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The Utilization and Practicality of Learning Media Based Augmented Reality

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

According to the skills and interests of the students, an effective learning process should be dynamic, enjoyable, demanding, motivating, and provide them more room to develop their creativity and independence. Theory is not as important in vocational high school as practice is. The following factors should be taken into account while choosing media: learning objectives, effectiveness, accessibility, students, usage, cost, and quality. One of the advancements in educational media that is still in use today, the new one uses augmented reality to learn media. Vuforia and Unity 3D are tools that can be used to create augmented reality. An interactive learning tool with augmented reality is the end product. The created learning media's validity was analyzed, and the average result fell into the "Valid" category at 3.21. In the "very practical" category, augmented reality learning materials have an average practicality of 88.9%. The conclusion of the research is digital technology that can be used by teachers in improving the quality of the learning process including augmented reality technology. Utilization of digital technology in the process learning can increase interest and motivation student learning, the quality of the learning process, and results learning.

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Keywords: Learning media; validity; practicality; augmented reality.

1. INTRODUCTION

In the modern era, technology is developing at a very quick pace. As science and technology continue to improve and permeate many domains, schooling remains unaffected. Individuals working in the field of education will have the ability to keep up with technological advancements. Students also need to be able to stay up to date with technology advancements, in addition to being skilled instructors or lecturers [1].

Digital competence has emerged as a central idea in conversations about the kinds of knowledge and abilities that students require in the information age. But in policy documents, academic literature, and teaching, learning, and certification practice, it has been interpreted in a variety of ways (e.g., Digital Literacy, Digital Competence, e-Literacy, e-Skills, e-Competence, Computer literacy, and media literacy). In the digital age, all of these phrases emphasize how important it is to talk about technology. Teachers and students can receive rapid feedback while using digital technology in the classroom. In order to enhance the direction of learning activities and to share the ability of students to moderate learning outcomes, teachers find that receiving feedback during the learning process is crucial [2].

The goals, resources, techniques, media, and learning evaluation are five crucial elements of the teaching and learning process. Each of these five factors affects the others. Selecting a certain teaching strategy will influence the kind of learning media that is best, but don't overlook the other three crucial factors: learning objectives, resources, and assessment. Learning media can spark curiosity and new desires, motivate students and enhance their learning activities, and even have psychological effects on them when used in the teaching and learning process [3].

Everything that can be used to direct a message from the sender to the recipient in a way that piques students' interests, feelings, and worries is considered learning media. From traditional media to multimedia and computer technology-based media, learning materials have changed with time [4]. Augmented reality technology is one digital technology that can be utilized in educational materials. Because this technology offers a more dynamic, 3D, and realistic display, it will provide an engaging learning environment. Furthermore, as a teaching aid in the classroom, augmented reality (AR) technology is extensively used to create multimedia presentations; it does not, however, take the place of the teacher in their entirety [5]. AR can be used in various activities such as presentations, estimating an object, stimulating equipment performance, simulating the performance of a tool in 3D and so on [6].

Vocational education should always make updates which refers to technological developments at this time so as to be able to produce human resources that can compete in the future [7]. Augmentation technology is the technology that best supports vocational learning in the era of the industrial revolution 4.0. The technology is very efficiently used in the vocational learning process [8]. Some of the advantages of MAR technology include: (1) Intelligent Display Technology; this technology allows supported by various displays based on intelligent screen display; (2) Intelligent 3D Registration; with the use of this feature, it is possible to pour virtual images into the real world; and (3) Intelligent Interaction Technology; With the development of intelligent interaction technology, augmented reality not only superimposes virtual information onto real scenes, but also realizes interactions between virtual people and objects in real scenes [9].

According to [10], learning media is any tool that is used to transmit messages from the sender to the recipient and has the power to broaden or deepen students' perspectives, emotions, and areas of interest in learning. This study aims to elucidate the potential of metaverse technology as a microcontroller learning tool in vocational education. Background: The utilization of augmented reality as a learning tool for the depiction of microcontroller components is the main emphasis of this study.

2. METHODS

2.1 Data Research

The data in this study were obtained through user responses to the practicality of learning media. This research was conducted at the Department of Electrical Engineering Education, Makassar State University. The learning media

that will be designed is a microcontroller learning media. Lecturers and students are involved in determining the practicality of using metaverse learning media.

