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Designing Performance Assessment for Ethnomathematics Project-Based Learning to Assess University Students' Mathematical Thinking Skills

Himmatul Ulya[1,*], Ratri Rahayu[1], Cholis Sa'dijah[2], Abd. Qohar[2], & Muhamad Ikhwan Mat Saad[3]
[1]Mathematics Education, Universitas Muria Kudus, Indonesia
[2]Mathematics Education,Universitas Negeri Malang, Indonesia
[3]Faculty of Science and Mathematics, Universiti Pendidikan Sultan Idris, Malaysia

Abstract: The skills involved in the mathematical thinking process are crucial for university students pursuing Mathematics Education. However, most of them lack proficiency in seeing patterns while addressing an issue and articulating the problem in mathematical terms. The objectives of this research are (1) to analyze students' mathematical thinking process skills; (2) to ascertain students' expectations regarding the learning process and assessment in Ethnomathematical education; (3) to develop a performance assessment model design; (4) to evaluate the quality of the performance assessment model within Ethnomathematics-based Project-based Learning (PjBL) for measuring students' mathematical thinking process skills; and (5) to report the outcomes of measuring students' mathematical thinking process skills. This study employs a research and development (R&D) design. This study's population comprises all 6th-semester students enrolled in the Mathematics Education program at Muria Kudus University. The research sample was obtained by a saturation sampling procedure, comprising 107 students. The study instruments employed consist of assessment tools designed to evaluate students' mathematics cognitive processing skills. The acquired data were analyzed descriptively. The research findings indicate that: (1) students' mathematical thinking process skills are suboptimal, with a mean value of 54.14%; (2) students desire greater engagement in an active learning process that connects to real-life situations and cultural contexts, incorporating assessments that reflect individual performance; (3) a performance assessment model design for Ethnomathematics-based Project-Based Learning (PjBL) has been developed, encompassing objectives, components, instruments, syntax, and model guidelines. The created performance assessment approach for ethnomathematics-based project-based learning is both valid and reliable, and the evaluation of mathematical thinking process abilities demonstrates exceptional outcomes. This study suggests the necessity of implementing the ethnomathematics-based Project-Based Learning (PJBL) performance evaluation model to enhance students' mathematical thinking skills through an active, contextual, and culturally relevant method.

Keywords: ethnomathematics, performance assessment, pjbl, project-based learning.

▪ INTRODUCTION

The learning requirements of the 21st century encompass the cultivation of critical thinking, cooperation, creativity, and communication skills. The skills involved in mathematical thinking reflect all of these dimensions. In the study of Mathematics, students are expected to not only comprehend topics but also articulate mathematical ideas effectively. Consequently, pupils need proficient mathematical reasoning skills. Mathematical thinking process skills include the ability to identify patterns, draw conclusions, translate problems into mathematical concepts, and carry out calculations (Albawawi, 2023).

The cognitive processes of students are influenced by their understanding of the nature of a problem (Rizqika et al., 2021). Research has shown that students in Indonesia

Himmatul Ulya
*Email: himmatul.ulya@umk.ac.id

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struggle with conceptual comprehension (Ningrum et al., 2023). This deficiency has hindered the development of students' mathematical reasoning skills (Er et al., 2023; Marjuwita et al., 2020). This essential skill is regarded as a critical component and key focus of the Mathematics Education Study Program at Universitas Muria Kudus, Indonesia. The primary objective of the study program is to cultivate teacher candidates who are equipped to enhance students' mathematical thinking abilities and implement innovative learning strategies. By doing so, students will develop optimal mathematical reasoning skills in the future.

Preliminary research has indicated that students lack proficiency in identifying patterns while addressing problems and in translating these problems into mathematical terms. Their limited reasoning skills stem from an inability to comprehend the underlying issues, making it difficult for them to integrate concepts required for problem-solving.

