



MEDIA DEVELOPMENT AUGMENTED REALITY INTEGRATED IN THE HUMAN EXCRETORY SYSTEM MATERIAL LKS FOR SMPK COR JESU MALANG STUDENTS

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Abstract

This study aims to develop science learning media by applying Augmented Reality technology integrated in teaching materials in the form of LKS for junior high school students who are valid and feasible to be applied in the learning process. The method used in this research is development research known as Research & Development (R&D). The development model applied is the Lee & Owens model which has been adapted to the needs of the research. Augmented Reality media integrated in this LKS is designed to be able to support the science learning process at SMPK Cor Jesu Malang especially in complementing learning that is still conventional. The results of this development in the form of Augmented Reality applications and LKS in science learning are valid by media experts and material experts and feasible to apply as learning media.

Keywords: Learning Media; Augmented Reality; Student Worksheet; Science

1. Introduction

The rapid advancement of technology has brought developments in science, including the learning process in schools. With this, teachers are certainly encouraged to continue to utilize the results of technology and innovate in the learning process as a result of this. In learning, students also consider the need for learning using teaching materials or learning media that are in accordance with the material. The real conditions that occur in learning activities, teachers still use conventional media and methods without any innovation, especially in learning biology (Jayawardana, 2017). The term learning media can be summarized as something (tools, materials, or environment) that serves as a communication medium in learning activities (Ibrahim et al., 2000). In today's technological era, the importance of the role of learning media in learning activities can determine how effectively and efficiently learning objectives are achieved. Students' understanding of what they are learning can be accelerated by the availability of learning media (Ibad et al., 2018).

In essence, science lessons, especially biological material on the one hand can be seen as simple, while on the other hand it can also be seen as complex and complicated (Hasrudin, 2009). One of the materials that are considered difficult to understand by students is the material of the human excretory system. It is known that in the human excretory system material there are many subchapters (Aprilianti, 2013). Because it is considered less interesting, the material about the human excretory system provides its own challenges for students. This is because the human excretory system material contains a series of human body processes involving internal organs and is difficult to explain without technological support. For this reason, it is necessary to develop media or technology that can accurately represent the content of the material.

Based on the results of observations and interviews at SMPK Cor Jesu Malang in science learning, several facts were found that the learning carried out still relied on printed teaching materials and lecture methods, so that the interaction carried out by students in learning activities was still considered less than optimal because concrete visualization was needed in understanding science learning, especially human excretory system material. The basic competency to be achieved in this material is to be able to explain the structure and function of the excretory system in humans. So that the explanation of learning is not enough just text and images. The application of augmented reality technology that has the advantage of combining the real world and the virtual world has the potential to overcome this problem, by increasing student motivation, supporting and supporting ongoing learning activities (Nincarean et al., 2013).

One solution to this problem is augmented reality media integrated with teaching materials in the form of Student Worksheets (LKS). Learning with augmented reality media integrated with LKS can facilitate students because it is more interesting and memorable, thus preventing students from feeling bored and easily bored during the learning process. Student Worksheet (LKS) is a guide that students use to carry out problem-solving or investigation activities. LKS itself contains a set of basic activities that students must do in an effort to form basic abilities according to indicators and to maximize understanding. Here, the Student Worksheet (LKS) is a teaching material for students that includes tasks with augmented reality-based content. These tasks are expected to attract students' attention during learning. Students can also see the material more realistically thanks to the 3D visuals in the worksheet.

A technology known as augmented reality can simultaneously project 3D virtual objects from a webcam into a real-world environment (Juannita & Adhi, 2017). Augmented reality becomes a real-time link between the real world and the virtual world (Sagita & AMALIA, 2015). Augmented reality does not completely replace reality with virtual reality. This technology only adds or complements the existing reality. Therefore, augmented reality can be used to enhance users' perception of the real world and interaction through the media they use (Saputra & Astuti, 2018). Learning content that applies augmented reality can help students see things that are difficult to see. In addition, the ability of augmented reality to bring virtual objects to the real world in real time can make students feel more connected, present, and in it. The application of augmented reality as learning media is able to stimulate students to think conceptually and feel 3D, this helps learners to understand concepts and theories, improve perception and representation (images), make the learning atmosphere more attractive and interactive in a fun environment (Ivanova & Ivanov, n.d.)

