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Development of Ethnomathematics Student Worksheets Based on Augmented Reality on Geometric Material

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ABSTRACT: The aim of this research is to describe the results of the development of Augmented Reality Based Ethnomathematics Student Worksheets (LKPD). This research is motivated by a problem being faced by 5th grade teachers at Islamic Global School Malang Elementary School, namely the absence of interactive learning media to support students' abilities, so that students tend to find it difficult to understand geometric material. This type of research is R&D Research and Development using the 4D research method, namely define, design (planning), develop, disseminate, but the research only reaches the development stage. The population used in this research was 20 grade 5 students at SD Islamic Global School Malang. The sampling technique is a purposive sampling technique. The test subjects were divided into two, namely expert trials and student response trials. The subject of expert testing was carried out by 3 mathematics education lecturers at Insan Budi Utomo University Malang and 1 class teacher at SD Islamic Global School Malang. The sample method used was purposive sampling. Purposive sampling was used because of several criteria. Namely, students received material based on the curriculum, LKPD, and the same class facilities were used and taught by the same teacher. The samples were 5th grade students and teachers at Islamic Global School Malang Elementary School. Data collection techniques use observation and questionnaires. The data analysis technique in this LKPD development research is a Likert scale using 2 types of data, namely qualitative data and quantitative data. Qualitative data was obtained from interviews at the defined stage and qualitative data was obtained from expert assessment questionnaires and student response questionnaires. Based on the results of the research and discussion, it can be concluded that the development of Augmented Reality-based Ethnomathematics Student Worksheets (LKPD) can be used in learning. This is based on the results of expert validation by obtaining a percentage of 96.33%, with a percentage of 100% for the suitability of the indicator, a percentage of 95% for the augmented reality indicator, a percentage of 88% for the language suitability indicator, a percentage of 100% for the interest indicator display, 100% percentage on material suitability indicators, and 95% percentage on ethnomathematicsindicators.

KEYWORDS: augmented reality, ethnomathematics, LKPD.

INTRODUCTION

Mathematics is one of the subjects that is expected to shape students to have the ability to solve problems both in mathematical problems and everyday problems, so that mathematics has been taught from elementary school level to university level (Nurulaeni, 2022). Mathematics is closely related to the problem solving process, because mathematics is an exact scientific discipline that requires reasoning and creative thinking in understanding a theorem. Students' ability to solve mathematical problems becomes a provision in facing the era of globalization in the future (Aledya, 2019). But in fact the results of the 2018 survey conducted by one of the international programs that measures the level of educational success in a country, namely the Program for International Students Assessment (PISA), stated that in the mathematics category, Indonesia was ranked 7th from the bottom (73rd out of 79 countries) with average score 379. (Hewi, 2020)

Based on the results of observations that have been made using interviews with a mathematics teacher at the Islamic Global School Malang Elementary School, the difficulties experienced by students are almost the same, namely working on questions related to geometric shapes, most students have difficulty understanding word problems so there are still many errors in carrying out calculations. This is also in line with the results of research conducted by Lipianto and Budiarto which stated that there were still students making mistakes in writing the final answer correctly and students tending to memorize without understanding the concepts related to the material. (Ambarita, 2023)

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Currently, the difficulties experienced by the majority of students in spatial geometric material are caused by several factors, including a lack of understanding of the basic material (namely plane geometric material), a lack of mastery of the Pythagorean Theorem, a lack of mastery of the concept of spatial figures, and a lack of mastery of spatial geometric context problems (Lois, 2022). One of the factors causing students' low mathematical problem solving abilities is a lack of interest in learning mathematics because they think that mathematics has too many formulas that are difficult to understand (Ikha, 2021). Interest in learning mathematics is one of the important factors that influences mastery of mathematical concepts in solving mathematical problems (Fikri, 2022). Without interest in students, it will be difficult to develop students' desire to learn mathematics, because this interest will encourage students to continue trying to find strategies by using all their abilities to produce creative ideas to find solutions to solving mathematical problems. (Siagian, 2016). In line with that, based on the results of interviews with class teachers at Islamic Global School Elementary School, the teaching materials used are still monotonous and conventional without compiling their own teaching materials. And it has not provided learning experiences and has not been able to encourage the development of students' thinking abilities. Therefore, it is necessary to develop teaching materials that can help students learn material more meaningfully.

