



Augmented Reality Assisted Mathematics Learning Media in The Covid-19 Pandemic

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Abstract

Utilization of cultural literacy is still low in the school environment. However, learning at Veterans Vocational High School is done online due to the Covid-19 pandemic which requires students to study at their respective homes. Augmented Reality as an alternative media for learning mathematics. The purpose of this study was to determine the use of cultural literacy as a medium for learning mathematics assisted by augmented reality in Veterans Vocational School. The design of this research is qualitative research. In this study, researchers tried to describe, identify, and classify the use of mathematics learning media in Veterans Vocational School. By taking a sample of 1 mathematics teacher and 9 students of class XI AKL. The researcher used the instrument in this study was a non-test instrument. The application of augmented reality learning media is only at the learning theory stage in the stimulus stage where mathematics learning material geometric transformation can be done by applying learning media using Cultural Literacy, namely "Batik Trusmi", in the learning process after students are given an understanding of geometric transformation students will be given examples of problem cases which usually happens in real life and is evident in Trusmi's batik art. The learning process is expected to be able to make students better understand the material of geometric transformation because students analyze problems that can be encountered in real life regarding the material.

Keywords: *Mathematics Learning Media; Augmented Reality; COVID - 19*

A. Introduction

The situation that is developing now is very unlikely for learning information to be carried out face-to-face. Face-to-face learning is classically vulnerable and has the potential to spread the corona virus in schools. Therefore, the distance learning model is recommended as a substitute. Conceptually, distance education is education in which students are separated from educators and learning uses various learning resources through cultural literacy as a learning medium. The Ministry of Education and Culture (Kemdikbud, 2017) states that, "Cultural literacy and citizenship skills are behavioral skills in culture. national identity as a nation's identity and understand the rights and obligations as citizens. Cultural literacy and citizenship is a person's ability to act as part of a culture and nation in their social environment.

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The government uses literacy education as a medium for inculcating the values of nationalism and patriotism in society in the millennial era through the National Literacy Movement program in Indonesia. According to the Minister of Education and Culture, Mr. Nadiem Makariem, he has decided to abolish the National Examination (UN) in 2021. The replacement is Minimum Competency Assessment (AKM) and Character Survey. The introduction of literacy for children from an early age has been widely carried out in developed countries, especially in Europe and America since the post 1970s. This is supported by the results of research and studies on the literacy skills of early childhood who are able to understand the formulation of the relationship between sounds and word meanings instantly so that children gain amazing literacy skills (Cahyana, 2020).

The development of increasingly advanced technology, of course, has an effect on various sectors of human life. This development also plays a role in the development of a learning media. Learning media is becoming more interesting and more concise even though it does not reduce the essence of the material. One of the developments of learning media that is currently still new is learning media using Augmented Reality. Augmented Reality is a technology that combines two-dimensional and or three-dimensional virtual objects into a real three-dimensional environment and then projects these virtual objects in real time. Unlike virtual reality which completely replaces reality, Augmented Reality only adds or complements reality.

Augmented Reality as an alternative learning media, is expected in a learning activity to be more interesting for students. Another benefit obtained is a more advanced learning media by utilizing current technological developments. Through Augmented Reality, it can be one solution to overcome distance learning because this Learning Media can be downloaded and installed on students' smart phones.

Utilization of Augmented Reality technology is needed by mobile devices. Mobile devices such as laptops, personal digital assistants, and cellphones have become learning tools with great potential for both classroom and outdoor learning, in this case they are very useful for conducting online learning at each student's home.

Cirebon City Veterans Vocational School is one of the private vocational schools in Cirebon City Vocational School which has implemented the Revised 2013 Curriculum or K13 REV dated July 13, 2016 until now by using the main teacher and student handbooks, Kemdikbud and other supporting media such as Cultural literacy, especially for learning media that is used to facilitate students in the teaching and learning process in Mathematics. Based on the documentation data of the Cirebon City Veterans Vocational School. Based on the observations of researchers at the Veterans Vocational School, the researchers saw that cultural literacy activities in schools had been carried out in 2017 there were several mathematics subject teachers who used cultural literacy as a medium of learning at the Veterans Vocational School in Cirebon City.

