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Available at:
https://journal.nahnuinisiatif.com/index.php/ARJI
Volume 7 Number 3 Year 2025
DOI : 10.61227
E-ISSN : 2775-0787
P-ISSN : 2774-9290

Action Research Journal Indonesia

1520 – 1534

Ethnomathematics-Based Missouri Mathematics Project Learning Model to Improve Learning Process and Achievements

Article Submitted :
2025-06-12
Article Received :
2025-06-18
Article Pusblished :
2025-07-18

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Kata Kunci:
etnomatematika; hasil belajar; *missouri mathematics project*

Abstrak: Peningkatan proses dan hasil pembelajaran matematika di sekolah dasar menjadi salah satu langkah penting mengatasi rendahnya kemampuan numerasi yang masih dihadapi Indonesia. Penelitian ini bertujuan untuk mengetahui peningkatan proses pembelajaran dan prestasi belajar siswa dengan menerapkan model pembelajaran *Missouri Mathematics Project* (MMP) berbasis etnomatematika. Penelitian ini merupakan penelitian tindakan kelas dengan model Kemmis and McTaggart. Subjek dalam penelitian ini adalah guru dan siswa kelas 5 SDN 35 Barru, Sulawesi Selatan, Indonesia, yang terdiri dari seorang guru, enam siswa laki-laki, dan enam siswa perempuan. Teknik pengumpulan data yang digunakan adalah observasi, tes, dan dokumentasi. Teknik analisis data yang digunakan adalah kondensasi data, penyajian data dan penarikan kesimpulan, yang diolah secara kualitatif. Hasil penelitian ini menunjukkan bahwa pada siklus I, proses pembelajaran dalam aktivitas guru dan siswa berada pada kualifikasi cukup, antusias belajar siswa mulai nampak ada perbaikan dan siswa di berikan contoh yang dekat dengan kehidupan mereka. Tampak pula siswa antusias mengamati benda-benda budaya Bugis. Namun demikian hasil belajar siswa masih pada kualifikasi cukup. Pada siklus II terjadi peningkatan, hasil penelitian menunjukkan bahwa proses pembelajaran dari sisi aktivitas guru dan siswa berada pada kualifikasi baik. Terlihat bahwa kegiatan pembelajaran menjadi lebih menyenangkan sehingga siswa lebih mudah memahami materi dan proses diskusi kelompok menjadi lebih aktif, sehingga hasil belajar siswa juga berada pada kualifikasi baik. Dengan demikian, penelitian ini merekomendasikan penerapan model pembelajaran MMP

berbasis etnomatematika sebagai pendekatan efektif untuk meningkatkan proses pembelajaran dan prestasi siswa dalam matematika, terutama dengan mengintegrasikan konteks relevan secara budaya yang meningkatkan keterlibatan dan pemahaman siswa.

Keywords:
Islamic boarding school, yellow books, learning.

Abstract: Indonesian pesantren uniquely uphold the kitab kuning tradition—classical Arabic texts crucial for Islamic sciences. Mastering these unvocalized, unpunctuated texts demands advanced linguistic skill, especially in determining i'rab. The Al-Miftah li al-'Ulum Method offers an effective pedagogical solution. This qualitative study explores its implementation at Pondok Pesantren Sullamul Hidayah Jorongan Leces Probolinggo, investigating how it improves santri's ability to read, comprehend, and analyze kitab kuning. Participants included pesantren leaders, instructors, santri (selected via stratified sampling), and alumni. Data, gathered through observation, semi-structured interviews (cognitive, affective, psychomotor, contextual dimensions), and documentation, was analyzed via iterative reduction, presentation, and conclusion verification using triangulation. Findings confirm Al-Miftah's effectiveness in enhancing santri's understanding and memorization of nahwu and sharaf rules, boosting i'rab analysis, and fostering independent kitab kuning comprehension by reducing reliance on literal translation. The study implies Al-Miftah is an effective solution for Arabic grammar challenges in pesantren, strengthening linguistic foundations, cultivating self-directed learning, and providing constructive recommendations for advancing Islamic scholarly traditions.