The rapid advancement of technology has affected various aspects of the lives of various groups including students. Because of this influence, learner characteristics such as skills and areas of expertise and knowledge that are valuable to society, continue to develop (Yuen et al., 2011). So that existing technology can make it easier for students to learn and understand a material. Augmented reality is one of the technological applications that is starting to be used in the world of education and is growing rapidly today.

The application of augmented reality technology is an alternative learning media that is interesting for students to learn both independently and in groups. In learning biology, most of the material is memorized and in the form of Latin terms or scientific language, so that the existence of augmented reality technology can arouse students' interest in biology lessons

(Aripin & Suryaningsih, 2019) It has been recognized that the use of media with augmented reality technology as a learning medium can help students face real-world tasks with the help of digital systems (Chang & Hwang, 2018). Applying augmented reality technology also helps make learning activities more interesting for students (Mustaqim, 2017).

The utilization of augmented reality technology on devices such as smartphones that are currently very familiar with students can be accepted by students as an alternative to developing innovative learning media. Students can learn independently using smartphones, this makes students more actively involved and can save time in learning (Rahardjo et al., 2019). Currently, research applying augmented reality has also been widely focused on mobile learning, where learners can do learning dynamically and flexibly anywhere and anytime so that it is not limited to a PC or in a certain room. Learning does not always have to be in a classroom, laboratory, or teacher centered, the use of smartphones by students is considered easier to use and students quickly adjust to the media (Surahman & Surjono, 2017).

So the creation of augmented reality media can help students become familiar with the application of technology and smartphones in the classroom (Mustaqim, 2017). And then this media is integrated with Student Worksheets (LKS) which are also flexible teaching materials and support independent learning. With the augmented reality media integrated in this LKS, students will be motivated to learn and prepare beforehand independently, and overcome boredom when learning is carried out.

Based on the description and exposure of the problems above, therefore the authors intend to conduct research on the development of augmented reality media integrated in the Human Excretion System Student Worksheet (LKS), and examine the feasibility of using this media in student learning at SMPK Cor Jesu Malang. It is hoped that the LKS prepared later can support learning and increase the enthusiasm for student learning by displaying real learning objects.

2. Method

This research applies the method for research and development (Research & Development). The steps to develop learning designs and produce products are determined using the Lee & Owens research procedure in this study. In this case, the product is augmented reality media integrated in the LKS of human excretory system material for junior high school students in grade VIII (eight). The subjects and trials of this study were 36 students of class VIII A SMPK Cor Jesu Malang who had never used the developed product before developed. Then there are material experts and media experts who have previously tested this product. The trial conducted is to test the quality and feasibility of the product as augmented reality learning media which includes several aspects, namely content suitability, material accuracy, material recency, motivation, convenience, attractiveness and quality aspects in learning.

In this study, the object of research is the development of augmented reality integrated in LKS as a learning support for junior high school students on the material of the human excretory system. This product is one of the teaching materials as well as science learning media for excretory system material that is digital. Then this product was tested to obtain data. A questionnaire or questionnaire is used as a research instrument to collect this data. As an evaluation and testing material for the learning media developed, this questionnaire is made to assess the quality of the media obtained from students, material experts, and media experts.

The feasibility instrument for Augmented Reality learning media integrated with LKS uses a rating scale with 4 scales, without using a doubtful/neutral scale. With reference (4) strongly agree, (3) agree, (2) disagree, (1) strongly disagree. Then the data analysis technique used in this research is descriptive analysis.

In this study, a survey using a questionnaire was used for data collection. There were two types of questionnaires used: one designed for experts and one designed for users. Based on usability factors,(usability), eligibility was determined using a user questionnaire. A total of 36 respondents, namely students at SMPK Cor Jesu Malang, were tested using this user questionnaire.

