learning resource.

The validation results carried out by the validator were 90%, including in the very valid category. These results indicate that the Pupuh ethnomathematics-based worksheets are suitable for use and in accordance with the learning objectives. In addition, there are also suggestions for improvement from validators in the design and language used, including the addition of pictures that match the context, the addition of sentences and questions that train literacy, the addition of components in pupuh and motivational sentences that contain positive values for students. After validation and improvement of the worksheets, a limited practicality test was conducted on students. The result was 92.6% with a very practical category, there were notes from students including the language in the worksheets that were easy to understand, as well as additional suggestions that the design of the worksheets be made more attractive. Despite the positive results, this research has several limitations that the practicality test only involved three students, which may not represent the diverse range of abilities in a full classroom setting, the study was conducted at only one private junior high school in Cianjur, limiting the generalizability of the findings to other regions, and this study focused on development (validity and practicality) and did not yet conduct an experimental test to measure the direct impact on student learning outcomes or effectiveness.

From the results obtained through this practicality test, it shows that the worksheets based on pupuh ethnomathematics are easy to understand, interesting, and help in the learning process, especially in understanding the concept of number patterns. These results are in line with Fairuz et al. (2020) and Dahoklory et al. (2023) who prove that worksheets on ethnomathematics-based number pattern material for class VIII junior high school meet valid and practical criteria. These worksheets can be used in learning, while also having a positive impact on student involvement, practicing character strengthening as well as cultural preservation in learning. This research has limitations, including the limited number of test subjects and has not tested the effect of these worksheets directly on student learning outcomes. Therefore, further research is recommended to involve a wider range of participants and conduct quantitative effectiveness tests to measure the impact of the use of worksheets on improving students' math skills and learning outcomes on number pattern material.

4. Conclusion

The development of Pupuh ethnomathematics-based Learner Worksheets on number pattern material meets the eligibility criteria for use in learning. The validation results show that the Learner Worksheet is in the "very valid" category. Even so, there are several suggestions for improvement given by the validators, thus this learning media not only supports the understanding of mathematics material but also helps students recognize and understand Sundanese cultural arts, in this case, namely pupuh. In addition, students' responses to the practicality of this worksheets were positive and in the "practical" category. So that the worksheets based on pupuh ethnomathematics on number pattern material can contribute to interesting and meaningful learning, as well as help in understanding and motivating

student learning by linking number pattern material with local culture, namely Pupuh. This study demonstrates that ethnomathematics has high applicability in the classroom by bridging abstract mathematical concepts with students' cultural reality. By integrating Pupuh into the mathematics curriculum, this study contributes to the preservation of Sundanese cultural heritage among the younger generation, ensuring that traditional art forms remain relevant in a modern educational context. The created Pupuh-based ethnomathematics-based worksheet has been shown to be reliable and useful for teaching number patterns. Through the teaching of mathematics, the incorporation of cultural components promotes conceptual understanding, increases student engagement, and helps to preserve local culture. Teachers are encouraged to use this worksheet as an alternative learning resource to increase student engagement and reduce the perception that mathematics is overly abstract. When implementing this worksheet, teachers should facilitate group discussions and inquiry-based activities to maximize the benefits of the cultural context in exploring number sequences. This study supports the incorporation of local knowledge into formal education and offers implications for math teachers to create culturally sensitive teaching materials. It is advised that future studies evaluate this worksheet's impact on learning objectives, extend its application to other mathematical subjects, and investigate digital modifications for wider use. Future studies should focus on conducting quantitative experimental tests to measure the direct impact of these worksheets on student learning outcomes and numeracy skills. It is recommended to involve a wider and more diverse range of participants across multiple schools to ensure the generalizability of the results.

Limitations

The scope of this article is limited to reviewing mathematical issues, difficulties in understanding number patterns, and the use of ethnomathematics-based worksheets, without conducting an in-depth empirical evaluation of classroom implementation. In addition, the discussion focuses specifically on the development of student worksheets using the pupuh cultural context, so the findings may not be generalisable to other mathematical topics or cultural settings.

Author Contribution

Author 1: Conceptualization, Writing - Original Draft, Editing and Visualization;
Author 2: Writing - Review & Editing, Formal analysis, and Methodology;
Author 3: Validation

Conflict of Interest

The authors declare no conflict of interest.

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