To address these issues, students should be engaged in a learning process linked to real-world challenges. Project-Based Learning (PjBL) offers a solution by involving students in project-based activities where they transfer knowledge and skills through discovery and inquiry facilitated by guided questions (Fisher et al., 2020; Serin, 2023). Authentic challenges in PjBL are designed to reflect the local culture and unique features of Kudus City. Studying Mathematics through a cultural lens (Ethnomathematics) has gained significance (Arisetyawan et al., 2014; Chahine, 2020). Learning grounded in ethnomathematics helps students understand topics by connecting them to their cultural context (Aikpitanyi & Eraikhuemen, 2017). This approach seeks to create an engaging educational environment that promotes students' comprehension of problems and enhances their mathematical reasoning skills.

Project-Based Learning (PjBL) differs significantly from traditional teaching methods and has proven to be effective in improving students' learning outcomes in mathematics (Rijken, 2017). However, its full potential has not yet been realized in secondary-level mathematics instruction (Kirilova, 2022; Strobel & Barneveld, 2009). PjBL is characterized by research-driven, open-ended, and student-centered learning activities, with teachers serving as facilitators (Al-Busaidi & Al-Seyabi, 2021; Bell, 2010) Consequently, the Mathematics Education program at Universitas Muria Kudus, Indonesia, aims to implement PjBL in Ethnomathematics courses to prepare future teachers who can design innovative learning experiences for their students. By doing so, prospective educators will be equipped to enhance students' mathematical thinking skills.

The concept of ethnomathematics was introduced by Brazilian mathematician d'Ambrosio. Ethnomathematics serves as a dynamic and evolving framework that illustrates the role of culture in shaping the application of Mathematics (Anderson-Pence, 2013; Supiyati et al., 2019). As an educational approach, ethnomathematics links mathematical concepts to students' cultural contexts, making them more accessible and relatable. Research has demonstrated that integrating PjBL with ethnomathematics improves students' mathematics learning outcomes (Asmi et al., 2022).

This study applies Ethnomathematics-based PjBL by incorporating the local culture and geographical strengths of Kudus City into project assignments and learning media. For ethnomathematics to be effective, the study materials must be relevant to students' cultural contexts (Barros & da Silva, 2022; Fouze & Amit, 2018; Pradhan, 2018). Students better understand content that is directly linked to the culture they encounter in their daily lives.

Mathematical cognitive skills are assessed through various evaluation methods, with authentic assessment being one approach (Nguyen & Phan, 2020). One suitable method for evaluating process skills is performance assessment, which requires students to complete complex tasks. Such assessments focus on competencies for solving real-world challenges (Bland et al., 2016; Koh et al., 2019; VanTassel-Baska, 2014). In previous studies, performance evaluation rubrics were used solely to assess students' reasoning skills (Shirawia et al., 2024; Tashtoush & Rasheed, 2024), even though this type of assessment is inherently linked to learning. Therefore, there is a need for innovative approaches to assess the mathematical thinking process in Ethnomathematics-based PjBL.

Assessment should extend beyond the evaluation of final student outcomes. It should be conducted throughout the learning process, enabling instructors to monitor students' cognitive processes as they solve problems. One approach is to use authentic assessments that are conducted in stages (Fauziah et al., 2018). This assessment can be implemented through a performance evaluation process involving six key stages: planning, data collection, organization, processing, analysis, and presentation of results. Performance assessments are continuous and require students to actively participate, allowing them to turn assessment experiences into valuable learning opportunities (Rosenstein et al., 1996; Ukashatu, 2021).

Performance assessment emphasizes the process and allows students to demonstrate their capabilities rather than simply selecting from multiple-choice options (Mahendra et al., 2019). In mathematics education, performance assessment can be conducted through assignments, projects, investigations, observations, interviews, and student-created products (Yudha et al., 2019). Mathematical knowledge is evaluated by examining students' (1) conceptual understanding, (2) correct use of mathematical language and notation, and (3) accurate and comprehensive execution of procedures (Parke, 2003; Salsabila et al., 2020).

Performance assessment offers several benefits, including (1) encouraging students to apply discovery skills, (2) providing opportunities to respond to open-ended questions, (3) enabling students to articulate mathematical concepts to peers and teachers, (4) improving the thoroughness and accuracy of assessments, (5) promoting knowledge and skill development through extended responses, and (6) enhancing learning when integrated into the educational process (Zlatkin-Troitschanskaia & Shavelson, 2019).

