JPP

by Jpp Jpp

Vol. 12, No. 2, pp. 785-795, 2022 DOI: 10.23960/jpp.v12.i2.202230

Jurnal Pendidikan Progresif

e-ISSN: 2550-1313 | p-ISSN: 2087-9849
http://jurnal.fkip.unila.ac.id/index.php/jpp/

How do Digital Native Students Responses to Balinese Ethnomathematics Problems?

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Received: 07 May 2022 *Accepted: 04 June 2022* *Published: 10 June 2022*

Abstract: How do Digital Native Students Responses to Balinese Ethnomathematics Problems? Objectives: This study determines digital native students' responses to ethnomathematical problems in Balinese culture. **Methods:** This study uses descriptive analysis techniques. The subjects were 42 students of class VIII.1 and VIII.5 SMP Widiatmika. Data was collected through questionnaires, tests, and interviews. The student response questionnaire consists of 3 aspects, namely familiar or not familiar, appropriate or not appropriate, and interested or not interested. The responses data the percentage of positive and negative responses is then calculated. **Findings:** The results showed that only 16.67% of students are familiar with Balinese ethnomathematics problems, 95.24% of students considered that the ethnomathematics was appropriate in learning mathematics, and 90.48% of students are interested in ethnomathematics. **Conclusion:** It was found that digital native students tend to give a positive response but are unable to understand Balinese ethnomathematics. From these findings, Future learning is expected to become a culture and technology-based learning.

Keywords: Digital Native Students**,** Ethnomathematics, Student Response, Problem Solving, Balinese Culture.

Abstrak: Bagaimana Respon Siswa Generasi Digital Native terhadap Masalah Etnomatematika Bali? Tujuan: *Penelitian ini untuk mengetahui respon siswa digital native terhadap permasalahan etnomatematika dalam budaya Bali.* ***Metode:*** *Penelitian ini menggunakan teknik analisis deskriptif. Subjek penelitian adalah 42 siswa kelas VIII.1 dan VIII.5 SMP Widiatmika. Pengumpulan data dilakukan melalui angket, tes, dan wawancara. Angket respon siswa terdiri dari 3 aspek yaitu familiar atau tidak familiar, sesuai atau tidak sesuai, dan tertarik atau tidak tertarik. Data tanggapan kemudian dihitung persentase tanggapan positif dan negatifnya.* ***Temuan:*** *Hasil penelitian menunjukkan bahwa hanya 16,67% siswa yang paham dengan masalah etnomatematika Bali, 95,24% siswa menganggap etnomatematika sesuai dalam pembelajaran matematika, dan 90,48% siswa tertarik dengan etnomatematika.* ***Kesimpulan:*** *Ditemukan bahwa siswa digital native cenderung memberikan respon positif tetapi tidak mampu memahami etnomatematika Bali. Dari temuan tersebut, pembelajaran masa depan diharapkan menjadi pembelajaran berbasis budaya dan teknologi.*

Kata Kunci: *Siswa Digital Native, Etnomatematika, Respon Siswa, Pemecahan Masalah, Budaya Bali*

To cite this article:

Payadnya, I., P., A., A., & Jayantika, I., G., A., N., T. (2022). How do Digital Native Students Responses to Balinese Ethnomathematics Problems?. *Jurnal Pendidikan Progresif*, *12*(2), 785-795. doi: 10.23960/jpp.v12.i2.202230.

INTRODUCTION

The development of the era towards the digital era has caused many changes in human life. The digital era is a period where most people in that era use digital systems in their daily lives (Rahayu, 2019). Advancement in technology, education, and media by using mobile phones, computers, and the internet, has encouraged humans to improve efficiency and effectiveness in their daily activities (Setiyani, 2020). The digital era causes various changes in various sectors, one of which is the education sector.

