

Designing Effective Student Worksheets Based on Ethnomathematics Pupuh in Number Patterns Material

Pitri Aulia^a, Rani Sugiarni^b, Reza Rahman Hakim^c

^aUniversitas Suryakencana, Cianjur, Indonesia, auliapitri07@gmail.com

^bUniversitas Suryakencana, Cianjur, Indonesia, ranisugiarni@gmail.com

^cUniversitas Suryakencana, Cianjur, Indonesia, rezarahmanhakim@gmail.com

*Correspondence email: ranisugiarni@gmail.com

Abstract

Students have difficulty in representing patterns in learning number pattern material. This condition is caused by not optimal teaching materials that support students' understanding, including aspects of teaching methods or lack of materials that support understanding of number patterns. Consequently students struggle to grasp the material, lack of motivation and interest in learning. This study aims to develop Pupuh ethnomathematics-based Student Worksheets on number pattern material that has valid and practical qualities. The research method used is the Research and Development (R&D) method with the 4D model at the Define, Design, to Develop stages. The participants of this study involved 1 lecturer, 1 teacher and 3 students of class VIII of a private junior high school in Cianjur Regency. The instruments of this research are validation sheets by material experts, media experts, and educational practitioners to ensure feasibility, practicality assessment sheets by students through questionnaires. The validation results show that this worksheet is feasible to use with an average validation score of 95%, which is included in the "very valid" category based on the Guttman scale. The limited practicality test was conducted on grade VIII students in one of the junior high schools in Cianjur, and the practicality assessed by students was 92.63% with the criteria "very practical". This research contributes to the development of innovative and contextually based teaching materials.

Keywords:

Worksheet,
Ethnomathematics,
Pupuh,
Number Patterns

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. 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). Mathematical activities are often carried out by society without being realised (Dhiki & Bantas, 2021). 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 (Setyaningrum & 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 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 (Sugiarni et al., 2023).

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



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:

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

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

$$V = \frac{NP_{r_1} + NP_{r_2}}{2} = \dots \% \quad (2)$$

Description:

V = Validasi (gabungan)

NP_{r_1} = First validator process score

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:

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

Description:

P = Percentage 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:

3.1.1. Define

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 (Wiguna & Tristianingrat, 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.

3.1.2. 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 7.

