The Development of Applications using Augmented Reality (Check Similarity)

By Dwi Sulisworo

JPF | Volume 9 | Number 2 | 2021 | 117-124

p - ISSN: 2302-8939
e - ISSN: 2527-4015

Jurnal Pendidikan Fisika

https://journal.unismuh.ac.id/index.php/jpf

DOI: 10.26618/jpf.v9i2.4899

The Development of Applications using Augmented Reality Technology as the Teaching Media of Special Mirror Lights

Rosynanda Nur Fauziah[1)*], Dwi Sulisworo[2)]

[1)]*Postgraduate Program of Physics Education, Universitas Ahmad Dahlan Yogyakarta, Yogyakarta, 55161, Indonesia*
[2)]*Departement of Physics Education, Universitas Ahmad Dahlan Yogyakarta, Yogyakarta, 55161, Indonesia*

**Corresponding author: rosynanda1907041002@webmail.uad.ac.id*

Received: February 17, 2021; Accepted: April 10, 2021; Published: April 30, 2021

Abstract *– This research was conducted due to the low interest of researchers to develop applications using smartphone-based Augmented Reality technology. The objective of this study was to produce a teaching media based on smartphone applications using augmented reality technology. The research method used was research and development with a 4D (Four-D) development model, which consisted of 4 stages, namely Define, Design, Develop, and Disseminate, which aimed to produce products with experts validity, namely media and material experts and also students' responses. The results of assessment in the teaching media development conducted by the media experts was 4.273 (Good), while the assessment value from the material experts was 4.291 (Good). The average value of students' responses was 4.083, and it can also classified as Good. It means that the applications can be used as teaching media in the classroom to boost innovation for efficient and interactive teaching. Therefore, it can be concluded that the applications are suitable for use and apply in learning activities.*

Keywords: *Augmented Reality, Learning Media, Smartphone, Special Lights Mirror*

I. INTRODUCTION

Information and communication technology (ICT) has developed rapidly and cannot be separated from human life. Information and communication technology can also reach all fields, including education (Agrawal et al., 2018). Education is the biggest investment of a nation; it has a major role in creating quality human resources to be able to master and develop science and technology (Marisda, 2016). Information and communication technology in education is alleged to be able to make changes and create new learning experiences for both students and teachers (Chaidar, 2014). The development of science and technology, especially the advances of information and communication technology (ICT) which is very rapid in recent years has created a new tradition and culture in education (Ishaq, 2018). One example of the use of information and communication technology in education is the use of ICT to create many new learning media used in the teaching and learning

process (Roblek et al., 2016). The use of instructional media using interactive technology aims to help students understand the concepts of learning it's self (Anwariningsih & Ernawati, 2013).

The learning concept that will be applied with technology-based teaching media leads to smartphones in teaching and learning activities (Martono & Nurhayati, 2014). The smartphone is a device that has a function as a communication tool, video playback tools, web browsing, email, media downloading, games, and is a social necessity. Smartphones can be used portably and are more compact. A sophisticated operating system's ability supports its use in completing tasks well in a relatively fast and short time (Foen et al., 2017). Therefore, smartphones have attracted the world of education and can be used as learning assistive technologies.

One of the uses of smartphones that can be applied in the world of education as a teaching medium is to use Augmented Reality as a technology used to create applications that will be used for learning. Augmented Reality is a technology that combines two dimensional or three dimensional virtual objects to become real and then projects these virtual objects to become real in virtual objects (Budiman, 2016). Augmented Reality is a technology that allows the precise integration of digital content created by computers with the real world (Chen et al., 2019). Augmented Reality technology can be used interactively on computers and smartphones to explore information (Kaji et al., 2018).

The learning media that will be developed using a smartphone with augmented reality technology is the ARSIF application. Arsif stands for Augmented Reality *Sinar Istimewa Fisika*, or an application that can be used as a learning medium in teaching and learning activities in physics subjects. This development was carried out due to the lack of learning media results using smartphone-based augmented reality technology. This is because researchers still lack interest in developing applications using Augmented Reality technology (Febrianti, 2016).

This research aims to produce a learning media based on smartphone applications called ARSIF using augmented reality technology on special lights mirror material. With this research, the teacher can use it as a reference for producing innovative, effective, and interactive learning media.