Performance assessment serves as an effective method for evaluating students' mathematical reasoning skills. To be effective, it must be implemented consistently and continuously in mathematics education. This study aims to integrate performance assessment within an Ethnomathematics-oriented PjBL framework.

Mathematics is viewed as an active, dynamic, and generative subject. It can be seen as a language with rules and terminology (Ledibane et al., 2018). In Mathematics, students must not only understand concepts but also express them clearly using various formats, such as tables, graphs, and diagrams. Mathematical thinking process skills include identifying patterns, predicting outcomes, and translating problems into mathematical language (Kamid et al., 2023).

This research aims to (1) evaluate students' mathematical thinking skills, (2) analyze students' learning experiences, (3) develop a performance assessment model for

Ethnomathematics-based PjBL, (4) assess the quality of the performance assessment model, and (5) present the findings of students' mathematical thinking process skills.

▪ METHOD

Participants

The population included all 6th-semester students of the Mathematics Education study program at Muria Kudus University. The research sample was selected using a saturated sampling technique, with a sample size of 107 students.

Research Design and Procedures

This research and development (R&D) design applied the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model. The research stages began with a needs analysis to identify the characteristics of students' mathematical thinking process skills, expectations of the learning process and its assessment, and field necessity related to learning and assessment in the Ethnomathematics course. Furthermore, a performance assessment instrument design was carried out by ethnomathematics-based PjBL learning. At the development stage, experts created and validated a model prototype. The implementation stage involved testing the instrument in learning to evaluate the developed model. At the evaluation stage, the data analysis implementation data revealed students' mathematical thinking process skills. This research was designed to be finished within 2 years, including planning, implementation in class, data analysis, and reporting results.

Instrument

The research instruments include test instruments to measure students' mathematical thinking process skills. The developed instruments consisted of the designed and developed assessment. The validity of the instrument is proven through content validation by experts using the Delphi technique, while the reliability of the rubric is estimated using Cronbach's Alpha coefficient to ensure the reliability of the instrument. The test instrument consists of 10 items in the form of descriptions. The blueprint of the developed instrument is presented in Table 1.

Table 1. Distribution of indicators and number of instrument items

No	Indicators	Numbers of Items
1	Determining the pattern and drawing a conclusion	1. 3. 9
2	Communicating problems into mathematics ideas	2. 4. 5
3	Calculating mathematically	6. 7. 8. 10
	Total	10

Data Analysis

The applied statistical techniques in this study included descriptive statistics for students' mathematical thinking process skills, detecting students' expectations of the learning process and assessment in Ethnomathematics learning; content proof validity; and students' mathematical thinking process skill descriptions. The estimation of the reliability of the assessment model is estimated through Cronbach's Alpha.

▪ RESULT AND DISSCUSSION

Performance Assessment of Ethnomathematics-based Project-Based Learning

This section describes the results of product development from the initial stages of development, starting from the preliminary study stage, literature review, and field study to the initial product development stage in the form of the developed assessment design.

Students' Mathematical Thinking Process Skills

The descriptive data analysis presents data regarding the mathematical thinking process skills of students of the Mathematics Education Study Program in the 6th semester. The descriptive data of students' mathematical thinking process skills are presented in Table 1.

Table 1. A Descriptive statistics of mathematical thinking process skills data

No	Descriptive Statistics	Value
1	Number of Students	32
2	Highest Score	100
3	Lowest Score	6
4	Mean	54.14
5	Median	51
6	Modus	66
7	Variance	457.54
8	Standard Deviation	21.39

In Table 1, students' highest value reaches the perfect numbers but students' lowest one is very low. The students' mathematical thinking process skills are classified as poor because their value only reaches 54.14. The median and modus values of students' mathematical thinking process skills data are 51 and 66. In general, students' mathematical thinking process skills need to be improved because their mean and minimum values are still relatively low.