Figure 2
Cover page

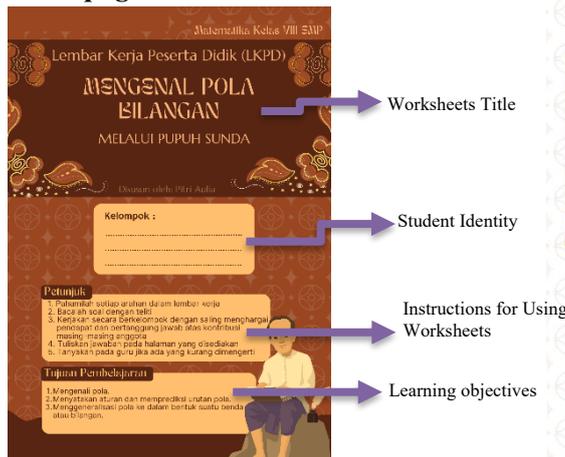


Figure 3
Contents page

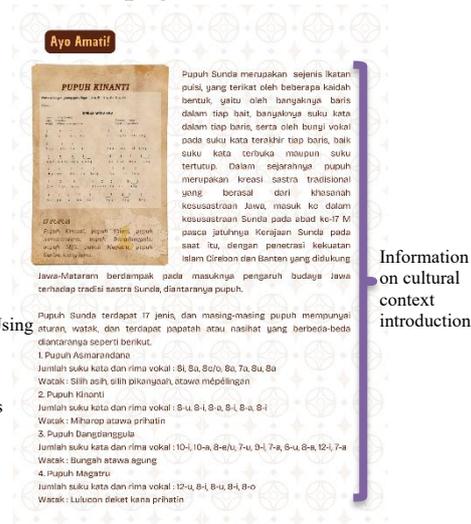


Figure 4
Contents page

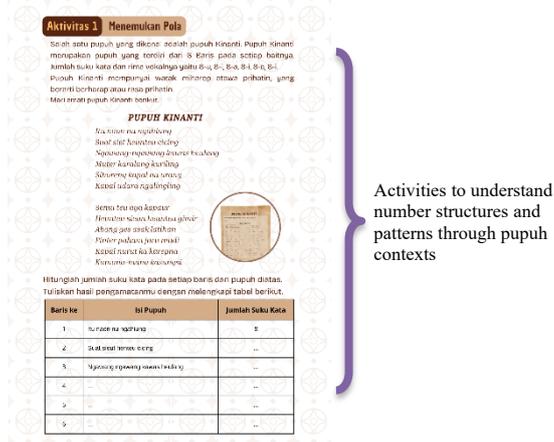


Figure 5
Contents page

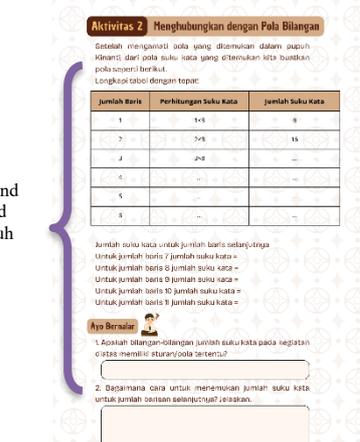
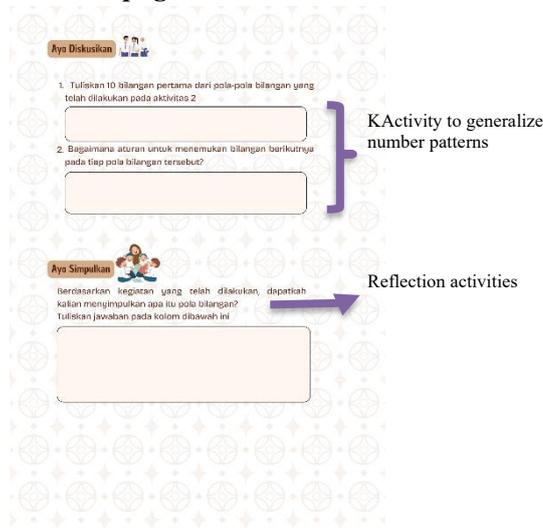


Figure 6
Contents page



3.1.3. Develop

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.

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

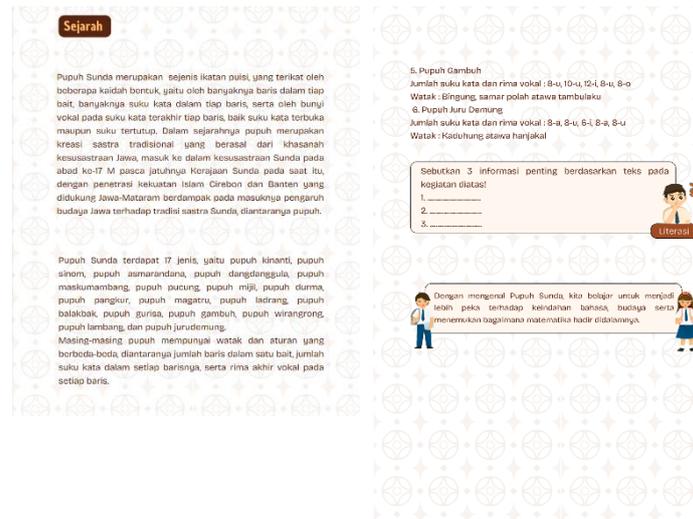
The development of the Student Worksheet was validated by two validators, one mathematics education lecturer and one prospective mathematics teacher. Validator 1 gave an empirical score of 52 out of a maximum score of 55, resulting in a validity percentage of 94.55%. Validator 2 gave an empirical score 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.