ARSIF is an augmented reality of special lights mirror, which will be developed in this study. This study is also to assess the effectiveness of the ARSIF application as a learning medium used in the learning process in physics subject matter special lights mirror. The augmented reality technology used in this development is a technology that combines natural objects with virtual objects (Sumardani, 2020).

Augmented Reality is a technology in the form of an application by combining the real

world and the virtual world into three dimensions that are projected simultaneously and can be displayed on a smartphone camera (Dewi & Anggaryani, 2020). This three-dimensional display of Augmented Reality is in the form of a virtual image superimposed on a real environment accurately. Augmented Reality in 3D can be displayed via a smartphone camera (Bacca et al., 2014). So that Augmented Reality technology can be applied using a mobile phone that uses the Android operating system. The Android system is very supportive of the learning process strategy for use in today's digital era (Dewi & Anggaryani, 2020).

The ARSIF application can be operated with a smartphone's help by combining virtual objects how special Lights with their properties can reflect. This application itself is developed with computer assistance, augmented reality software, and also smartphones. The combination of virtual objects and real objects will be used as a medium of pursuit in schools and help students get closer to themselves. This application can help students to see for real the latest technologies.

II. METHODS

Based on the problems and research objectives then the research method used is a method Research and Development (R&D), a research and development method is a method for producing a product and is a series of processes or steps in order to develop a new product (Miraza et al., 2015) . R&D research methods can produce certain instructional media products (Haryati, 2012). This research's development model is the 4-D development model (four-D Model) proposed by Thiagarajan and Semmel in 1974 (Wahyudi et al., 2014). The 4-D development model was chosen to develop learning media using Augmented Reality technology. The 4-D development model is arranged systematically with a sequence of activities that can be used to create a learning medium (Wardani et al., 2019). The 4-D Model is divided into Define, Design, Development, and Dissemination (Irawan et al., 2018)

A. Research Subject

The subjects of this study were 19 high school students in grade ten in Subang, Jawa Barat. Classification of students as respondents is carried out randomly, due to limitations in learning activities. This research was conducted in November 2020.

B. Data Collection Techniques

A questionnaire was used to collect data in this study. The questionnaire is an instrument for data collection, in which participants or respondents fill out questions or statements given by the researcher. The type of questionnaire used for data collection is a closed questionnaire. This questionnaire consisted of 3 questionnaires, namely the media validation questionnaire, the material validation and the students' responses questionnaire.

C. *Data Analysis Techniques*

Data analysis techniques are carried out to obtain good quality products that meet the aspects of validity, practicality, and effectiveness data obtained through expert validation sheets and student responses to learning media with AR technology or ARSIF applications. The data analysis technique used in this research and development is descriptive with a Likert scale. The descriptive analysis technique aims to describe the data that has been collected. Formula 1 shows the calculation of validity and students' response.

$$\overline{X} = \frac{\sum X}{N_{X_i}} \quad (1)$$

remark:

$\overline{X}$ = Averagescore
X_i = Score per item
n = Number of respondents
$\sum x$ = The sum of all respondents' scores

Table 1. The scoring rules (Setiono & Riwinoto, 2015)

Category	Skor
Very Good	5
Good	4
Neutral	3
Bad	2
Worse	1

III. RESULT AND DISCUSSION

The results of this research are the development of ARSIF application learning media with augmented reality technology. The results can be seen in the image below:

Figure 1. ARSIF application icon

Figure 1 shows the icon of the application being developed; the image contained in this icon displays a special mirror light illustration.

Figure 2. Concave mirror illustration

Figure 2 shows the results of the illustration from the concave mirror, ARSIP application development with augmented reality technology requires some software such as Unity 3D, Blender, and Vuforia Engine. Apart from requiring software, ARSIF application development also requires hardware in the form of laptops and smartphones. From this development, the results obtained from the media expert validation, the material expert validation, and also the student's responsibility.

Learning applications with smartphone-assisted Augmented reality technology on special lights mirror material tested for their

validity by media experts and are declared Good (G) as in Figure 3.

