JoTaLP: Journal of Teaching and Learning Physics 8, 1 (2023): 33-38
Website: http://journal.uinsgd.ac.id/index.php/jtlp/index
ISSN 2580-3107 **(online) ISSN** 2528-5505 **(print)**

[Research Article]

AUGMENTED REALITY INTEGRATED POSTER AS A MEDIA TO INTRODUCE GAUSS SCIENCE FIGURE AND THE CONCEPT OF ELECTRIC FIELDS

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DOI: http://dx.doi.org/10.15575/jotalp.v8i1.24319
Received: 26 February 2023 ; Accepted: 28 February 2023 ; Published: 28 February 2023

ABSTRACT

Poster is one of the learning media used by educators and students in the learning process. However, poster that only displayed in two-dimensional form makes the poster unable to describe three-dimensional concepts in physics, so it requires a combination with augmented reality technology that can combine two- and three-dimensional objects. Therefore, this study aims to produce an integrated augmented reality poster as a medium to introduce the scientist Johann Carl Friedrich Gauss or known as Gauss and the concept of the electric field. This research was developed using the ADDIE approach (Analysis, Design, Development, Implementation, Evaluation). The results of the feasibility tests have been carried out by material experts, media experts, and users and it can be concluded that the integrated augmented reality poster as a medium to introduce scientist Gauss and the concept of the electric field is feasible to be used as a teaching medium in learning physics.

Kaeyword: Augmented Reality, Electric Field, Gauss, Posters

How to cite: Afifah, S., Bakri, F. & Muliyati, D.. (2023) Augmented reality integrated poster as a media to introduce gauss science figure and the concept of electric fields, *Journal of Teaching and Learning Physics* ***8*** (1), 33-38. DOI: http://dx.doi.org/10.15575/jotalp.v8i1.24319

1. INTRODUCTION

The use of media as a companion in the learning process is increasingly needed to overcome problems that arise due to limited time, place, and other facilities. The role of the media is very much needed in learning by distributing messages from the teacher to the students. Utilization of media that is used as an intermediary in learning one of which is a poster. A poster is an image that combines visual elements such as lines, pictures, and words that intend to attract attention and communicate messages briefly (Anitah, 2008).

And one of the media that is used as a mediator in learning is a poster. The principle of posters used in education is to embody ideas in the form of simplified and large-sized illustrations of image objects (Daryanto, 2012). The goal is to attract attention, persuade, motivate, or warn about certain main ideas, facts, or events. Educational Posters can function to attract students' interest in the messages that want to be conveyed, seek support for an idea, as well as a method for students to carry out the messages displayed on the posters (Sadiman et al., 2011).

One of the uses of posters in science education is the use of posters to introduce science figures (scientists) and their discoveries. Scientists are the main key to the development of science. A scientist must always think, research, and make various efforts for the development of science. And it is fitting for scientists to be role models for their role in science. Instead of science figures and scientists, we can be inspired to explore more ideas and hone creativity, science and technology, and ethical solidarity aspects that can later be applied in everyday life (Maftukin, 2015).

Several studies that use posters as learning media have been developed into various types, including using posters based on pictorial riddles to increase interest and learning outcomes in class X SMA Negeri 1 Jogonalan (Indah, 2018). In addition, a schematic-based poster was also developed to increase students' understanding of the material for class XI human movement systems (Irnawati, 2018). But besides the advantages mentioned above, posters also have weaknesses, one of which is the two-dimensional poster media making it difficult to describe a concept in real terms, one of which is in the physics of the electric field concept studied by Johann Friedrich Gauss, or known as Gauss. So that it is necessary to combine posters with other technologies to further optimize the function of posters as learning media, namely with augmented reality technology.

In recent years, AR technology has shown rapid development and has been widely applied in various fields, one of which is education (Chen et al, 2019; Chusni & Zakwandi, 2022)). According to Haller et al. (2007), augmented reality aims to develop technology that allows the real-time merging of digital content created by computers with the real world. Apart from computer media, currently AR technology has been developed on Android smartphones. Based on research on the use of augmented reality applications in the learning process, it was obtained that the average value of student learning outcomes using augmented reality-based learning media was higher than the average value of student learning outcomes that did not use augmented reality-based learning media (Khan et al., 2019). This is possible because the AR system combines objects in the real world with virtual objects to present a display of positive imagination, both from the viewpoint the hearing from the student point of view (Jorge, 2014).