3.1.3.2. 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

Before Revision	Image	Suggestions and Improvements
<p>Sejarah</p> <p>Pupuh Sunda merupakan sejenis ikatan puisi yang terikat oleh beberapa kaidah bentuk, yaitu oleh banyaknya baris dalam tiap bait, banyaknya suku kata dalam tiap baris, serta oleh bunyi vokal pada suku kata terakhir tiap baris, baik suku kata terbuka maupun suku tertutup. Dalam sejarahnya pupuh merupakan kreasi sastra tradisional yang berasal dari khasanah kesusastraan Jawa, masuk ke dalam kesusastraan Sunda pada abad ke-17 M pasca jatuhnya Kerajaan Sunda pada saat itu, dengan pemertaa kekuatan Islam Cirebon dan Banten yang didukung Jawa-Mataram berdampak pada masuknya pengaruh budaya Jawa terhadap tradisi sastra Sunda, diantaranya pupuh.</p> <p>Pupuh Sunda terdapat 17 jenis, yaitu pupuh kinanti, pupuh sinom, pupuh asmarandana, pupuh dangdanggula, pupuh maskumambang, pupuh pucung, pupuh miji, pupuh duma, pupuh pangkur, pupuh magaru, pupuh ladrang, pupuh balakbak, pupuh gurisa, pupuh gambuh, pupuh wirangrong, pupuh lambang, dan pupuh jurudemang.</p> <p>Masing-masing pupuh mempunyai watak dan aturan yang berbeda-beda, diantaranya jumlah baris dalam satu bait, jumlah suku kata dalam setiap barisnya, serta rima akhir vokal pada setiap baris.</p>	<p>Ayo Amati!</p> <p>Pupuh Sunda merupakan sejenis ikatan puisi yang terikat oleh beberapa kaidah bentuk, yaitu oleh banyaknya baris dalam tiap bait, banyaknya suku kata dalam tiap baris, serta oleh bunyi vokal pada suku kata terakhir tiap baris, baik suku kata terbuka maupun suku tertutup. Dalam sejarahnya pupuh merupakan kreasi sastra tradisional yang berasal dari khasanah kesusastraan Jawa, masuk ke dalam kesusastraan Sunda pada abad ke-17 M pasca jatuhnya Kerajaan Sunda pada saat itu, dengan pemertaa kekuatan Islam Cirebon dan Banten yang didukung Jawa-Mataram berdampak pada masuknya pengaruh budaya Jawa terhadap tradisi sastra Sunda, diantaranya pupuh.</p> <p>Pupuh Sunda terdapat 17 jenis, dan masing-masing pupuh mempunyai aturan watak, dan terdapat papatih atau nasihat yang berbeda-beda diantaranya seperti berikut.</p> <ol style="list-style-type: none"> 1. Pupuh Asmarandana Jumlah suku kata dan rima vokal: 8i, Ba, 8o/0, Ba, 7o, 8i, 8a Watak: silih asih, silih pikangmah, acawa mepelingan 2. Pupuh Kinanti Jumlah suku kata dan rima vokal: 8-i, 8-i, 8-i, 8-i Watak: Miharep acawa prihatin 3. Pupuh Dangdanggula Jumlah suku kata dan rima vokal: 10-i, 10-a, 8-a/i, 7-i, 7-a, 8-i, 8-a, 12-i, 7-a Watak: Burangh acawa agung 4. Pupuh Magaru Jumlah suku kata dan rima vokal: 12-i, 8-i, 8-i, 8-i, 8-o Watak: Luucon deket kana prihatin <p>5. Pupuh Miji Jumlah suku kata dan rima vokal: 8-i, 10-i, 8-i, 8-i Watak: Simping samar pohan atawa tambak 6. Pupuh Awi Dangsi Jumlah suku kata dan rima vokal: 8-i, 8-i, 8-i, 8-i, 8-i Watak: Macukung atawa hampal <p>Sebutkan 3 informasi penting berdasarkan teks pada kegiatan diatas!