Introduction of Augmented Reality to Create Interactive Learning Media for Teachers in Purwakarta

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ABSTRACT

Utilization of educational media using Augmented Reality (AR) technology can stimulate students' mindset in thinking critically about problems and events that exist in everyday life. The use of educational media with augmented reality directly can helps students learn wherever and whenever they want. In order to facilitate knowledge sharing, a community service activity was carried out by the UPI Telecommunication Systems Study Program, Purwakarta Campus, to introduce AR technology and train teachers to be able to create interactive technology-based learning media. The results obtained show that 1) participants are very satisfied with the content of the material with a percentage of 90.3% which means good; 2) the method of delivery of the workshop material by the presenters is considered good with a percentage of 89% and 3) according to the participants the activity of making the AR program is very useful with a response percentage of 93%.

Keywords: *Workshop, Introduction to AR, Elementary School Teachers*

1. INTRODUCTION

Entering the era of education 4.0, learning media innovations are increasingly developing. Learning media can be interpreted as a tool that functions and is useful for funneling learning messages **(Sanaky, 2013)** as well as a tool and material in the learning process **(Daryanto, 2011).** Some researchers put forward learning media as anything that can channel messages from sources in a planned manner as an effort to create an effective and efficient learning process **(Munadi, 2013)** as was done in the previous experience, activities have been carried out to improve the quality of education at SMP Negeri 7 Satu Atap Majene regarding the application of online learning media. The method used in these activities is training. **(Rahmi, 2022)** Learning problems are often the reason why teachers do not provide optimal material in class. The situations such as when teachers are having meetings, out of town services and so on are obstacles for teachers to deliver material at school. Therefore, media is needed by teachers to keep conveying material under those circumstances.

Learning the industrial revolution 4.0 is one way to face the challenges of the world of technology in the education sector through learning media. The media used is online-based such as Google Classroom. Workshops are needed to improve the quality of teachers in dealing with industrial revolution 4.0 learning with the aim of increasing teacher knowledge in teaching and learning activities inside and outside of school **(Efendi, 2022).** In other experiences, mentoring and training has been carried out through The Power of Edu Game (TPOEG) Workshop which aims at improving skills in the use of IT media by teachers at SMP Negeri 1 Lumajang. This study uses the school action research method. The research instruments are observation sheets, documentation and interviews. The results showed that the implementation of the TPOEG workshop could improve teachers' skills in using IT media in cycle I by 80.33% to 90.56%. This is also supported by data on the level of student well-being after participating in edu games with an average student response of 90.36% or very good. Based on these results, the integration of edu games is proven to make learning fun for students, therefore the teacher can recommend it in further learning. Further development related to the integration of edu games in learning can be carried out through the Musyawarah Guru Mata Pelajaran Sekolah (MGMPS) **(Purwanto, 2022).**

Education in the era of the industrial revolution 4.0 has several challenges such as changes in the way or pattern of thinking and acting in society, especially students in developing creative innovations **(Daryanto, 2014).** One of the technologies that can be applied to create interactive learning media is *Augmented Reality technology,* that combines two-dimensional or three-dimensional virtual objects and then projects these virtual objects in real time **(James, 1998).** *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 **(Azuma, 1997).**

The pandemic situation which requires learning to be done remotely results in students having to study independently **(Kustnadi, 2013).** The learning process that is carried out independently sometimes occurs in a monotonous and boring manner, resulting in less understanding of the subject matter. This is a challenge for teachers to create interactive learning media. However, the problem that occur with AR technology is that it has not been massively introduced to all teachers at both the elementary and secondary school levels in Purwakarta. In order to facilitate sharing knowledge of the use of AR technology in creating learning media, it is necessary to conduct an introduction workshop on AR technology to create learning media.