The problems and explanations above encourage developers to develop posters integrated with augmented reality as learning media that are appropriate as learning media. With the advantages of the augmented reality technology described above, it is hoped that this technology can complement the shortcomings of the poster to make the poster a more suitable learning medium as one of the physics learning media.

2. METHOD

The methode used in this research is Research and Development (R&D). R&D is described as a

research method used to produce a particular product and test the effectiveness of the product being made.

The procedure for this study uses the ADDIE approach, which consists of five phases which include analyze, design, development, implementation, and evaluation. Researchers used the ADDIE approach because the system is simple and reinforced by Pawana's opinion (Maharani, 2013) where ADDIE is suitable for use in this study because the product is in the form of software designed to assist the learning process.

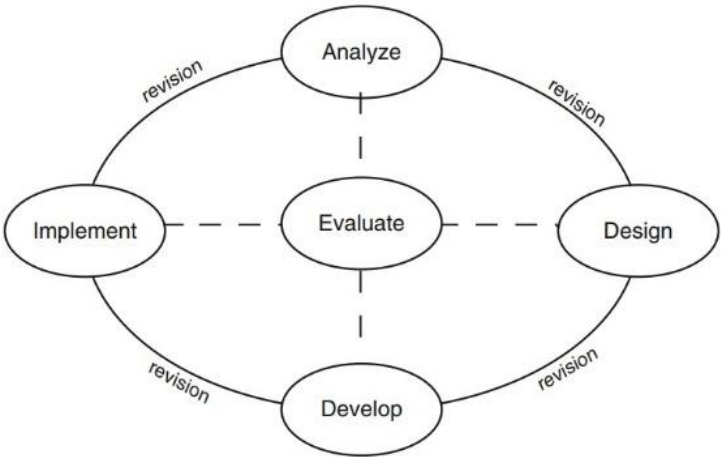

Figure 1. Phases of the ADDIE Research Procedure (Branch R.M., 2009)

Researchers modify this ADDIE approach according to needs. The development procedure consists of five phases, namely:

2.1 Analyze Phase

At this phase, the researcher analyzes material that can be developed and displayed in posters and augmented reality. After that, an evaluation will be carried out at the analysis phase.

2.2 Design Phase

At the design phase, an integrated augmented reality poster assessment instrument will be designed in the form of a product assessment instrument grid, a collection of various materials, images, and animations that will be included in the product, and evaluation at the development phase.

2.3 Development Phase

In the development phase, an integrated augmented reality poster product will be developed as a medium to introduce the science figure Gauss and the concept of the electric field in the form of developing posters, AR content, and AR applications. After that validation will be carried out by material and media experts, then the product will be revised and evaluated based on the validation results.

2.4 Implementation Phase

In this implementation phase, the product will be tested on users by distributing questionnaires to measure and find out the opinions/responses of users regarding the media that has been made.

2.5 Evaluation Phase

At the evaluation phase, the data obtained from the questionnaire will be analyzed to determine the feasibility level of the product and the final product will be an integrated augmented reality poster as a medium to introduce the scientific figure Gauss and the concept of the electric field.

The data collection technique used to obtain data and information in this study was distributing questionnaires to respondents. The form of the questionnaire used is a

structured questionnaire (closed questionnaire) because the questionnaire form will provide several alternative answers. The answer uses 5 scales, namely very feasible, feasible, moderately feasible, less feasible, and not feasible.

Table 1. Example of an Assessment Score for Answer Choices.

Score	Answer Choices
5	All AR videos match the markers
4	Most of AR videos match the markers
3	Part of AR videos match the markers
2	A small portion of AR videos match the markers
1	All AR videos don't match the markers

Table 2. Student Response Questionnaire Grid

Aspect		Criteria
1	Display	The attractiveness of the poster view
		The quality of the image on the poster
		The level of readability of the writing on the poster
2	Language	Appropriateness of the use of language in the poster
AR		
3	*AR Application*	The ease of use of AR applications
		The attractiveness of the AR video display
		AR video quality
		AR video content can motivate respondents

After the results of the assessment score data are obtained, then the average is searched and converted into an assessment statement to determine the quality and feasibility level of the resulting product based on user opinion. Converting scores into the requirements for this assessment can be seen in Table 3.