2.2 Design of System

Before conducting research, it is necessary to have a concept and research design planning. In this study, a stage was designed for how augmented reality technology works. the planning stages include media selection criteria, application development, hardware and software analysis.

2.3 Implementation Stage

Augmented Reality Learning Media will be tested and experimented with in order to get learning media products that are suitable for use. The final product that has been developed will then be used thoroughly in the microcontroller learning process at the Department of Electronic Engineering Education, Makassar State University.

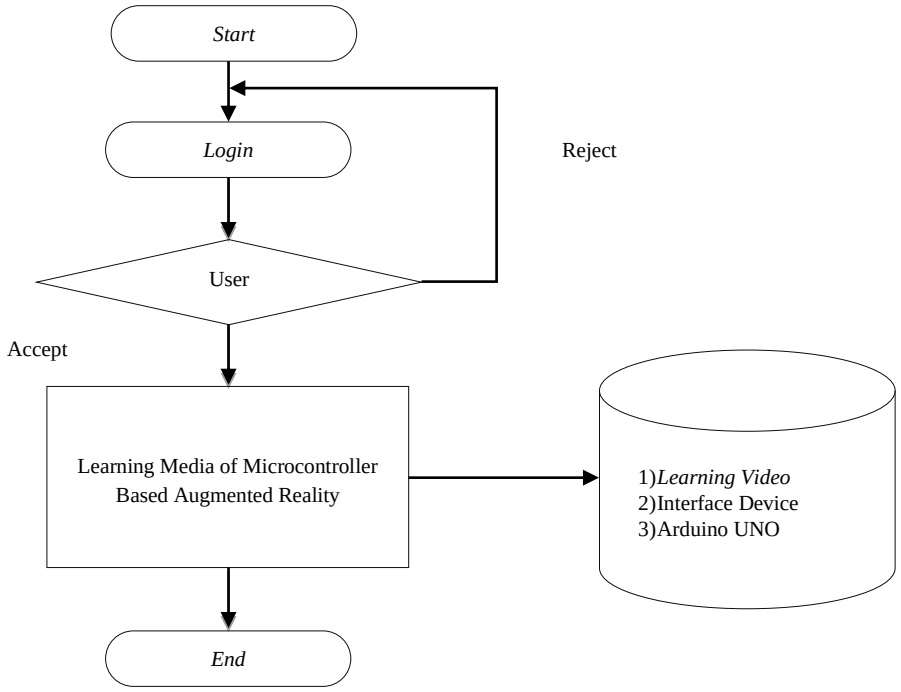

Fig. 1. Flowchart system

Fig. 2. Block diagram system

3. RESULTS AND DISCUSSION

Augmented Reality is a technology that combines virtual objects with real objects. One of field that uses AR technology is the field of education, which is used as a learning aid for students make students better understand the material given. The MAR learning media that will be developed first are designed and developed based on the initial needs analysis. The results of the development of the MAR learning media are as follows.

3.1 Result of Making Learning Media

Augmented Reality learning media is designed and created based on the results of the needs analysis at the time of observation. The prototypes of the learning media are as following Fig. 3.

Fig. 3. Login view

Fig. 1 shows the initial menu for using *Augmented Reality*. In this menu there are start and exit options buttons. To start the process, the user can click the start button and then it will immediately display the Main Menu. After the login process, the Mobile Augmented Reality Learning Media will display the main menu. In the main menu there are four selection buttons, namely: (1) Start; (2) Arduino; (3) Interfaces; and (4) Videos.

The first menu on this metaverse Learning Media is start. The function of this menu is to detect marker objects of microcontrollers or other interface devices and visualize them directly. The prototype display of the start menu can be seen as following Fig. 5.

The next menu contained in the *Augmented Reality* Learning Media is the Arduino menu. This menu displays the Arduino UNO Board along with an explanation of its function and component layout. The display prototype of the Arduino menu can be seen as following Fig. 6.