2. METHODS

To make AR, several important components needed in the manufacture and development of applications including computers, markers and cameras. In outline, the simple process that is carried out when AR is run can be seen in figure 1.
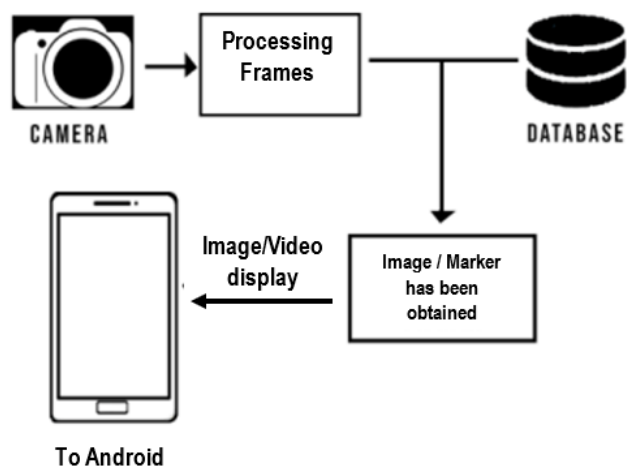
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Figure 1. *Augmented Reality* Process

AR has 2 types, namely using markers and not using markers (*Marker less*). Marker is a tool to be able to detect what virtual objects will appear **(Azuma, 1999).** A marker is an image object having a square shape in black and white according to the size specified in Figure 2. Augmented Reality Technology using Marker media can detect Single Marker and Multi Marker. Single Marker is a detection on a marker to display a virtual object, as can be seen in Figure 2 Media Marker. The method for single marker and multi-marker is almost the same. However they differ in the position estimation process. Single marker's position estimation will use (x,y, and z) only, while multi-marker position estimation will be (x1,... xn,y1,... 10 yn, and z1,... zn) (n) on the x,y,z axes depending on how many markers are used in the multi-marker.
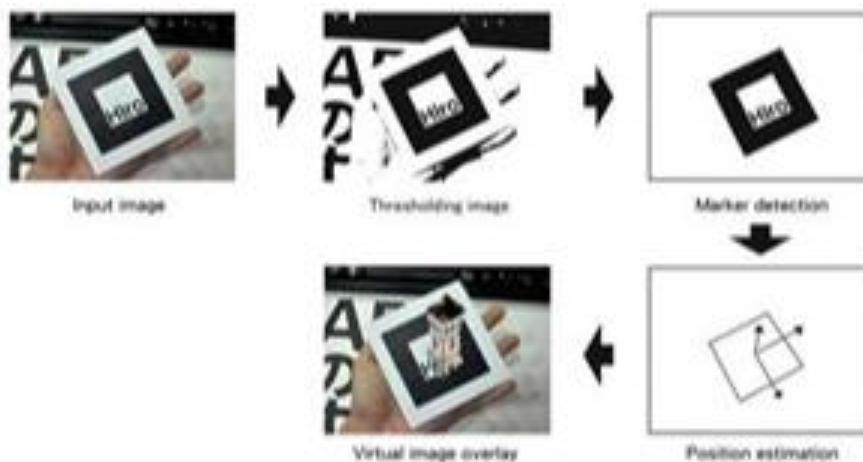

Figure 2. Markers

Meanwhile, Marker-less AR is a term to indicate AR-based applications that do not require knowledge of the user's environment to overlay 3D content onto a scene and be locked into a certain position. With the marker-less method, users no longer need to use a marker to display real-time virtual objects. Currently there are various AR methods for marker-less tracking such as face tracking, 3D objects tracking, and motion tracking **(R. Behringer, 2000).**

