

## **DEVELOPMENT OF ANDROID-BASED AUGMENTED REALITY LEARNING MEDIA ON CHEMICAL BONDING MATERIAL IN CLASS XI AT SMA N 1 SIDIKALANG**

**Erianti Simbolon <sup>\*1)</sup>, Zainuddin Muchtar <sup>2)</sup>**

<sup>1,2)</sup> Department of Chemistry, Faculty of Mathematics and Natural Science,  
State University of Medan, North Sumatera, Indonesia.

*\* Corresponding author*

*e-mail: [erianti833@gmail.com](mailto:erianti833@gmail.com) <sup>\*1)</sup>*

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### **ABSTRAK**

This research aims to determine the feasibility and student response to android-based Augmented Reality learning media on chemical bonding materials. This study uses the research and development method (R&D). The model used in the study is the development of the 4D model: 1) Define, 2) Design, 3) Develop, and 4) Disseminate. The results showed that the assessment results from validators, both material experts and media experts, showed that this learning media was included in the very valid category with a validity value of 98% from material experts and 95% from media experts, which indicates that this media is very feasible to use as learning media. Student response to the use of augmented reality learning media is positive, with a value of 93%, which is a very interesting category. This shows that android-based Augmented Reality learning media on chemical bond materials are feasible, interesting, and can be used in learning chemistry.

**Keywords:** development; learning media; augmented reality

### **INTRODUCTION**

In the Industrial Revolution 4.0 era, technology and communication have become the main factors driving change in all aspects of life, including education. This requires the world of education to continue developing education relevant to the needs of the times, utilizing technological innovation, and ensuring that every individual has equal access to the learning opportunities offered by this era. According to (Lase, 2019), education in this rapid technological development reflects a variety of methods to integrate science and technology, both in physical and virtual form, into the learning process.

One of the most rapidly advancing technologies today is the smartphone. Smartphones have become highly valuable

due to their internet capabilities, enabling users to share information worldwide. Consequently, the number of smartphone users rises annually. Indonesia ranks fourth with the highest number of users in Asia. KOMINFO states that smartphone users in Indonesia have reached 89% (Fitria, et al., 2022). It is important to carefully approach technology, particularly smartphones, as it is increasingly evolving. In education, the high number of smartphone users unquestionably represents both a challenge and an opportunity. The challenge arises from the potential misuse for harmful purposes. However, the advancement of

technology beneficial to education is significantly aided by smartphones, presenting both a difficulty and a remarkable opportunity. Utilizing this technology as an efficient, original, and informative learning media is one of the advantages that may be gained from its existence. So that new educational application media, such as Augmented Reality (AR) technologies, can be produced.

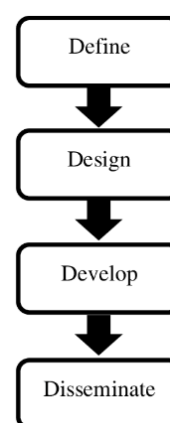
Augmented reality is an application that combines physical reality with the virtual world in two or three dimensions, which is displayed simultaneously in a real environment. Augmented reality innovation emerges as a solution to overcome human memory's limitations for only written information. Augmented reality technology can virtually display 3D science objects on a smartphone screen, creating a more interactive learning experience by involving students. The augmented reality approach is a new way to enhance learning through three-dimensional representations (Kristina et al., 2021). Learning Media that utilizes AR technology improves the learning process and student interest in understanding the material because AR has visuals that can increase student interest in learning and playing (Prasetyo et al., 2020).

Based on the observations at SMA Negeri 1 Sidikalang, the learning methods used were still ineffective. Students are unresponsive and less enthusiastic about chemistry lessons. This is due to the limited learning media facilities, which only include printed books and PowerPoint

presentations. The utilization of technology and information as learning media is also still lacking. Therefore, augmented reality in education is one of the developing technologies that allow users to interact realistically. World of education that allows users to interact in real-time with the system. With the system, augmented reality can combine the real world with the virtual world made by computers. This technology is expected to solve current educational problems, especially the demand for the application of ICT in every subject, especially chemistry. This research aims to determine the feasibility and student response to Android-based Augmented Reality learning media on chemical bonding materials.

## METHOD

This research uses the development method of Research and Development (R&D), which produces Android-based augmented reality learning media products. The model used in the research is the 4D model:



**Figure 1.** Research Design Flow

Define, the step in determining and defining the requirements for the required learning media is the definition stage: (1)

Front-end analysis; this stage analyzes and determines the basic problems that occur at SMAN 1 Sidikalang in developing learning media through interviews and observations. (2) Student analysis: A student needs questionnaire is distributed to determine students' learning obstacles. 3) Concept analysis identifies chemical bonding material in class X containing the scope of material that students will learn and complete. 4) The formulation of learning objectives is derived from the Learning Objectives Flow (ATP), which guides the creation of the Teaching Module based on the independent curriculum.

Design, based on the needs analysis results conducted during the definition stage, the design stage proceeds, which involves: (1) Media selection: Media selection is performed to identify learning resources that are appropriate for the material's characteristics and meet the needs of students. Media is selected according to student analysis and concept analysis in the previous stage. (2) Selection of the form of presentation of learning media. The Augmented Reality (AR) learning media is delivered as an application designed for Android smartphones. (3) Initial design, the initial design carried out using the Unity application, with Vuforia for the creation of augmented reality applications

Development, at this stage, aims to produce valid and appropriate learning media. Expert Testing: At this stage, the learning media is tested by competent experts in their fields, namely material experts and media experts, to revise the learning media developed at the design stage. The data obtained in the form of

numbers is analyzed to see the suitability of the media using a measurement scale (Likert scale) with the categories: (4) very valid, (3) Valid, (2) less valid, (1) invalid (Sugiyono, 2015).