3. Results and Discussion

3.1 Result

The results of the development compiled are in the form of products, namely Augmented Reality applications that are integrated in the LKS of human excretory system material which is also developed as a support for the science learning process of grade VIII junior high school students. This product is also a complement to the existing learning media. In the LKS there are instructions for use and also worksheets that must be completed by students. There are 4 markers on the LKS that can project 3-dimensional objects when scanned using the application. The markers in this LKS are in the form of images of each organ.

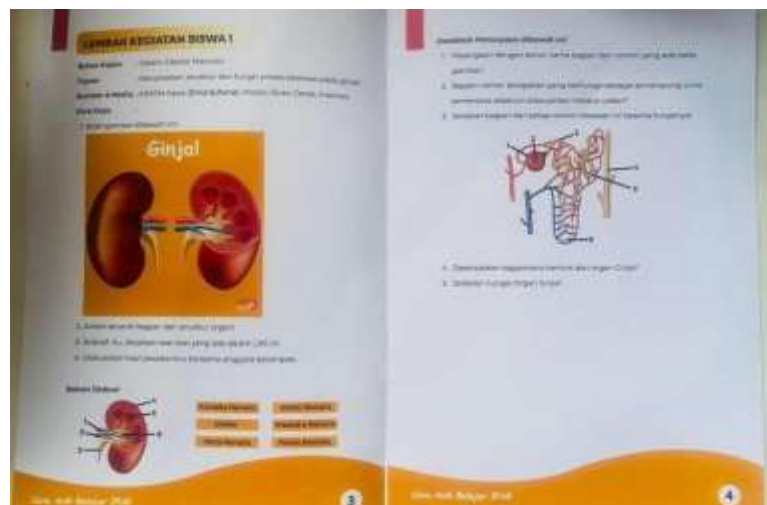


Figure 1. Student Worksheet (LKS) with Augmented Reality Markers

If the marker is scanned by the Augmented Reality application by pointing the camera at the marker, it will automatically bring up a 3-dimensional object. Each object that appears displays a different model according to the marker that is being scanned. When the object has There are features in the application that can show the inside of the object, in this case the organs, as well as an explanation of the structure contained in the object.



Figure 2. Student using AR application on LKS

Media feasibility and validity tests were conducted on media experts, material experts, and users based on the results of this development product. One of the lecturers of the Department of Educational Technology, State University of Malang as a media expert in this study and tested the feasibility test data on the media. Then as a material expert, one of the science subject teachers at SMPK Cor Jesu Malang tested the feasibility test data on the material. And responses by users obtained from students of class VIII A SMP K Cor Jesu Malang. The following presents the results of responses from users, material experts, and media experts regarding integrated augmented reality media on LKS.

