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Efforts to Improve Mathematics Learning Outcomes with Ethnomathematics Based Differentiated Learning in Junior High School Students

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Abstrak

Penelitian ini bertujuan untuk mengetahui hasil belajar matematika dengan pembelajaran berdiferensiasi berbasis etnomatematika pada siswa kelas VII SMP Negeri Maubeli. Penelitian ini merupakan Penelitian Tindakan Kelas (PTK), yang dilaksanakan di SMP Negeri Maubeli.Teknik pengumpulan data yang digunakan adalah tes dan observasi. Instrumen penelitian yang digunakan adalah soal tes dan lembar observasi.Teknik analisis data yang digunakan adalah analisis data hasil tes dan analisis data hasil pengamatan. Hasil penelitian menunjukkan bahwa terjadi peningkatan hasil belajar matematika siswa dengan pendekatan pembelajaran berdiferensiasi berbasis etnomatematika. Rata-rata hasil belajar siswa dan persentase ketuntasan kelas dari siklus I hingga siklus II telah melewati standar yang ditentukan yakni rata-rata nilai siswa mencapai 68,64 dengan persentase ketuntasan klasikal 64% pada siklus I meningkat menjadi 80,52 dengan persentase ketuntasan klasikal 84% pada siklus II. Hasil observasi pelaksanaan pembelajaran pesertadidik pada siklus I termasuk dalam kategori kurang, sedangkan pada siklus II termasuk dalam kategori sangat baik. Integrasi etnomatematika dalam pembelajaran memberikan konteks yang lebih relevan dan bermakna bagi siswa dengan menghubungkan konsep-konsep matematika dengan budaya lokal pada kain tenun. Pembelajaran dengan pendekatan etnomatematika dapat meningkatkan pemahaman peserta didik terhadap materi karena berkaitan dengan aktivitas-aktivitas yang mereka lakukan dalam kehidupan sehari-hari, terutama dalam proyek Penguatan Profil Pelajar Pancasila (P5).

Abstract

This study aims to determine the results of mathematics learning with ethnomathematics-based differentiated learning in grade VII students of Maubeli State Junior High School. This research is called Classroom Action Research, and it was carried out at Maubeli State Middle School. The data collection techniques used are tests and observations. The research instruments used were test questions and observation sheets. The data analysis techniques used are data analysis of test results and analysis of observation data. The results of the study showed that there was an increase in students' mathematics learning outcomes with an ethnomathematics-based differentiated learning approach. The average student learning outcomes and the percentage of class completion from cycle I to cycle II have exceeded the specified standard, namely the average student score reached 68.64 with a classical completion percentage of 64% in the first cycle increasing to 80.52 with a classical completion percentage of 84% in cycle II. The results of observations on the implementation of student learning in cycle I are included in the poor category, while in cycle II it is included in the very good category. The integration of ethnomathematics in learning provides a more relevant and meaningful context for students by connecting mathematical concepts with local culture in woven fabrics. Learning with an ethnomathematical approach can increase students' understanding of the material because it is related to the activities they do in their daily lives, especially in the Pancasila Student Profile Strengthening (P5) project

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Introduction

Mathematics learning at SMP Negeri Maubeli has currently implemented the Independent Curriculum which always prioritizes a student-centered approach, where students' freedom and independence in learning are highly emphasized. The implementation of the independent curriculum is characterized by the freedom to explore their interests and talents through a wide selection of relevant and contextual learning topics. Teachers act as facilitators who help students find ways of learning that best suit their needs and potential.

The Independent Curriculum consists of six Phases, namely Phase A to Phase F. At the junior high school level, learning is in Phase D, which consists of grades VII, VIII, and IX. This phase includes two types of learning, namely intracurricular and co-curricular learning. Intracurricular learning is structured face-to-face learning and must be followed by all students in the class. Meanwhile, co-curricular learning is a project-based learning to realize the Pancasila Student Profile. Co-curricular learning involves activities based on the Pancasila Student Profile Strengthening Project (P5) which is flexible both in content and implementation time and does not have to be related to the learning outcomes determined in each subject. The implementation of P5 aims to form a profile of Pancasila Students that is in accordance with the phase of student development.