The influence of the digital era in the field of education is very significant. According to Afif (2019), digitalization will progress very quickly, namely through the emergence of various learning sources and the spread of mass media, especially the internet and electronic media as sources of knowledge and educational centers. The impact is that teachers/educators are not the only sources of knowledge. As a result, students can master knowledge that has not been mastered by the teacher. Various other developments, such as online learning, which methods and learning media dominate in this Pandemic era, started the era of education disruption towards digitalization. To enter the digital era, students and teachers learn and need to be proficient in information (Setyosari, 2015). With this view, Spiers & Bartlet (2012) stated that to search for information, students need to be equipped with new skills and strategies related to literacy skills. A student may be equipped with the skills to use technology to search for information but not have the necessary skills to select the appropriate information from the number of available facilities.

Rapid developments in the field of technology will have an impact on aspects of the culture and values of a nation. The convenience provided by technology in the digital era has also given birth to a different generation than before. This new generation consists of students who are technologically literate and live in an environment filled with technological advances and internet media. This generation is known as a digital native. 'Digital native is a term used to describe a generation that has been surrounded by digital tools in everyday life since birth. Their way of thinking and learning is different from the previous generation, which is different from digital natives who are often called 'digital immigrants' (Kivunja, 2014). It is said that they use technology 'like breathing air' (Tapscot, 2009); for example, they can study while listening to music or chatting online.

Another assumption that characterizes Digital Natives is that this generation prefers to receive information quickly; proficient in processing information quickly; prefers multi-task and non-linear access to information; has a low tolerance for lectures; prefers active rather than passive learning, and relies heavily on communication technologies to access information and to engage in social and professional interactions (Prensky 2001a) Technology also causes the digital native generation to tend not to pay attention to their culture. Though this culture is one important aspect of mathematics education. Because the characteristic of realistic mathematics is to bring students closer to their environment, students need to understand mathematics through its culture. Understanding mathematics through culture is at the heart of ethnomathematics.

Ethnomathematics is defined as mathematics practiced by cultural groups, such as urban and rural communities, labor groups, children of certain age groups, indigenous peoples, and others (Rachmawati, 2012). Ethnomathematics can also be considered as an approach that aims to study how students can understand, articulate, process, and ultimately use mathematical ideas, concepts, and practices that can solve problems related to their daily activities. Pathuddin et al (2021) added that ethnomathematics is the field of study explaining the relationship between mathematics and culture.

Ethnomathematics is very important because it is one of the indicators of the realization of realistic mathematics learning and is a determinant of students' mathematics success. Several studies have demonstrated the role of ethnomathematics in learning mathematics. Research by Darmayasa et al. (2019) found that ethnomathematics has a very important role in the era of the industrial revolution 4.0, where the presence of ethnomathematics can be a bridge between advances in information and communication technology and culture that flows from generation to generation of Indonesian people. In addition, a person's mathematical ability is influenced by their cultural background, because what they do is based on what they see and feel or experience in the environment closest to them (Darmayasa et al, 2019; Zusmelia, 2016). According to Nur et al. (2019) and Awaliyah (2019), ethnomathematics needs to be considered as a curriculum material that has its standards to improve students' mathematical abilities. In addition, Prahmana & D'Ambrosio (2020) found that ethnomathematics in Indonesia does not only stop at cultural exploration and experiments on mathematics learning in several schools but also the future, it can also be introduced to the mathematics education curriculum in Indonesia. Several studies have not specifically discussed how the response of digital native students to ethnomathematics problems in Balinese culture.

The existence of a digitally native generation whose daily life is always side by side with technology can produce a generation that is literate, but also not familiar with the culture. Given the importance of culture in learning mathematics that is manifested in ethnomathematics-based learning, it is very important to know in depth how students of the digital native generation respond to ethnomathematics problems. Therefore, the researchers conducted research on "How Digital Native Students Responses to Balinese Ethnomathematics Problems?". The purpose of this study was to obtain detailed responses from digital native generation students to culture-based mathematics. The results of this study are expected to provide information and become the basis for determining the right mathematics learning for the digital native generation so that they are close to cultural values in understanding mathematical concepts.