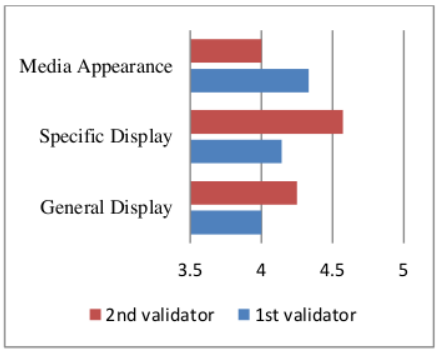

Figure 3. Media validation results

Based on Figure 3, the assessment for media validation includes aspects of general appearance, special appearance, and media presentation validated by two validators. Validator 1 assessed the general display aspect 4, special display 4.142, and media presentation 4.333 with a score range using a Likert scale of 1 to 5, with an average value of 4.158 and declared Good (G). Validator 2 assesses general display aspects of 4.25, special displays of 4.571, and media presentation of 4 with a score range of 1 to 5, and an average value of 4.273 and declared Good (G). The media validator assessed that the application was excellent to use and became a new learning medium for students at 10th-grade students in Subang. Besides, this ARSIF application is considered an innovative, effective, and interactive learning medium because it uses AR technology to combine the virtual world and the real world.

Then, for the results of material validation as in the following Figure 4.

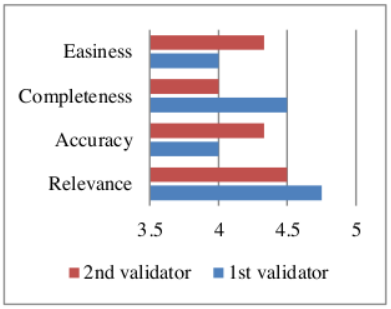

Figure 4. Material validation results

Based on Figure 4, the assessment for material validation includes aspects of material relevance, material accuracy, material completeness, and suitability of material validated by two material expert validators who state that the material is Good (G) to be used. 1st validator assessed the relevance (4.75), the accuracy (4), the completeness (4.5), and the suitability (4). The average value was 4.312 with a score range of 1 to 5 and stated that the material was Good (G). 2nd validator assessed the relevance (4.5), the accuracy (4.333), the completeness (4), and the suitability (4.333). The average score was 4.291 or Good (G). The material validator assesses that the material presented is straightforward and easy to understand by students. The material is following the essential competencies and core competencies contained in the 2013 Curriculum. The material selection is also suitable for the development of learning media using smartphone assisted Augmented Reality technology.

The validated application is then disseminated to students to get a response.

The responses from students are as for Figure 5.

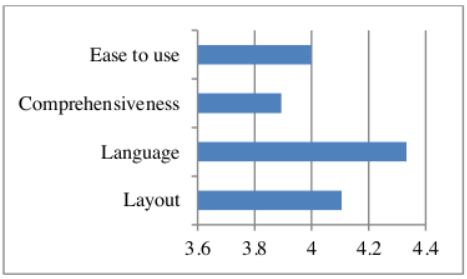

Figure 5. Student response score results

Based on Figure 5, the results of student responses to the development of ARSIF applications with smartphone-assisted AR technology are viewed from the layout/display aspects of 4.105, language/structure aspects of 4.333, aspects of completeness of content 3.894, aspects of ease of use 4. The average value of student responses to ARSIF was 4.083 or categorized in Good (G). ARSIF application with smartphone assisted Augmented Reality technology on special mirror lights material was suitable for students as a learning medium.

Based on student requests, the development of the ARSIF application with smartphone-assisted Augmented reality technology on this special light mirror material helps students understand the original physics concept combined with the virtual world. The ARSIF application can help students train independence in learning (Al-Fawareh & Jusoh, 2017). Students can use this application to present and solve problems of everyday life (Nandyansah et al., 2019). In addition, students can see special mirror light from natural objects in cyberspace using Augmented Reality technology (Bacca et al., 2014).

According to the concept used, Augmented Reality is an attempt to merge the real world into cyberspace via a computer so that the boundary is very thin. The ARSIF application has also combined the two worlds, so that the ARSIF application becomes an interactive application and is also effectively used in learning activities (Febrianti, 2016). By using augmented reality technology as an alternative to learning media, it is hoped that learning activities can be more attractive to people students. Another benefit obtained is a more advanced learning media by taking advantage of current technological developments this (Hakim, 2018).