Available at : https://journal.nahnuinisiatif.com/index.php/ARJI
DOI : 10.61227
P-ISSN : 2774-9290
E-ISSN : 2775-0787

INTRODUCTION

One of the subjects that play an important role in the Merdeka Curriculum, developing students' basic abilities and building logical, critical, and analytical thinking skills that are indispensable in various aspects of life, is mathematics. Therefore, all students from elementary school to college need to be taught mathematics subjects. Given the importance of mathematics learning in schools, Law Number 20 of 2003 concerning the National Education System Article 37 emphasizes that "Mathematics subjects are compulsory subjects that must be given at every level of education". However, it is undeniable that there are still many students who find maths to be a stressful and challenging subject. Mathematics is actually considered a difficult subject by many students which causes them to give up easily before learning mathematics (Fauzy et al. 2021).

Based on the results of pre-research observations conducted by researchers in grade 5 of SDN 35 Barru on mathematics learning, data was obtained that the mathematics learning achievements of grade 5 students still did not reach the SKBM determined by the school. This shows that the student's ability to understand the subject matter is low. Looking at this situation, the low mathematics learning achievements of grade 5 students of SDN 35 Barru is caused by two factors: the teacher and the student factor. The factors from teachers are the learning model applied less varied, the lack of use of concrete learning media, and the lack of involvement of students to play an active role in learning activities. Meanwhile, from the student factor, namely difficulty in understanding the learning material, students are less skilled in solving mathematics problems, students feel bored and not enthusiastic in participating in learning.

In the context of mathematics learning in elementary schools, various learning models can be applied as a reference in overcoming problems, such as what happened in grade 5 of SDN 35 Barru. The learning model can be interpreted as a series of materials that include various aspects before, during, and after learning carried out by teac and all facilities or indirectly in the learning process (Magdalena et al., 2020). One of the learning models that can be applied in mathematics learning is the Missouri Mathematics Project (MMP) model. Nurussobah et al. (2021) stated that the MMP model is a mathematics learning model that provides guided exercises through projects and practice questions in groups or independently to build their understanding so that students are trained to apply their knowledge and skills to solve practice problems. According to Zainal et al. (2024), the MMP model is a learning model designed to assist teachers in using practice questions effectively to strengthen students' understanding of concepts and problem-solving skills, allowing them to build answers independently through project worksheets that are relevant to the situation around students. In the MMP learning model, several steps can be applied. According to Krissandi et al. (2022) the steps include introduction (review), development, controlled exercises (cooperative work), independent work (seatwork), and closing.

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DOI : 10.61227
P-ISSN : 2774-9290
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In mathematics learning, various learning strategies are used to make it easier for students to learn and interpret learning materials. One of them is ethnomathematics ethnomathematics, which relates the learning material of mathematics to the cultural characteristics of students' daily lives. According to Purbaningrum et al. (2021), ethnomathematics is a culture-based mathematics learning by combining students' cultural understanding with mathematical materials so that students find it easier to understand the material and love their native culture. Some of the benefits of applying ethnomathematics-based learning are that learning mathematics is fun and contextual, can reduce the impression that mathematics is complex and abstract and replace it with the impression that mathematics is fun and honest in every life activity, getting to know one's own culture and other cultures, awareness of appreciating and loving one's own culture and other cultures, part of efforts to systematically preserve culture through mathematics education in and education in general.

Researchers have previously researched a lot about implementing MMP in the context of mathematics learning in elementary schools. Among them is research by Aini et al. (2020), which concluded that the MMP learning model could improve the mathematics learning achievements of students. Similarly, the research of Tahir et al. (2023) concluded that applying the MMP model to mathematics lessons of data collection and presentation materials can improve the activities and learning achievements of students. Research by Susanti (2018), also concluded that applying the MMP model can improve student activities and learning achievements. Various previous studies have also examined the application of ethnomathematics to mathematics learning in elementary schools. Among them is research by Zulfa et al. (2023), which concludes that ethnomathematics can improve learning achievements because the use of ethnomathematics in teaching and learning activities can foster a fun atmosphere in the classroom, students are enthusiastic about participating in lessons when students see the culture somewhere, they will remember the mathematics material so that students better understand the material being studied and encourage an increase in learning achievements. Similarly, research by Ajmain et al. (2020), concluded that implementing an ethnomathematical approach to mathematics learning can make learning more contextual, provide understanding and foster cultural values to increase student learning achievements. Research by Arif & Mahmudah (2022), also concluded that mathematics learning that integrates ethnomathematics can improve students' mathematics learning achievements. The study results show an increase in the average mathematics results when mathematics learning internalizes the values of local wisdom in the community; this shows that implementing ethnomathematics can increase mathematics learning achievements.

