

The Implementation of Ethnomathematics Based-Learning for Students

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ABSTRACT

Ethnomathematics-based learning is a very important part for the development of knowledge, especially for students. This reflects the diversity of cultures that can be integrated into learning. So that knowledge about mathematics can be more easily understood and developed in an innovative and creative way through existing cultures. The purpose of this study was to find out ethnomathematics learning among students majoring in mathematics education at Yogyakarta State University, as well as extent of students' understanding, especially in applying ethno-mathematics in a learning process in the classroom. This study used a qualitative approach with the type of case study, the object of research was one class of mathematics education students at Yogyakarta State University consisting of 31 students. The results provide information that students understood ethnomathematics but were still constrained by the implementation of learning. Students were constrained in preparing lesson plans and teaching materials where they are still unable to integrate cultural material into the mathematics material. This research has a real contribution to mathematics students, namely being able to better understand ethnomathematical-based learning by planning carefully and integrating it with existing cultural values.

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INTRODUCTION

Education is a deliberate and well-thought-out attempt to build a learning environment and a learning process that encourages students to take an active role in their own growth. This is explained in Law Number 20 of 2003. It is a conscious and planned effort which means that education is a process carried out based on the results of a mature and best thought. Education, especially in schools, must be carried out as well as possible so that the learning process can take place effectively. This is important because the learning process will have a huge impact on children in the future. This is as conveyed by Arisetyawan & Surpiadi (2019) that ethnomathematics-based learning anticipates children's boredom and is more interesting because children will be able to learn mathematics with a local wisdom approach.

The learning process itself is a condition that is deliberately created by the teacher with the aim of educating students (Djamarah & Zain, 2013). Teachers must be able to encourage pupils to participate in programs. In learning activities, students are not only implementers

of learning who act as objects of giving by educators, but also must actively interact. This learning activity leads to an education system that facilitates students through their own experiences, knowledge, skills, and abilities and obtains methods that they can then apply when learning independently (Kozulin et al., 2003).

A teacher, in preparing a lesson plan, especially mathematics learning, should be based on the knowledge that students have from the experiences they experience in everyday life. According to Prasetya & Mahmudah (2021) need learning conditions, the implementation process, and learning outcomes in mathematics learning. In order to teach formal mathematics, a teacher can begin by exploring students' informal mathematical knowledge gained from the society in which they live (Marsigit, 2006). He went on to say the learning opportunities that students find appealing must be concrete and relevant to their everyday lives. One aspect that can be developed is the local culture that exists in the local area. The same statement also say by oleh Marinka, Febriani, & Wirne (2018) that the ability of students' understanding, namely in terms of identifying, translating, assessing the meaning of symbols, understanding and applying mathematical ideas, making an exploration through local culture.

Mathematics and culture are two things that cannot be avoided in daily activities. Essentially, humans are cultured creatures, culture is deeply rooted in human life. Culture applies in a society because it is a complete and comprehensive unit, while humans in their daily life use mathematics to solve their problems. This statement is supported by the results of a study conducted by Abi (2016) that mathematics learning based on multicultural education aims to optimize mathematics learning achievement while at the same time fostering awareness, understanding, tolerance, mutual understanding and the national spirit of individual students as part of a multicultural society. Therefore, culture becomes a balance when humans get education to open their horizons universally, so that when humans become superior, they don't forget their cultural life with other people (Mora, 2012). The introduction of culture must be combined with an introduction to education because culture requires education to adapt it to something that has distinctive features and is more interesting.

Mathematics itself is a cultural form that has been integrated into all aspects of people's life (Bishop, 1994). So that all the behavior and events that occur cannot be separated from the name mathematics. Since mathematics is a symbolic technology that develops in cultural skills or environmental practices, a person's cultural context affects their mathematics. What they see and experience can affect their actions. Ethnomathematics is one that can serve as a link between culture and mathematics (Wahyuni, 2013). Ethnomathematics in short means mathematics in culture, meaning that there is a process to identify the mathematical elements that exist in a culture. D'Ambrosio is a mathematician from Brazil who introduced this term in 1977. The term "etho" simply refers to the socio-cultural meaning, which includes vocabulary, jargon, codes of conduct, symbols, and myths. Explaining, learning, remembering, and carrying out tasks like coding, calculating, clarifying, concluding, and designing are all examples of "mathema". And "tics," which is derived from the term *techne*, is synonymous with technique (D'Ambrosio, 1994).