Differentiated learning is learning that accommodates the differences or diversity of students, including: diversity in terms of parents' work, interests, learning readiness, potential or learning style. Differentiated forms of learning have 3 main aspects, namely: Content, Process and Product (Marlina 2020). Content differentiation is related to the difference in the context of the material taught by students in response to students' learning readiness, interests or learning profiles (visual, auditory, kinesthetic) or it can be a combination of the three. Process differentiation is related to differences in the learning process by providing tiered activities, there are guiding questions or challenges, creating individual agendas of students, time variations, flexible grouping. Product differentiation is related to the difference in bill products to students by providing responses or diversity of variations and choosing what products they are interested in.

Mathematics learning should utilize various forms of entrepreneurship that are familiar to students. One approach that uses entrepreneurship is ethnomathematics. Ethnomathematics, which connects mathematical concepts with local culture, is believed to make learning more meaningful. Ethnomathematics-based learning is a mathematics learning approach that links cultural elements in instilling mathematical concepts. Ethnomathematics-based learning can make learning more meaningful and contextual, which can help students receive material exposure at a younger age.

Mathematics learning applied at SMP Negeri Maubeli is differentiated learning, which is an approach that accommodates the diversity of students, including parents' work backgrounds, interests, learning readiness, potential, and learning styles. There are three main aspects that are the focus of its implementation, namely content, processes, and products. However, the learning process currently carried out at Maubeli State Junior High School has not fully implemented differentiated learning appropriately. Based on the results of initial observations, teachers have never conducted tests to identify students' learning styles. As a result, teachers have also not implemented differentiated learning that should pay attention to differences in learning styles. All students are treated equally in the learning process and delivery of material, without considering their respective learning needs. The results of observations in class VIIA of SMP Negeri Maubeli show that differences in learning styles are one of the main factors that affect students' learning outcomes. The learning styles of students vary greatly, with details of 9 people having visual learning styles, 11 auditory people, and 5 kinesthetic people. But in practice, teachers have not fully paid attention to this difference. This causes some students to find it difficult to follow learning, because the method used is not in accordance with their learning style.

The solutions offered to improve student learning outcomes through ethnomathematics-based differentiated learning, using this method are expected to improve student learning outcomes because differentiated learning is all student-centered activities and in accordance with the current learning paradigm. Differentiated learning has several distinctive characteristics, such as creating a learning environment that encourages students to be active in learning, providing varied learning resources, understanding curriculum limitations, conducting appropriate evaluations and assessments, and developing classroom management skills. Ethnomathematics is a teaching approach to mathematics learning that links cultural elements in instilling mathematical concepts.

The integration of ethnomathematics in mathematics learning can also be an effective solution. Ethnomathematics is a learning approach that links mathematical concepts to students' local cultures. By integrating cultural elements in mathematics learning, students can more easily understand and appreciate mathematical concepts, as the material studied is more contextual and relevant to their lives. Ethnomathematics is a mathematical study in the form of the study of cultural forms (ideas, activities or cultural objects) that have become characteristic of a certain group of people (Firisa, R., 2018). Ethnomathematics is a form of mathematics that is influenced or culturally based. Through the application of ethnomathematics mathematics education, it is hoped that later students will be able to understand mathematics better, and understand their culture better, and later it will be easier for educators to instill cultural values themselves in students, so that cultural values that are part of the nation's character are embedded from an early age in students (Wahyuni et al., 2013).

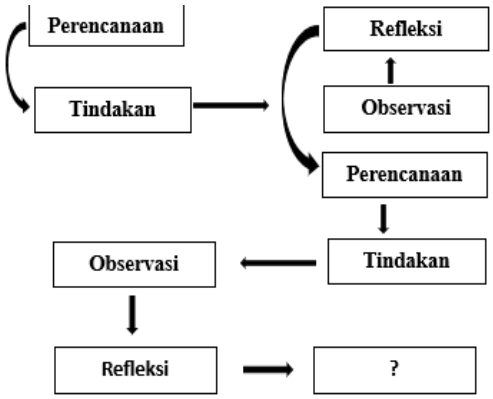
Ethnomathematics-based differentiated learning has been shown to be effective in improving student learning outcomes. According to research conducted by Gutila (2020), this approach not only

improves the understanding of mathematical concepts, but also increases students' motivation and interest in learning. According to Tomlinson (2001), differentiated learning is an effort to combine differences to obtain information, create ideas, and express or convey the results that students have learned. Differentiated learning is learning that accommodates the needs of each individual to gain learning experience and mastery of the concepts learned (Nurdini, 2021; Kamal, 2021; Lupita & Hidajat, 2022). Learning becomes more meaningful and relevant to learners by blending their individual needs and cultural contexts. The results obtained after using differentiated learning include: students have a better understanding of learning materials, changes in students' ability to solve a problem, there is an increase in students' involvement in participation in discussions, or willingness to share opinions and ideas.

