

Research Article

Augmented Reality as a Media of Mathematics Learning in the Post-COVID-19 Pandemic

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Abstract.

In this era, the development of technology is going quite fast. Smart phones are common to use in every element in society. The usage of technology increased rapidly especially after COVID-19. People have started using gadgets more intensively almost for every activity and working from home is the one of it. The advancement of technology has affected every aspect of human life and one of these is education which should be able to adjust with the development of technology. The new innovation in educational aspect is learning media that should be done. R&D is the method to know how the design that wants to be developed and know the development of augmented reality learning media in elementary school at second-grade mathematics subjects in space shape lesson. As for the result of this research are states that the augmented reality learning media that is developed is worthy and good in both material and media aspects as the solution for today's learning innovation especially for mathematics subjects in space shape lessons.

Keywords: Augmented Reality, Mathematics Learning, Post-COVID-19

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1. INTRODUCTION

The process of learning mathematics in the classroom is strongly influenced by how the teacher field is to a learning process it's means that the teacher must pay attention to how to convey a material so that the material can be absorbed optimally by students [1]. The learning process is influenced by one of the things that are quite important to make make learning activities more easily that is learning media [2]. Media in learning uses to make activities learning more easily do learning goals can be reached [3]. In the period of distance or online learning applied during the Covid-19 pandemic, the role of the media is considered very important as a forum or intermediary for the achievement of effective and efficient learning [4].

Online learning that has been applied in Indonesia makes the educational aspect must adjust to technology so that learning can still take place. The adjustments should

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be done can be seen from the research conducted by the Ministry of Communication and Informatics and United Nations Children's Fund Indonesia or UNICEF Indonesia states that out of 30 million children and adolescents in Indonesia choose digital media as a communication and information channel such as smartphones [5]. Based on these things, it can be concluded that the need for the development of android-based media in or subjects so that there is a fun, effective and efficient learning that is in line with the development of science and technology[6]

Regarding the development of technology-based learning media Quoted from kompasTv page of head of Semarang City Education Office Gunawan Saptogiri [7] Emphasizing that currently there is a need for a new innovation and breakthrough, one of which is in the development of the use of technology carried out by mathematics teachers so that the subject feels more interesting and fun for students. Mishra & Koehler [8] He said that right now teachers must be able to master technological pedagogical content knowledge (TPACK) in order to integrate technology well in learning. The meaning of the message and the purpose of education or learning can be conveyed well to students can use a tool called a learning medium. [9]. The use of learning media is also considered capable of optimizing interaction between teachers and students or students with other students [10]. Augmented Reality media or commonly called AR is considered capable of providing solutions, the solution we can know that Augmented Reality media has many advantages as said Mustakim and Kurniawan [11] that Augmented Reality media is considered more interactive, effective and easy to operate.

2. RESEARCH METHOD

The method used in this research is the Research and development method or abbreviated as R&D where the end of its implementation produces a product[12]. In the world of education has the goal to create a product that can be used to help a learning process [13]. Research activities which means looking for and exploring the analysis of user needs and development is an activity that can produce a learning media that has been validated by both material experts and media experts [14]. Development research is a procedure or procedure performed to develop a new product or perfect an existing product and then can be accounted for [15].

The types and data sources used in this study are using validation and trials by developing Augmented Reality media. The type of data in this study is qualitative data which is data from classification or classification that aims to improve Augmented Reality media that will be developed in the subject of trials in the study. With this, researchers

obtain primary data sources by providing instrument sheets in the form of questionnaires to material expert validators and media expert validators and secondary data sources by conducting interviews with material expert validators and media experts about this research.

Data collection techniques use likert scales for both validation instruments research. The data obtained is then calculated using the average formula and categorized based on the conversion table 1 and 2 [16] :

TABLE 1: Likert scale conversion.

Range	Category
$x > 4.8$	Very good
$3.36 < X \leq 4.08$	Good
$2.64 < X \leq 3.36$	Enough
$1.92 < X \leq 2.64$	Bad
$X \leq 1.92$	Very Bad

TABLE 2: Eligibility level likert scale.