■ METHODS

The type of research is descriptive research. In this study, what is described is the digital native student's response to ethnomathematics problems. Thus, the object of this research is the student's response to ethnomathematical problems in Balinese culture given at school.

This research was conducted on eighth-grade students of SMP Widiatmika which is located in Jimbaran, Badung Regency, Bali. The research subjects were chosen because SMP Widiatmika is one of the schools in Bali that is active in introducing Balinese culture to students to support the preservation of Balinese culture. Of the 10 classes, two classes were selected, namely class VIII.1 and VIII. 5 which is a representative class as a sample by purposive sampling. The total research subjects were 42 students.

This research went through the following procedures: 1) Initial observation, 2) Preparation of instruments in the form of questionnaires and tests, 3) Testing the validity of the instrument, 4) Application of the instrument, 5) Data collection, 6) Interview, 7) Data analysis, 8) Drawing conclusions, and 9) Preparation of reports.

The material used in this study is geometric material related to Balinese culture. Several ethnomathematical forms of geometric concepts taken are the concept of Balinese Hindu ceremonial facilities and the concept of traditional Balinese buildings. The data collection technique in this study used a description test of 3 questions regarding the ethnomathematics of geometric concepts in Balinese culture. The results of students' answers were then analyzed to find out how students' abilities and understanding of ethnomathematical concepts existed in Balinese culture. The following are the problems given to students.

1. Gede will make a Klakat for a religious ceremony. Gede was given 12 pieces of bamboo that were ready to be assembled to make a Klakat. The length and width of the bamboo are 25 cm and 1 cm. How many holes were in the Klakat design made by Gede? What is the area and perimeter of the Klakat and what is the total area of the holes in the Klakat?

Figure 1. Example of Klakat

2. Sintia wants to make Ituk-ituk with sizes like the one below.

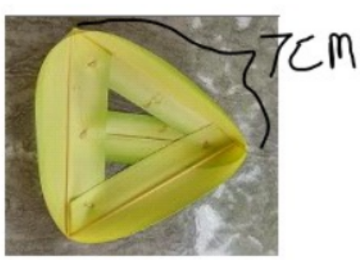

Figure 2. Example of Ituk-Ituk

If Sintia has busung (coconut leaves) that are 1 m long each, how many Ituk-ituk can be made from one of these leaves?

3. Mr. Made will build a Pelinggih like the picture below on his land measuring 10x10 m.

Figure 3. Example of Pelinggih Roof

If the height of the Pelinggih roof is 1 m and the volume of the Pelinggih roof is 4 m^3, how many Pelinggih can be lined up on the ground?

The instrument used in this study was a student response questionnaire. This response questionnaire aims to provide opportunities for students to provide their responses about mathematical concepts in Balinese culture given in the form of ethnomathematical problems. The student response questionnaire component consists of 3 aspects that adapted from Simanjuntak & Imelda (2018), namely familiar or not familiar which aims to measure how familiar digital native students are with mathematical concepts in Balinese culture, appropriate or not appropriate which aims to find out how appropriate mathematics problems in Balinese culture are to be applicated in learning activity to digital native students, and interested or not interested to find out how interested digital native students are to mathematics problems in Balinese culture. The component that is assessed in each aspect is the type of ethnomathematical questions given to students.

Student responses were measured using a questionnaire through the number of positive or negative responses for each given category. The response is said to be positive if students are familiar with the problems given, the problems given are familiar for students, and the students think that the prroblems appropriate and interesting. On the other hand, the response is said to be negative if students are not familiar with the problems given, the problems given are not appropriate for students, and students are not interested in the problems given.

The instrument in this study was calculated using the content validity formula. Gregory (2000) developed a technique for testing the validity of content that has been quantified. The mechanism for testing content validity according to Gregory is as follows.