Culture in Indonesia produces various works of art that are incalculable in quantity and quality, especially in the City and Regency of Cirebon. One of them is Trusmi Batik. Trusmi batik has long had mathematical and geometric properties, although Trusmi batik makers did not realize that there was an application of geometric transformation in this Trusmi Batik work. The Trusmi Cirebon batik motif also contains the concept of transformation, such as reflection, translation, and rotation. The study of the concept of this transformation in batik motifs. Therefore, between Trusmi batik culture and Augmented Reality Technology, it is modified in such a way that it becomes an application that is used for cultural literacy-based mathematics learning media that is included in learning mathematics in class XI AKL even semester at KD 3.24. Geometry Transformation includes Materials: Translation, Reflection, Rotation, Dilation.

B. Theoretical Frameworks

1. Learning Media

The Association for Education and Communication Technology (AECT, 2017) defines media, namely all forms used for a process of distributing information. While the Education Association (NEA) defines as objects that can be manipulated, seen, heard, read or discussed along with instruments that are used properly in teaching and learning activities, which can affect the effectiveness of instructional programs.

Factors that can affect the learning process include teachers, students, and the surrounding environment. The teacher's learning process must create a pleasant atmosphere so that students can increase their activeness and creativity. The learning carried out should be varied, so that it affects the interest of students to study mathematics further (Arumsari., Sumliyah., 2019). Therefore, in this study, researchers will applying mathematics learning by using cultural literacy as a medium for learning mathematics assisted by augmented reality.

2. Mathematics Learning Media

Mathematics is one of the disciplines studied in educational institutions, given to students from elementary to higher levels. This indicates that mathematics as a subject that has a fairly important role, both the mathematical mindset in shaping students to be qualified and useful in everyday life, and by using mathematical concepts and principles, can help students to study things logically, creatively, and systematic. To support students' ability in learning mathematics. In essence, learning resources and media can be obtained from any form, while still containing elements of strengthening students' ability to understand concepts. As stated by Hamalik that the use of learning media in the teaching and learning process can generate new desires and interests, generate motivation and stimulation of teaching activities, and even bring psychological effects on students

3. Cultural Literacy as a Learning Media

Literacy skills and understanding of mathematical concepts are closely related, therefore the ability to understand concepts that are still low can also be caused by poor mathematical literacy, because in studying and answering questions, good mathematical literacy is needed (Arumsari., Sumliyah., 2019). Math learning activities will be more meaningful and easier understood by students if the material in learning can be related to culture or everyday life. The concept of learning mathematics that relates mathematics to culture or everyday life known as ethnomathematics (Arwanto et al., 2021)

Culture is a habit that contains elements of important and fundamental values that are passed down from generation to generation. The habits that are carried out cannot be separated from the application of mathematical concepts, thus providing unique and varied results. Arwanto argues that in Cirebon Trusmi batik contains mathematical elements, including geometrical concepts of symmetry, transformation (reflection, translation, and rotation), and congruence (Arwanto, 2017).

The use of the trusmi Batik context in Geometric Transformation material can also be used as a means to train students' higher-order thinking skills. One of the characteristics of learning that trains students' higher order thinking skills is using real contexts (Mu, 2017). Thus, through this ethnomathematical study related to Trusmi Batik, designs and learning media can be produced which are expected to facilitate students to develop higher order thinking skills.

One of the other advantages of using the Trusmi Batik context in learning mathematics is that it makes mathematics more interesting for students. In addition, the context used can also be used as a means for students to learn about civilizations in the past, so it is hoped that a sense of pride will grow as well as awareness to maintain and care for this historical heritage. This is in accordance with previous research studies, including research who have reported that ethnomathematical studies can

be used to explore various potentials that can be used as a means of learning mathematics, so that students become more motivated in learning mathematics. Augmented Reality (AR) (L. Hakim, 2018).

James said that Augmented Reality is a technology that combines two-dimensional or three-dimensional virtual objects and then projects these virtual objects in real time. Augmented Reality is defined as a technology that combines the real world with the virtual world, is interactive in real time, and is in the form of three-dimensional animation. Thus Augmented Reality (AR) can be defined as a technology that is able to combine virtual objects in two or three dimensions into a real environment and then display them or project them in real time (L. Hakim, 2016).

Augmented Reality is a concept of combining the virtual world with the real world to produce information from data taken from a system on a designated real object so that the boundary between the two becomes increasingly thin. AR can create interactions between the real world and the virtual world, all information can be added so that the information is displayed in real time as if the information is interactive and real. The concept of AR itself was first introduced by Thomas P. Caudell in 1990 in The Term 'Augmented Reality'.