One way to increase students' interest in learning mathematics is to apply the concept of ethnomathematics to learning. Ethnomathematics has the potential to help students develop significant interest in learning mathematics. Ethnomathematics-based Student Worksheets (LKPD) are teaching materials that use the cultural context of certain areas in learning mathematics, so that they will make students feel familiar and love and understand more because they consider mathematics to be part of their culture. In line with Francois, the expansion of the use of ethnomathematics in accordance with students' cultural diversity and with the practice of mathematics in their daily lives brings mathematics closer to the students' environment because ethnomathematics is implicitly a program or activity that conveys values in mathematics and mathematics education. (Ayuningtyas, 2019)

According to previous research, the application of ethnomathematics concepts in mathematics learning is very effective in increasing students' interest and understanding regarding mathematics material. Research conducted by (Dosinaeng, 2020) with the title "Ethnomathematics for Middle School Students: Exploration of Geometry Concepts in Boti Tribe Culture." shows the results that culture can be used as a context in the mathematics learning process, such as the axioms of points, lines and planes, the concept of tangent lines, the concepts of area and volume of geometric shapes.

Ethnomathematics concepts can also be integrated with technology. This is effective according to research conducted by (Ayu, 2020) with the title "Development of Prezi Learning Media Based on Ethnomathematics on Flat Building Materials", which states that integrating culture using interactive media is effective because it is not only easy to understand but also contains cultural values. local so that mathematics learning is more meaningful, this is proven by survey results which stated that 97% were in the very practical category. This interactive media is accompanied by the use of ZUI (Zooming User Interface) technology where students can have more freedom to regulate the size of the material. Apart from that, research conducted by Ilmawan Mustaqim with the title "Utilization of Augmented Reality as a Learning Media", states that Augmented Reality (AR) is a new technology that is capable of combining two-dimensional or three-dimensional virtual objects into a real environment and then generating or projecting them automatically. real time. (Mustaqim, 2016)

Considering the importance of geometry material in the learning process, the role of Student Worksheets (LKPD) is needed to help students understand the material according to students' daily experiences. Worksheets are part of print media. Print media is a general term used in reference to media that distribute printed materials. Print media in education is a program that is widespread throughout the world which is used as a forum or means for disseminating educational information (Yaumi, 2018). In connection with the country of Indonesia which has potential and cultural diversity that can be utilized and connected to mathematics in everyday problems to increase students' mastery of mathematics. In this case, the researcher took spatial construction material found at the 5th grade elementary school level due to students' difficulties and many everyday problems that can be connected to local cultural ethnomathematics. Based on the explanation above, it is necessary to develop Student Worksheets (LKPD) which can improve the learning atmosphere of students and can be understood easily in accordance with the social and cultural conditions in their region.

RESEARCH METHODS

This type of research is R&D Research and Development using the 4D research method, namely define, design (planning), develop, disseminate, but the research only reaches the development stage. The population used in this research was 20 grade 5 students at SD Islamic Global School Malang. The sampling technique is a purposive sampling technique. The test subjects were divided into two, namely expert trials and student response trials. The subject of expert testing was carried out on 3

mathematics education lecturers at Insan Budi Utomo University Malang and 1 class teacher at SD Islamic Global School Malang. The sample method used was purposive sampling. Purposive sampling was used because of several criteria, namely students received material based on the curriculum, LKPD, the same class facilities were used and taught by the same teacher. The samples were 5th grade students and teachers at Islamic Global School Malang Elementary School. Data collection techniques use observation and questionnaires. The data analysis technique in this LKPD development research is a Likert scale using 2 types of data, namely qualitative data and quantitative data. Qualitative data was obtained from interviews at the define stage and qualitative data was obtained from expert assessment questionnaires and student response questionnaires. The results of data analysis are used to revise the LKPD with the following assessment guidelines:

Table 1 . Likert Scale Scoring Rules

Score	Information
1	Invalid
2	Less Valid
3	Valid
4	Very Valid

Then the data that has been collected is analyzed into percentages with the following formula: (Ridwan, 2019)

$$P = \frac{Number\ of\ data\ scores\ collected}{Maximum\ Number\ of\ Scores}\ x\ 100\%$$

Where P is the percentage of validity of ethnomathematics-based teaching materials and the ideal score is obtained from the highest score of each respondent.

