



Study of the Applicability Level of Merge Cube Augmented Reality Media on Junior High School Science Teachers

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Abstract

Science learning media based on Merge Cube Augmented Reality (AR) has been developed. This research aims to determine the level of applicability of science learning media based on Merge Cube AR to users, especially junior high school science teachers. The research method was carried out through a descriptive survey after testing the use of science learning media based on Merge Cube Augmented Reality. The respondents of this research were 41 teachers from 13 different junior high schools. Based on the analysis data showed that respondents were very confident of being able to apply Merge Cube AR media in science learning and the percentage of applicability level in this description reach 87.8%, those indicate that the media is in very good criteria. Teachers are very confident that they can achieve learning goals by implementing Merge Cube AR learning media. The percentage of applicability level in this description reach 82.9%, those indicate that the media is in very good criteria. The results of the analysis also show that teachers are strongly believe that the Merge Cube AR media helps them in a more effective way to deliver science learning activity. The percentage of applicability level in this description reach 90.3%, those also indicate that the media is in very good criteria. The average percentage of applicability level reach 87.0 %, it is indicated that the applicability level of science learning media based on merge cube ar in the very good criteria. It can be concluded that science learning media based on Merge Cube AR has a very good level of applicability and can be used in science learning.

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INTRODUCTION

In today's learning and education era, the mobile technology has become a priority requirement. All people and institutions cannot be separated from mobile technology. Learning activities are increasingly available in a variety of choices for learning media based on mobile technology or mobile learning technology. Learning media is a tool or intermediary that is useful for facilitating the teaching and learning process (Williamson, 2015; Taufiq et al., 2017; Fuady & Mutalib, 2018). Learning media also have functions as a tool that help to make easier for students to receive and understand lessons in a more comprehensive manner (McQuiggan et al., 2015; Anshari et al, 2017; So et al., 2019).

Science learning activities in today's era should be directed to build attitudes, skills, and mastery material both concrete and abstract content in natural sciences to then expand science learning that equips students which called as 21st century skills. The 21st century skills including critical thinking, problem solving, creativity, communication, and ability to work collaboratively (Erdoğan, 2019; Tang et al., 2020). Students must master science content, both complex and abstract concepts, but if they only rely on media in the form of static images, while animation or video is less interactive, so they are often ineffective (Ibrahim, 2012; Bell et al., 2013; Winarto et al., 2020).

In science learning, media is needed to visualize the content of science material, especially those are abstract, microscopic, macroscopic, dangerous and may also be expensive in the learning process and experiment or practicum activity (George & Kolobe, 2014; Rude et al., 2018; Wibowo et al., 2019). The limitations of the functional, technical, or cost aspects of developing learning media can be reduced through the use or integration of mobile and multimedia technology, including Augmented Reality (AR) technology (Wu et al., 2013; Mekni & Lemieux, 2014; Palmarini et al., 2018; Qiao et al., 2019).

AR technology has been developed into an innovative learning media where the details of complex and abstract concept material can be visualized interactively so that it is easier for students to understand (Fonseca et al., 2011; Kiryakova et al., 2018; Kurniawan & Witjaksono, 2018; Pujiastuti & Haryadi, 2020; Taufiq et al., 2021) and provide real-time interaction

with what is displayed in the application (Huang et al., 2015; Chen et al., 2019; Jha et al., 2019). Science learning media based on Merge Cube Augmented Reality (AR) has been developed. Merge Cube is a cube-shaped holographic media that allows users to physically hold and interact with 3D objects using AR technology (Cordeil et al., 2020). Merge Cube has been developed as a solution of the weaknesses of AR technology in the "marker" of AR objects in the form of two-dimensional images, so they are static and do not allow users to physically hold and interact. This research aims to determine the level of applicability of science learning media based on Merge Cube AR to users, especially junior high school science teachers.

METHOD

The research method was carried out through a descriptive survey, by taking a sample from a population and using a questionnaire as a data collection tool (Morrison, 2012). Response data retrieved after testing the use of science learning media based on Merge Cube Augmented Reality. The respondents of this research were 41 teachers from 13 different junior high schools.

Applicability Level Analysis

Data on the applicability of science learning media based on Merge Cube AR was obtained from field trials using questionnaires related to ease of applying Merge Cube AR media in science learning, achievement of learning goals by implementing Merge Cube AR learning media, and the function of Merge Cube AR media to helps teachers in a more effective way to deliver science learning activity. Applicable data were obtained from questionnaire responses during field trials. The data on applicability level of science learning media based on Merge Cube AR analyzed with the following formula:

$$A = \frac{TSEV}{(S-max)} \times 100\%$$

where:

A = applicability level

TSEV = Total Empirical Score

S-max = maximum score expected

The interpretation of applicability level of science learning media based on Merge Cube AR then given using the product applicability criteria on Table 1.