There are three characteristics that state that a technology applies the AR concept::

- a. Able to combine the real world and the virtual world.
- b. Able to provide information interactively and in real time.
- c. Able to display in three-dimensional form. AR can be used to help visualize abstract concepts for understanding and structure of an object model of this trusmi batik.

Then there are several benefits regarding Augmented Reality (AR) technology for the world of education:

- a. AR technology can be used in object-based subjects, to provide a variety of learning methods and facilitate user visualization understanding.
- b. Helping users visualize abstract learning materials to be easier to understand.
- c. As a learning media that is more interesting and fun.

4. Online Learning During the Covid-19 Pandemic Masa

As of April 17, 2020, it is estimated that 91.3% or around 1.5 billion students worldwide are unable to attend school due to the emergence of the Covid-19 pandemic (UNESCO, 2020). This number includes approximately 45 million students in Indonesia or about 3% of the global affected student population (Fijanah, M.S.Safitri.N.R, 2020)

The widespread spread of Covid-19 has forced the government to close schools and encourage distance learning at home. Various initiatives were carried out to ensure that learning activities continued even in the absence of face-to-face sessions. Technology, more specifically the internet, smartphones, and laptops are now widely used to support distance learning. One of the largest telecommunications service providers in Indonesia recorded a 16% increase in broadband flows during the Covid-19 crisis, due to the sharp increase in the use of distance learning platforms.

However, this disruption to the traditional education system has harmed students who come from underprivileged families and those in rural areas. They are students who, even under normal conditions, already face barriers to accessing education. Now they need to face the additional barriers that inequalities have created to access technology infrastructure.

5. Use of Augmented Reality Learning Media in Veterans Vocational High School

Technological developments are increasing rapidly, advanced technologies are also created according to human needs in this modern era more modern. It can increase quality of human life (Rusnandi et al., 2016). There are three key points in this definition. First, this virtual environment is a computer-generated three-dimensional scene that requires high performance computer graphics to provide an adequate level of realism ((Vallino, 2011). Augmented Reality (3D) is a world merging app real with the virtual world in the form of two-dimensional and

three-dimensional projected in a real environment at the same time (Lukman Hakim, 2018). Sumliyah explained that The use of learning models supported by IT as an effort to refresh the learning process provides a new atmosphere that is not monotonous and has a broad scope of time allocation and unlimited in understanding the material, tasks and discussion (Sumliyah & Handoko.h, 2019).

Culture in Indonesia produces various works of art that are incalculable in quantity and quality, especially in the City and Regency of Cirebon. One of them is Trusmi Batik. Trusmi batik has long had mathematical and geometric properties, although Trusmi batik makers did not realize that there was an application of geometric transformation in this Trusmi Batik work. The Trusmi Cirebon batik motif also contains the concept of transformation, such as reflection, translation, and rotation. The study of these concepts in batik motifs. So from this trusmi batik culture, the Cultural Literacy-based Mathematics Learning Media at the Cirebon Veterans Vocational School is used in Class XI AKL Even Semester at KD 3.24. Geometry Transformation includes Material: Translation, Reflection, Rotation, Dilation.

With the help of Augmented Reality (AR)-based Learning Media, it will further help the learning of PJJ students at SMK Veteran Cirebon because it can be studied at home without face to face. Examples of the Use of Geometry Transformation AR Learning Media in Cirebon Veteran Vocational School:

a. Markeless for 3D Batik Scanner



Gambar 1 Barcode/Marker AR

b. Main Menu AR Application Geometry Transformation

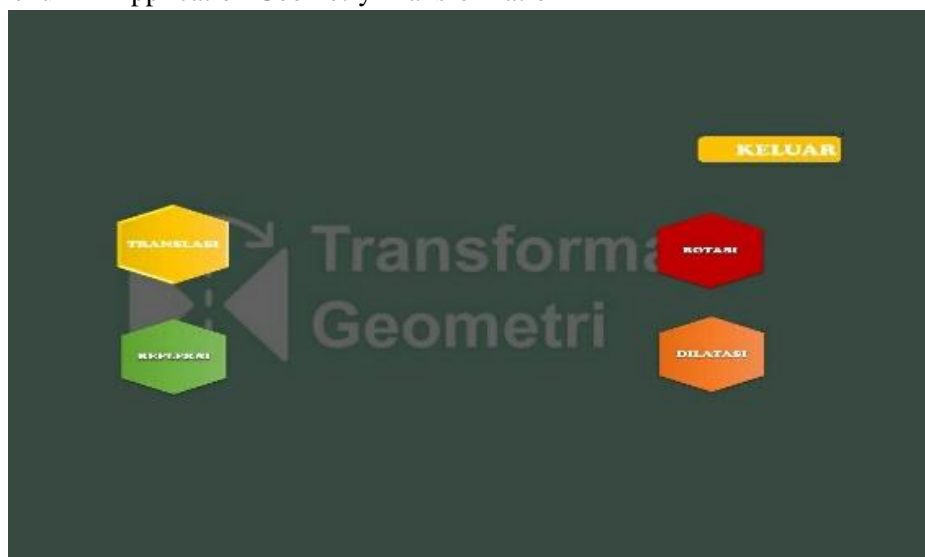


Figure 2. Main AR Application Menu

c. Menu Button Translation



Figure 3 Translation Menu

d. Menu Button Reflection



Figure 4 Reflection Menu

e. Menu Button Rotation

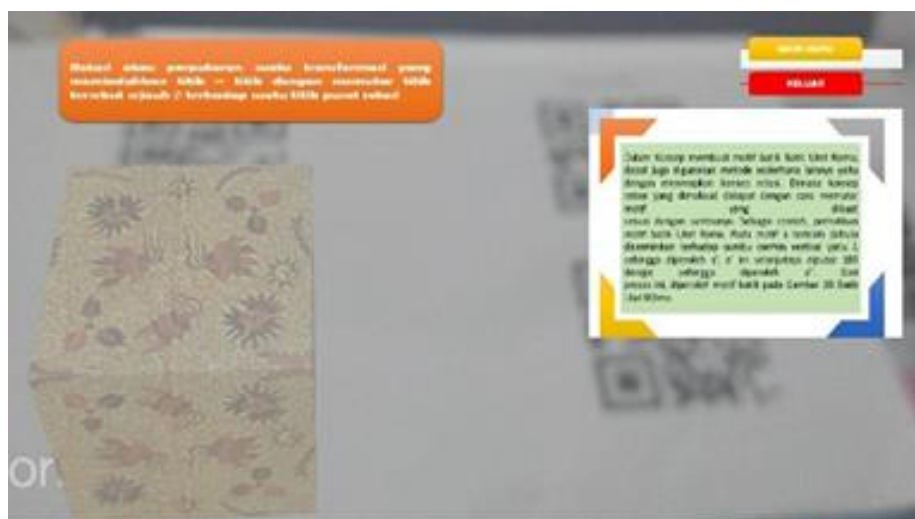


Figure 4 Reflection Menu

f. Menu Button Rotation



Figure 5 Rotation Menu

g. Menu Button Dilated



Figure 6 Dilated Menu

C. Methods

This research was carried out in the even semester of 2020 with the research subject of one Mathematics Teacher Class XI and 9 students from class XI AKL. This research uses a case study design. Studies Case is a series of scientific activities carried out intensively, detailed and in-depth information about a program, event, and activity, both at individual level, group of people, institutions, or organizations to gain in-depth knowledge of the event. In this study, this study uses a case study design (Rahardjo, 2017). In this study, the analysis of the use of cultural literacy as an augmented reality-assisted mathematics learning media during the COVID-19 pandemic was analyzed on the geometry transformation material at the Veteran Vocational School in Cirebon City. The subjects involved in this study were 1 mathematics teacher and 9 students of class XI AKL.

The data sources of this research are primary data and secondary data. The main data obtained by researchers directly from respondents through observation, interviews and questionnaires. While secondary data obtained by researchers from records or documentation. The data validity test in qualitative research includes credibility, transferability, dependability and confirmability tests. (1) Credibility testing can be carried out in various ways, including extension of observations, increased persistence in research, triangulation (triangulation of sources, triangulation of techniques, triangulation of time), discussions with colleagues, negative case analysis and member checks. (2) transferability is external validity to indicate the level of accuracy or applicability of research results in the population where the sample is taken. (3) dependence, the testing process is carried out by auditing the entire research process. (4) confirmability, which is also known as the research objectivity test, which is testing the research results and relating them to the process being carried out (Moleong, 2007). The method used in testing the validity of the data in this study is the triangulation method. Triangulation in testing the validity of data is defined as checking data from various sources, methods and at various times.

