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Improving Students Mathematics Learning Outcomes Through Sundanese Ethnomathematics: A Systematic Literature Review

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ABSTRACT

Students' low mathematics learning outcomes are influenced by the lack of teachers linking learning with daily life; teachers also apply conventional learning models that emphasize lectures and lectures. Ethnomathematics is a link between culture and education, especially mathematics education. Sundanese culture can be integrated into ethnomathematics, as seen from the use of non-standard units by Sundanese society. In addition, games and household appliances can be used as ethnomathematical-based problem-solving models. The method used in this study uses a qualitative library research approach with data collection techniques using a literature review. The focus of this study is the improvement of students' mathematics learning outcomes through Sundanese ethnomathematics in the fields of geometry and measurement. The results of this study stated that ethnomathematics-based mathematics learning could improve student learning outcomes and problem-solving abilities by learning, analyzing, and practicing in learning activities. Then integrating ethnomathematics indirectly can increase understanding and open new insights about local cultures, such as Sundanese culture. Thus students are expected to increase their insight into Sundanese culture and achievements simultaneously.

ABSTRAK

Rendahnya hasil belajar matematika siswa dipengaruhi oleh kurangnya guru mengaitkan pembelajaran dengan kehidupan sehari-hari, selain itu guru masih menerapkan model pembelajaran konvensional yang menekankan pada ceramah dan penugasan. Etnomatematika merupakan penghubung antara budaya dan Pendidikan khususnya Pendidikan matematika. Budaya Sunda dapat diintegrasikan kedalam etnomatematika, hal tersebut dapat dilihat dari penggunaan satuan tidak baku oleh masyarakat sunda. Selain itu permainan dan peralatan rumah tangga dapat dijadikan model pemecahan masalah berbasis etnomatematika. Metode yang digunakan dalam penelitian ini menggunakan pendekatan kualitatif library reseach dengan Teknik pengumpulan data dengan cara literature review. Fokus dalam penelitian ini adalah peningkatan hasil belajar matematika siswa melalui etnomatematika sunda pada bidang geometri dan pengukuran. Hasil dari penelitian ini menyebutkan bahwa pembelajaran matematika berbasis etnomatematika mampu meningkatkan hasil belajar dan kemampuan pemecahan masalah siswa dengan cara mempelajari, menganalisis, serta mempraktekkan pada kegiatan pembelajaran. Kemudian pengintegrasian etnomatematika secara tidak langsung dapat meningkatkan pemahaman serta membuka wawasan baru tentang budaya lokalnya dalam hal ini budaya sunda. Dengan demikian siswa diharapkan dapat meningkatkan wawasannya tentang budaya sunda dan prestasinya sekaligus.

INTRODUCTION

Today we already know that there has been a very rapid development of technology, which has brought several impacts. One of the most visible impacts is cultural exchange. With that immediate cultural exchange, we can know cultures from other regions and even foreign countries. On the other hand, cultural exchanges across regions or countries can erode local culture. This is in line with Parhan (2021), who explained that the influence of current developments is likely to corrupt culture, especially Sundanese customs. This is seen from the geographical and strategic location of the Sunda area, which, if considered inhabited by people outside the area, allows cultural rotation. Meanwhile, Saepudin (2017) also argues that modernization is currently a scapegoat for the fading of traditional societal values. Therefore we must preserve the eroded Sundanese cultures.

To bridge this, ethnomathematical integration can be done. Widada et al. (2018) explained that ethnomathematics represents a particular group's daily or cultural mathematical practices in a socio-cultural environment and can build mathematical reasoning and mathematics as cultural constructs. In addition, ethnomathematics can be defined as specific methods used by a particular cultural group or society in mathematical activities (Sarwoedi et al. 2018). Therefore, ethnomathematics is a link between culture and mathematics. This aligns with Dhiki and Bantas (2021), who explain that ethnomathematics exists to bridge culture and education, especially in mathematics learning, because various community activities use mathematical concepts without us realizing it. This was reinforced by Nova and Putra (2022), who said that ethnomathematics is one of the right solutions to be involved in the learning process because it positively impacts student understanding by integrating culture into mathematics learning.

Ethnomathematical integration in the learning process is critical to be applied to preserve culture, especially Sundanese culture, which is being eroded gradually due to the impact of technological advances and globalization. In mathematics learning, we can directly integrate Sundanese culture so that students do not lose their identity as "urang sunda". This study will be discussed further the integration of

ethnomathematics in learning. The novelty of this study will emphasize the discussion of Sundanese

METHOD

The method carried out in this study uses a qualitative library research approach, often referred to as a literature study. Qualitative approaches can be used to examine enography at the behavioral level, understand the culture of a group at the level of cognition, and understand the values behind tradition (Subadi, 2006). The data in this study was obtained based on research that others have done. The literature review will reflect a methodological approach with a general view to decide the process and flow of thought. The literature review is a summary of the synthesized sources. (Rorong, 2019).