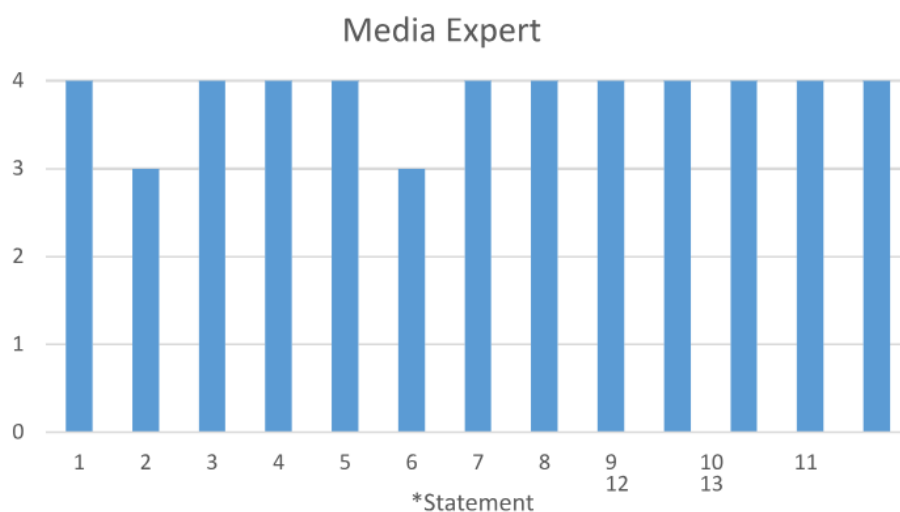


Figure 3. Media Expert Assessment Chart

Based on Graph 1 the results of responses from media experts, there are 13 statements in total from the data presentation above. 11 statements received a score of 4 and 2 statements received a score of 3. So that the mode is 4, the median is 4, and the mean or average is 3.85. From the results of the value obtained, the media gets a positive value and is suitable for use. Comments and suggestions obtained from media experts, namely in general, are good,

interesting and have features relevant to the characteristics of learning. And the suggestion is that it is more optimized in the graphic aspect, for example the thickness of the pointing lines.



Figure 4. Subject Matter Expert Chart

Based on graph 2 of the results of responses by material experts, from the presentation of the 12 statements above, all of them get a score of 4. So that the mode is 4, the median is 4, and the average value is 4. From the value obtained, augmented reality media integrated with LKS gets a positive value and is feasible to use. Comments obtained from material experts, namely learning media are very interesting and easy to use. The suggestion is that it can be developed again with the addition of narration / voice notes.

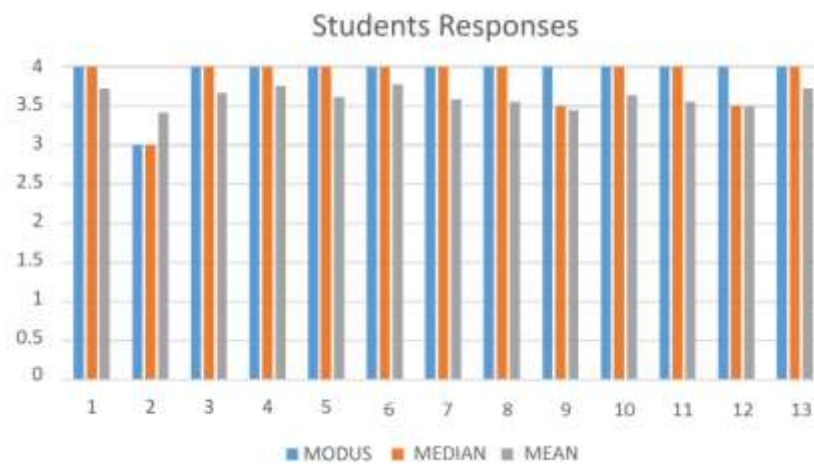


Figure 5. Student Responses

From graph 3, the results of student responses were obtained from media utilization trials conducted on 36 students. There are 13 statements from the entire data presentation. From the presentation of data that has been accumulated and processed data from each statement, the mode is obtained 12 statements with a value of 4 and 1 statement with a value of 3, namely in the 2nd statement. The median or middle value of 10 statements received a value of 4, 2 statements with a value of 3.5 and 1 statement with a value of 3. The results of the mean or

average value are 1 statement with a value of 3.78, 1 statement with a value of 3.75, 2 statements with a value of 3.72, 1 statement got a value of 3.67, 1 statement with a value of 3.64, 1 statement with a value of 3.61, 1 statement with a value of 3.58, 2 statements with a value of 3.56, 1 statement with a value of 3.50, 1 statement with a value of 3.44 and 1 statement with a value of 3.42. From the results of the responses From the results of the responses obtained, the augmented reality media integrated with LKS received a positive response and is feasible to use in the learning process in class but there needs to be some revisions, for example, it can add interesting features such as quizzes and can be developed on all types of smartphones.