Based on the data and facts found in the field, the researcher was encouraged to conduct research to determine the improvement of mathematics learning outcomes with ethnomathematics-based differentiated learning in grade VII students of Maubeli State Junior High School.

Methods

This research is a PTK consisting of stages of planning, action, observation, and reflection adopted from Arikunto (2015), as shown in Figure 1. This research was carried out at Maubeli State Junior High School in the odd semester of the 2024/2025 school year, with the research subjects being grade VIIA students. The selection of class VII A is in accordance with the characteristics of students who have different learning styles, in accordance with the purpose of implementing defined learning.



Picture 1. Classroom Action Research Cycle.

The type of data used in this study is primary data. The techniques used in this study are to conduct tests and observations, while the instruments used to collect data in this study are test questions and observation sheets. Test questions are used as an instrument to measure students' skills, knowledge, abilities, or talents after participating in learning. The type of questions used in this study are description questions designed to measure student learning outcomes in general, especially in terms of understanding concepts and critical thinking skills. These questions are developed to assess

the extent to which students are able to understand, apply, and reason mathematical concepts associated with the local cultural context (ethnomathematics). Observation sheets or observations made by researchers with research partners to record activities that occur during the learning process, both by teachers and students. This observation sheet uses an assessment scale format with several categories, for example: Very Good (VG), Good (B), Sufficient (S), Less (L), and Very Less (VL).

The test result data collected in each cycle is analyzed to determine the level of student learning completeness. In this study, to determine individual and classical completeness, the following learning completeness guidelines were used:

a. Individual Completeness

A student is said to be complete if he achieves learning completeness and a minimum level of mastery obtained a score of 75 (school stipulation according to national standards) calculated by the formula:

$$\text{KB} = \frac{T}{Tt} \times 100$$ (Trianto, 2018)

Information:

KB : Completeness of Learning

Q : The number of scores obtained by students

Tt : Total score

b. Classical/group completeness.

Completeness in the classroom can be seen from the standards given from the school according to the national standard, which is 75%. Class completeness is calculated using the formula:

$$\text{P} = \frac{\sum Siswa\ yang\ tuntas\ belajar}{\sum Siswa} \times 100\%$$ (Aqib, 2016)

Information:

P : Presentation of learning completion.

$\sum siswa\ yang\ tuntas\ belajar$: the number of students who have completed their studies.

$\sum siswa$: total number of students

Result and Discussion

Beforecarrying out the research, the researcher first conducted a pre-study to identify the learning style of grade VIIa students of Maubeli State Junior High School. In the pre-research activity, the researcher asked several questions orally in accordance with the indicators of Visual, Auditor and Kinetic learning styles. Based on the information obtained from the students, the following details were obtained: as many as 9 students had a visual learning style, 11 students had an auditory learning style, and 5 students had a kinesthetic learning style.

Results

Based on the test results in the first cycle, there were 9 students who had not reached completion out of 25 students. The test results in cycle I can be seen in the following table:

Table 1 Cycle I Test Results

No	Student Name	Value	Information	
			T	TT
Visual Learning Style				
1	CAN	81	√	
2	WITH	85	√	
3	DYU	86	√	
4	GFA	77	√	
5	CALM	75	√	
6	ORIGINAL	31		√
7	QSEB	76	√	
8	RN	59		√
9	YYO	43		√
Auditorium Learning Style				
10	AST	76	√	
11	OFFICE	79	√	
12	AJK	54		√
13	DSRT	80	√	
14	FH	63		√
15	GRP	31		√
16	FXDF	79	√	
17	KJ	79	√	
18	LOT	57		√
19	NEN	34		√
20	YBB	85	√	
Kinesthetic Learning Style				
21	BAO	89	√	
22	DDM	91	√	
23	FLIGHT	83	√	
24	NOT	37		√
25	RNPS	86	√	
Number of students who have completed				**16**
Number of Students in Class				**25**
Classical Completeness Percentage				**64%**

In detail, in the visual learning style, there are 3 students who have not completed with an average student score of 68.11 and a percentage of class completion of 66.66%. In the auditory learning style, there were 5 students who had not completed with an average student score of 65.18 and a percentage of class completion of 54.54%. Meanwhile, in the kinesthetic learning style, there was 1 student who had not completed with an average student score of 77.2 and a class completion percentage of 80%. Therefore, learning activities need to be evaluated to find out the factors that cause the level of understanding of students to not reach the expected target.