Table 3. Feasibility Conversion

Score Range	Category
$X > 4.0$	Very Feasible
$3.3 < X \leq 4.0$	Feasible
$2.7 < X \leq 3.3$	Moderately Feasible
$1.9 < X \leq 2.7$	Less Feasible
$X \leq 1.9$	Not Feasible

Based on the table data above, the product of developing an integrated poster with augmented reality as a medium for introducing the science figure Gauss and the concept of the electric field will end when the assessment score for this learning media meets the feasibility requirements in the very feasible, feasible, or moderately feasible categories.

3. RESULT AND DISCUSSION

3.1 Result

The results of product development are AR posters on the science figure Johann Carl Friedrich Gauss (Gauss) and an Augmented Reality application containing content about the Gauss science figure along with the concept of an electric field which will be installed on Android OS mobile phones.

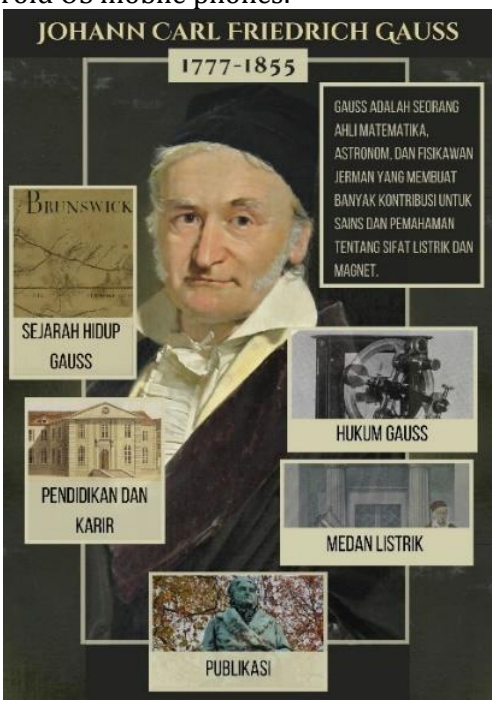

Figure 2. Poster of Gauss science figures

Figure 3. Animation displayed on the poster

The validation test by material and media experts was carried out by lecturers from Universitas Negeri Jakarta with the results of the average score being as provide in Table 4.

Table 4. Validation Results

Type of Validation Test	Content Validation	Media Validation
Average Score	4.5	4.29

Table 5. User Response Results

User	Average Score Each User
1	4.8
2	4.53
3	4.4
4	4.3
5	4.47
6	3.8
7	4.53
8	3.93
9	4.27
10	4.47

3.2 Discussion

Based on the development results, it can be seen that an integrated augmented reality poster has been developed as a medium to introduce the scientific figure Gauss and the electric field concept which was developed according to the ADDIE approach (Analyze, Design, Development, Implementation, Evaluation).

This AR application contains content from the life history of the science figure Gauss and the electric field concept material. When the AR application is opened, it will display the camera used to scan markers in the Augmented Reality Digital System book. There are 5 markers on the poster which contain animated content about Gauss's life history, education, career, publications, Gauss's law, and electric fields.

The validation test by material experts is carried out focusing on the content of the material to be conveyed through the application and is carried out to ensure that the content of the material is following the material that has been determined. The material expert validation test was carried out by a Lecturer at Universitas Negeri Jakarta. Based on the assessment of the material validation expert, it can be analyzed that the average rating score is 4.5 and is in the Very Feasible category.

Media validation expert testing focuses on assessing posters and AR applications to determine the feasibility of posters and AR applications to be tested on users. The media expert validation test was carried out by lecturers from Universitas Negeri Jakarta. Based on the assessment of experts, it can be analyzed that the average rating score is 4.29 and is in the Very Feasible category

In testing the user's response, the test was carried out to find out the response from the user after using the integrated augmented reality poster as a medium to introduce the scientific figure Gauss and the concept of the electric field that the researchers developed by filling out a questionnaire. The requirement to carry out field tests is of course that learning applications have been declared feasible for field trials by content experts and media experts. From the results of the user response test, it is known that the average rating score is 4.353 and is in the Very Feasible category.

4. CONCLUSION

The conclusions obtained from the results and discussion of the development of an integrated augmented reality poster as a medium for introducing Gauss science figures and the electric field concept, namely: 1) An integrated augmented reality poster has been successfully developed as a medium for introducing Gauss science figures and the electric field concept following the development flow application with the ADDIE approach. 2) Based on the product validation process by material experts, an average rating score of 4.5 is obtained, an average media expert validation score is 4.29, and an average user response score is 4.353, so the poster is integrated with augmented reality as a medium to introduce the science figure Gauss and the concept of the electric field proved to be appropriate as a learning media.

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