3.2 Discussion

This research was conducted at a school where learning has been fully implemented offline or directly. Until now, the learning process is still teacher-centered. Where most teachers still use traditional teaching strategies, which are only based on printed books and modules. Furthermore, the teacher also said that the media that is often used is Powerpoint media, which for students this media is considered not varied. So that in the learning process requires other media that can add to the learning atmosphere, especially science lessons to make it more interesting. In addition, the media used cannot be moved and is still limited to the learning location. As a result, students can only use the media in the classroom.

Teachers in the learning process are expected to innovate and be more varied in the utilization of learning media. Students are more likely to accept material on learning media that follows technological advances, such as 3D images, videos, animations, and interactive technology on mobile devices (Qumillaila et al., 2017). Learning media described by Kemp & Dayton has contributions including interactive by applying learning theory, learning messages can be more standardized, learning can be made more interesting and interactive, learning quality can be improved with shortened learning time, the learning process can be done anywhere and anytime, students' attitudes towards learning materials and the learning process can be improved, and the role of the teacher has changed to be more positive (Daryanto, 2013). This interactive and mobile learning media can also be referred to as multimedia. Multimedia is able to offer listening, viewing and doing experiences in a computer-mediated setting. It can be fun, interesting, motivating, and help learners achieve new understanding (Hwa, 2018).

Based on the results of interviews and observations, it is found that the learning process carried out at SMPK Cor Jesu Malang, especially science learning, still uses classical learning methods (lecture method) and is still guided by printed books and modules. This activity is still considered less than optimal in meeting the diversity of student characteristics and also the absence of variations in the learning process. The difficulty of students in understanding the concept of learning the human excretory system that only focuses on text and images is also one of the obstacles. Therefore, as a support for student learning on excretory system material, augmented reality media was chosen as a solution to solve the obstacles that occur. Augmented reality media is an alternative learning media in the classroom to explain material that is not easily understood only with book media containing images and words. Learning using animation and narration is better than learning using narration alone (Mayer & Moreno, 2002).

The solution to this problem is the use of learning media in the form of artificial media that can explain the shape of objects packaged in mobile form with augmented reality technology. Student understanding can be improved by combining augmented reality technology with animation or 3-dimensional objects (Utami, 2011), and is able to attract students' attention to actual events or objects (Schwan & Papenmeier, 2017). In addition, the use of mobile-based augmented reality technology or applications on smartphones makes learning run efficiently without the barriers of time and space (Godwin-Jones, 2011). So in this development, learning multimedia is operated using a smartphone. Smartphones were chosen for the presentation of augmented reality technology because they are owned by almost all students and are often used daily. This makes it easier for students to use the media and makes it practical (Puspitasari et al., 2020).

The development of augmented reality media is intended as an alternative learning resource that can be used by students to assist the learning process. This media was also developed to support the student learning process by making learning materials clearer, increasing student interest, effectiveness, and learning outcomes. The purpose of developing this media is to be able to facilitate students in learning (Smaldino, 2011). In addition to the objectives, the advantages of this media include being able to overcome the constraints of space, time, and sensory perception while providing clarity in the presentation of messages (Sardiman, 2011). In addition, it can help the process of learning success and help teachers in delivering learning. So this media is deemed appropriate to achieve learning objectives in the classroom.

Next, the design stage is carried out. This design stage begins with determining the projected 3D shape model and also the images displayed on the LKS, the design of the LKS cover and the layout of an attractive LKS, the design of the application user interface, information or content content, menus and configuration controls, and media specifications.

Then the development stage. At this stage using some software in its manufacture. Adobe photoshop to design UI (application design), markers and LKS to make it look attractive. Furthermore, Blender software for making 3D objects of body organs, starting from modeling to the last texturing. Marker design, then uploaded to Vuforia as a target manager marker database page. Next, combining the prepared markers with 3D objects to create interfaces and augmented reality applications that are arranged as easily and attractively as possible. Everything is put together in android format on Unity software.

Then after going through a number of stages and basing it on the development objectives, the experts gave responses to test how the feasibility level of this LKS integrated augmented reality media. Responses from experts related to augmented reality media integrated with this worksheet get positive results, although there are some things that still need to be improved. A total of 11 statements received responses from media experts with a score of 4, while 2 statements received responses with a score of 3. Media experts also added suggestions that were more optimized in the graphic aspect, for example the thickness of the pointing lines.