Disseminate, at this stage, android-based augmented reality learning media on chemical bonding materials are distributed in class XI MIPA 8 SMA Negeri 1 Sidikalang. The media was tested on 33 students of class XI MIPA 8 SMA N 1 Sidikalang to get student responses by filling out a questionnaire that had been given to them. The data obtained in the form of numbers were analyzed using a measurement scale (Likert scale) with the categories: (4) very interesting, (3) interesting, (2) not interesting, and (1) very uninteresting (Sugiyono, 2015).

## RESULTS AND DISCUSSION

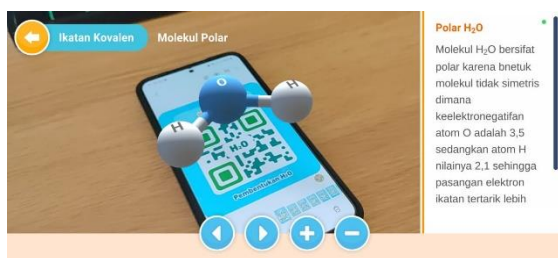
The development research results are in the form of Android-based Augmented Reality (AR) learning media, which focuses on chemical bonding material. Here are some displays on augmented reality learning media on Chemical Bonding material.



(a)



(b)



(c)

**Figure 2.** (a) Main Menu, (b) Material Menu, (c) AR Display

### The validity of Android-based Augmented Reality Learning Media

The augmented reality learning media that has been developed is then validated by material experts and media experts. Validators who are material experts in validating Android-based Augmented Reality learning media are chemistry teachers SMA Negeri 1 Sidikalang.

**Table 1.** Data Analysis of Material Expert Validation Results

Assessment Aspects	Feasibility Percentage (%)		Average Score (%)
	Material Expert 1	Material Expert 2	
	Learning Design	100	
Materia Benefits	100	95	97,5
<b>Avarage (%)</b>	<b>100</b>	<b>95,4</b>	<b>98</b>
<b>Category</b>	<b>Very Valid</b>	<b>Very Valid</b>	<b>Very Valid</b>

Based on the Table above, the overall average score is 98%, with a very valid category. The material aspect consists of three criteria for assessing aspects of learning design, material, and benefits, and each obtained an average

validity score of 95,8%, 97,5%, and 100% with a very valid category.

Validators who become media experts in validating Android-based Augmented Reality learning media are Unimed chemistry lecturers. The overall average score is 95%, which is a very valid category. The media aspect consists of three assessment criteria, namely aspects of learning design, software, and benefits, and each obtained an average validity score of 92%, 97.5%, and 100% with a very feasible category. Therefore, the media developed is very feasible to use as learning media. Data on the results of media validation can be seen in the table below

**Table 2.** Data Analysis of Media Expert Validation Results

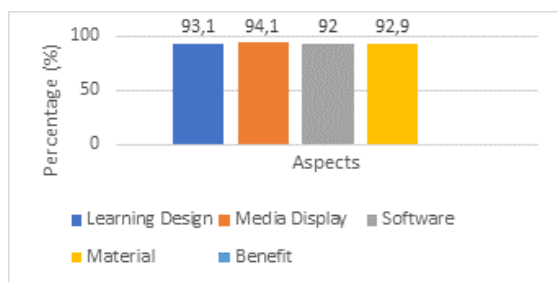
Assessment Aspects	Feasibility Percentage (%)		Average Score (%)
	Media Expert 1	Media Expert 2	
	Learning Design	93,1	
Software Benefits	95	100	97,5
<b>Avarage (%)</b>	<b>95</b>	<b>95</b>	<b>95%</b>
<b>Category</b>	<b>Very Valid</b>	<b>Very Valid</b>	<b>Very Valid</b>

### Students' Response to Android-based Augmented Reality Learning Media

Android-based Augmented Reality, learning media on chemical bonding material that is feasible, is distributed on a limited basis to 33 students of class XI-

MIPA 8 SMA N 1 Sidikalang through the Google Drive link [https://drive.google.com/file/d/1q8yPy0SL4amP4sObwO3sZ\\_41UC11wMPb/view?usp=sharing](https://drive.google.com/file/d/1q8yPy0SL4amP4sObwO3sZ_41UC11wMPb/view?usp=sharing) then conducted a trial of 33 students to determine the student response to the media developed.

The results of data analysis from student response sheets obtained a percentage of 93.3%, based on the criteria guidelines used in this study, namely learning media, which is declared very interesting if it is in the range of 76%-100%. These results indicate that the media developed are categorized as very interesting, in accordance with the categories set by Burhanuddin (Burhanuddin, 2017). So based on this, it can be concluded that the Android-based Augmented Reality learning media on chemistry bond material is interesting to use as learning media. The results of the data from the analysis of student responses can be seen in the figure below.



**Figure 3.** Students Respond Results

## CONCLUSION

Based on the results of the research obtained, it can be concluded that:

1. Android-based Augmented Reality Learning Media on chemical bonding material is feasible to use in learning, based on an assessment

by material experts with an average percentage of 98% with a very valid category and 95% of media experts with a very valid category.

2. Android-based Augmented Reality learning media on chemical bond materials received a positive response from students with a percentage of 93% with a very interesting category.

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