Figure 3 is the process of how this community service activity is carried out, such as the implementation steps from preparation to evaluation and reporting.
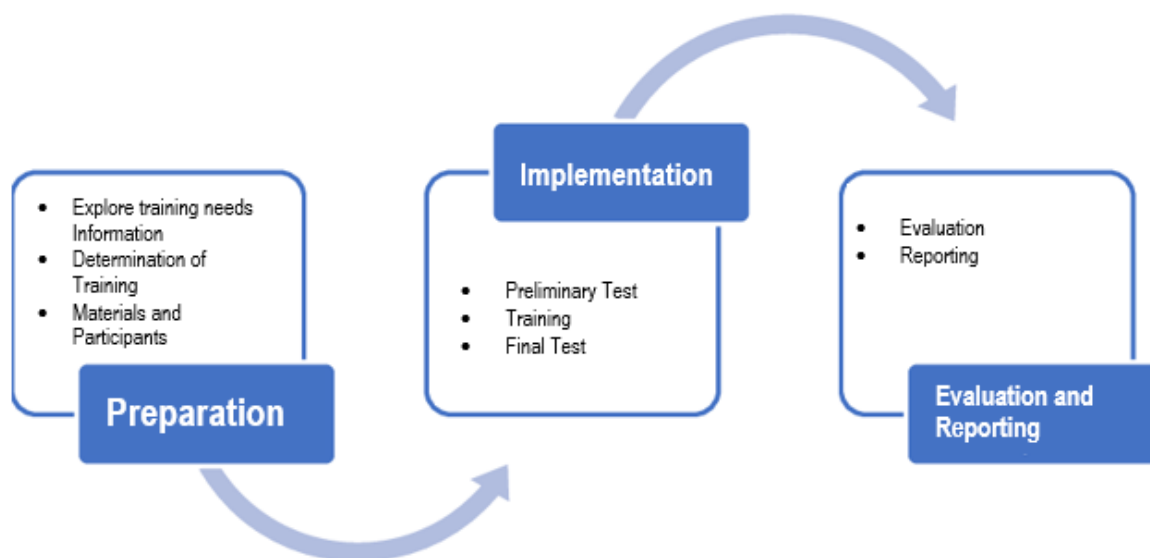
Figure 3. Chart of Implementation of Community Service Activities

3. RESULTS AND DISCUSSION

(a)

(b)

(c)

Figure 4. Documentation of the opening ceremony: (a) Chief Executive of PkM, (b) Speech by the Head of Telecommunication Systems Study Program, (c) Speech by the Director of UPI Purwakarta

The activity was carried out one day on August 27th, 2022 at the *Smart Classroom* Lt. III The New Building of the UPI Purwakarta Campus. The *workshop activity* was attended by 30 participants and started with checking the body temperature of the participants by the committee with a maximum temperature tolerance of 36 ^{0} C. After the participants met the temperature qualifications, they then registered by filling out the attendance list and taking

the seminar kit. Implementing the registration process using a queuing system with a distance of 1 m, the participants were directed to enter the room guided by the committee according to the place that had been arranged. When all participants had already been seated, the *workshop activities* began with the remarks by the Chief Executive of the PkM, the Head of the Telecommunication Systems Study Program and the Director of the UPI Campus Purwakarta, namely Prof. Turmudi. M.Ed., M.Sc., Ph.D as shown in figure 4.

Figure 5 shows Mr. Ichwan Nul Ichsan when delivered the first material on the topic of Introduction to Metaverse and Introduction to AR in children.

Figure 5. Documentation of the speaker Introduction to Metaverse, Introduction to AR

In the second session the material was delivered by the chief executive, namely Hafiyyan Putra Pratama. S.ST., MT with the topic Unity Software Installation Tutorial and introduction to unity tools (Game Engine) as shown in figure 6.

Figure 6. Documentation of the presenters Tutorial on Unity Software Installation and introduction to unity tools (Game Engine)

Figure 7 shows the third session provided material for making interactive learning media with AR technology (an example of a spatial case) guided by Agus Puji Prasetyo, S.Pd and was continued with an exploration session which was enthusiastically followed by the participants. In this session the participants made one of the geometric shapes using AR through unity tools. The best participant who was able to make the program was given a prize by the committee.

Figure 7. Documentation of speakers for making interactive learning media with AR technology

Figure 8 shows the last activity was a question-and-answer session as well as reflection of the workshop participants on the activity. The activity was closed by the chief executive, Dewi Indriati Hadi Putri. S.Pd, MT.

Figure 8. Documentation of participants' question and answer session

After the closing of the activity, a photo session was held with the participants and the chief executive of the PkM activity as shown on figure 9.