D. Finding and Discussion

This research was carried out in the even semester of 2020 with the research subject of one Mathematics Teacher Class XI and 9 students of class XI AKL. The data were analyzed in the implementation of learning using Augmented Reality-assisted mathematics learning media on Geometry Transformation material at the Veteran Vocational School of Cirebon City. Based on the observations of researchers at the Veterans Vocational School, the researchers saw that cultural literacy activities in schools had been carried out in 2017 there were several mathematics subject teachers who used cultural literacy as a medium of learning at the Veterans Vocational School in Cirebon City.

a. Use of AR Learning Media

Information on the use of AR Learning Media was also obtained through interviews with Mathematics Teachers. The following is a snippet of the results of interviews with teachers related to the use of AR Learning Media:

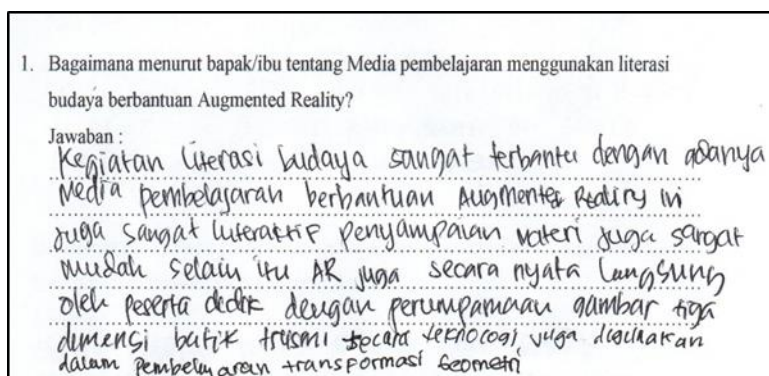


Figure 7. G1 Interview Snippets No. 1

Based on the results of interviews with mathematics teachers, it was explained that the use of AR-assisted learning media was very interactive and real and directly seen by students with the parable of three-dimensional images and by using smartphone technology to improve understanding of advanced technology in Geometry transformation material in class XI AKL.

b. Benefits of AR Learning Media

Utilization of this learning media, from the results of interviews with mathematics teachers. The following is a snippet of the results of interviews with teachers related to the benefits of using AR Learning Media:

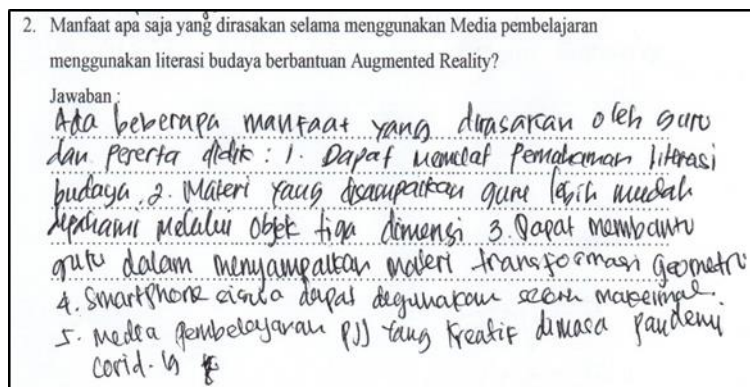


Figure 8. G1 Interview Snippets No. 2

Based on the results of interviews with mathematics teachers, it is explained that there are several benefits that students can get, including:

1. Can increase understanding of cultural literacy
2. The material presented by the teacher is easier to understand through the three-dimensional object of trusmi batik
3. Can help teachers in delivering Geometric Transformation material
4. Students' smartphones/androids can be used optimally
5. Creative PJJ learning media during the Pandemic

This Augmented Reality-assisted learning media provides good and significant benefits for the teaching and learning process of students and mathematics teachers at Veteran Vocational School.

c. Constraints of Using AR Learning Media

Constraints faced in the process of learning mathematics by using AR learning media, from the results of interviews with mathematics teachers. The following is a snippet of the results of interviews with teachers related to the constraints of using AR Learning Media:

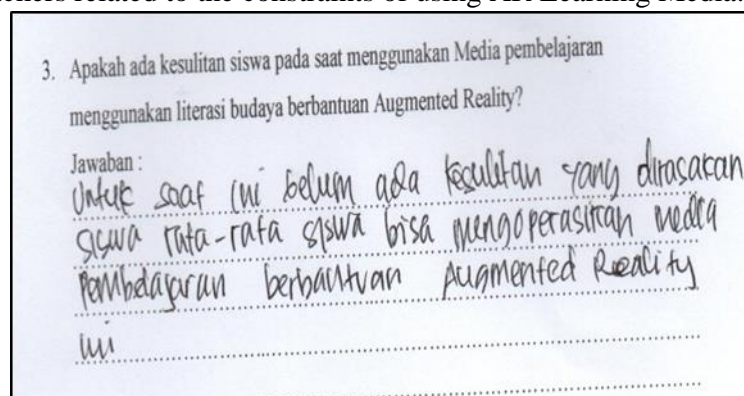


Figure 9. Excerpts of G1 Interview No. 3

d. Student Responses to the Use of AR Learning Media

Student responses to mathematics learning media in learning mathematics from the results of interviews with mathematics teachers. The following is a snippet of the results of interviews with teachers related to student responses to AR Learning Media:

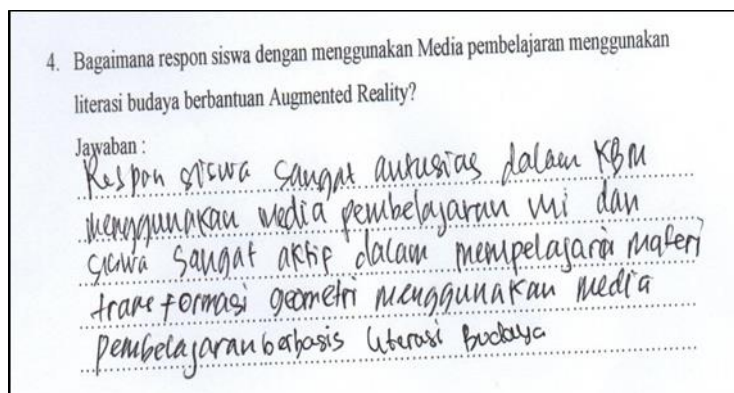


Figure 10. G1 Interview Snippets No. 4

Based on the results of interviews with mathematics teachers, it was explained that the Augmented Reality learning media received quite a response from students in studying geometry transformation material using mathematics learning media, this was as explained by the mathematics teacher "Student responses are very enthusiastic in studying this learning media". (interview with G1, 24 June 2021).

e. Student learning outcomes

Student learning outcomes in the mathematics learning process using AR learning media, from interviews with mathematics teachers. The following is a snippet of the results of interviews with teachers related to the constraints of using AR Learning Media:

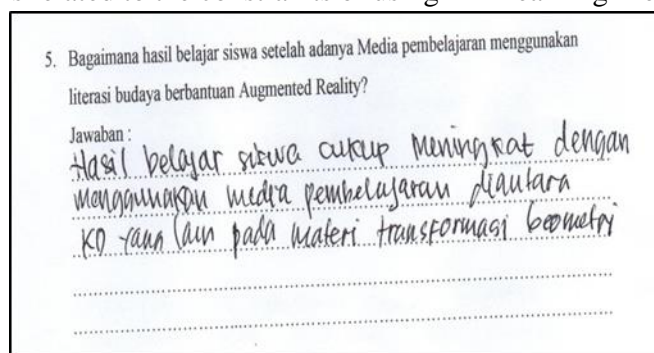


Figure 11 G1 interview excerpt No. 5

Based on the results of interviews with mathematics teachers, it was explained that Augmented Reality learning media that the learning outcomes obtained from the use of AR media in learning mathematics were quite good, this was as explained by the mathematics teacher (interview with G1, June 24, 2021).

The application of augmented reality learning media is only at the learning theory stage in the stimulus stage where mathematics learning material geometric transformation can be done by applying learning media using Cultural Literacy, namely "Batik Trusmi", in the learning process after students are given an understanding of geometric transformation students will be given examples of problem cases which usually happens in real life and is evident in Trusmi's batik art. The learning process is expected to be able to make students understand the material of geometric transformation better because students analyze problems that can be encountered in real life regarding the material.

D. Conclusion

Based on the results of research and analysis of the use of cultural literacy as a medium for learning mathematics assisted by augmented reality, it can be concluded that:

1. Application of cultural literacy-based mathematics learning media at Veterans Vocational High School Mathematics learning media during the covid-19 pandemic at Cirebon Veterans Vocational School, namely Learning Media using Augmented Reality (AR) assisted cultural literacy Using Augmented Reality Markers, online learning is carried out at home student.
2. Student responses to the use of cultural literacy as an augmented reality-assisted learning medium based on the results of interviews with mathematics teachers, it was explained that this Augmented Reality learning media received quite a response from students in studying geometry transformation material using mathematics learning media, this is as explained by the mathematics teacher " Student responses are very enthusiastic in learning this learning media"

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