Table 1. Applicability Criteria

Percentage (%)	Criteria
80 - 100	very good
60 - 79	sufficient
50 - 59	poorly
< 49	prohibited

(Adapted from Akbar & Sriwiyana, 2011)

RESULT AND DISCUSSION

In this research, trials have been conducted on the use of science learning media based on the Merge Cube AR, which is a set of science learning media devices consisting of a Merge Cube with a companion application installed on a Smartphone or tablet computer, where when used together the Merge cube can turn into a learning resource object. Detailed science, such as a planet in the solar system or more real human organs to complete more fun science learning activities. Merge Cube is a holographic cube-like puzzle product developed by Merge Labs through Merge Edu, a subscription-based AR/VR platform for STEM learning and digital creation designed to work with the Merge Cube. The platform includes an Explorer app, a premium version of the Object Viewer app, lesson activities, and a teacher dashboard. In this research, a replica of the Merge Cube was used with paper materials that were printed with techniques and sizes that were adapted for the function of science learning in the classroom, especially for junior high school students.

Applicability level of of science learning media based on Merge Cube AR were obtained from questionnaire responses during field trials. The data analysis and interpretation of applicability level of science learning media based on Merge Cube AR can be seen on Table 2.

Based on the analysis data showed that respondents were very confident of being able to apply Merge Cube AR media in science learning and the percentage of applicability level in this description reach 87.8%, those indicate that the media is in very good criteria. The level of teacher literacy in digital technology is an important factor related to the ease of application of AR technology (Durodolu, 2016). This can be seen from 85% of respondents who have had experience teaching using IT and Smartphones, although not all of them have experience using science media based on AR technology. There are three smartphone operating systems that support AR technology through their respective app-

lication programming interfaces. The camera on the smartphone is used as a source of visual data flow, which is combined with other sensors and applications used on the smartphone (Mustaqim, 2017; Hamzah, & Kurniadi, 2019).

Table 2. Applicability Level Science Learning Media Based on Merge Cube AR

Description	Percentage (%)	Criteria
Being able to apply Merge Cube AR media in science learning	87.8	Very good
Able to achieve learning goals by implementing Merge Cube AR learning media	82.9	Very good
Merge Cube AR media helps teachers in a more effective way to deliver science learning activity	90.3	Very good
Average Percentage (%)	87.0	Very good

Teachers are very confident that they can achieve learning goals by implementing Merge Cube AR learning media. The percentage of applicability level in this description reach 82.9%, those indicate that the media is in very good criteria. Merge Cube AR technology as a learning media can be used as a teaching aid for modeling science concepts (Cowin, 2020). Teachers applying Merge Cube AR as an innovative learning media and inform that details of complex and abstract concept material can be visualized interactively so that it is easier for students to understand (Fonseca et al., 20114; Kiryakova et al., 2018; Kurniawan & Witjaksono, 2018; Pujiastuti & Haryadi, 2020; Taufiq et al., 2021) and provide real-time interaction with what is displayed in the application (Huang et al., 2015; Chen et al., 2019; Jha et al., 2019)

The results of the analysis also show that teachers are strongly believe that the Merge Cube AR media helps them in a more effective way to deliver science learning activity. The percentage of applicability level in this description reach 90.3%, those also indicate that the media is in very good criteria. Merge Cube AR which is used as a learning media of science teachers able to create a new and more interactive atmosphere in learning science which usually seems boring to students. AR-based media is very useful as an interactive and real learning media for students

(Crofton et al., 2019). By utilizing AR media, it can combine the virtual world that can increase students' imagination with the real world directly (Oranç & Küntay, 2019). The use of AR-based learning media can stimulate students' mindsets in thinking critically about problems and events that occur in everyday life because learning media is very helpful for students in the learning process (Sonntag et al., 2019). So that the use of educational media with augmented reality can directly provide learning wherever and whenever students want to carry out the learning process (Taufiq et al., 2021).

The average percentage of applicability level reach 87.0 %, it is indicated that the applicability level of science learning media based on merge cube ar in the very good criteria. It can be described that science learning media based on the Merge Cube AR can be used as an alternative to AR-based learning media.

CONCLUSION

Based on the analysis data can be concluded that science learning media based on Merge Cube AR has a very good level of applicability and can be used in science learning.

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