The results of observation of teacher activities in the first cycle can be seen in the following table:

Table 2 Results of Teacher Observation Cycle I

No	COMPONENT	SHOES					KET
		1	2	3	4	5	
1	The teacher greets and prays before the lesson begins					√	
2	Teacher checks student attendance					√	
3	Convey the learning objectives to be achieved					√	
4	Doing Perception and Motivation			√			
5	Instruct students in completing LKPD			√			
6	Controlling student activity and giving reprimands to students who are not active in the group			√			
7	Guiding the implementation of discussions between students			√			
8	Provide opportunities and direct each student to conclude the subject matter			√			
9	Deliver the material to be studied at the next meeting					√	

Based on the results of observation of the first cycle of teacher activities in the learning process, data was obtained that teachers were only able to implement 4 indicators with very good qualifications (SB) and 5 indicators with sufficient qualifications (C).

The results of observation of student activities in cycle I can be described in the following table:

Table 3 Observation Results of Cycle I Students

No	COMPONENT	SHOES					KET
		1	2	3	4	5	
1	Students answer greetings and pray before the lesson starts					√	
2	Students listen and answer attendance			√			
3	Students listen to what the teacher says about learning objectives and perception		√				
4	Students listen to the teacher's explanation		√				
5	Students ask the teacher what they don't understand	√					
6	Students are active in groups		√				
7	Students present the results of their group discussions in a clear voice and other groups are given the opportunity to respond		√				
8	Students are active in asking and answering questions	√					
9	Students are involved in concluding the subject matter	√					
10	Students listen to information about the material to be studied at the next meeting					√	

The results of the observation of students' learning activities obtained data that students were only able to implement 2 indicators with very good qualifications (SB), 1 indicator with sufficient qualifications (C), 4 indicators with poor qualifications (K) and 3 indicators with very poor qualifications (SK).

What is still lacking that can be seen at the reflection stage of the first cycle is that students are not used to learning with a differentiated learning approach based on ethnomathematics,

classroom management is not optimal, and there are some students who do not show enthusiasm in following the learning process. Other things that are also still lacking in the first cycle are the lack of understanding of students so that students cannot make conclusions about the material that has been studied. The results of the evaluation of the learning process in the first cycle can be seen that the learning results are not in accordance with expectations because there are still many shortcomings so that the next step taken by the researcher is to plan the implementation of improvement actions by implementing cycle II.

Based on the results of the test in cycle II, as many as 21 students were declared complete out of 25 students. The test results in cycle II can be seen in the following table:

Table 4 Cycle II Test Results

No	Student Name	Value	Information	
			T	TT
Visual Learning Style				
1	CAN	86	√	
2	WITH	89	√	
3	DYU	89	√	
4	GFA	80	√	
5	CALM	78	√	
6	ORIGINAL	58		√
7	QSEB	79	√	
8	RN	76	√	
9	YYO	61		√
Auditorium Learning Style				
10	AST	81	√	
11	OFFICE	87	√	
12	AJK	77	√	
13	DSRT	85	√	
14	FH	79	√	
15	GRP	63		√
16	FXDF	83	√	
17	KJ	84	√	
18	LOT	78	√	
19	NEN	67		√
20	YBB	91	√	
Kinesthetic Learning Style				
21	BAO	93	√	
22	DDM	95	√	
23	FLIGHT	90	√	
24	NOT	76	√	
25	RNPS	88	√	

In detail, in the visual learning style, there are 2 students who have not completed with an average student score of 77.33 and a class completion percentage of 77.77%. In the auditory learning style, there were 2 students who had not completed with an average student score of 79.54 and a class completion percentage of 81.81%. Meanwhile, in the kinesthetic learning style, all students completed with an average student score of 88.4 and a percentage of class completion of 100%. Thus, the results of the second cycle test have met the indicators of the success of the action,

namely individual completeness of at least 75% and class completeness of at least 75%, so the implementation of learning activities in cycle II can be declared successful and limited in cycle II.