The data collection technique used is a literature review. A literature review is a data collection by reviewing the literature, articles, journals, and various library materials relevant to relevant learning (Hamidah & Susilawati, 2023). Another use of this literature is to helps interpret the results of the research found, namely by comparing and combining the results that have just been discovered with existing literature (Afiyanti, 2005).

The focus of this study is the improvement of students' mathematics learning outcomes through Sundanese ethnomathematics in the fields of geometry and measurement. Some of the criteria in the article search are about learning mathematics, Sundanese ethnomathematics, geometry and measurement, and the influence of ethnomathematics on student learning outcomes. Literature studies are carried out by tracing the publication of articles indexed by Sinta or Scopus and other reference books. Then analyze several relevant papers and documents and conclude about improving students' mathematics learning outcomes through Sundanese ethnomathematics in geometry and measurement.

RESULTS AND DISCUSSION

Mathematics learning is an abstract and concrete science that will be meaningful if associated with everyday life. It will give students mathematical confidence if good communication is established between teachers and students (Retnodari et al., 2020). This is directly proportional to Hapsyah et al. (2019), which

explains student attitudes that students must possess today, including the ability to think critically and carefully, as well as curiosity and love to learn mathematics. However, the reality on the ground is not directly proportional. This is by Putri et al. (2019), which explain that elementary school students lose interest in learning mathematics which is mainly influenced by students' love for mathematics lessons and thinks that mathematics is a complex subject and the monotony of the way teachers teach and rarely use learning media when learning mathematics. While learning media is an intermediary for teachers and students who can connect, provide information, and channel messages to create an efficient learning process (Hidayat, 2012). According to Hidayani et al. (2021), Contextual learning media will help students understand mathematical concepts by relating them to objects in the surrounding environment encountered in everyday life.

Realizing the importance of learning related to everyday life makes it inseparable from the surrounding culture. Ethnomathematics is mathematics learning based on the local culture (Marsigit et al., 2018). Fitriatien (2016) explained that Ethnomathematics grows and develops as an alternative to developing mathematics learning tools that still tend to be conventional and less contextual. In direct proportion to Wahyuni and Pertiwi (2017), who explained that Ethnomathematics is a form of mathematics learning strategy that links local cultural wisdom and mathematics learning. We need to know together that local culture, one of which is Sundanese culture, has begun to be eroded slowly by the impact of technological developments and globalization. This is in line with Madjid et al. (2016), who explain that Sundanese culture is being hit by a shift due to the development of globalization, which results in the vortex of cultural globalization where cultures and crocodiles around the world will merge into one unit.

To preserve Sundanese culture, supporting learning is needed, one of which is ethnomathematical-based learning of Sundanese culture. Sundanese ethnomathematics talks about learning mathematics that integrates Sundanese culture. On the other hand, Muhtadi & Prahmana (2017) explained that Sundanese people carrying out mathematical activities are based on values inherent in daily practice, which are reflected in measuring activities based on the objects used, as well

as estimates based on cultural activities carried out for generations by applying rigorous mathematical concepts. According to Abdullah (2017), Sundanese people, in general, have universal communication tools that apply in community life, while the description of this is presented in the table below:

Table 1. Symbol/unit for measuring Length (Abdullah 2017)

Unit	Description
Jeungkal	The distance between the thumb and little finger when stretched maximally and used to measure objects that are relatively short and stored horizontally. 1 *"Jeungkal"* equivalent to 20 cm
Depa	Illustrates the length of an object measured using maximum hand span from the tip of the left hand to the end of the right hand straight with the shoulder. 1 *"Depa"* equivalent to 1 meter
Siku	The tool used for the length of objects measured with the tip of the hand to the base of the elbow is usually used to measure the length of the rope; 1 *"Siku"* is equivalent to 50 cm.
Lengkah	It describes the span of the foot when stepping and is used to measure distances that are not too far. 1 *"Lengkah"* is equivalent to 1 meter

Table 2. Symbol/unit for measuring width (Abdullah 2017)

Unit	Description
Ramo	Depicting the width of a human finger, it is used to measure objects that do not exceed five *"Ramo".* 1 "*Ramo"* equivalent with 1 cm
Jempol	Describes the width of an adult's thumb, which measures relatively short differences. 1 *"Jempol"* equivalent to 1.5cm
Tampah	Depicts a width of 5 *ramo*/*dampal*, used to measure relatively short objects that do not exceed five *ramo*. 1 *"Tampah"* is equivalent to 5 cm.