Figure 9. Photo session with the organizers and participants

To find out the response of the participants to the workshop on the introduction of augmented reality technology for creating learning media among teachers in Purwakarta district, they were

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given questionnaire as an evaluation before the final session (group photo session). Through the questionnaire form two types of data were obtained, namely qualitative data and quantitative data. In the questionnaire there are 6 questions whose answers contain numbers to indicate the scale of agreement with the statements on the questionnaire starting from a scale of 1 to 4 with criteria from not good to very good. The questionnaire includes two main aspects, namely the presenters and the organization of the training. Meanwhile, quantitative data is processed by calculating percentages that refer to equation [1]. The number of participants is 8 people so that the maximum score obtained is 32 or a maximum percentage of 100% if all participants answer on a scale of 4. Meanwhile the value obtained depends on the participant's entry. If all participants give a value of 1 then the lowest number is 8 or a minimum percentage of 25%. Based on this, the difference between the maximum percentage and the minimum percentage is 75%.

$$\frac{Total\ value\ obtained}{Total\ value\ maximum} \: x \: 100\% \quad ....(1)$$

The PKM team used a Likert scale of 1 to 4, so the interval class was also divided into four levels. The interval value obtained is 18.75% with the following calculations: $\frac{75\%}{4}$. The conversion results as well as the level of satisfaction are shown in Table 1.

Table 1. The level of participant satisfaction with the implementation of the *workshop*

No	Percentage	Information
1.	81.26 % - 100%	Very good
2.	62.51 % - 81.25 %	Well
3.	43.76 % - 62.50 %	Pretty good
4.	25.00 % – 43.75 %	Not good

Based on these criteria, the obtained data from the questionnaire were then processed using the equation formula [1], and the results are presented in table 2.

Table 2. Results of questionnaires by workshop participants

No	Question	Number of Respondents	Percentage	Information
1.	How is the mastery of the material presented by the presenters?		90.3%	Very good
2.	How is the systematic presentation of the material?		89 %	Very good
3.	Is the method used properly?		87%	Very good
4.	Are the supporting facilities for PKM activities good?	30 people	85%	Very good
5.	How useful is the AR technology introduction workshop for you?		93%	Very good
6.	How is the speaker's empathy for the diversity of the trainee's competencies?		83%	Very good
7.	How did the presenter provide feedback to the workshop's participants?		81%	Very good

Based on the summary of the quantitative data obtained, it can be concluded that the workshop activities have been carried out very well.

Qualitative data obtained from participants' answers in the form of essays filled with suggestions for a series of improvements to the implementation of similar *workshops* in the future. In Table 3 is an excerpt from the responses written by the participants about consumption, the friendliness of the committee, the affordability of the *workshop venue,* as well as the facilities.

Table 3. Responses from participants about the workshop activities

No	Suggestions and Impressions
1.	This training provides benefits for us as teachers to learn to teach computational thinking in the elementary school environment.
2.	Hopefully there will be a more in-depth follow-up workshop
3.	It's really exciting, elementary school children have to try it because it will be an interesting lesson
4.	Conduct training on technology frequently, keep going
5.	Very useful to help learning in class
6.	Alhamdulillah, his knowledge is very useful for student learning media, especially elementary students. And hopefully there will be other activities that can be shared with teachers both in the UPI and Purwakarta environments
7.	Pretty good, hopefully it can be developed
8.	The training continues
9.	Very useful, hopefully it can expand its usefulness to people across the spectrum
10.	It's great, I hope there will be another opportunity for another workshop

4. CONCLUSIONS

The workshop on the introduction of *augmented reality* technology to create learning media among teachers in Purwakarta district has been carried out well and smoothly. The number of participants attending this workshop were 30 teachers who are members of the FOKUSDAS in Purwakarta. The training materials cover three topics, namely introduction to metaverse and AR technology, installation of Unity tools to create AR and tutorials for making learning media with AR technology, with one example of the field of geometrical mathematics. By carrying out this activity, teachers can add insight and skills to utilize AR technology as an interactive learning medium.

Suggestions that need to be considered so that other similar activities can be carried out properly are related to the time or duration of the workshop activities which should be longer and more intensive. Furthermore, the material exploration session should be expanded again with the target participants being all teachers who are members of FOKUSDAS as well as public school teachers in Purwakarta Regency. Further, monitoring the work of teachers in implementing workshop materials for the learning process should also be done.

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