The results of observation of teacher activities in cycle II can be seen in the following table:

Table 5 Observation Results of Cycle II Teachers

No	COMPONENT	SHOES					KET
		1	2	3	4	5	
1	The teacher greets and prays before the lesson begins					√	
2	Teacher checks student attendance					√	
3	Convey the learning objectives to be achieved					√	
4	Doing Perception and Motivation					√	
5	Instruct students in completing LKPD					√	
6	Controlling student activity and giving reprimands to students who are not active in the group					√	
7	Guiding the implementation of discussions between students					√	
8	Provide opportunities and direct each student to conclude the subject matter				√		
9	Deliver the material to be studied at the next meeting					√	

The results of observation of teacher activities in cycle II have increased by implementing 8 indicators with very good qualifications (SB) and 1 indicator with good qualifications (B).

The results of observation of student activities in cycle II can be described in the following table:

Table 6 Observation Results of Cycle II Students

No	COMPONENT	SHOES					KET
		1	2	3	4	5	
1	Students answer greetings and pray before the lesson starts					√	
2	Students listen and answer attendance					√	
3	Students listen to what the teacher says about learning objectives and perception				√		
4	Students listen to the teacher's explanation				√		
5	Students ask the teacher what they don't understand				√		
6	Students are active in groups				√		
7	Students present the results of their group discussions in a clear voice and other groups are given the opportunity to respond				√		
8	Students are active in asking and answering questions				√		
9	Students are involved in concluding the subject matter			√			
10	Students listen to information about the material to be studied at the next meeting					√	

The results of observation of student activities also increased with 3 indicators with very good qualifications (SB), 6 indicators with good qualifications (B), and 1 indicator with sufficient

qualifications (C).

After making improvements to the shortcomings in cycle I, there was an increase in cycle II, with the percentage of classical completeness reaching 84% and the average score of students increasing to 80.52. This increase is due to developments in the learning process, which are as follows: In cycle II learning activities, students can adjust well, dare to communicate the results of their discoveries, and students show high enthusiasm in the learning process, where they are very actively involved in learning activities.

Discussion

Based on the results of each cycle, the results of the implementation of the action, namely ethnomathematics-based differentiated learning, can be described in the bar chart below:

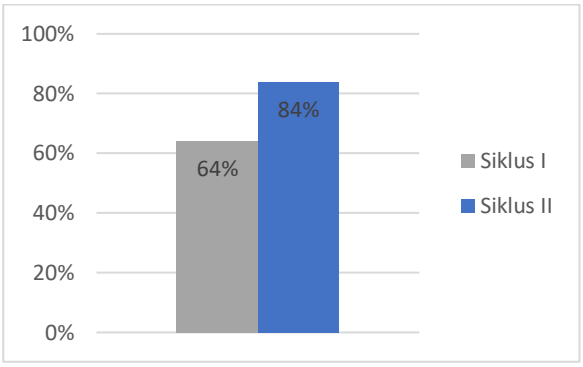


Figure 2. Data Results Increase in Cycle Test Results

Based on thetest results for each cycle listed in the image above, it can be seen that the test results in the first cycle, out of 25 students, there were 16 students who achieved completeness with a classical completion percentage of 64%. In detail, in the visual learning style, there are 3 students who have not completed with a class completion percentage of 66.66%. In the auditory learning style, there were 5 students who had not completed with a class completion percentage of 54.54%. Meanwhile, in the kinesthetic learning style, there is 1 student who has not completed with a class completion percentage of 80% and the observation results in the first cycle are still in the poor category. Some of the obstacles faced in the first cycle are that students are not used to ethnomathematics-based differentiated learning, lack of classroom management, and lack of enthusiasm and understanding of students.

In cycle II, after improvements were made such as increasing motivation, class management, and monitoring student performance in the learning process, classical completeness increased to 84% with 21 students completed. In detail, in the visual learning style, there are 2 students who have not completed with a class completion percentage of 77.77%. In the auditory learning style, there were 2 students who had not completed with a class completion percentage of 81.81%. Meanwhile, in the kinesthetic learning style, all students completed with a percentage of class completion of 100%, and the observation results in the second cycle were in the very good category. Students are more active and enthusiastic in learning.

The results of data analysis in cycle I and cycle II showed an increase in classical completeness by 20%, from 64% in cycle I to 84% in cycle II. This is because there are corrective actions carried out in cycle II based on the reflexive records in cycle I. Because students have reached the percentage of classical completeness in cycle II, the researcher does not need further action to cycle III.