1. Experts who are trusted to assess the instrument conduct an assessment of the itemized instrument, using a certain scale, for example a 1-2-3-4 scale.
2. Grouping the scale, a score of 1-2 is grouped into less relevant and a score of 3-4 is grouped into very relevant.
3. The results of the expert assessments are cross tabulated, for example for the two assessors as follows.

Tabel 1. Tabulation of Expert Assessment

		Validator 1	
		Less Relevan (score 1-2)	Very Relevan (score 3-4)
Validator 2	Less Relevant (Score 1-2)	(A)	(B)
	Very Relevant (Score 3-4)	(C)	(D)

Calculation of content validity with the formula:

$$\text{Content Validity} = \frac{??}{?? + ?? + ?? + ??}$$

The student's answer questionnaire data is then recapitulated and the percentage of positive and negative answers is calculated using a simple calculation formula, that is:

$$\frac{Number\ of\ Positive\ or\ Negative\ Response}{Total\ Number\ of\ Students} x100\%$$

RESULT AND DISCUSSIONS

The results of the expert test show that the value of the content validity of the instrument is 1. So, the instrument is valid and feasible to use. From the results of the student response questionnaire using 3 aspects namely familiar or not familiar, appropriate or not appropriate, and interested or not interested, students got a positive and negative response. The following is a breakdown of student responses in each aspect.

Discussion

From Table 2, it can be seen that only 16.67% of students are familiar with ethnomathematical problems in Balinese culture. This gives negative responses from students that caused by digital native students who mostly don't know the concepts of mathematics from their own culture. This is following the research results from of Rusdiyani (2016) who found that the digital native generation tends to ignore the cultural values they have. Meanwhile, positive responses were shown by appropriate and interesting aspects, while 95.24% of students considered that the ethnomathematical problems presented were appropriate for inclusion in learning mathematics and 90.48% of students are interested in learning more about ethnomathematical concepts in Balinese culture. This is because ethnomathematics-based learning can increase students' motivation and interest in learning. This finding is in accordance with result found by Sari et al. (2020) that stated thus ethnomathemics-based learning with cultural context for junior high school students, received a positive response that is more interesting and increased student interest in learning. In addition, Muhtadi et al. (2017) states that mathematics is a cultural product since the development of mathematics would not be separated from the development of existing culture.

The results shows that although students are not familiar with mathematical problems in Balinese culture, students feel that ethnomathematics problems like this are appropriate and interesting math problems to work on. Since the extent of mathematical knowledge is growing and has implications for how mathematics influences the development of culture in order to achieve a civilization. This means that students provide an acceptable response to ethnomathematics problems in learning. This is following the results of research from Sari (2020) which states that students show good response results in helping students learn mathematics, as well as an interest in knowing culture to make students' interests in learning mathematics better.

The positive response shown by these students indicates that the concept of ethnomathematics in Balinese culture can be well received by students. Ethnomathematics can increase student interest in learning as well as a challenge that can be a means to improve students' mathematical abilities. Students consider ethnomathematics, especially in Balinese culture, an interesting problem to solve. This is in line with the results of research by Wulantina et al. (2019) which states that ethnomathematics-based mathematics teaching materials can foster student interest in learning mathematics, increase student motivation in learning mathematics, and make students feel satisfied and happy in learning mathematics. In addition, Khairida (2019) found that the application of an ethnomathematical-based learning approach could significantly increase students' interest in learning and cognitive aspects. In this case, it is also known that ethnomathematics-based learning provides opportunities for students to recognize and understand mathematics learning.

The positive response shown by the students was not matched by the students' ability to solve ethnomathematical problems. Most students have difficulty solving ethnomathematical problems in the given Balinese culture. Most of the students are not able to understand the given ethnomathematical problems and are not able to translate real conditions based on culture into mathematical concepts. The following are examples of student answers.