The final step is to change the percentage value that has been obtained into qualitative form and then conclude the value based on the following table criteria: (Ridwan, 2019)

Assessment criteria table :

Highest score = 4 (very valid), the highest score percentage = $\frac{4}{4}$ × 100% = 100%

Lowest score = 1 (very poor), lowest score percentage = $\frac{1}{4}$ × 100% = 25%

Range = 100% - 25% = 75%

So the interval distance = $\frac{75\%}{4}$ = 18,75%

Table 2. Percentage range and quality criteria for student worksheets (LKPD)

Score	Information
25,00% - 43,74%	Invalid
43,75% - 62,49%	Less Valid
62,50% - 81,24%	Valid
81,25% - 100%	Very Valid

LKPD can be used if it meets valid criteria, and is very valid. However, if it is not valid or invalid, there needs to be revision and review so that the LKPD can be used by students..

RESULTS AND DISCUSSION

Before carrying out development, the researcher first made initial observations by conducting interviews with the supporting teachers to find out what media had been used and the needs needed for this development. From the results of these observations, it was found that the goal of mathematics learning for grade 5 elementary school in the Merdeka curriculum

is that students are able to understand the differences in drawings of prism shapes, know the number of edges of a prism, know the number of corner points of a prism, know the sides of a prism and a cylinder, and can draw sketches/nets. prisms and tubes. Apart from that, it was found that what causes students' low understanding is the absence of interactive teaching materials that are able to support the learning process, while the facilities provided by the school are very adequate to be utilized optimally.

Based on the description above, these conditions and potential support researchers to develop Augmented Reality-based Ethnomathematics Student Worksheets (LKPD) on geometry material. The prepared LKPD is then validated by experts with the following explanation:

Table 3. Media Expert Validation

No	Aspect Indicator	Percentage	Criteria
1	Suitability Of Presentation	100,00%	Very Valid
2	Augmented Reality	95,00%	Very Valid
3	Display Interest	100,00%	Very Valid
Total		98,33%	Very Valid

In the media expert assessment, there are three assessment indicators presented in the table above. Based on the table above, the overall assessment of the LKPD is included in the very valid criteria with a percentage of 98.33%. This shows that the presentation given is in accordance with the guidelines for preparing LKPD on spatial construction material for class V SD/MI students. (Salaudin, 2019)

Table 4. Material Expert Validation

No	Aspect Indicator	Percentage	Criteria
1	Language Suitability	88,00%	Very Valid
2	Validity Of Material	100,00%	Very Valid
3	Etnomatematics	95,00%	Very Valid
Total		94,33%	Very Valid

In the material expert assessment, there are three assessment indicators which are presented in the table above. Based on the table above, the overall assessment of the LKPD is included in the very valid criteria with a percentage of 94.33%. This shows that the presentation given is in accordance with the student handbook on spatial construction material for fifth grade SD/MI students. (Salahudin, 2019)

Table 5. Teacher Validation Results

No	Aspect Indicator	Percentage	Criteria
1	Suitability of Presentation	100,00%	Very Valid
2	Augmented Reality	95,00%	Very Valid
3	Language Suitability	88,00%	Very Valid
4	Display Interest	100,00%	Very Valid
5	Validity of Material	100,00%	Very Valid
6	Etnomatematics	95,00%	Very Valid
Total		96,33%	Very Valid

In teacher assessment, there are six assessment indicators which are presented in the table above. Based on the table above, the overall assessment of the LKPD is included in the very valid criteria with a percentage of 96.33%. This shows that the presentation given is in accordance with the student handbook on spatial construction material for fifth grade SD/MI students. (Salaudin, 2019) The Student Worksheet (LKPD) that was developed can be seen in table 3-5. After revising according to the experts' suggestions, the final product was the Ethnomathematics Student Worksheet (LKPD) based on Augmented Reality on geometry material.