Range	Category
$X > 4.00$	Worthy
$3.49 < X \leq 4.00$	Worthy
$2.99 < X \leq 3.49$	Not Worthy
$1.99 < X \leq 2.99$	Not Worthy
$1.00 < X \leq 1.99$	Not Worthy

3. RESULTS AND DISCUSSION

The development process is carried out by creating an initial design of learning media using a variety of software that can support and prepare assets that must be owned to create an initial design of AR learning media. Such software as Blender, Photoshop, Vuforia, Unity and Marker generator. Display user interface or UI and space building objects that appear in the initial design. Please note that the marker is a gamble that will later be scanned by the android camera then will appear an AR object right at the marker and then the AR object that appears will match the image on the scanned marker. While Blender, Photoshop, Vuforia, Unity is software used to prepare AR media design both objects, animations, UI designs. The basic competencies contained in this study are 3.10 and 4.10 in the second-grade mathematics subjects of space building materials.

This research is a development study that aims to get information and direction from expert media validators from aspects of media design both in color selection, display on screen, display design and animation [17]. Aspects of the device that must also be loaded in the validation instrument sheet [18]. Researchers asked several questions and discussed during the validation process about the feasibility of AR learning media with media expert validators.

TABLE 3: Media expert validation results.

No.	Aspect	Media Expert 1	Media Expert 2	Average	Category
1	Display Design	4.75	4.25	4.50	Worthy
2	Use of Color	5.00	3.00	4.00	Worthy
3	Animations and Objects	5.00	4.75	4.87	Worthy
4	Device Aspects	5.00	3.33	4.17	Worthy
Total				4.38	Worthy

The results of the validation process to the media expert validator above use the likert scale to find out the level of media feasibility. It is then calculated with an average formula and produces an average score of 4.38 and falls into a worthy category with some revisions that add instructions for using AR media and the addition of quizzes to make the media more interactive. The appearance of the results of the revision of media experts can be seen in Figure 2 below.



Figure 1: Menu addition to AR media.

The next step is the valuation process by the material expert validator by assessing aspects of the curriculum, material content and learning [18].

TABLE 4: Material expert validation results.

No.	Aspect	Range	Category
1	Curriculum	3.60	Good
2	Content	3.50	Good
3	Learning	5.00	Very Good
Total		3.89	Good

The score obtained from the validation results of media experts uses the same scale, namely the likert scale to find out the level of media feasibility. The average formula is used to calculate the validation results of material experts and produces an average score of 3.89 and entered into the category both to be used but with revisions they are AR position that appears must be in accordance with the image on the marker, additional material content and changes in menu order and changes in AR display that appear.



Figure 2: Emerging AR display changes.

Ui's initial design in the initial design of AR learning media also changed after the addition and improvement of media by validators who had only three menus then increased to four menus by adding a menu "line segment" and menu order that pays attention to aspects of the material sequence on the syllabus.

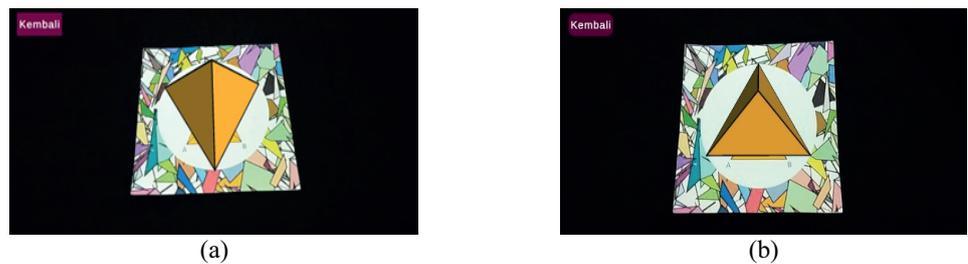


Figure 3: User interface changes.

The addition of the menu made is an adjustment to the material that should also be taught to students so that the concept of student understanding is more appropriate. The material added is the material of the line segment where the material is an introduction before the material builds space. The addition of quizzes is done so that the media feels more interactive.

4. CONCLUSION

Based on the results of validation of Augmented Reality learning media by material expert validators and media experts and the completion of recommended revisions, it

can be known that Augmented Reality learning media in mathematics subjects grade II elementary / MI space building materials are declared good and feasible as learning media. The results of learning media development research that reached 4.38 worthy in terms of media and reached 3.89 are included in the good category by materials aspect. The limitations of this research only come down to validation by media experts and material experts. Therefore, there needs to be further research to apply AR media to small group trials and large group trials.

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