The descriptive analysis of the data in this research presents data on students' mathematical thinking process skills for each indicator. The data on students' mathematical thinking process skills that are described according to indicators of mathematical thinking process skills are presented in Table 2.

Table 2. A Description of mathematical thinking process skills data

No	Indicators	Percentage
1	Determine patterns and draw conclusions	47.86%
2	Communicate problems into mathematical ideas	57.93%
3	Perform mathematical calculations	59.14%

Based on Table 2, students achieve indicators of determining patterns and drawing conclusions by 47.86%, communicating problems into mathematical ideas by 57.93%, and performing mathematical calculations by 59,14%. Critical thinking involves deep reasoning and consideration of what we receive rather than direct acceptance of differences in mathematical ideas (Insorio & Librada, 2020; Mansoor & Pezeshki, 2012).

Thus, all indicators of students' mathematical thinking process skills have not been achieved, indicating that students' mathematical thinking process skills are not optimal because they only reach an mean value of 54.14%. Their poor mathematical thinking ability is caused by several factors, namely: 1) their low interest in mathematics, 2) their lack of understanding of basic concepts of mathematics, and 3) their low mastery of strategies for solving problems (Mabena et al., 2021).

Students' Expectations on the Learning Process and Assessment in Ethnomathematical Learning

A questionnaire survey was conducted on 27 students with low, medium, and high abilities who were chosen selectively. Table 3 shows the students' expectations about the learning process and assessment in Ethnomathematical learning.

Table 3. Questionnaire results of the preliminary research on students

No	Indicators	Percentage
1	Students' interest in being involved in learning	87.04
2	Students' interest in learning that is associated with real-life/cultural problems to improve their mathematical thinking process skills	86.57
3	Students' interest in regional excellence	87.96
4	Students' interest in project activities that are carried out in and associated with their surrounding environment and culture	78.24
5	Students' interest in realistic and authentic assessments that show the performance of each individual	85.19

The results of student questionnaires show that the mean of students who are interested in being involved in an active learning process is 87.04%. Students who are involved in the learning process will have a more meaningful understanding of the material and have better achievements (Amit & Qouder, 2015; Fouze & Amit, 2018). The general view of Mathematics as a tool could describe the importance of individuals possessing mathematical knowledge (Umbara et al., 2019) so that the need to interpret the uniqueness, complexity, and originality of mathematical thinking is an invaluable art contained in the values and nature of Mathematics itself (Umbara et al., 2021). The mean of students who are interested in learning that is associated with real-life/cultural problems to improve their mathematical thinking process skills is 86.57%.

Critical thinking is closely related to mathematical problems. Mathematical problems are contextual questions. They usually include story problems that can be found in real life. These problems do not always have established routines or procedures so certain analytical rules and concepts should be used for solving them (Pearson, 2020; Richardo et al., 2019). The use of the analytical context has several purposes, namely: developing a concept; developing a model; providing tools for procedural thinking, notations, pictures, and rules; using reality as a source and application domain; and practicing special skills in certain situations (Richardo et al., 2019). One context that can be used is culture (Aikpitanyi & Eraikhuemen, 2017; Cimen, 2014). The mean student's interest in regional excellence is 87.96%. A process of learning Mathematics that is based on regional excellence can make students more enthusiastic (Agusdianita et al., 2021). Regional excellence refers to cultural values within the community. They can help students understand and solve problems more easily and make them more interested in solving given problems because the problems exist in their daily lives (Faiziyah et al., 2020; Presmeg, 1998). 78.24% of students are interested in project activities carried out in their surrounding environment and associated with their culture and 85.19% of students are interested in realistic and authentic assessments that show the performance of each individual. These indicate that students are interested in assessments that show performance. Performance assessment places more emphasis on the process rather than the product/outcome (Langee et al., 2022).