Based on the literature review in the previous paragraphs, the existing literature is still limited in combining MMP with ethnomathematics in a classroom action study. This research gap is necessary and important to be completed so that a variety of alternatives in improving the process and achievements of mathematics learning in elementary schools are more comprehensive. By applying this ethnomathematics-based MMP

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DOI : 10.61227
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learning model, it is hoped that it can improve the mathematics learning process in elementary schools and student learning achievements. The MMP learning model will be more meaningful if combined with ethnomathematics because it can provide more contextual and meaningful learning by utilizing local cultural elements in the presentation of the material so that students can more easily understand mathematical concepts through ethnomathematics can improve learning achievements because the use of ethnomathematics in teaching and learning activities can foster a fun atmosphere in the classroom, students are enthusiastic about the lesson when students see the culture somewhere, they will remember the mathematics material so that students better understand the material learned and encourage an improvement in learning achievements. Based on the above problem's presentation, this study aims to improve the learning process and achievements of Grade 5 students of SDN 35 Barru by implementing the ethnomathematics-based MMP learning model. The research question that will be answered is 1) How is implementing the ethnomathematics-based MMP learning model in improving the learning process of building materials for students in class SDN 35 Barru? 2) Can implementing the ethnomathematics-based MMP learning model improve the learning achievements for students in grade 5 of SDN 35 Barru?

METHOD

This study used a qualitative research approach with type of class action research (CAR), because can be used to describe the activities of teachers and students in the learning process. The others, CAR is a research effort carried out by educators or prospective educators to solve problems in the classroom by providing pre-planned actions based on cycles made with the aim of or improving the quality of learning in the classroom and developing educator professionalism (Mustafa et al. 2022). In this study, the design of the action study of the Kemmis and McTaggart model classes was used. This research will be carried out at SDN 35 Barru, located in Pao, Lipukasi Village, Tanete Rilau District, Barru Regency. The subjects of this study are teachers and students of grade 5 of SDN 35 Barru who are involved in the mathematics learning process. There are 13 people involved, with one teacher and 12 students, six male and six female.

This research consists of several cycles: planning, implementation, observation, and reflection. However, before entering the four stages, pre-research was carried out. The implementation in each cycle is a flow of interrelated activities, meaning that if the implementation of the first cycle has not been successful, it will be continued to the next cycle until it is successful. The actions applied in this study are ethnomathematics-based MMP. The details of the activities of the implementation of the action are in the initial learning activities of the teacher starting from the activity of saying greetings, asking how is doing, filling out the attendance list and continuing to read prayers led by the class leader. Then it was continued by singing the national compulsory song to instill the spirit of nationalism in students. Next, ask about the material that has been studied previously

and explain the learning objectives to be carried out. In the core activities, teachers apply the steps of the MMP learning model, as Figure 1.

The data collection technique in this class action research involves observation, testing, documentation, and reflection techniques. The instruments used in this study are observation sheets, test sheets, documentation, and reflection sheets. The data collected in this study was analyzed using qualitative data analysis techniques according to Miles & Huberman (Purwanto, 2023) which consisted of three stages: data condensation, data presentation, and drawing conclusions or verifying data.

To measure the success of the process and results in this study, the percentage of scores and the level of success are referred to. The success indicator of the process in this study is said to be successful if all steps of the ethnomathematics-based MMP learning model are carried out well and achieve a success level of ≥ 76% or in the good category. As for the success indicator, the result is if ≥ 76% of all students in grade 5 of SDN 35 Barru have reached the Minimum Learning Completeness Standard, which is 70.