Table 3. Symbol/unit for measuring height (Abdullah 2017)

Unit	Description
Curuk	Describes the height of the steep if placed vertically, used to measure the height of the volume of water. 1 *"Buku Curuk*" is equivalent to 2 cm.
Tangtung	Describes the height of a person standing from foot to tip of the hair. They are used to measure shallow water. *"Satangtung"* (1 *tangtung*) is equivalent to 1.5 meters.
Mumuncangan, bitis, cangkeng, dada, sirah	Used to measure water height, usually used when rivers flood.

Table 4. Symbol/unit for measuring volume (Abdullah 2017)

Unit	Description
Kulak	Depicts one kulak cylindrical object. *"Sakulak"* (1 *kulak*) is equivalent to 1 liter.
Dolak	Describes one truck repellent or small truckload bin. They are used to measure the volume of a pile of sand. *"Sadolak"* (1 Dolak) is equivalent to 1 cubic.
Bakul	Describes one basket of objects that cannot be measured individually, used to measure the volume of a certain amount of rice. 1 *"Bakul"* equivalent to 10 cm^3
Gantang	Depicts one kulak cylindrical object. 1 *"gantang"* is equivalent to 10 liters.
Cangkir	They measure the volume of rice or other objects that can be sold. 6 *"Cangkir"* is equivalent to 1 liter.
Keupeul	Describes the grip of a person's hand, used to measure the volume of objects that can only be grasped by the hand. 1 *"Keupeul*" is equivalent to 3cm^3

Table 5. Symbol / unit for measuring area (Abdullah 2017)

Unit	Description
Tumbak	A unit of rice field area to describe the size or size of a plot of land. 1 *"Tumbak"* equivalent to 14 m^2
Bata	A unit of rice field area to describe the size or size of a piece of land. 1 *Bata* = 1 *Tumbak* = 14 m^2.
Bau	The size of the area to describe a piece of land. 1 *"Bau"* is equivalent to 5,000 m^2 or half a hectare
Bebecek	Describing the area of rice fields, used to describe rice fields that are narrow enough. 1 *"Bebecek"* equivalent to 5 to 10 m^2
Nengah	Describing the yield of the area divided in half, used by farmers cultivating land whose area is divided in half at harvest with those with the land. The size depends on the results obtained.
Mertelu	Describes the yield of area divided by three, used by farmers cultivating land whose crop area is divided by three.

Units in Sundanese culture above can be integrated into mathematics learning by converting the size of non-standard units into international standards. Goldthwaite (1872a) explained that the international standard unit of length consists of kilometers, hectometers, decameters, meters, decimeters, centimeters, and millimeters. Examples of Sundanese ethnomathematics in everyday life are "eta kolam renang jerona aya mereun satangtung satengah (The deep of the swimming pool is

about one-half of tangtung)". This example can be interpreted by converting into international standards because 1 "tangtung" is equivalent to 1.5 meters, meaning one-half of "tangtung" is equal to 2.25 meters. The depth of the swimming pool is 2.25 meters.

Then there are other examples from Sundanese ethnomathematics related to the area, for example, "Asep tos meser tanah 8 tumbak (Asep has bought 8 tumbak area of land)". From these problems, we can do the conversion; it is known that 1 "tumbak" is equivalent to 14 square meters. So to find the land area by international standards, only by multiplying between the purchased land area, which is eight tumbak with 14 square meters so that a land area of 112 square meters is obtained. The international standard unit of the area consists of square kilometers, square hectometers/hectares, square decameters/are, square meters/centare, square decimeters, and square millimeters (Goldthwaite, 1872b).

Then this statement can be parsed so that high-level practice questions are obtained. Examples of questions that can be made from such information are: 1) Make some sketches of the land purchased by Asep! (Pek jieun ku hidep sababaraha gambar sketsa tanah nu tos dipeser ku Asep!). From this statement, students can explore their thoughts to spark some original ideas and possible answers, as shown below.

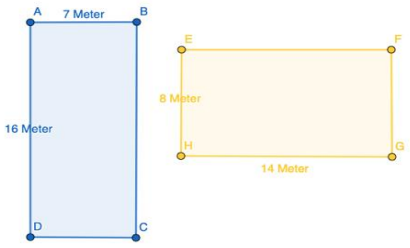

Figure 1. Possible student answers

Figure 1 is a possible answer that students will choose. The two rectangular shapes have the same area of 112 square meters.

