

## ***Application Of Augmented Reality (Ar) In Android-Based Artificial Fiber Spinning Learning Media For Class Xi Students Tpsb Smk Texmaco Semarang***

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**Abstract :** *This research was motivated by limited depictions of objects in learning materials, lack of variation in the learning media used, lack of student interest in learning and students' final grades in productive subjects , especially in artificial fiber spinning material, with the average value of the material achieved not meeting the criteria. Minimum Completeness (KKM). This research is aimed at class This application was created with the aim of complementing the limitations of depicting objects in existing learning media, helping students learn the material more easily, improving student learning outcomes, and increasing media variations in learning. This research uses the Research and Development (RnD) method, using 6 of the 10 research stages, namely potential and problems, data collection, product design, design validation, design improvement and product testing. This research produces Artificial Fiber Spinning Learning Media that applies Augmented Reality (AR) for Class XI TPSB SMK Texmaco Semarang students as a learning aid. The final result of making this learning media is an application in Android application format, used on every Android-based mobile phone. As for the validity value from the media expert, the value obtained was 3.2, which was declared feasible, the results of the material expert validation test obtained the value 3.6, which was stated to be very feasible and able to increase the average score in the class XI artificial fiber spinning subject at TPSB SMK Texmaco Semarang which originally 61.5% with 17 students who had not reached the KKM to 80.5% with 4 students who had not reached the KKM.*

**Keywords :** *learning media, augmented reality, Android .*

### **INTRODUCTION**

The rapid development of Information and Communication Technology (ICT) has influenced many areas of human life. The various sophisticated ICT devices that exist have a big influence on how humans live their lives. Areas of life that cannot escape its influence include education. Education and more specifically learning today is greatly influenced by the development of ICT, not only from the various equipment used and the conveniences it offers, but also from the influence on various pedagogical aspects that accompany it (Ismayani, 2018).

The existence of smart phones ( *smartphones* ), tablets, applications and social media, for example, are now inseparable from everyday life. These changes have changed the views and practices of learning in schools. Teacher-centered learning using limited media has shifted to student-centered learning.

On the other hand, in the current era of globalization, students face a number of challenges in the way they obtain information. The development of information and communication technology has changed student learning styles. Learning by only using teacher-centered methods is no longer suitable to be applied in the technological era with the

current unlimited rush of information. Students will not feel comfortable if they just listen to the teacher's lecture for hours. A combination of diverse learning approaches by utilizing information technology tools is necessary to change student learning, from passive learning to active learning, learning dependent on the teacher to independent learning, which can explore skills and collaboration in a profitable collaboration.

*smartphone* technology in the educational sector is as a learning medium. Learning media is everything related to *software* and *hardware* that can be used to convey the content of teaching material from learning sources to students (individuals or groups). Sanaky (2013) in Suryani, Setiawan, & Putra, (2018: 4) states that learning media is a tool that functions and can be used to convey learning messages.

Based on observations made at Texmaco Semarang Vocational School, class This tends to make students feel bored and in the end become passive in receiving lessons, it can be seen from the attitude of students who prefer to talk to their friends, play with *smartphones* without the teacher's knowledge, there are even students who sleep when the teacher is not paying attention to the students, only a few students only those who follow the lessons well.

The teacher's passive way of teaching, such as just giving notes or just dictating with little explanation, can reduce students' interest in the lesson, because students don't see anything interesting to pay attention to in the teaching and learning process, thus causing boredom and sleepiness, so students will not concentrate on the learning process.

Based on observations on the printed learning media and *e-book modules* used, the fiber spinning process material is described in two dimensions. Based on the results of interviews with Mrs. Istiharoh, as a competency teacher in artificial fiber spinning techniques, said that: "The pictures in the book are not enough to depict the object that I want, so additional media is needed to teach it to students."

Class XI TPSB has 2 productive subjects, namely artificial fiber spinning and polymerization. Based on the data above, it can be seen that the average score for productive subjects in class 73.6 compared to the polymerization subject score of 77.6.