IV. CONCLUSION AND SUGGESTION

This study's objective was to develop ARSIF application learning media with smartphone-based augmented reality technology on the material based on the results of the assessments of the experts. The score of validation from the media experts was 4,273 and classified as good (G), while the score of validation from material validation expert was 4.291 and classified as good (G). Students' responses indicated that the development of the ARSIF application was good (G), with an average score of 4,083. Thus, it can be concluded that the ARSIF application is suitable for use and application

in learning activities, and teachers can use learning media with this Android based augmented reality technology in everyday learning and in different physics subject matters.

Suggestions for further research are the development of smartphone-based learning media with augmented reality technology that can function as a simulator not only as a learning medium, and researchers also hope that the ARSIF learning media that has been developed can be a reference in further research as a learning medium for other physics materials.

REFERENCE

Agrawal, A., Schaefer, S., & Funke, T. (2018). Incorporating industry 4.0 in corporate strategy. In R. Brunet-Thornton, & F. Martinez (Eds.), *Analyzing the Impacts of Industry 4.0 in Modern Business Environments,* 161-176. IGI global. https://doi.org/10.4018/978-1-5225-3468-6.ch009

Al-Fawareh, H. M. A., & Jusoh, S. (2017). The use and effects of smartphones in higher education. *International Journal of Interactive Mobile Technologies*, *11*(6), 103–111. https://doi.org/10.3991/ijim.v11i6.7453

Anwariningsih, S. H., & Ernawati, S. (2013). Development of interactive media for ict learning at elementary school based on student self learning. *Journal of Education and Learning (EduLearn)*, *7*(2), 121. https://doi.org/10.11591/edulearn.v7i2.226

Bacca, J., Baldiris, S., Fabregat, R., Graf, S., & Kinshuk. (2014). International forum of educational technology & society augmented reality trends in education : a systematic review of research and applications. *Educational Technology*, *17*(4), 133–149. Diakses dari http://hdl.handle.net/10256/17763

Budiman, R. D. A. (2016). Developing learning media based on augmented reality (Ar) to improve learning motivation. *JETL (Journal Of Education, Teaching and Learning)*, *1*(2),89.https://doi.org/10.26737/jetl.v1i2.45

Chaidar, H. (2014). Pemanfaatan teknologi informasi dan komunikasi dalam pembelajaran di sma muhammadiyah tarakan. *Jurnal Kebijakan Dan Pengembangan Pendidikan*, *2*(2), 184–192.

Chen, Y., Wang, Q., Chen, H., Song, X., Tang, H., & Tian, M. (2019). An overview of augmented reality technology. *Journal of Physics: Conference Series*, *1237*(2), 1-5. https://doi.org/10.1088/17426596/1237/2/022082

Dewi, L. R., & Anggaryani, M. (2020). Pembuatan media pembelajaran fisika dengan augmented reality berbasis android pada materi alat optik. *Inovasi Pendidikan Fisika*, *09*(03), 369–376.

Febrianti, R. (2016). Pengembangan media pembelajaran berbasis augmented reality pada kompetensi dasar memahami rangkaian multiplexer, decoder, flip-flop dan counter kelas X SMK Negeri 2 Surabaya. *It-Edu*, *1*(01), 48–56.

Foen, N. S., Hassan, N. S. I. C., Hassan, C., Nor, N. H. M., Ain, N., & Malek, N. A. A. (2017). The relationship between smartphone use and academic performance: a case of students in a malaysian tertiary institution. *Malaysian Online Journal of Educational Technology*, *5*(4), 58–70. Diakses dari https://eric.ed.gov/?id=EJ1156718

Hakim, L. (2018). Pengembangan media pembelajaran PAI berbasis augmented reality. *Lentera Pendidikan : Jurnal Ilmu Tarbiyah Dan Keguruan*, *21*(1), 59–72. https://doi.org/10.24252/lp.2018v21n1i6

Haryati, S. (2012). Research and development (R&D) sebagai salah satu model penelitian dalam bidang pendidikan. *Majalah Ilmiah Dinamika*, *37*(1), 11–26.

Ishaq. (2018). Desain pengembangan pembelajaran design development based learning information and communication technology (ICT). *Jurnal Pendidikan Fisika*, *I*(3), 73–85.

Irawan, A. G., Padmadewi, N. N., Artini, L. P. (2018). Instructional materials tevelopment through 4D model. *SHS Web of Conferences*, *42(00086)*, 1-4. https://doi.org/10.1051/shsconf/20184200086

Kaji, S., Kolivand, H., Madani, R., Salehinia, M., & Shafaie, M. (2018). Augmented reality in smart cities: a multimedia approach. *Journal of Engineering Technology*, *6*(1), 28–45.