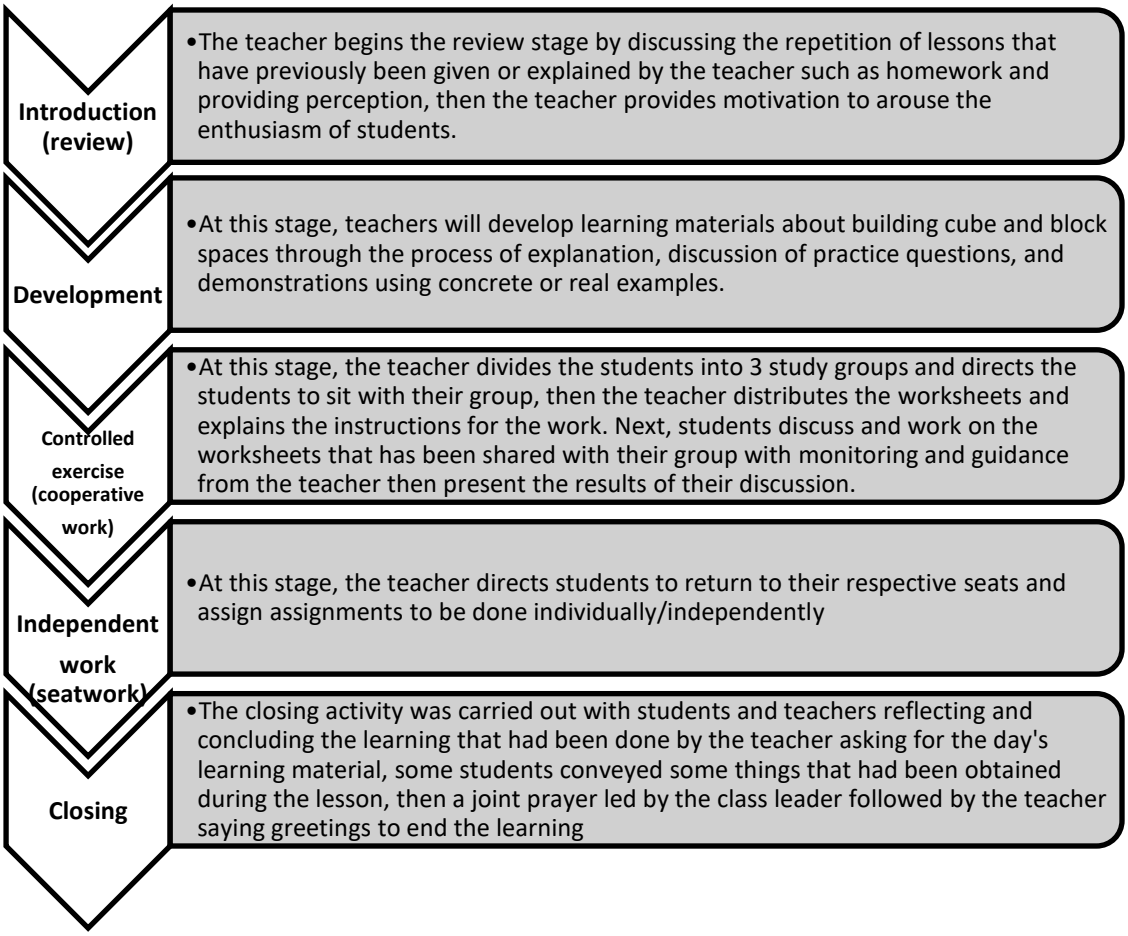

Figure 1. Details of the Learning Activities of the Action

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DOI : 10.61227
P-ISSN : 2774-9290
E-ISSN : 2775-0787

RESULTS

This classroom action research was carried out in two cycles. The aim was to improve the process and learning achievements of mathematics in building space materials through the application of an ethnomathematics-based MMP learning model. This research has four stages: planning, implementation, observation, and reflection.

Cycle I

In implementing Cycle I, the action taken was implementing the ethnomathematics-based Missouri Mathematics Project (MMP) learning model. Learning is focused on the characteristics and examples of building cubes and beams. The teaching module used has been designed with details of the implementation of actions consisting of three parts: preliminary activities, core activities, and closing activities.

In the core learning steps, teachers apply the steps of the systematic MMP model based on ethnomathematics, namely introduction (review), development, controlled practice (cooperative work), independent work (seatwork), and closing. During the implementation of learning, teachers associate the material with Bugis culture by using images of Bugis cultural objects such as walasuji, satirical cakes, Jiang cakes, lamming, and others as concrete media to associate the concept of building space with daily life.

Figure 2.
Implementation of the First Cycle of Learning

The teaching materials used are in the form of printed modules that contain explanations of the concept of building cubes and block spaces, examples of drawings of Bugis cultural objects, and examples of questions that support understanding concepts. In addition, students were divided into small groups and given group worksheets, which contained activities to determine the characteristics and examples of objects in cubes and blocks associated with Bugis cultural objects. This group activity encourages students to discuss and present their work in front of the class.