Fig. 4. Main menu

Fig. 5. AR display on start menu

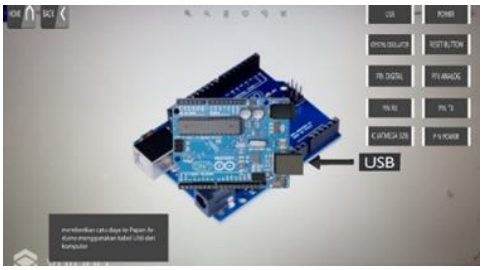

Fig. 6. AR display on arduino menu

The next menu contained in the *Augmented Reality* Learning Media is the Interface menu. This menu displays several interface devices such as LCD 16 Characters, Seven Segments, LEDs, Push Buttons, etc. The prototype display of the interface menu can be seen as following Fig. 7.

The last menu contained in the Augmented Reality Learning Media is the Video menu. This menu displays a virtual button which will then connect to several learning videos. The display prototype of the Video menu can be seen as following Fig. 8.

3.2 MAR Learning Media Validity Analysis

Learning Media Augmented Reality is declared valid if the results of the assessment of the two validators are at an average acquisition of > 2.50 to 4.00. Testing of metaverse learning media

includes aspects of content, display, and programs. The results of the validity analysis test that have been assessed by the validator are presented as follows in Table 1.