In response to this, to optimize student learning outcomes and interest in learning, as well as complement the limitations of depicting objects on artificial fiber spinning materials, the right method requires modern *media* . In this case, *the smartphone* supports the delivery of material and is packaged through application media using *Augmented Reality (AR)* technology.

Currently AR technology has also been developed on Android *smartphones* . Android is a complete *platform* starting from the operating system, applications, *developing tools* ,

*market, support from mobile industry vendors, even support from the open system community, which is certainly an advantage that other (Mulyadi, 2010) platforms do not have.*

*from a questionnaire regarding smartphone use with a total of 20 questionnaires given to class*

Developing learning media supported by adequate devices such as Android smartphones and augmented reality technology combined directly with material from printed books, objects can be visualized through virtual modeling on top of the printed book material, so that the learning process becomes more interactive.

Research regarding the application of Augmented Reality and the use of learning media has been extensively researched previously by several researchers, including conducted by Mantasia & Hendra Jaya (2016) the resulting application can help teachers understand learning methods and approaches to implement the 2013 Curriculum. Other research was also conducted by Muhammad Iqbal Meslilesi, Hengky Anra, Helen Sasty Pratiwi (2017) research results show that the percentage The increase in scores from *Pre Test* to *Post Test*, students who studied using textbooks received an increase of 20.06%, while the group of students who studied using applications received an increase of 25.31%. Other research also carried out by Rizqi Mauludin, Anggi Srimurdianti Sukanto, Hafiz Muhardi (2017) showed that the application developed could be an alternative learning medium for studying the human digestive system so that it could increase students' interest and understanding of the material. From several studies that have been carried out, applying augmented reality to learning media can produce good responses for teachers and students who are the objects of testing.

## **BASIC THEORY**

### **Study**

According to Sadiman, et al. (1986) in Warsita (2008) learning *is* a complex process that occurs in everyone and lasts a lifetime. Learning can occur at home, at school, at work, in places of worship, and in society, and takes place in any way, from anything, and from anyone. People's ability to learn is one of the important characteristics that distinguishes humans from other creatures.

### **Learning**

According to Sadiman, et al. (1986) in Warsita (2008) Learning is an effort to make students learn or an activity to teach students. Learning is an effort to create conditions for learning activities to occur. Another definition, learning is planned efforts to manipulate learning resources so that a learning process occurs within students.

## **Media**

The word media comes from the Latin *medius* which literally means 'middle', 'intermediary', or 'introduction'. More specifically, the definition of media in the teaching and learning process tends to be defined as graphic, photographic or electronic tools for capturing, processing and reconstructing visual or verbal information (Arsyad, 2013, p. 3).

## **Instructional Media**

Learning media is everything related to *software* and *hardware* that can be used to convey the content of teaching materials from learning sources to students (individuals or groups), which can stimulate students' thoughts, feelings, attention and interests in such a way that the learning process (in / outside the classroom) to be more effective (Nizwardi & Ambiyar, 2016, p. 4).

## **Augmented Reality**

In general, *augmented reality* (AR) is a combination of virtual objects with real objects. For example, when a television station broadcasts a football match, there is a virtual object about the score of the match that is taking place. *Augmented reality* or in Indonesian (additional reality) is a technique that combines two-dimensional and three-dimensional virtual objects into a real environment and then projects these virtual objects in real time (Pamoedji, Maryuni, & Sanjaya, 2017). According to Ronald T. Azuma (1997), *augmented reality* is combining the real and virtual worlds, is interactive in *real time*, and is 3D animation. (Pramono, 2013).

*Augmented Reality* (AR) is the opposite of *Virtual Reality* (VR), where VR adds real objects to the virtual world, while AR is adding virtual objects to the real world. (Joefrie & Anshori, 2011).

## **Android**

*Linux* -based operating system designed for touch-screen mobile devices such as smartphones and tablet computers (MADCOMS, 2018). Android is the name of a variant of the operating system based on the *Linux kernel* which is specifically intended for mobile phone devices with touch screen features, for example *smartphones* and tablets.