</p> <p>1. 2. 3.</p> <p>1. Pupuh Asmarandana Jumlah suku kata dan rima vokal: 8i, Ba, 8o/0, Ba, 7o, 8i, 8a Watak: silih asih, silih pikangmah, acawa mepelingan</p> <p>2. Pupuh Kinanti Jumlah suku kata dan rima vokal: 8-i, 8-i, 8-i, 8-i Watak: Miharep acawa prihatin</p> <p>3. Pupuh Dangdanggula Jumlah suku kata dan rima vokal: 10-i, 10-a, 8-a/i, 7-i, 7-a, 8-i, 8-a, 12-i, 7-a Watak: Burangh acawa agung</p> <p>4. Pupuh Magaru Jumlah suku kata dan rima vokal: 12-i, 8-i, 8-i, 8-i, 8-o Watak: Luucon deket kana prihatin</p> </p>	<p>In the history section, add pictures related to pupuh, then add questions that train students literacy.</p>
<p>Sejarah</p> <p>Pupuh Sunda merupakan sejenis ikatan puisi yang terikat oleh beberapa kaidah bentuk, yaitu oleh banyaknya baris dalam tiap bait, banyaknya suku kata dalam tiap baris, serta oleh bunyi vokal pada suku kata terakhir tiap baris, baik suku kata terbuka maupun suku tertutup. Dalam sejarahnya pupuh merupakan kreasi sastra tradisional yang berasal dari khasanah kesusastraan Jawa, masuk ke dalam kesusastraan Sunda pada abad ke-17 M pasca jatuhnya Kerajaan Sunda pada saat itu, dengan pemertaa kekuatan Islam Cirebon dan Banten yang didukung Jawa-Mataram berdampak pada masuknya pengaruh budaya Jawa terhadap tradisi sastra Sunda, diantaranya pupuh.</p> <p>Pupuh Sunda terdapat 17 jenis, yaitu pupuh kinanti, pupuh sinom, pupuh asmarandana, pupuh dangdanggula, pupuh maskumambang, pupuh pucung, pupuh miji, pupuh duma, pupuh pangkur, pupuh magaru, pupuh ladrang, pupuh balakbak, pupuh gurisa, pupuh gambuh, pupuh wirangrong, pupuh lambang, dan pupuh jurudemang.</p> <p>Masing-masing pupuh mempunyai watak dan aturan yang berbeda-beda, diantaranya jumlah baris dalam satu bait, jumlah suku kata dalam setiap barisnya, serta rima akhir vokal pada setiap baris.</p>	<p>Jawa-Mataram berdampak pada masuknya pengaruh budaya Jan terhadap tradisi sastra Sunda, diantaranya pupuh.</p> <p>Pupuh Sunda terdapat 17 jenis, dan masing-masing pupuh mempunyai aturan watak, dan terdapat papatih atau nasihat yang berbeda-beda diantaranya seperti berikut.</p> <ol style="list-style-type: none"> 1. Pupuh Asmarandana Jumlah suku kata dan rima vokal: 8i, Ba, 8o/0, Ba, 7o, 8i, 8a Watak: silih asih, silih pikangmah, acawa mepelingan 2. Pupuh Kinanti Jumlah suku kata dan rima vokal: 8-i, 8-i, 8-i, 8-i Watak: Miharep acawa prihatin 3. Pupuh Dangdanggula Jumlah suku kata dan rima vokal: 10-i, 10-a, 8-a/i, 7-i, 7-a, 8-i, 8-a, 12-i, 7-a Watak: Burangh acawa agung 4. Pupuh Magaru Jumlah suku kata dan rima vokal: 12-i, 8-i, 8-i, 8-i, 8-o Watak: Luucon deket kana prihatin 	<p>In pupuh, there is a trait or character component for each pupuh, add the character.</p>