In answering Problem 1, students tend not to be able to understand the problem well so they make mistakes in calculations. Students are also not able to identify the information from the problems. The following are examples of students' answers.

Translation:

Knowing: Gede was given bamboo sticks that are ready to assemble to make 12 Klakat with a length of 25 cm and a width of 1 cm.

Question: Klakat with how many holes can be made?

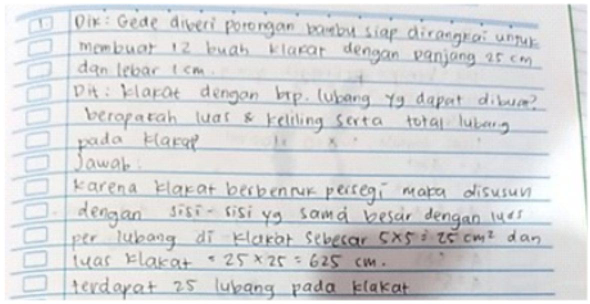

Figure 6. Example of student's answer in problem 1

What is the area and perimeter of the total holes of the Klakat?

Answer: Since the Klakat is a square so it's arranged on the same side with the same size with the area of each hole is 5 x 5 = 25 cm² and the area of Klakat is 25 x 25 = 625 cm.

There are 25 holes on the Klakat

From Figure 6, it can be seen that the student didn't fully understand the information given in the questions. From the knowing part of the student's answer, the student understands that the size of bamboo sticks is 25 cm x 1 cm but thinks the number of bamboos given (12 pieces) is the number of Klakat that must be made. The student also obtained the hole size from Klakat which was 5 x 5 cm without giving any reasons for choosing this size. The student was able to understand the purpose of the question but are unable to understand the information provided.

In answering Problem 2, students did not seem to be able to understand and identify information from the questions appropriately. The following are examples of student answers.

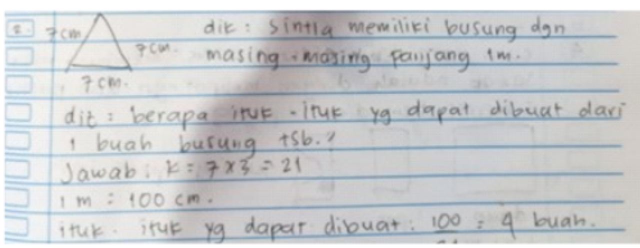

Figure 7. Example of student's answer for problems 2

Translation:

Equilateral Triangle picture with a side of 7 cm

Knowing: Sintia has busung (coconut leaf) with a length of 1 m

Question: How many Ituk-Ituk can be made from 1 busung?

Answer: Perimeter = 7 x 3 = 21

1 m = 100 cm

The number of Ituk-ituk can be made: 100/4 = 4 pieces

From Figure 7 it can be seen that the students did not fully understand the questions given. Even though the student was able to provide simple reasoning, students do not realize the middle part of the Ituk-ituk which requires an additional part so that the student only count the side of the Ituk-ituk. This causes the student to produced more Ituk-ituk than they should be able to make using 1 busung.

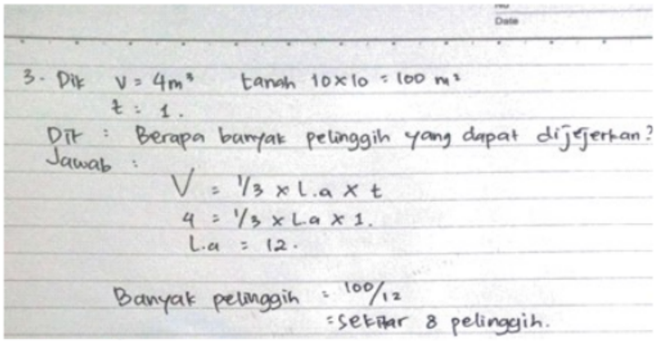

Figure 8. Example of student's answer for problem 3

Problem 3 is the most complex problem among the three where in addition to having to understand the questions and information provided well, students must also be able to make appropriate representations to get the right answer. The following are examples of student's answers from the high group to Problem 3.