## **Artificial Fiber Spinning**

Artificial Fiber Spinning is one of the productive subjects of the Vocational High School, Artificial Fiber Spinning Technique (TPSB) expertise competency at Texmaco Vocational School, Semarang. Spinning artificial fibers is a very important subject for class XI TPSB students before carrying out Field Work Practices (PKL) in the industrial world.

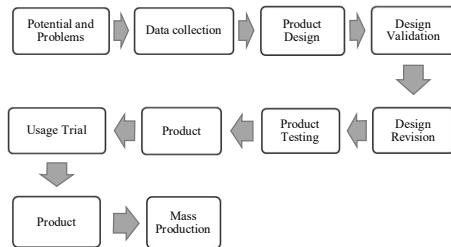
## RESEARCH METHODS

### Types of research

This type of research is research and development ( *Research and Development* ). Research and Development Methods are methods research used to produce certain products, and testing effectiveness of the product (Sugiyono, 2017: 297).

Method Sugiyono's *Research and Development* (R&D) has 10 steps as follows:

Figure 1. Steps for using Research and Development (R&D) Methods



#### 1. Potential and problems

research starts from the existence of a potential or problem. Potential is anything or ability that has the possibility of being developed in order to obtain added value to the product being studied. Problems will arise when there is a deviation between something that is expected and the reality that occurs. Problems can also be used as potential, if you can utilize them. The potential and problems raised in research must be accompanied by empirical data.

#### 2. Data collection

After the potential and problems can be demonstrated factually, it is then necessary to collect various information that can be used as material for planning certain products in order to solve these problems.

#### 3. Product Design

The products produced in Research and Development research are varied. This product design must be realized in the form of a drawing or chart, so that it can be used as a guide to assess and make it. The product design must be equipped with an explanation of the materials and tools used to work on the product. The final result of this activity is a system design, namely the Design of a New Work System. This design is still hypothetical because the product's effectiveness has not been proven and tested in the field.

#### 4. Design Validation

Design validation is an activity process to rationally assess whether a product design will be more effective than the old one or not. It is said to be rational, because this validation is an assessment based on rational thinking, not field facts.

#### 5. Design Improvements

After the product design is validated with experts and other experts, weaknesses can be identified. These weaknesses were then tried to be reduced by improving the design. In this case the researcher is tasked with improving the design of the product produced.

#### 6. Product Trial

Product trials are carried out after the product design has been refined. This test is carried out to obtain information whether the new work system produced is more effective and efficient compared to the old product.

#### 7. Product Revision

Product revisions are carried out after the product design has been tested. The deficiencies that appear in the test results will be minimized. This revision step is carried out to improve products that are less effective or efficient so that maximum product results are obtained.

#### 8. Trial Use

After testing and revising the product, the product is then applied in real conditions for a wide scope. In testing the use of the product, deficiencies or obstacles that arise must be assessed for further improvement.

#### 9. Product Revision

Product revisions are carried out if during trial use there are deficiencies and weaknesses. During use trials, product makers should always evaluate how the product performs to find out existing weaknesses, so that they can be used to improve the product.

#### 10. Mass Product Manufacturing

This mass product production is carried out if the product that has been tested is declared effective and suitable for mass production.

### **The scope of research**

The definition of research scope is limitations. The scope can also be stated in terms of the variables studied, population or research subjects, and research location. So the author determines the scope of research in SMK Texmaco Semarang, namely in class XI TPSB.

### **Research variable**

There are two variables in this research, including the learning design aspect and the visual communication design aspect.

### **Data retrieval**

This research and development uses several methods to collect data, namely interviews, observation and questionnaires.