Figure 3.
Examples of Bugis Cultural Objects in The Form of Cubes and Blocks

After learning in the first cycle by implementing the ethnomathematics-based MMP model, the researcher observed that there had begun to change; namely, students looked enthusiastic and interested in participating in learning because what they learned was something close to them. Students also find it easy to understand the material through explanations that teachers deliver systematically, accompanied by examples. The classroom atmosphere is more lively, and students' attention is more directed to learning activities.

The results of the observations made by the researcher are also strengthened by the observations made by observers, which show that the activities of teachers and students are in the sufficient category. The result of teacher observation was 73.33%, while the result of student observation reached a percentage of 73.88%. This shows that this level has not reached the success indicator ≥76%. As for the student learning achievements, it shows that out of 12 students, only eight scored above SKBM, which is 70.

Furthermore, the researcher reflects on learning by filling out reflection sheets from observations and discussing with observers after the implementation of cycle I that the application of the ethnomathematics-based MMP learning model has been carried out according to its stages. The material is delivered gradually, and the examples are associated with local cultural objects such as walasuji and traditional Bugis cakes. This positively impacts students' interest and enthusiasm in participating in lessons. Most students are involved in discussion activities, although there are still some students who are not yet fully active. Time management at the training stage is also still not optimal, so not all students have the opportunity to complete the exercise optimally. The group's composition is also unbalanced, which causes groups that are less active in working together. Therefore, the research continued to cycle II by improving the shortcomings in implementing cycle I.

Cycle II

The actions in Cycle II are a continuation and improvement of the previous cycle. Learning is focused on cube and block volume material. Implementing learning in cycle II is the same as the last cycle, using an ethnomathematics-based MMP flow. The teacher introduced the Bugis traditional house, some of which are cubes and blocks, to introduce the concept of volume. The teaching materials in this cycle explain the volume of cubes and blocks, equipped with illustrations of cultural objects and contextual exercise questions.

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DOI : 10.61227
P-ISSN : 2774-9290
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Group worksheets are structured more systematically with clear instructions. They allow students to measure and quantify the volume of cube—and block-shaped objects by involving concrete objects around them. In this worksheet, students are asked to calculate the volume of the traditional house drawing. The group's work is then presented and discussed together in class.

Figure 4.
Implementation of the Second Cycle of Learning

After carrying out learning, the researcher observed that the learning process in cycle II experienced a significant increase compared to cycle I. Changes were seen in the increasingly conducive classroom atmosphere, which became more active in group discussions. Students were confident in asking questions and expressing opinions, and students were skilled in completing the exercises given questions. The focus on learning and student participation is seen to be improved.

The results of the observations made by the researcher were strengthened by the observations made by observers, which showed a significant increase. Observation of teacher activity increased by 93.33% of the good category, and student activity reached 86.66% of the good category. The results of the learning evaluation also improved, with 11 out of 12 students achieving a score of ≥70 with a completion percentage of 91.66. This shows that the actions provided through the ethnomathematics-based MMP learning model positively impact the improvement during the learning process of building space materials and on student learning achievements.

Furthermore, the researcher reflected on learning by filling in reflection sheets from observations and discussing with observers after the implementation of cycle II; it was seen that the learning atmosphere became more active because students were able to associate learning with cultural objects and students looked more confident in asking and answering questions. The study groups formed in a heterogeneous manner have succeeded in increasing student collaboration so that discussion activities run well. However, some students still do not understand certain materials, so it is necessary to be given additional reinforcement and practice. The following is a comparison table of learning achievements in Cycle I and II.