Marisda, D. H. (2016). Pengembangan modul fisika kesehatan materi getaran, gelombang, dan bunyi melalui model pembelajaran langsung di SMK Kesehatan Terpadu Mega Rezky Makassar. *Jurnal Pendidikan Fisika*, *4*(3), 267–275.

Martono, K. T., & Nurhayati, O. D. (2014). Implementation of android based mobile learning application as a flexible learning. *International Journal of Computer Science Issues*, *11*(3), 168–174.

Miraza, R., Jufrida., & Pathoni, H. (2015). Pengembangan media e-learning berbasis edmodo dengan pendekatan saintifik pada materi gelombang bunyi. *Jurnal Pendidikan Fisika*, *3*(3), 231–240.

Nandyansah, W., & Suprapto, N. (2019). Pengembangan media pembelajaran berbasis augmented reality untuk melatihkan keterampilan berpikir abstrak pada materi model atom. *Inovasi Pendidikan Fisika*, *8*(2), 756–760.

Roblek, V., Meško, M., & Krapež, A. (2016). A complex view of industry 4.0. *SAGE Open*, *6*(2), 1-11. https://doi.org/10.1177/2158244016653987

Setiono, M. A., & Riwinoto. (2015). Analisa pengaruh visual efek terhadap minat responden film pendek eyes for eyes pada bagian pengenalan cerita (part 1) dengan metode skala likert. *Jurnal Komputer Terapan*, *1*(2), 29–36.

Sumardani, D., Saraswati, R. R., Putri, A., Bakri, F., & Muliyati, D. (2020). System implementation of augmented reality application in student worksheet. *Jurnal Informatika : Fakultas Sains dan Teknologi*, *8*(1), 10-18.

Wahyudi, B. S., Hariyadi, S., & Hariani, S. A. (2014). Pengembangan bahan ajar berbasis model problem based learning pada pokok bahasan pencemaran lingkungan untuk meningkatkan hasil belajar siswa kelas X SMA Negeri Grujugan Bondowoso. *Pancaran*, *3*(3), 83–92.

Wardani, D. L., Degeng, I. N. S., & Cholid, A. (2019). Developing Interactive Multimedia Model 4D For Teaching Tatural Science Subject. *International Journal of Education and Research*, *7*(1), 63-72.

The Development of Applications using Augmented Reality (Check Similarity)

ORIGINALITY REPORT

12%
SIMILARITY INDEX

PRIMARY SOURCES

1	eudl.eu Internet	57 words — 2%
2	garuda.kemdikbud.go.id Internet	53 words — 2%
3	journal.iaimnumetrolampung.ac.id Internet	33 words — 1%
4	www.coursehero.com Internet	31 words — 1%
5	jurnal.fkip.unila.ac.id Internet	30 words — 1%
6	i-jeh.com Internet	22 words — 1%
7	Jumadi Jumadi, Moh Irma Sukarelawan, Heru Kuswanto. "An investigation of item bias in the four-tier diagnostic test using Rasch model", International Journal of Evaluation and Research in Education (IJERE), 2023 Crossref	19 words — 1%
8	conference.ut.ac.id Internet	15 words — 1%

9	www.fig.net Internet	11 words — < 1%
10	Elvir Munirovich Akhmetshin, Rinat Rivkatovich Ibatullin, Almaz Rafisovich Gapsalamov, Vladimir Lvovich Vasilev et al. "Audiovisual aids application in the secondary-level vocational education establishments", International Journal of Educational Management, 2019 Crossref	10 words — < 1%
11	Hazar Nicholas Dib, Nicoletta Adamo. "An Augmented Reality Environment for Students' Learning of Steel Connection Behavior", Computing in Civil Engineering 2017, 2017 Crossref	10 words — < 1%
12	journal.unesa.ac.id Internet	10 words — < 1%
13	repository.ung.ac.id Internet	10 words — < 1%

EXCLUDE QUOTES	ON	EXCLUDE SOURCES	< 10 WORDS
EXCLUDE BIBLIOGRAPHY	ON	EXCLUDE MATCHES	< 10 WORDS