Translation:

Knowing: V = 4 m^3, Height = 1 m

Ground = 10 x 10 = 100 m^2

Question: How many Pelinggih can be lined up?

Answer: V = 1/3 x Base Area x Height

4 = 1/3 x Based Area x 1

Based Area = 12

The number of Pelinggih = 100/12 = around 8 Pelinggih

From Figure 8, it can be seen that this student wasn't able to fully understand the problem and was less successful in developing appropriate problem-solving strategies. The student managed to understand that what must be sought first is the size of the Pelinggih roof base to determine the number of Pelinggih that can be lined up on the land. However, the student stopped only until they find the base area of the Pelinggih roof and use procedural ways to determine the number of Pelinggih that can be lined up by dividing the land area by the area of the Pelinggih roof base. This method will produce an incorrect answer because the results obtained do not represent the exact number. First, not all of the 8 Pelinggih can fit on the land, the student should use the side of the Pelinggih roof base and draw an appropriate plan to determine the number of Pelinggih that can be lined up on the land. Second, the student did not take into account that Hindu temples usually do not place Pelinggih in the middle of the land and only line up Pelinggih on the side of the land. Because of this, the student's answers were not correct.

From the results of the analysis of student's answers, it was found that digital native students tend not to be able to understand mathematical concepts in culture. Students tend to be less relatable to the problems presented. This is due to the characteristics of digital native students who use technology more as a source of knowledge and activities. Following what was conveyed by Thompson (2013) who stated that the development of technology has influenced their learning habits and behaviors during childhood and adolescence. This strong influence of technology causes digital native students to become dependent on technology and often forget things in their environment. Digital native students also assume that all the things they need have been provided by technology so they often don't care about other things and unconsciously form their knowledge with technology such as the internet and social media as the main source.

From the results obtained, although students are less familiar with ethnomathematics problems, it turns out that students find ethnomathematics problems challenging and interesting to solve. From the results of the interviews, it was found that students considered ethnomathematics problems to be interesting problems presented in learning. This is because students feel that ethnomathematics problems are different from what they are used to so far and can connect and increase their knowledge of the real world and their culture. Students also stated that they prefer to work on ethnomathematics problems together with their friends. Following the characteristics of digital native students who prefer to learn in technological environments and informal learning structures, valuing unlimited space and time, have short attention spans, expect quick feedback, prefer teamwork, prefer learning through activity rather than reading and listening, and prefer to use mobile devices (Sarkar et al., 2017).

From these findings, in the future, learning is expected to be designed to suit the characteristics of digital native students who like technology-based learning but cultural aspects such as ethnomathematics should not be forgotten. To realize this learning, cultural elements can be included in the technology-based learning media used by teachers. This will make students more interested and more familiar with mathematical concepts in their culture.

■ CONCLUSIONS

From the results of research and discussion, it is known that students give positive and negative responses to the given ethnomathematical problems in Balinese culture. Students tend to be unfamiliar with ethnomathematical problems in Balinese culture that are presented. However, even though students are not familiar with ethnomathematical problems, most students also find ethnomathematical problems challenging and interesting to learn. From these findings, it is hoped that in the future teachers will be able to design appropriate learning for digital native students based on technology and equipped with cultural elements.

The limitation of this research is in terms of the material which still focuses on geometry. Development can be done in other ethnomathematics materials in Balinese culture and other regional cultures. Other ethnomathematical materials that can be taken are for example: day calculation system, measurement system, price calculation in traditional markets, and others. In addition, this research is also limited to junior high school students. It would be better if this research could later be expanded to other level students and involve more students as participants.

This research will have a positive impact on the development of mathematics education in Indonesia. This research can be used as a basic reference for a teacher in preparing learning designs that are used in order to improve students' mathematical abilities through culture-based learning.

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