Sugiyono 's R&D design has 10 steps aimed at developing and validating the product, however in this research only the first 6 steps in product development will be implemented, namely as follows:

#### 1. Potential and problems

*In* this research, the potential of Texmaco Semarang Vocational School, especially in class

The problems that arise are limited depiction of objects in learning materials, lack of variation in the learning media used, lack of student interest in learning and students' final grades in productive subjects , especially in artificial fiber spinning material, with the average value of the material achieved not meeting the Completion Criteria. The minimum (KKM) set is 75 .

Some of these potentials and problems gave rise to ideas on how to create valid and effective learning media for Class XI TPSB SMK Texmaco Semarang students.

#### 2. Data collection

Problems that arise at Texmaco Semarang Vocational School, obtained from information through interviews with resource persons , observing media and learning activities in class, 20 questionnaires given to class XI TPSB students with questions about *smartphone use* , and information about the list of class average scores. XI TPSB for the 2016-2018 academic year from the curriculum section.

#### 3. Product Design

At this stage, a product design for applying Augmented Reality to Android-based artificial fiber spinning learning media is carried out. The steps taken are:

- a. Create application *flowcharts* and *storyboards* . *Flowcharts* and *storyboards* are created with the aim of making it easier to create media and to determine the next development stage so that the parts of the learning media can be arranged well.
- b. Storyboards are made by drawing sketches on paper, the sketches that have been completed are then redrawn using a computer.

c. The storyboard is then used as a reference for creating the layout. The layout is made by paying attention to aspects of color and design composition.

The following is a flowchart for implementing Augmented Reality in Android-based learning media:

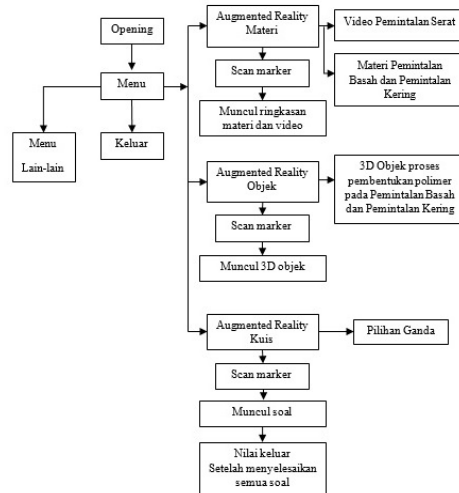


Figure 2. Application flowchart

#### 4. Design Validation

Design validation is one of the development processes carried out to determine the level of effectiveness of the product. The validity test presents material experts and media experts with an assessment using a questionnaire.

Validation calculations can be applied with the formula:

$$\bar{X} = \frac{\sum x}{n}$$

Information:

$\bar{X}$  = average value

$\sum x$  = total number of validation values

n = number of validators

Based on the explanation of the formula above, the average result value is determined using the validity criteria scale. The criteria scale starts from scale 1 which is the lowest and scale 4 as the highest scale. Next, the scale is grouped into 4 classes with the same range. Determining the range for each class is done by calculating the highest scale value minus the difference in scale values. The difference in scale values is 0.75.



Table 1. Validity Criteria

Mark	Validity Criteria
3.26-4.00	Very Valid
2.51-3.25	Valid
1.76-2.50	Invalid (revised)
1.00-1.75	Invalid (total revision)

## 5. Design Improvements

Design improvements are carried out if assessments from experts show that the design designed by the researcher is considered less valid. So researchers are obliged to improve (revise) the design until the design is truly valid and suitable for implementation.

## 6. Product Testing

The product trial was carried out at Texmaco Semarang Vocational School class XI TPSB with a total of 20 test subjects. This trial is intended to determine the level of effectiveness, efficiency and attractiveness of the product produced. This includes several parts of the trial, including:

### 1. Trial Design

The trial design was carried out by grouping value data obtained from distributing questionnaires to design experts and material experts. Filling out the questionnaire contains several points regarding the feasibility of the product design and experts are required to provide suggestions and criticism. This aims to enable researchers to find out whether the product design is feasible and can be tested for further validation or what is called empirical validation. Empirical validation is carried out by comparing the criteria in the instrument with empirical facts that occur in the field. However, in this research empirical validation was not carried out due to time and cost limitations, so testing was only carried out until validation by experts (expert testing) and small groups.