Sejarah

Pupuh Sunda merupakan sejenis ikatan puisi, yang terikat oleh beberapa kaidah bentuk, yaitu oleh banyaknya baris dalam tiap bait, banyaknya suku kata dalam tiap baris, serta oleh bunyi vokal pada suku kata terakhir tiap baris, baik suku kata terbuka maupun suku tertutup. Dalam sejarahnya pupuh merupakan kreasi sastra tradisional yang berasal dari khasanah kesusastraan Jawa, masuk ke dalam kesusastraan Sunda pada abad ke-17 M pasca jatuhnya Kerajaan Sunda pada saat itu, dengan penetrasi kekuatan Islam Cirebon dan Banten yang didukung Jawa-Mataram berdampak pada masuknya pengaruh budaya Jawa terhadap tradisi sastra Sunda, diantaranya pupuh.

Pupuh Sunda terdapat 17 jenis, yaitu pupuh kinanti, pupuh sinom, pupuh asmarandana, pupuh dangdanggula, pupuh maskumambang, pupuh putung, pupuh miji, pupuh durma, pupuh pangkur, pupuh magatu, pupuh laclarang, pupuh batakak, pupuh gurisa, pupuh gambuh, pupuh wirangrong, pupuh lambang, dan pupuh jurudemung.

Setiap-masing pupuh mempunyai watak dan aturan yang berbeda-beda, diantaranya jumlah baris dalam satu bait, jumlah suku kata dalam setiap barisnya, serta rima akhir vokal pada setiap baris.

5. Pupuh Gambuh
Jumlah suku kata dan rima vokal : 6-4, 10-4, 10-4, 8-4, 8-4
Watak : Beringang, samar polah atawa tambulaku
6. Pupuh Juru Demung
Jumlah suku kata dan rima vokal : 8-4, 8-4, 6-4, 8-4
Watak : Kasuhung atawa hanjakal

Sebutkan 3 informasi penting berdasarkan teks pada kegiatan diatas!

1. _____
2. _____
3. _____

Dengan mengenal Pupuh Sunda, kita belajar untuk mengabdikan pada bangsa dan negara. Dengan mempelajari pupuh Sunda, kita belajar untuk mengabdikan pada bangsa dan negara.

Added motivational words in the content section so that it contains positive character values for students.

3.1.3.3. 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

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.