In addition, several Sundanese cultures, such as Sundanese games, can be adapted into mathematics learning, including engkle. In the engkle game, ethnomathematical elements are related to learning many-sided flat building mathematics where students can calculate the circumference and area of the engkle plot made (Irawan & Kencanawaty, 2017). In addition to crank games, there are

other games, such as congklak. Irawan et al. (2020) explained that conglak is a game that explains material about counting and counting, addition, and subtraction for elementary school students from grade 1 to grade 3. In addition to games with local wisdom, we can also use household appliances such as nyiru, aseupan, hihid, and boboko. Because these household appliances can be calculated for surface area, this is in line with Wahyuni (2021), which explains that there is ethnomathematics in Sundanese household appliances such as nyiru, aseupan, hihid, and boboko, which contains several mathematics learning concepts at the elementary and junior high school levels.

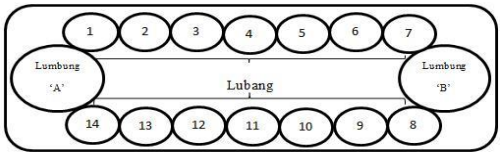

Figure 2. Congklak

Figure 2 explains that in the game of congklak, there are 16 barns, and played by two people. Then granaries 1-14 are filled with seven congklak seeds (Rahim et al., 2018). The first player uses granary numbers 1-7 and granary "A" while the second player uses granary numbers 8-14 and granary "B". Initially, each hole is filled with N stones. A large hole is empty, then the large hole on the player's right side represents his score and is usually played with N = 7 Field (Kasim, 2016). When moving seeds from one granary to another, there is a process of counting, adding and subtracting.

Figure 3. Nyiru, Aseupan, Hihid, dan Boboko

In Figure 3, it can be seen that Sundanese household appliances can be associated with geometry. That means ethnomathematics plays a role in bridging between Sundanese culture in the form of household appliances and mathematics in the form of geometric integration. In developing students' understanding of geometry, the geometry shape itself needs to be contextualized. It is expected to help students build imagination in constructing a geometric shape or solving everyday geometry-related problems. The geometry needs to be taught because it is a field of

mathematics that can be associated with real-world and can visualize mathematical ideas. Geometry concepts can be applied to specific fields of work that require design using the concepts of building two-dimensional and three-dimensional figure (Susilastuti and Permana 2021).

Nyiru, aseupan, hihid, and boboko can be given as case studies to students because these household tools represent two-dimensional and three-dimensional figures. For example, aseupan accurately visualizes conical shapes in everyday life. Sundanese people use aseupan as a tool to cook half-cooked rice. Besides that, aseupan can be used as a tool to make a tumpeng. The integration of aseupan into mathematics through ethnomathematics can be quickly done. For example, teachers can ask lighter questions about the use of aseupan in the daily life of Sundanese people. Afterward, the teacher can explore information about the similarity between aseupan and cones, followed by providing questions related to food that can be created using aseupan until calculating the volume of food made using the aseupan. Thus students can use concepts from measurement and geometry.

Ethnomathematics can improve students' mathematical problem-solving skills in mathematics learning, especially in working on problem-solving that is relevant to the culture in direct proportion to Martyanti (2017), who explained that ethnomathematics helps students in learning, analyzing, and practicing learning activities by solving culturally relevant problems. Implementing an ethnomathematical approach to mathematics learning can improve student learning outcomes (Ajmain et al. 2020; Sulaiman and Nasir 2020; Yumiati et al. 2023).

CONCLUSION

Ethnomathematics-based mathematics learning can improve student learning outcomes by learning, analyzing, and practicing in learning activities. In addition, ethnomathematics-based mathematics learning can improve students' problem-solving abilities, especially in everyday life, because ethnomathematics will relate to culture in everyday life contextually. Thus, students can feel that mathematics is the problem they find daily, emphasizing what they see.

Integrating ethnomathematics indirectly can increase understanding and open new insights about local cultures, such as Sundanese culture. Some Sundanese cultures can be implemented, such as doing non-standard calculations using units/symbols

used by Sundanese people, such as length units, width units, height units, and volume units. And can also integrate household appliances made of woven bamboo, connected with geometry material in mathematics learning. Some Sundanese games can be integrated into ethnomathematics, such as congklak and engkle. Thus students are expected to increase their insight into Sundanese culture and achievements simultaneously.

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