### 2. Test Subjects

Subject testing on the development product to be researched is carried out by presenting validators. These validators are divided into groups of experts, namely material experts, multimedia experts, and 20 students acting as small groups.

### 3. Data Type

The data used in this research are quantitative data and qualitative data.

- a. Qualitative data is a type of data used to measure a product in research based on product quality. The qualitative data used in this research are:
    - 1) Highly Valid (SV)
    - 2) Valid (V)
    - 3) Less Valid (KV)
    - 4) Invalid (TV)
  
  - b. Quantitative data is a type of data used to measure a product in research based on product assessment scores. The quantitative data used in this research are:
    - 1) Very Valid (SV) with a Score of 4
    - 2) Valid (V) with a score of 3
    - 3) Less Valid (KV) with a score of 2
    - 4) Invalid (TV) with a score of 1
4. Data Collection Instrument

In this case the author uses a research instrument in the form of a questionnaire which is divided into three types, namely a questionnaire for validating learning media experts, a questionnaire for validating learning material experts, and a questionnaire for validating *users* .

5. Data analysis technique

In this research and development, two data analysis techniques were used, namely: qualitative descriptive analysis techniques and quantitative descriptive analysis. Qualitative data in the form of comments and suggestions for product improvements from learning media experts and learning material experts in the field of study which will later be described qualitatively to revise the product being developed. Meanwhile, quantitative data is data in the form of assessment scores from learning media experts, learning material experts in the field of study in the form of filling out questionnaires. The purpose of filling out the questionnaire is to evaluate the learning media created.

The collected data was analyzed using quantitative descriptive analysis techniques expressed in the distribution of scores and percentages of predetermined assessment scale categories. After presenting it in percentage form, the next step is to describe and draw conclusions about each indicator.

Suitability of aspects in developing teaching materials and learning media can use the following table:

Table 2 Percentage Scale

Percentage of achievement	Interpretation
76 - 100 %	worthy
56 - 75 %	quite decent
40 - 55 %	not worthy
0 - 39 %	not feasible

In the table above, the percentage of achievement, value scale and interpretation are stated. To determine the feasibility, use the table above as a reference for assessing data resulting from validation by media experts, material experts and small group tests as well as large group trials.

## RESULTS AND DISCUSSION

### Research result

Artificial fiber spinning learning media is one of the means for quality education for class XI TPSB S M K Texmaco Semarang by utilizing current technological developments, namely *augmented reality*. The application of *augmented reality* to this learning media can ultimately increase enthusiasm for learning and improve student learning achievement.

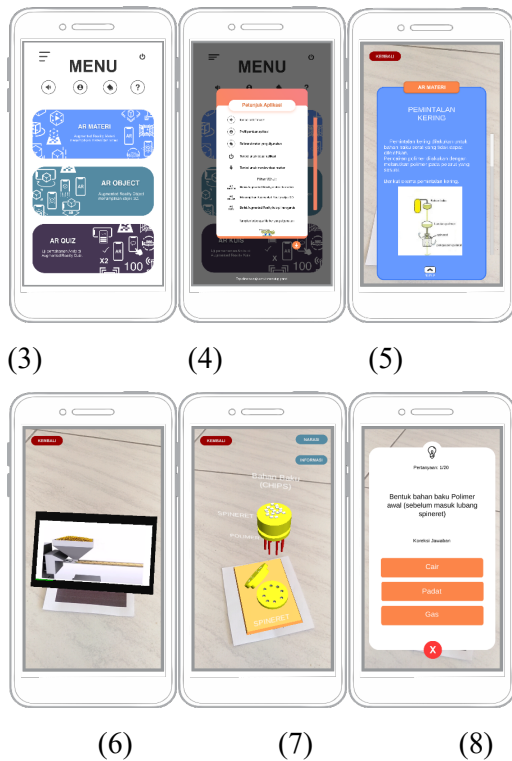
initial stage of research is determining the type learning media applied at S M K Texmaco Semarang, then observations were carried out to find out the problems that occurred at the location. Data collection is carried out in order to accurately determine the problems that occur in the field. This data is then used as a basis for designing and developing the learning media that will be created. The results of the data obtained indicate that the value of the productive subject of artificial fiber spinning techniques in artificial fiber spinning material is less than optimal. The results of the interview also obtained several concepts that will be applied to learning media. The media used must be able to display writing, images, 3D objects and animations about spinning artificial fibers.