5. References

- Ardiyanti, B., Choirudin, C., & Ningsih, E. F. (2024). Etnomatematika bangunan pionering pramuka terhadap minat dan kreativitas siswa. *Jurnal Penelitian Tindakan Kelas*, 1(3), 156–161. <https://doi.org/10.61650/jptk.v1i3.509>
- Asma, A. (2023). Development of an ethnic-math HOTS-based assessment instrument to measure students' numerical literacy. *Journal of Innovation in Educational and Cultural Research*, 4(4), 691–699. <https://doi.org/10.46843/jiecr.v4i4.909>
- Bela, M. E., & Wewe, M. (2024). Integrating ethnomathematics into a transformation geometry module to enhance self-efficacy. *Al-Jabar: Jurnal Pendidikan Matematika*, 15(2), 547. <https://doi.org/10.24042/ajpm.v15i2.24564>
- Chrisnawati, Y., & Pratama, F. W. (2023). Analisis kesulitan peserta didik kelas VIII dalam belajar pola bilangan. *Jurnal Pendidikan Matematika Undiksha*, 14(2), 117–127. <https://doi.org/10.23887/jjpm.v14i2.61266>
- D'Ambrosio, U. (2001). In my opinion: What is ethnomathematics, and how can it help children in schools? *Teaching Children Mathematics*, 7(6), 308–310. <https://doi.org/10.5951/TCM.7.6.0308>
- Dahoklory, A. S. K., Laurens, T., & Palinussa, A. L. (2023). Development of learning devices based on ethnomathematics of the Meher tribe woven fabrics (Kisar Island) with realistic mathematics education approach on number pattern material. *Jurnal Pendidikan Matematika (JUPITEK)*, 6(2), 82–92. <https://doi.org/10.30598/jupitekvol6iss2pp82-92>
- Dhiki, Y. Y., & Bantas, M. G. D. (2021). Eksplorasi etnomatematika sebagai sumber belajar matematika di Kabupaten Ende. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 10(4), 2698. <https://doi.org/10.24127/ajpm.v10i4.4254>
- Dinta, A., Luthfi, A., & Wahyuni, M. (2023). Media pembelajaran matematika berbasis chatbot untuk kemampuan pemahaman konsep pola bilangan siswa. *Journal of Education Research*, 4(4), 2385–2392. <https://doi.org/10.37985/jer.v4i4.633>
- Fairuz, F. R., Fajriah, N., & Danaryanti, A. (2020). Pengembangan LKS materi pola bilangan berbasis etnomatematika Sasirangan di kelas VIII sekolah menengah pertama. *EDU-MAT: Jurnal Pendidikan Matematika*, 8(1). <https://doi.org/10.20527/edumat.v8i1.8343>
- Faqih, A., Nurdiawan, O., & Setiawan, A. (2021). Pengembangan media pembelajaran multimedia interaktif alat masak tradisional berbasis etnomatematika. *Mosharafa: Jurnal Pendidikan Matematika*, 10(2), 301–310. <https://doi.org/10.31980/mosharafa.v10i2.663>
- Gunawan, F., Septian, A., & Sugiarni, R. (2023). Analisis kemampuan representasi matematis ditinjau dari gaya kognitif. *Intellectual Mathematics Education (IME)*, 1(2), 67–78. <https://doi.org/10.59108/ime.v1i2.49>
- Haerudin, D., Hermawan, B., Ruhaliah, R., Wibawa, S., Awaliah, Y. R., & Hardini, T. I. (2023). Inventorying authentic teaching materials on YouTube for listening learning plan of Pupuh in elementary school. *Jurnal Cakrawala Pendidikan*, 42(2). <https://doi.org/10.21831/cp.v42i2.46233>
- Hartindya, R. P., Sunardi, S., & Yuliati, N. (2022). Pengembangan perangkat pembelajaran berorientasi etnomatematika batik nusantara materi transformasi geometri terhadap keterampilan berpikir tingkat tinggi. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 11(3), 2257. <https://doi.org/10.24127/ajpm.v11i3.5775>
- Iskandar, R. S. F., Darhim, D., Dahlan, J. A., & Jupri, A. (2025). Students' learning difficulties on mathematical understanding of a number pattern. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 14(1), 199–210. <https://doi.org/10.24127/ajpm.v14i1.9677>
- Kemdikbud. (2024). *Rapor pendidikan Indonesia 2024*. <https://pusatinformasi.raporpendidikan.kemdikbud.go.id/hc/en-us/articles/6545029651609-Tentang-Rapor-Pendidikan-dan-Rapor-Mutu>