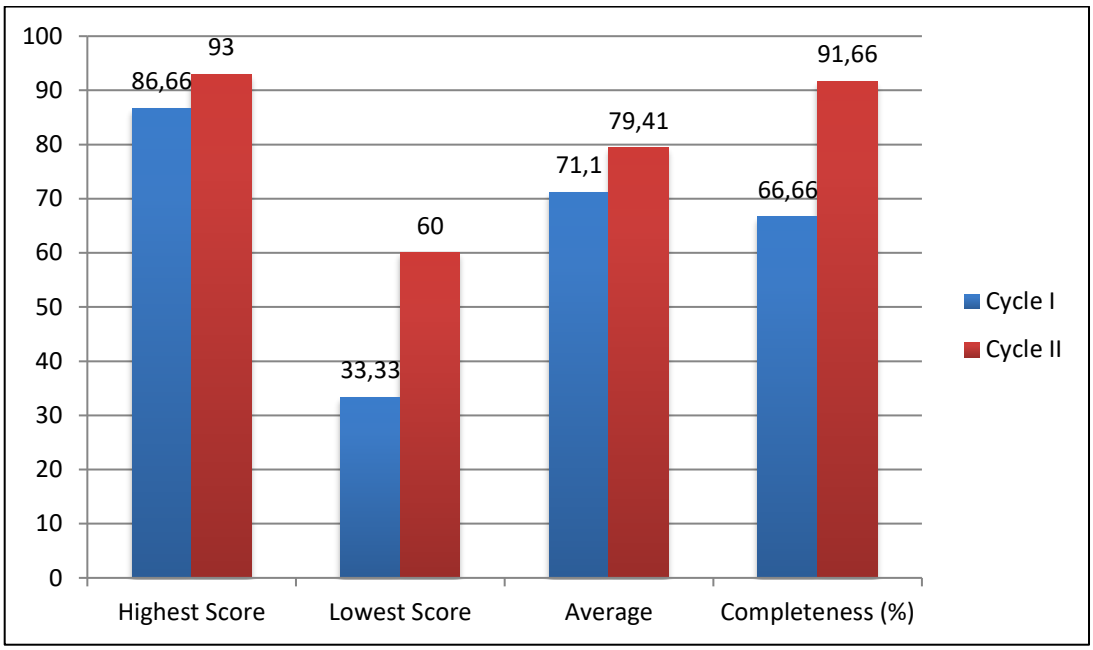

Figure 5.
Comparison of Learning Achievements in Cycle I and II

DISCUSSION

This research employs a two-cycle classroom action research approach aimed at enhancing fifth-grade students' mathematics achievement through the implementation of the Missouri Mathematics Project (MMP) model with an ethnomathematics basis. As noted by Lestari et al. (2024), the MMP model emphasizes structured project worksheets that support students in developing problem-solving skills through collaborative and individual tasks. This approach is particularly effective in mathematics education because it encourages active engagement and critical thinking. By embedding local cultural content—such as Bugis traditional architecture—into mathematical concepts, the model fosters a more meaningful and contextualized learning experience. This aligns with Purbaningrum et al. (2021), who argue that ethnomathematics bridges cultural knowledge with abstract mathematics, thereby increasing comprehension and fostering cultural appreciation. The integration of local culture as a concrete learning medium not only enhances understanding but also strengthens students' connection to their heritage, making learning both relevant and enjoyable.

Based on the data obtained from the learning process and achievements by implementing the ethnomathematics-based MMP model, it can be concluded that the learning process has not been maximized and is only at sufficient qualifications, and the results of the learning test in the first cycle have not reached the success indicators that have been set with a completion percentage of 66.66%. This is because implementing the first cycle has several shortcomings, so the implementation process or indicators are not carried out optimally, and teachers still tend to be dominant in explaining. Teachers fail to monitor and help students who have difficulties doing independent assignments; there are still passive students in the group, and student concentration begins to decline due to

a reasonably long duration. Therefore, improvements are made to improve the learning process that will be carried out in the next cycle.

However, in the first cycle, various changes have begun to appear, namely, the application of the ethnomathematics-based MMP model turns out to make students enthusiastic in participating in learning because what is learned is something around them, this is by the opinion of Kencanawaty et al. (2020), who stated that learning by applying the concept of ethnomathematics as a source or teaching material can increase students' enthusiasm when following the process learning so that there is an increase in student learning achievements. The following change is that students understand the material more easily; this is in line with the opinion of Anggraini et al. (2020), who states that the MMP model is designed to improve students' understanding in solving problems and solving problems so that students can generate their answers.

The improvements made by teachers in cycle II by paying attention to the reflection of the cycle I are that teachers need to involve students by providing more varied triggering questions, providing clear directions and accompanying students who have difficulties when doing the assigned assignments, and forming groups heterogeneously, inserting ice breaking so that students' concentration is maintained. From several shortcomings in the first cycle that were improved in the second cycle, the results showed that teachers' teaching activities and student activities increased significantly with the Good category, as well as learning achievements increased and had reached the success indicators set with a completion percentage of 91.66% with the Good category.

The changes that occur in learning in the second cycle are that learning takes place more effectively because the material can be delivered well; this is to the opinion that one of the advantages of the MMP model is that the use of time is strictly regulated so that much material can be delivered well (Asfar et al., 2018). The following change is that students are skilled in solving the practice questions given; this is the opinion of Nurussobah et al. (2021) who stated that with practice questions in group work and independently, students can be trained to apply their knowledge and skills to solve various kinds of problems. Another change is that students become more active in working together to complete the group assignments given; this is according to the concept that learning can be said to be prosperous if, in teaching and learning activities, students can actively participate in groups or individuals so that a pleasant learning situation is created which results in student learning achievements to increase after the teaching and learning process is carried out (Machmud et al., 2023).