The concept chosen as a learning medium is to explain material about understanding, introduction to the parts, as well as an evaluation containing questions about spinning artificial fibers (dry and wet). This content is aligned with three-dimensional objects, animated videos,

layouts , color selection and buttons, as well as *background* music and narration. This learning media has also received validation from Media Experts, namely Lecturers, and Material Experts, namely Teachers of productive subjects in artificial fiber spinning techniques. This

learning media can be used easily and can create an interesting and enjoyable teaching and learning process.

The application of *augmented reality* to Android-based learning media was developed with the help of Unity3D 2017, 3ds Max 2010, CorelDraw X8, and WavePad Sound Editor *software* . Following are several views of the application design results seen in Figure 3-8:



### **Test result**

*user* trial scores before using the application obtained data from 17 students who had not reached the KKM or a score  $\leq 75$ , and 3 students who had reached the KKM or it could be said that 85% of students had not reached the KKM score, and *user* trial data after Using the application, 4 students obtained data on students who had not yet reached the KKM or a score  $\leq 75$ , and 16 students who had reached the KKM or it could be said that after using the product students who had not yet reached the KKM experienced a decrease, namely from 85% to just 20%.

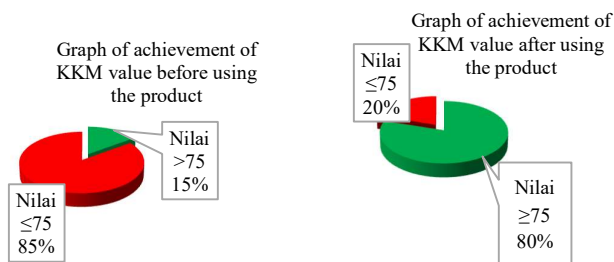


Figure 9. Value graph before and after application use

## CONCLUSION

Conclusions that can be drawn based on data from design research and testing of the Application of Augmented Reality (AR) in Android-Based Artificial Fiber Spinning Learning Media for Class XI TPSB SMK Texmaco Semarang Students are:

1. The development of Communication and Information Technology in learning models and patterns has developed rapidly, with many using tools such as computers, laptops and *smartphones*. The lack of skills of teaching staff in managing learning using conventional methods causes a lack of student interest in learning, so that students find it difficult to receive learning material resulting in low learning achievement.
2. Application *Augmented reality* on Android-based learning media is one of the appropriate strategies for learning, when compared to conventional learning, learning using Android *smartphone tools* becomes more interactive.
3. *augmented reality* applications can be done using Unity3D and Vuforia software. 3D modeling was created using 3Ds Max 2010 software. Button design and *layout* were created using CorelDraw X8. Additions to evaluation questions can be made by editing the question *script* via Monodevelop software.
4. Based on the media expert validation test results, a value of 3.2 was obtained, including the valid category, material expert validation test results obtained a value of 3.6, including a very valid category, and *user validation test results* obtained a value of 3.45, including a very valid category, so it can be said that the media This learning meets the criteria for a score of 3.26-4.00, which is included in the appropriate category, so this media can be used at Texmaco Semarang Vocational School.
5. Based on the discussion analysis obtained from data from *users* before using the product, there were 85% of students who had not reached the KKM score, and the data after using the product decreased, namely only 20% had not reached the KKM, so the research on

the application of *augmented reality* Android-based artificial fiber spinning learning media can be said to be very effective.

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