The development of Augmented Reality-based Ethnomathematics LKPD has fulfilled the learning concept. Based on the concept of constructivism, learning is the result of student construction as a result of interaction with the surrounding environment. According to constructivism theory, the concept of learning is that students must find out for themselves and change complex information, check new information with old provisions, and change it if the provisions no longer apply. (Susanto, 2016)

According to M. Fanni Marufi Arif and Agus Wiyono Student Worksheets (LKPD) are teaching materials developed by educators as facilitators in learning. LKPD contains tasks that must be carried out by students as a form of training which aims to ensure that students can understand and understand the material being taught and can increase student activity in improving learning achievement. (Fitria, 2020)

Student worksheets can be used as a medium for active learning so that they require active student involvement in learning (Pada, 2021). Therefore, this LKPD is designed so that students can be actively involved in the learning process.

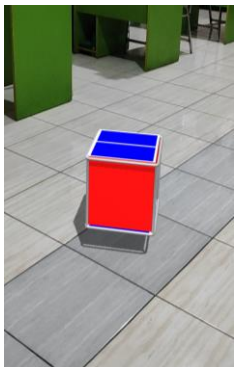
Gambar 1. Tampilan

Gambar 2. Tampilan Capaian

Gambar 3. Tampilan Review Materi

Gambar 4. Tampilan Langkah Etnomatematika

Gambar 5. Tampilan Barcode AR dan Petualangan Etnomatematika



Gambar 6.. Tampilan Augmented Reality

This Augmented Reality-based Ethnomathematics Student Worksheet (LKPD) is considered very valid by material experts, media experts and practitioners. The results of this research are supported by research conducted by (Utami, 2018). The results of this research show that ethnomathematics-based LKPD is very suitable and suitable for use in learning. Apart from that, research conducted by (Afifah, 2019) showed that the development of teaching materials containing augmented reality was able to foster student activity.

Apart from that, the LKPD developed can help the learning process, make it easier for students to understand the material and can make students learn actively. This statement is in accordance with research conducted by (Sartika, 2022) that student worksheets are student learning tools that contain various activities that will be carried out by students actively. These

activities take the form of observations, experiments, and asking questions. Therefore, student worksheets are related to the choice of learning strategies that are integrated into the entire learning process.

According to M. Fanni Marufi Arif and Agus Wiyono Student Worksheets (LKPD) are teaching materials developed by educators as facilitators in learning. LKPD contains tasks that must be carried out by students as a form of training which aims to ensure that students can understand and understand the material being taught and can increase student activity in improving learning achievement. (Pada, 2021)

Based on the explanation above, it shows the importance of developing ethnomathematics worksheet based on augmented reality. This Student Worksheet (LKPD) is a motivational tool to increase students' interest in learning. With the help of the Augmented Reality-based Ethnomathematics Student Worksheet (LKPD), students will try to solve problems related to building space and can explore the culture that exists in Indonesia as a form of cultural preservation. What has been explained above can conclude that the Ethnomathematics Student Worksheet (LKPD) based on Augmented Reality on Geometry Material can be said to be suitable for use.

CONCLUTIONS

The development of Augmented Reality-based Ethnomathematics Student Worksheets (LKPD) has provided a solution to the problem of fifth grade students at Islamic Global School Elementary School, where students' lack of interest in studying mathematics has affected students' understanding of geometry material, especially geometric shapes. With the Augmented Reality-based Ethnomathematics Student Worksheet (LKPD), teachers can also maximize school facilities such as a stable network and learning media using Android. This Augmented Reality-based Ethnomathematics Student Worksheet (LKPD) has gone through a validation process by experts. With this validation test, this LKPD has been declared valid.

Based on the research and discussion, it can be concluded that the development of Augmented Reality-based Ethnomathematics Student Worksheets (LKPD) on geometry material is very suitable for use in the learning process. This is based on media expert validation of 98.33%, material expert validation results of 94.33%, and practitioners or teachers of 96.33%.

This Ethnomathematics Student Worksheet (LKPD) based on Augmented Reality on Geometry Material can be a motivation for teachers to use it in classroom learning. The school principal can give instructions to teachers in the hope that this will be a motivation to make LKPD according to students' needs by utilizing existing facilities.

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