In addition, the changes that have occurred can also be seen from the use of ethnomathematics associated with learning, which can create fun, memorable and contextual learning because it is related to students' lives. In theory, this is also in line with the constructivist approach, where students build knowledge through experiences that are contextual and relevant to their lives. According to Akbar & Ulya (2021), applying ethnomathematics in learning activities can make learning enjoyable. Furthermore,

according to Soebagyo et al. (2021), one of the benefits of applying ethnomathematics is to make mathematics learning fun and contextual.

Furthermore, applying ethnomathematics in learning makes mathematics more real and contextual because it relates to students' lives. This is by the opinion expressed by Famella, (2023), that ethnomathematics learning makes mathematics more realistic so that students become interested and easier to understand the material. Furthermore, according to Soebagyo et al. (2021), ethnomathematics can reduce the impression that mathematics is complex and abstract and replace it with the impression that mathematics is fun and honest in every life activity. Learning associated with ethnomathematics also makes students more familiar with the culture. According to Famella (2023), ethnomathematics learning will make students acquainted with culture, which is expected so that students have the ability to preserve culture. In line with the opinion of Soebagyo et al. (2021), who stated that ethnomathematics can be introduced to one's culture and other cultures so that it becomes part of efforts to preserve culture systematically through mathematics education in particular and education in general.

The results of cycles I and II were obtained using the hypothesis described by the researcher. It has been proven that the entire process that has been carried out by the researcher, from planning, implementation, observation, and reflection, shows that learning by implementing the ethnomathematics-based MMP model well to the building materials can improve the learning achievements of grade 5 students of SDN 35 Barru. This is to several previous studies that have examined the MMP and ethnomathematics learning models in improving learning achievements, namely according to Aini et al. (2020), based on the results of research that has been carried out showing that the MMP learning model can improve students' mathematics learning achievements.

Furthermore, Ajmain et al. (2020), stated that culture-based learning can improve mathematics learning achievements because with ethnomathematics, problems and phenomena that arise and develop in society, such as art, special foods, games, and others, can be used as learning resources for students so that students can be motivated to learn and will be more free to think. The integration of culture into mathematics learning has been proven to help students connect mathematical concepts with real contexts, while strengthening local cultural identity (Qonitah & Kusaeri, 2024). Ethnomathematics is crucial for building self-confidence, self-esteem of young learners and improved learners' mathematics knowledge, skills, and understanding (Venketsamy, 2024). Ethnomathematical be employed as a teaching strategy as they are found to encourage active learning (Meeran, Kodisang, Moila, Davids, & Makokotlela, 2024). Furthermore, Arif & Mahmudah (2022), in the results of the research conducted, concluded that mathematics learning that integrates ethnomathematics can improve students' mathematics learning achievements. Ethnomathematics can be used as a pedagogical, learning, or assessment method for teaching and learning mathematics in schools (Batiibwe, 2024). Thus, implementing the ethnomathematics-based MMP model can be an alternative innovative learning strategy to enhance the mathematics learning achievements of elementary school students.

Available at : https://journal.nahnuinisiatif.com/index.php/ARJI
DOI : 10.61227
P-ISSN : 2774-9290
E-ISSN : 2775-0787

CONCLUSION

Based on the research results, it can be concluded that: 1) The application of the ethnomathematics-based MMP learning model can improve the learning process of building materials for grade 5 students of SDN 35 Barru. 2) Implementing the ethnomathematics-based MMP learning model can improve the learning achievements of building materials for grade 5 students of SDN 35 Barru. The weakness of this research is that the implementation of the action was shortly and the learning material was still limited compared to the breadth of mathematics material in grade 5 of elementary school. For the next researcher, it is recommended to develop this research on other mathematics materials with different grade levels and be able to develop media or teaching materials used in the MMP learning model. For teachers, in applying the MMP learning model in the classroom, it is hoped that teachers need to manage time from the beginning of learning so that the time used is sufficient. In addition, using the ethnomathematics-based MMP model, teachers are expected to find the most complete list possible of cultural objects associated with the material being taught.

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