Objects of ethno-mathematics are cultural objects that contain mathematical concepts in a particular society and are used for activities such as counting, determining locations, measuring, designing, playing, and explaining. These objects can be in the form of traditional games, traditional crafts, artifacts, and activities (actions) that take the form of a culture. Based on the various statements in the background above, it can be concluded that the importance of learning mathematics for students is aimed at facilitating the understanding of mathematics that is integrated into local wisdom.

METHOD

This study uses a qualitative research approach (post-positivistic) in order to obtain detailed, complete and in-depth data. A qualitative approach is carried out naturally without any treatment from researchers to interpret a case that occurs. This meaning can be subjective and influenced by a person's mental and experience so that the truth is emic. The reason for using this method is to explore local wisdom that can be integrated into mathematics learning.

This research uses case study research because it is done to describe and interpret ethnomathematics learning itself. This is as stated by Creswell (2015) that case study research is research that will explore in-depth an activity, event, or process. The process consists of a series of steps, for example a curriculum process that shapes a sequence of activities.

Time and Research Setting

This research was conducted at Yogyakarta State University. The research period was carried out from March to April.

Unit of Analysis

In this research, the unit of analysis is ethnomathematics learning in Yogyakarta State University students, how students understand ethno-mathematics learning. The observation unit is the 6th semester UNY students.

Data Collection Techniques and Instruments

The data collection technique used in this study was participatory observation. The instrument used was a participatory observation guide

Data Validity

Validity is the form and provision of instruments that can measure and assess what instruments you want to assess. Triangulation is one way to make credibility in the validity of the data. There are two triangulations used in this study, namely the triangulation of data collection techniques. Triangulation techniques are used to corroborate evidence from different types or different data collection methods. That way it will be more accurate because information is based on many sources of information, many individuals, and many processes (Creswell, 2015).

Data Analysis Technique

Data analysis was performed inductively. It begins with working with data, arranging it, separating it into usable units, synthesizing it, searching for and identifying patterns to determine what is relevant and what is learned, and determining what to teach others is all part of qualitative data analysis. According to Miles, Huberman & Saldana (2014) analysis as three concurrent flows of activity: (1) data condensation, (2) data display, and (3) conclusion drawing/verification.

The research procedure using an interactive model can be described as follows: (1) Data collection was carried out in March-April using structured participatory observation; (2) Data reduction is done by compiling codes from the research results. This is done to select relevant and meaningful data and focus on data in exploration related to student ethno-mathematics learning; Furthermore (3) Display data in this study is to display the results of

the analysis carried out using the Atlas.ti software version 8. The final step is (4) drawing conclusions. The drawing of this conclusion is done by answering questions about the implementation ethnomathematics based-learning from the research then discussing it by linking relevant theories related to ethnomathematics learning.

RESULT AND DISCUSSION

The results of research that have been carried out by observing students' mathematics learning are then interpreted and analyzed using atlas.ti software version 8. The data obtained in the field are then coded to find new studies related to the implementation of ethnomathematical learning. The codes obtained are then made a concept map. The following are the codes from the analysis results:

Table 1. The Data Coding

• confidence	• respect people	• defining the problem
• polite	• not hopeless	• organize
• exchange knowledge	• think	• problem
• preparation	• creative	• innovation
• solution	• achievement	• cross-cultural skills
• capacity	• analyze arguments	• determine value
• basic competence	• thinking smart	• integrated
• action	• learning tools	• character education
• enforcement	• commitment	• explanation
• cooperating	• technique	• self-concept
• elaboration	• achievement	• skills-4Cs
• ability	• resources	• reasoning
• practice	• think critically	• active
• character building	• learning models	• self-suffecient
• reflection	• attainment	• connect
• interpretation	• FGD	• self-lerning
• experience	• supportive	• evaluating
• analyze	• culture assessment	• focus control

The number of codes in table 1 above is then analyzed using a categorization approach. It aims to reduce the data back and relevant the data that has been collected and the coding has been compiled to find a concept map from the results of the study. Based on this, the concept map of the findings of this study can be described through the following data analysis results:

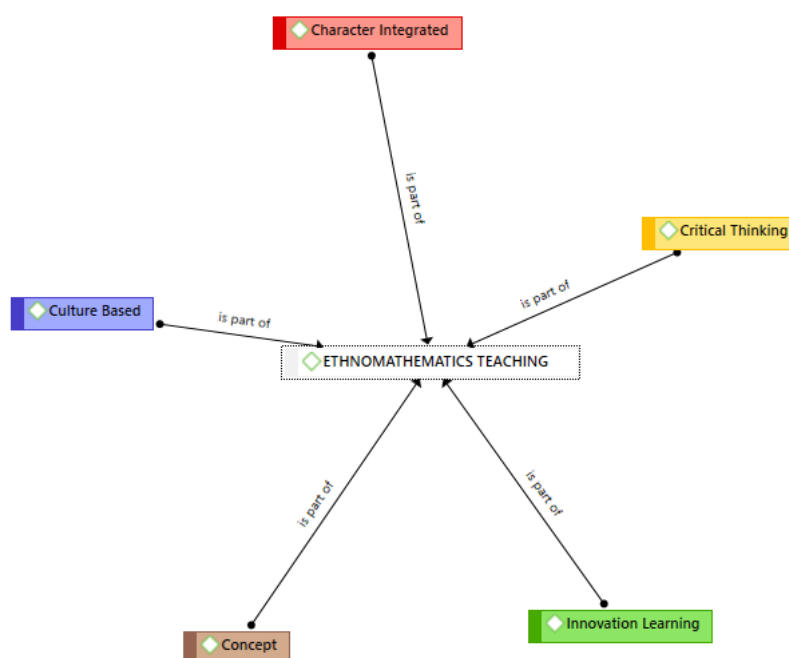


Figure 1. Data Analysis Results of Ethnomathematics Learning Research

Based on Figure 1 above, it can be concluded that the findings of this research provide insight about how ethno-mathematics instruction should be implemented, which is a learning innovation, which has mathematical concepts, is culture-based, which can be integrated into character education, and has the ability to improve students' critical thinking. Teachers and lecturers will use the results of this study to establish ethnography-based mathematics learning, as well as to improve students' knowledge of Indonesian cultures. Learning based on ethno-mathematics can create a culture so that many things can be explored and integrated into mathematics learning, including character, critical thinking, and being able to motivate students related to cultures in Indonesia and abroad whose knowledge can be developed through this ethnomathematics learning. One critical part of these ethnomathematical lessons that cannot be included in this booklet, according to Zepp (1993), is the taking in of concrete objects to share with the rest of the class.

Learning carried out by lecturers to students has been carried out using various variations in order to increase students' understanding of ethnomathematics. This requires teacher innovation in integrating existing sulcultural objects (Mahmudah, 2021). They have even been deployed directly to cultural objects around Yogyakarta so they can directly see and observe existing artifacts and can be used as a means of learning mathematics. This will certainly be very helpful in the process of providing understanding to students because through learning variations, it is hoped that students who have different characteristics can be maximally facilitated. In addition, visiting learning objects directly can improve student understanding of existing cultural heritage and what parts can be used as material in learning mathematics. So that it will train students to be able to think mathematically as stated by (Shigeo Katagiri, 2011).

The findings of this study support claims made by Agustin, Ambarawati, and Kartika (2018) that the advancement of ethnomathematics-based mathematics learning instruments has resulted in mathematical learning instruments. Mathematical thinking based on the mathematical content of Shigeo Katagiri is divided into 9 main points, namely, idea of sets, idea of units, idea of expression, idea of operation, idea of algorithm, idea of approximation,

idea of fundamental properties, functional thinking, and idea of formulas. According to Imswatama & Lukman (2018), ethnomathematics-based mathematics teaching content is useful in improving problem-solving skills and student mathematical critical thinking. The learning process carried out is by inviting students to go directly to the location of these cultural objects. This will certainly lead to a more real learning experience and can make an impression on students.