Results of Focus Group Discussion (FGD)

The creation of relevant design draft of an assessment model for learning based on the necessity was revealed by a Focus Group Discussion (FGD), attended by assessment experts, Mathematics learning experts, and Ethnomathematics experts. Through the group discussion, the opinions were obtained and used for elaborating the design of the assessment model in learning so it could improve students' mathematical thinking process skills. Feedback from experts is summarized as follows: (1) the performance assessment model within Ethnomathematics-based Project-Based Learning (PjBL) was useful in improving students' mathematical thinking process skills; (2) The performance assessment in Ethnomathematics-based PjBL was contextualized with the cultural elements of the East Coast region, encompassing Semarang, Demak, Jepara, Kudus, Pati, and Rembang; (3) The design of the performance assessment model in Ethnomathematics-based PjBL included objectives, components, instruments, syntax, and a comprehensive model guideline; and (4) the formulated rubrics evaluated mathematical thinking process skills through performance assessment in Ethnomathematics-based PjBL.

The Design of Performance Assessment Model in Ethnomathematics-Based PjBL Learning

The results of the preliminary study and the FGD that were carried out with experts as a reference and basis in developing a draft design for our performance assessment model on Ethnomathematics-based PjBL learning. The research product was a performance assessment model on Ethnomathematical-based PjBL learning. The model includes objectives, components, instruments, syntax, and a model guideline. The model is applied in Ethnomathematics-based PjBL learning by utilizing elements of regional culture in interesting and fun activities.

The performance assessment model was applied in Ethnomathematics-based PjBL learning. It covered a model guideline consisting of an introduction, the theory of performance assessment, the theory of Ethnomathematics-based PjBL, the theory of mathematical thinking process skills, performance assessment tools to measure mathematical thinking process skills, and guidelines for implementing performance assessment based on Ethnomathematics. Learning was designed based on ethnomathematics so that students were interested and active in learning mathematics (Rahayu et al., 2018, 2019; Ulya & Rahayu, 2021).

Marzano et al. (1994) explain performance assessment refers to mathematical tasks and situations that allow students to demonstrate their understanding and reasoning, and to apply their knowledge and skills in various contexts. This study measured students' mathematical thinking process skills through performance assessments within ethnomathematics-based project-based learning (PjBL). Students engaged in a series of project activities aimed at solving problems by directly participating in local excellence sites in Kudus. The researchers conducted the measurement of students' mathematical thinking process skills using three key indicators: (1) identifying patterns and drawing conclusions, (2) communicating problems into mathematical ideas, and (3) performing mathematical calculations. For the first indicator, the researchers expected students to solve problems using established problem-solving patterns and to draw conclusions. The second indicator required students to interpret mathematical ideas and represent problem situations in different forms. Meanwhile, the third indicator evaluated the students' abilities. Luh Nyoman Gita Acyuta Dewi et al. (2024) used ethnomathematics-based PjBL to grade students' work. They completed this process in five steps: planning, implementing, grading, agreeing on grades, using the results, and following up.

The ethnomathematics-based PjBL carried out performance assessment activities in five stages: preparation, implementation, grading agreement, utilization, and follow-up (Luh Nyoman Gita Acyuta Dewi et al., 2024). In the preparation stage, the lecturer designed the steps for the ethnomathematics-based PjBL learning process. The guidelines for performance assessments required both the lecturer and the students undergoing assessments to comprehend several key elements: (1) the concept of performance assessment, (2) the procedures for conducting performance assessment, and (3) the performance assessment instrument package. The package included the project task sheet, the performance assessment format, and the scoring rubric, which contained the performance assessment. The researchers also established a schedule for the performance assessment to give students time to adequately prepare; provided a summary of the results from the performance assessment; and established a schedule for the performance assessment implementation to give students enough time to adequately prepare.

The implementation stage involved PjBL steps. During this stage, the researchers assigned project tasks to students to develop learning tools, including ethnomathematics-based learning designs and their evaluations. This process served to measure students' mathematical thinking process skills. The researchers expected students to actively participate in the learning process and directly engage in the completion of project tasks that aligned with local excellence in Kudus.