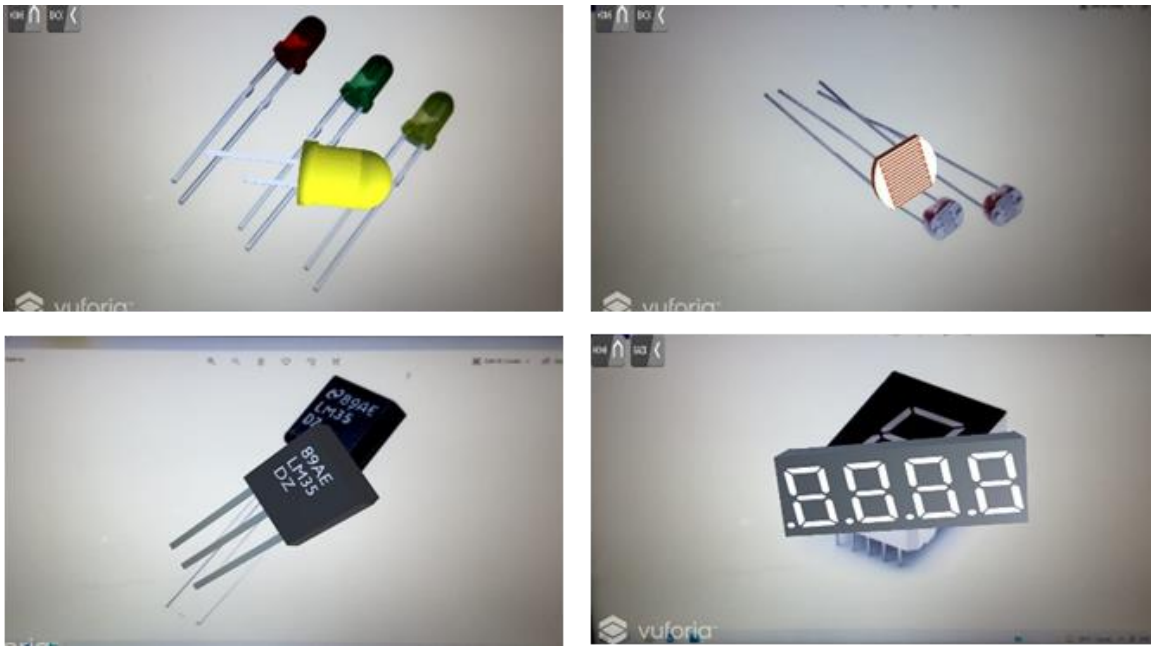

Fig. 7. AR display on interface menu

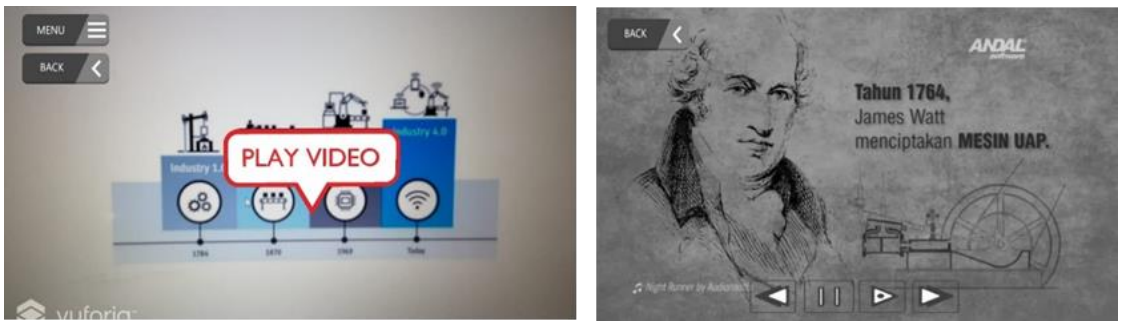

Fig. 8. Learning video display

Table 1. Content validation results

No.	Indicator	Validator 1	Validator 2	Average	Category
1	Material Quality	3.28	3.42	3.36	Very Valid
2	Language Quality	3.33	3.00	3.17	Valid
3	Material Update	3.00	3.00	3.00	Valid
	Overall Indicator			3.17	Valid

Table 2. Display validation results

No.	Indicator	Validator 1	Validator 2	Average	Category
1	Text Readability	3.50	3.50	3.50	Very Valid
2	Image Quality	3.00	3.00	3.00	Valid
3	Colour Compatibility	3.00	3.00	3.00	Valid
4	*Button*	3.50	4.00	3.75	Very Valid
5	Resolution	3.00	3.00	3.00	Valid
	Overall Indicator			3.25	Valid

Table 3. Programming validation results

No.	Indicator	Validator 1	Validator 2	Average	Category
1	Programming	3.25	3.50	3.38	Very Valid
2	Interaction	3.33	3.00	3.17	Valid
3	Efficiency	3.00	3.25	3.13	Valid
	Overall Indicator			3.22	Valid

Table 4. Description of learning media validation results

No.	Indicator	Average	Category
1	Content	3.17	Valid
2	Display	3.25	Valid
3	Programming	3.22	Valid
	Overall Indicator	3.21	Valid

Table 5. Practicality analysis result

No.	Indicator	Average	Category
1	Easy to use	88.3%	Very Practical
2	Easy of choosing the menu	86.6%	Very Practical
3	All the features provided are running well	88.3%	Very Practical
4	Use of language that is easy to understand	91.6%	Very Practical
5	Easy to understand	90.0%	Very Practical
	Overall Indicator	88.9%	Very Practical

The description of the general assessment results from the two validators on the aspects of the validity of the *Augmented Reality* Learning Media can be seen in Table 4.

Based on the results of the assessment of the two validators, the average assessment of the two validators is 3.21 so it can be concluded that the learning media developed in this study have met the valid criteria.

3.3 Augmented Reality Learning Media Practicality Analysis

Practical analysis was obtained from the responses of lecturers and students after the trial of the use of learning media. The results of the practicality test are as follows Table 5.

Based on the results of practicality data analysis, the average practicality of *Augmented Reality* learning media is 88.9% with very practical category. Therefore, the metaverse learning media is stated to be very practical for use in learning microcontrollers. This is in accordance with research conducted by (Ponta & Syafar, 2023) which concluded that AR technology provides ease of use and helps the learning process.

4. CONCLUSION

Digital technology that can be used by teachers in improving the quality of the learning process including augmented reality technology. Utilization of digital technology in the process learning can increase interest and motivation student learning, the quality of the learning process, and results learning.

Utilization of AR can be used in various activities, such as presentations, estimating an object, performance stimulant equipment, simulating a tool's performance, and others. There are several reasons for using *Augmented Reality* technology in education, namely: (1) to grab students' attention; (2) better understanding; (3) students can access the model from the device at any time; (4) students will retain more knowledge for a longer period of time; and (5) enjoy new ideas and think critically about the world around them [11]. The sophistication of AR technology can help students visualize objects and does not replace the role of the teacher at all [12].

Based on the results of the finding and discussion, the following conclusions are: 1) The *Augmented Reality* learning media consists of several main menu, including: start, Arduino, interface, and videos; 2) The validity of the *Augmented Reality* Learning obtained a value of 3.21 with valid category; and 3) The practicality analysis result show that the *Augmented Reality* Learning Media is 88.9% with very practical category.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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