- Kemendikdasmen. (2025). *Pembelajaran mendalam*. https://bpmkaltara.kemdikbud.go.id/wp-content/uploads/2025/02/nasmik-deep-learning-2025-full_10-feb.pdf
- Mania, S., Nur, F., & Amin, B. (2024). Development of ethnomathematics-based mathematical teaching materials at the Makassar 99 Kubah Mosque in facilitating student learning independence. *Kreano: Jurnal Matematika Kreatif-Inovatif*, 15(1), 123–135. <https://doi.org/10.15294/r9qd9r26>
- Maula, N. F., Suryadi, D., & Jupri, A. (2024). Learning obstacles in the generalization process: In case number pattern topic. *Research and Development in Education (RaDeN)*, 4(2), 964–976. <https://doi.org/10.22219/raden.v4i2.36342>
- Mursalina, D., Marhamah, M., & Retta, A. M. (2021). Development students worksheet using ethnomathematics-based CTL approach on SLETV subject material for grade X. *Kreano: Jurnal Matematika Kreatif-Inovatif*, 12(1), 118–129. <https://doi.org/10.15294/kreano.v12i1.28584>
- OECD. (2023). *PISA 2022 results: Factsheets – Indonesia*. https://www.oecd.org/en/publications/pisa-2022-results-volume-i-and-ii-country-notes_ed6fbcc5-en/indonesia_c2e1ae0e-en.html
- Prasetyo, P. W., & Atsila, K. S. (2022). Developing problem-based learning electronic student worksheet for number pattern topic. *Bulletin of Applied Mathematics and Mathematics Education*, 2(2), 79–86. <https://doi.org/10.12928/bamme.v2i2.6813>
- Putri, A. R. H., Wiryanto, W., Ekawati, R., & Srinivasarao, U. (2024). The implementation of ethnomathematics-based student worksheet “Surya Majapahit” on the circle elements material to build creative thinking of elementary students. *IJORER: International Journal of Recent Educational Research*, 5(6), 1522–1541. <https://doi.org/10.46245/ijorer.v5i6.712>
- Setiyadi, D., Munjaji, I., & Naimah, N. (2022). Pengembangan bahan ajar bernuansa etnomatematika pada tingkat sekolah dasar dengan satuan hitung tidak baku khas Banyumas. *Jurnal Eduscience*, 9(1), 227–234. <https://doi.org/10.36987/jes.v9i1.2571>
- Setiyaningrum, N., & Sari, C. K. (2023). LKS berbasis problem based learning: Upaya mendukung peningkatan kemampuan berpikir kritis pada materi pola bilangan. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 12(1), 202. <https://doi.org/10.24127/ajpm.v12i1.5819>
- Setyorini, A. I., Saefudin, A. A., & Haryanto, H. (2020). Pengembangan lembar kerja siswa menggunakan pendekatan saintifik pada materi pola bilangan. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 9(4), 1260. <https://doi.org/10.24127/ajpm.v9i4.3054>
- Sugiarni, R., Herman, T., Septian, A., Fazrianto Suwarman, R., & Inayah, S. (2023). Analysis of errors and difficulties on numeracy ability students in the new normal era. *AIP Conference Proceedings*, 030032. <https://doi.org/10.1063/5.0140355>
- Sugiarni, R., Herman, T., Suryadi, D., Prabawanto, S., & Zulnaldi, H. (2023). Ethnomathematics study of Pandanwangi village. *Union: Jurnal Ilmiah Pendidikan Matematika*, 11(2), 260–274. <https://doi.org/10.30738/union.v11i2.14614>
- Sugiarni, R., Mulya, D., Putri, V., & Zahira Shofa, G. (2023). Pengembangan lembar kerja peserta didik (LKS) interaktif berbasis live worksheet pada materi eksponen. *Sigma Didaktika: Jurnal Pendidikan Matematika*, 11(2), 117–127. <https://doi.org/10.17509/sigmadidaktika.v11i2.60003>
- Sumandya, I. W., & Widana, I. W. (2022). Reconstruction of vocational-based mathematics teaching materials using a smartphone. *Journal of Education Technology*, 6(1), 133–139. <https://doi.org/10.23887/jet.v6i1.42833>
- Susanti, O., Yanto, Y., & Luthfiana, M. (2024). Systematic literature review: Lembar kerja peserta didik (LKPD) berbasis etnomatematika. *Journal of Mathematics Science and Education*, 6(2). <https://doi.org/10.31540/jmse.v6i2.3374>
- Suwito, R. W., Sa’dijah, C., & Qohar, A. (2023). Implementasi media komik matematika digital dalam pembelajaran pola barisan bilangan. *JOHME: Journal of Holistic Mathematics Education*, 7(2), 227. <https://doi.org/10.19166/johme.v7i2.7621>
- Wiguna, I. K. W., & Tristianingrat, M. A. N. (2022). Langkah mempercepat perkembangan kurikulum merdeka belajar. *Edukasi: Jurnal Pendidikan Dasar*, 3(1), 17. <https://doi.org/10.55115/edukasi.v3i1.2296>
- Zaslavsky, C. (1991). World cultures in the mathematics class. *For the Learning of Mathematics*, 11(2), 32–36.