The assessment stage required the lecturer to evaluate each performance indicator of every aspect of the tasks completed by the students. The lecturer assigned scores on a 5-point scale (ranging from 1 to 5) by comparing the results of observations and/or monitoring with the descriptors. This stage not only assessed the students' performance but also measured their math proficiency. The researchers also utilized this stage to assess performance. The test comprised 10 essay questions, and the researchers calculated the students' mathematical thinking process skills scores by comparing the total obtained. The researchers calculated the scores for students' mathematical thinking process skills by comparing the total obtained score with the maximum possible score, consisting of the scores for students. The maximum score that students could achieve was 100 points.

The teacher responsible for the grade agreement informed us that the students were discussing the results of their performance assessment. If both the lecturer and the students agreed on the assessment results, they signed the assessment report document. The final assessment results were open to verification. If a student disagreed with the assessment results, they had the right to convey their objections to the lecturer. In response, the lecturer re-examined and reassessed the aspects that were not agreed upon or conducted a complete reassessment if necessary. The lecturer recorded the final score from the reassessment, which was based on the student's performance assessment results.

The implementation and follow-up focused on using the results of the performance assessment to reflect the student's performance and their mathematical thinking process skills. The results of the performance assessment served as one of the primary components in determining the final grade for the Ethnomathematics course. The first step involved mapping the students' competencies, followed by providing feedback on their learning. The purpose of the assessment stage was to provide feedback on the student's learning. The researchers analyzed the results of students' project performance and their mathematical thinking process skills to pinpoint the areas where students needed improvement. The analysis focused on their math skills. The analysis focused on their inking process skills. Conversely, the lecturer provided remedial programs or motivational support to students with a minimum proficiency level equivalent to a "C" grade. The lecturer offered enrichment activities. Despite a decline in their mathematical thinking process, they received both verbal and non-verbal recognition for their improvements in their mathematical thinking skills as a form of positive reinforcement.

Implementation of Performance Assessment of Ethnomathematics-based Project-Based Learning

Quality of Performance Assessment Model in PJBL Learning Based on Ethnomathematics

This study developed and evaluated the quality of a performance assessment model in Project-Based Learning (PJBL) that utilizes an ethnomathematics context. The emphasis on the ethnomathematics approach is intended to integrate local cultural values into mathematics learning to increase the relevance and involvement of students in the learning process. Assessors need to use quality assessment instruments to ensure accurate measurement results in assessing students (Ulya et al., 2024). As part of the quality evaluation, the developed assessment model was analyzed through two main aspects: content validity and reliability.

The content validity of the assessment model was assessed through expert judgment, where several experts in mathematics education, assessment, and ethnomathematics were asked to provide an assessment of the clarity, relevance, and suitability of the assessment model with learning objectives. Expert validation was carried out on three products of the performance assessment model in ethnomathematics-based PJBL learning, namely assessment procedures, assessment guidelines, and assessment instruments. The results of expert assessments of assessment procedures, assessment guidelines, and assessment instruments were respectively 3.67; 3.85; and 3.85. The three products were included in the very feasible criteria. The results of the expert assessment show excellent validity level of the assessment, with a mean score in the high category and indicating the suitability for measuring student performance in the context of ethnomathematics-based PJBL.

In addition, reliability estimation determined the consistency of this assessment model in producing stable scores. Reliability estimation using Cronbach's Alpha shows a coefficient of 0.87. This shows that the instrument of the assessment model developed is reliable. This instrument is consistent and can be relied on for use in various ethnomathematics-based learning contexts. With excellent validity and reliability results, this assessment model is expected to optimally support the ethnomathematics-based PJBL learning process, provide meaningful feedback, and contribute to improving the quality of culture-based mathematics learning.

Results of Measurement of Students' Mathematical Thinking Process Skills

The large-scale trial aims to assess students' mathematical thinking process skills using instruments that have been proven valid and reliable. The profile of students' mathematical thinking process skills is obtained through descriptive statistical analysis. The distribution of students' mathematical thinking abilities, as indicated by their scores, reveals that 5.26% of students fall within the score range of 0–20, signifying very low mathematical thinking skills. No students scored in the 21–40 range, thus we did not ascertain the level of mathematical thinking ability in this category. Additionally, 15.79% of students scored within the range of 41–60, indicating moderate mathematical reasoning skills. Approximately 31.58% of students scored within the range of 61–80, signifying proficient mathematical reasoning skills. Ultimately, the majority of students, specifically 47.37%, attained a score range of 81–100, signifying a commendable level of mathematical reasoning skills.