While the material expert's response related to augmented reality media integrated with this LKS obtained the results of 12 statements with a value of 4 in all statements. Then the material expert also added his suggestion that it could be developed again with the addition of narration / voice notes in the application developed.

According to Mustaqim's research, learning with augmented reality technology can increase student interest in learning because it combines the real world and the virtual world, allowing students' imaginations to develop to see real or real situations. Learning media can visualize abstract material for understanding, and augmented reality can serve as an effective alternative media according to the purpose of the product developed (Mustaqim, 2016).

The results of research from Soepriyanto stated that learning media that utilize augmented reality technology can help students better understand the material and meet their needs during learning (Soepriyanto et al., 2017). This result is also seen in textbooks that are modified by adding markers that can project 3D objects, then tested and valid to be used as a support for learning performance. Other studies also mention that incorporating augmented reality into learning can attract students' interest and give them comfort when studying augmented reality-based materials (Pradana et al., 2018) - (Hidayat et al., 2018). In line with previous research, it provides an explanation in the form of augmented reality media as a supplement to the sign language module and obtained a valid assessment as a learning media (Hapsari et al., 2018).

This research develops augmented reality media that can be integrated with student worksheets and displays 3D objects that can display all parts that distinguish it from previous research. Meanwhile, many other studies have used textbooks or modules. One of them is research by puspitasari entitled the development of augmented reality supplements in biology textbooks. In her research, the teaching materials used are existing textbooks which are then modified by adding markers to the book. Puspitasari also placed the developed media as a supplement (addition) in the learning process. While this research makes the media a complement in the learning process. The LKS (student worksheet) developed is designed in such a way that in completing it must use augmented reality media. Then also the LKS developed can be a complement to the learning process, after students learn the material, the teacher can give assignments to students through this LKS.

Learning activities using augmented reality media integrated with LKS on human excretory system material received positive results. Where this media has contributed optimally, both in the instructions for use, the available learning material, 3D animation, and the questions or worksheets prepared. Descriptive analysis revealed that the average student score of each statement was in the range of 3.42 to 3.78. Augmented reality media integrated with LKS, based on responses, received positive responses and is feasible to use in the classroom in the learning process.

Similar research conducted by Puspitasari, the use of augmented reality also obtained very good results. Students are greatly assisted by this media in terms of understanding, and augmented reality animated media makes it easier for teachers to achieve learning objectives effectively (Puspitasari et al., 2020). The material is presented in the form of animation and narration. This is in accordance with dual coding theory, where students will more easily learn using two senses. And this will strengthen students' cognitive in learning.

Augmented Reality is one of the applications of technology in the world of education in learning (Praherdhiono et al., 2019). It has been shown that using augmented reality for learning can attract student interest and provide comfort for learning the material (Wu et al., 2013). From the description of the research results which are also reinforced by previous findings, it can be concluded that the benefits of using augmented reality media have a

significant effect on the learning process and can be used mobile. Augmented reality can provide solutions to abstract and procedural material and have a positive effect on learning.

4. Conclusion

This development research produces products in the form of LKS which are then integrated with augmented reality media containing human excretory system material and mobile-based augmented reality applications. This product is used as a complementary alternative or to complement the shortcomings in science learning at Cor Jesu Junior High School, especially on the material of the human excretory system. Students' limitations in visualizing abstract objects such as organs in the body in science learning can be helped by this augmented reality media. LKS integrated with augmented reality media can help students to learn independently either in class or anywhere. Based on the validation that has been done to media experts, material experts, and trials to students, it can be concluded that the integrated augmented reality media on the human excretory system LKS for junior high school students is effective and feasible to use in the learning process, especially as a science learning media. Then future research and development is expected to be able to develop augmented reality integrated worksheets into a wider scope as needed and can also be operated by all types of smartphones.

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