Differences in students' learning styles are a challenge in learning activities, especially when the teaching method is not in accordance with the students' abilities. To overcome this problem, ethnomathematics-based differentiated learning can be an effective solution, where differentiated learning allows teachers to adjust teaching methods based on students' learning styles, while ethnomathematics associates mathematical concepts with local culture so that learning becomes more contextual and engaging. This is in line with the opinion (Pane et al., 2022) that learning tailored to students' interests, learning styles, and abilities is a hallmark of differentiated learning, the goal is to improve student learning achievement. So it can be concluded that differentiated learning is learning that adjusts the material and learning outcomes according to the characteristics, initial abilities and learning styles of students. According to Maryati&Pratiwi (2019) shows that ethnomathematics-based teaching materials are able to facilitate students in constructing mathematical knowledge inductively, because ethnomathematics has as its source activities carried out by a person or group and knowledge that results from daily life needs.

The results of research that have been conducted as many as two silks show that ethnomathematics-based differentiated learning with learning style strategies is an innovative approach that accommodates the learning needs of students with diverse learning styles. In the visual learning style, teachers can take advantage of ethnomathematical products such as woven fabrics produced in the Pancasila Student Profile Strengthening Project (P5), especially in the field of entrepreneurship. The teacher invited the students to observe the pattern on the woven fabric. Through the observation process, students can understand the material to be studied. For students with auditory learning styles, teachers can provide narrative explanations by showing the products produced in the Pancasila Student Profile Strengthening Project (P5) so that students can understand the material they are learning well. Meanwhile, students with kinesthetic learning styles are more optimal in learning through physical activity and direct practice. In the context of ethnomathematics, they can be involved in activities that mimic the process of making woven fabrics, such as drawing patterns or using simple props. This activity allows students to learn mathematical concepts directly through experiential experiences.

Based on the results of research conducted in the second cycle, it shows that the application of a differentiated learning model based on ethnomathematics is able to improve student learning outcomes at Maubeli State Junior High School. This increase in learning outcomes is in line with the results of research conducted by (Kamal, 2021; Iskandar, 2021) stated that the implementation of

differentiated learning has been previously shown that differentiated learning can improve student learning outcomes.

Differentiated learning is learning that coordinates the differences or diversity of students, including: diversity in terms of parents' work, interests, learning style, potential or learning style. Differentiated forms of learning have 3 main aspects, namely: Content, Process and Product. This means that the use of differentiated learning is able to improve participants' learning outcomes. This is in line with the results of research conducted by (Pane et al., 2022) that differentiated learning is learning that is tailored to students' interests, learning styles, and abilities, the goal is to improve student learning achievement.

Ethnomathematics is an approach in learning the material studied can be linked to the student's culture, so that students' understanding of the material becomes better. This is in line with the results of research conducted by (Anggraini et al., 2022) that ethnomathematics is an approach that is directly related to students' daily activities that are culturally based, so that students can understand lessons more easily and more effectively.

Several previous studies have shown that ethnomathematics-based differentiated learning has been proven to be effective in improving student learning outcomes for example, according to research conducted by Gutila (2020), this approach not only improves the understanding of mathematical concepts, but also increases students' motivation and interest in learning, and Cahyani (2016) emphasized that a learning process that is in accordance with students' learning styles and interests will improve their ability to students in understanding the material and creating a conducive and fun environment for students and teachers.

From the results of research and theoretical studies, it can be seen that the application of ethnomathematics-based differentiated learning with learning style strategies in mathematics learning can improve students' mathematics learning outcomes. This approach makes learning more enjoyable and creates more active learning situations. The ethnomathematics-based differentiated approach is very effective in terms of learning styles because it directs students to work together with their peers in solving problems and shaping their knowledge. Learning with an ethnomathematical approach can increase students' understanding of the material because it is related to the activities they do in their daily lives, especially in the Pancasila Student Profile Strengthening (P5) project.

Conclusion

Based on the results of the study, the researcher concluded that there was an increase in students' learning outcomes from cycle to cycle after participating in mathematics learning with an ethnomathematics-based differentiated learning approach. In the first cycle, the average student score reached 68.64 with a class completion percentage of 64%, while in the second cycle, the average student score increased to 80.52 with a class completion percentage of 84%. This increase occurs because differentiated learning allows learners to learn according to their learning style, making it

easier for them to understand mathematical concepts. In addition, the integration of ethnomathematics in learning provides a more relevant and meaningful context for students by connecting mathematical concepts with local culture. Learning with an ethnomathematical approach can increase students' understanding of the material because it is related to the activities they do in their daily lives, especially in the Pancasila Student Profile Strengthening (P5) project. Thus, it can be concluded that a differentiated approach based on ethnomathematics can improve the learning outcomes of grade VII students of SMP Negeri Maubeli.

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