The results of the analysis show that the majority of students have very excellent mathematical thinking process skills, with scores in the range of 80-100. This reflects a high level of mastery of mathematical thinking process skills. However, the presence of 5.26% of students in the range of 0-20 indicates the existence of a small group that faces difficulties in developing mathematical thinking skills. This indicates the need for special attention, such as strengthening learning support, intensive guidance, or a more personalized approach to help students in this group achieve more optimal competencies. The measurement results were also analyzed based on the classification of aspects of mathematical thinking process skills. The distribution of the results of measuring mathematical thinking process skills based on their aspect classification can be seen in Figure 1.

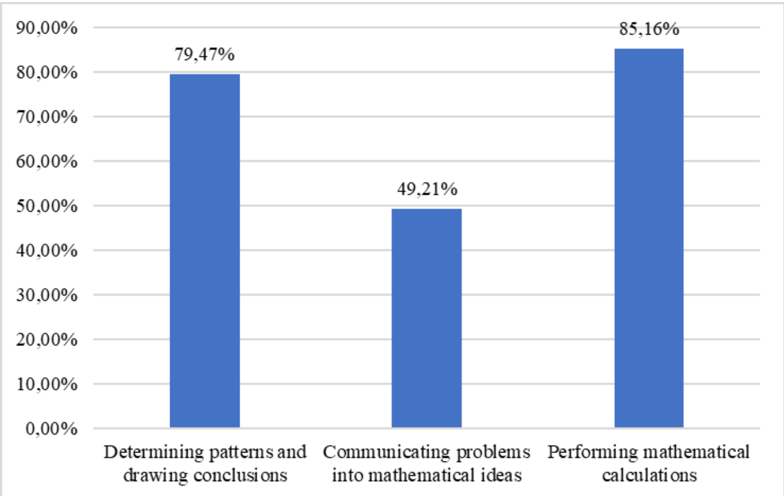

Figure 1. Histogram of distribution of results of mathematical thinking process skills measurement based on aspects

The figure shows that students' skills in performing mathematical calculations reached the highest value with a percentage of 85.16%, followed by the skills of determining patterns and drawing conclusions at 79.47%, classified as excellent. However, the skills in communicating problems into mathematical ideas were at a lower level, only 49.21%. This indicates that although students were quite strong in technical aspects such as calculations and pattern analysis, they still needed significant development in mathematical communication skills to formulate and convey mathematical ideas effectively. Improvement efforts can be focused on learning strategies that encourage discussion, presentation, and collaborative problem-solving so that students can communicate problems into mathematical ideas.

Through this assessment, students were expected to find unique problem solving, find various strategies, and introduce various strategies to solve a problem, including being able to prove and interpret results through proper reasoning (Manmai et al., 2021). In addition, teachers can also develop an understanding of students' concepts and skills so that they can provide maximum benefits to students (Shafiee & Meng, 2021). The assessment design developed takes into account four main themes derived from document analysis: purpose, measurement, evaluation, and use (Khalid et al., 2023).

▪ CONCLUSION

Based on the research results, the conclusions are: (1) students' mathematical thinking process skills are not optimal because its mean value is 54.14%; (2) students expect to be involved in an active learning process that is related to real-life events and based on culture and includes an assessment that shows the performance of each individual; (3) design of the performance assessment model in ethnomathematics-based PJBL learning which includes objectives, components, instruments, syntax, and model guidelines; (4) performance assessment model in ethnomathematics-based PJBL learning which is developed is valid and reliable; and (5) the results of measuring mathematical thinking process skills are classified as very excellent, with the majority of students in the range of 80-100. This study implies the need to apply the ethnomathematics-based PJBL performance assessment model in learning to improve students' mathematical thinking process skills through an active, contextual, and culture-based approach.

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