Ethnomathematics allows one to observe and grapple with how mathematics has been traditionally adapted and used by people all over the world and throughout history (Ambrosio, 2018). Through observation of cultural objects, students observe what buildings are contained in these objects. From here students can construct understanding and estimate what mistakes students can make from seeing objects that are almost the same, have the same characteristics but in slightly different forms. This is where children are trained to classify these objects, grouping them based on similar shapes and characteristics they have. This is in line with the argument (Fajriyah, 2018) that culture-based mathematics learning (Ethnomathematics) is one way to make mathematics learning more relevant and contextual in cultural cultures.

The ethnomathematics resources can be used to teach students about length, field, volume, tessellation, form, pattern, common multiples, common divisors, and multiplication in mathematics (Mauluah, 2019). In their elaboration, they have been able to compile a learning framework that is broadly in accordance with the concept of Katagiri regarding mathematical thinking. As stated by Charitas, Prahmana, Dahlan, Kartini, & Kartini (2018) learning math based on culture can be a good way to combine culture and math learning. Therefore implemented in school mathematics learning to make it more meaningful, fun, and not too complex since the meaning is closely relevant to their own culture's daily life (Supiyati & Hanum, 2019).

The development of ethnomathematics based teaching materials or socio-cultural values that can be integrated into teaching materials is very important (Dahlan & Permatasari, 2018). However, problems arise in the preparation of teaching materials and lesson plans, about 60% of students are still unable to incorporate cultural elements into learning materials so that in the teaching materials and lesson plans there is a separation between culture and material, not forming a complete unity of a culture-based mathematics learning. Even when teaching practice is carried out, students seem to make culture, in this case the Prambanan temple, Borobudur temple, and the palace only as an opening and introduction in starting the learning process. However, when entering the subject matter, this cultural element is released so that there is only mathematics as usual. Ethnomathematics is a subject in which the teacher and students respect cultures and make connections between cultures and the curriculum (Harding-dekam, 2007).

CONCLUSION

Ethnomathematics learning which is carried out in the mathematics education student class of Yogyakarta State University has been carried out in various and innovative ways. One of them is by using a local wisdom approach. Students also have understood the concept of ethnomathematics. However, they are still constrained in the preparation of teaching materials and lesson plans so that in their teaching practice, the culture and mathematics subject matter are still running separately. It can be inferred, based on the findings of the study and debate, that in the introduction of ethnomathematics learning in students, it has indicators of learning innovation, it has mathematical concepts, is culture-based, which can be integrated into character education, and has the ability to improve students' critical

thinking. The recommendations of this research are aimed at teachers and lecturers who teach mathematics education to be able to apply ethnomathematics concepts to students so that learning can be easily accepted and fun.

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Implementasi Pengajaran Etnomatematika Pada Mahasiswa

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Abstrak

Pembelajaran berbasis etnomatematika merupakan bagian yang sangat penting bagi perkembangan ilmu pengetahuan khususnya bagi mahasiswa. Hal ini mencerminkan keragaman budaya yang dapat diintegrasikan ke dalam pembelajaran. Sehingga pengetahuan tentang matematika dapat lebih mudah dipahami dan dikembangkan secara inovatif dan kreatif melalui budaya yang ada. Tujuan dari penelitian ini adalah untuk mengetahui pembelajaran etnomatematika pada mahasiswa jurusan pendidikan matematika di Universitas Negeri Yogyakarta, serta untuk mengetahui sejauh mana pemahaman mahasiswa khususnya dalam menerapkan etnomatematika dalam proses pembelajaran di kelas. Penelitian ini menggunakan pendekatan kualitatif dengan jenis studi kasus, objek penelitian adalah satu kelas mahasiswa pendidikan matematika Universitas Negeri Yogyakarta yang terdiri dari 31 mahasiswa. Hasil tersebut memberikan informasi bahwa siswa memahami etnomatematika namun masih terkendala dengan pelaksanaan pembelajaran. Siswa terkendala dalam menyusun RPP dan bahan ajar dimana mereka masih belum mampu mengintegrasikan materi budaya ke dalam materi matematika. Penelitian ini memiliki kontribusi nyata bagi mahasiswa matematika, yaitu mampu lebih memahami pembelajaran berbasis etnomatematika dengan merencanakan secara matang dan mengintegrasikannya dengan nilai-nilai budaya yang ada.

Keywords: Pengajaran, Etnomatematika, Mahasiswa

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