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# ME science as mobile learning based on virtual reality

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**Abstract.** The purpose of this article described about ME Science (Mobile Education Science) as mobile learning application learning of Fisika Inti. ME Science is a product of research and development (R&D) that was using Alessi and Trollip model. Alessi and Trollip model consists three stages that are: (a) planning include analysis of problems, goals, need, and idea of development product, (b) designing includes collecting of materials, designing of material content, creating of story board, evaluating and review product, (c) developing includes development of product, alpha testing, revision of product, validation of product, beta testing, and evaluation of product. The article describes ME Science only to development of product which include development stages. The result of development product has been generates mobile learning application based on virtual reality that can be run on android-based smartphone. These application consist a brief description of learning material, quizzes, video of material summery, and learning material based on virtual reality.

## 1. Introduction

Learning media has an important role in improving the quality of student learning. Using the learning media, students will be easier in understanding the material to be learned. Nowadays, the learning media that widely developed and researched is a mobile phone based learning media it's called mobile learning. Mobile learning can be categorized as a form of multimedia because it can present the material in the form of audio, visual, and audio visual. Mobile learning can be applied on a smartphone with Android, iOS, and Windows phone operating system. Mobile learning has advantages such as (1) advanced technology as computer, (2) portable so it is easy to carry and access anytime and anywhere, (3) most frequent technology operated by students, (4) flexibility in developing multimedia learning applications. The use of multimedia learning in science education is very important and highly recommended so that the material can be well explained to maximize student understanding. Form of material visualization through mobile learning can use images, animation, video and also Virtual reality technology (VR). Virtual reality is an advanced technology, because it not only visualizes an object in the form of images or video only, but in the form of a virtual environment that can simulate various forms as well as in reality. The use of virtual reality in science Education provides many advantages. This is because science also studies abstract material that cannot be seen directly with the eyes or learn an environment that is not around students or environments that have not been visited by students, by using virtual reality technology it can all be realized. Therefore, the development of multimedia virtual reality-based mobile learning is needed to review how much impact the student's learning outcomes have. Furthermore, the purpose of developing ME Science base on android virtual reality is to add variations of the types of instructional media that teachers and students can use.



## 2. Literature

### 2.1. *Multimedia for learning*

Multimedia learning is defined as the use of different types of media that are organized by an integrated system to accommodate the various senses in receiving information so that the learning process can run more optimally although the student's modality is different. The types of components that make up the multimedia can be text, graphic images, graphics, audio, animation, and video. The principles of multimedia learning include coherence principle, signaling principle, redundancy principle, spatial contiguity principle, temporal contiguity principle, segmented principle, pre-training principle, modality principle, multimedia principle, personalization principle, voice principle, and image principle [3]. Multimedia is divided into two forms of components, namely hypertext and hypermedia. Hypertext is a systematically organized use of text to link information with the reader. Hypermedia involves components that include video clips, graphics, or audio. Both forms of these components can be considered as components of the multimedia compiler. Collaboration of multimedia components will provide better understanding, repetition, and conclusions. To be able to collaborate these components into one multimedia, computer technology is required. Multimedia based on the use of computer technology is divided into four types, namely: (1) Hypermedia, (2) Webpages, (3) Presentation, and (4) Video [4]. Multimedia is divided into two categories, namely: linear multimedia and interactive multimedia. Linear multimedia is a multimedia that is not equipped with any controller that can be operated by the user. This multimedia runs in sequence so that the user just follows just what is displayed. Interactive multimedia is a multimedia equipped with user-operated controller tools, so users can choose what to display [6]. Learning using multimedia provides benefits: (1) more interest in students, (2) effective and efficient, (3) more practical, (4) more material being learned. In addition to these advantages, the use of multimedia in learning also has weaknesses, namely: (1) cost is more expensive, (2) constraints teacher competence in using multimedia and supporting equipment, (3) the availability of the device is still limited [5].

### 2.2. *Mobile learning*

Mobile learning can be grouped into several classifications based on the perspective used. According to the ICT technology perspective, mobile learning can be classified based on key indicators, namely the type of device supported and the type of wireless communication used to access learning materials as well as administrative information. Meanwhile, according to the perspective of teaching technology, mobile learning can be classified based on indicators; asynchronous and or synchronous learning support, standard e-learning support, availability of a permanent Internet connection between system and user, user location and access service to learning and / or administration materials.

### 2.3. *Virtual reality*

Virtual reality is a technology that utilizes three-dimensional design to simulate an object. Virtual reality is defined as a medium built by interactive computer simulations involving the senses in motion and position activity, then the interaction of one or more senses with the simulated environment presented [7]. In the beginning, virtual reality technology is an expensive technology that is difficult to realize. Nowadays, the rapid development of technology, especially on smartphone technology allows virtual reality to be implemented easily. Virtual reality can run on android-based smartphone with additional devices such as VR box or google cardboard. Through these additional devices, the screen display on the android smartphone can be turned into a visual tool of three-dimensional so as to be able to present a virtual environment.

## 3. Research method

The research method used in the study is Research and Development (R & D) by using Alessi and Trollip model. The stages of Alessi and Trollip model consists three stages that are (a) planning include analysis of problems, goals, need, and idea of development product, (b) designing includes collecting of

materials, designing of material content, creating of story board, evaluating and review product, (c) developing includes development of product, alpha testing, revision of product, validation of product, beta testing, and evaluation of product [1]. The development research conducted aims to produce multimedia mobile based learning products android virtual reality (ME Science).

#### **4. Result and discussion**

Virtual reality is a technology that is currently easily realized. Through android-based smartphone and additional devices such as VR box and Google cardboard virtual reality can be enjoyed by the user. Development of virtual reality as a learning media has been mostly done in the field of education. But in Indonesia, virtual reality-based learning media is still not widely used as a teaching tool in school. This can happen because not many people have developed virtual reality for specific learning materials. Some areas of education that have implemented virtual reality are health, mechanical engineering, history, geography, and science.

In science education, virtual reality can be used to create a simulation of science phenomena that cannot occur directly during the learning process. But unfortunately, the virtual reality learning media in science is still very hard to find especially in Indonesia that use Indonesian language and use Indonesian curriculum. Therefore, the development of multimedia mobile learning-based virtual reality needs to be developed in the field of science education in Indonesia to provide new nuances of interesting learning media.

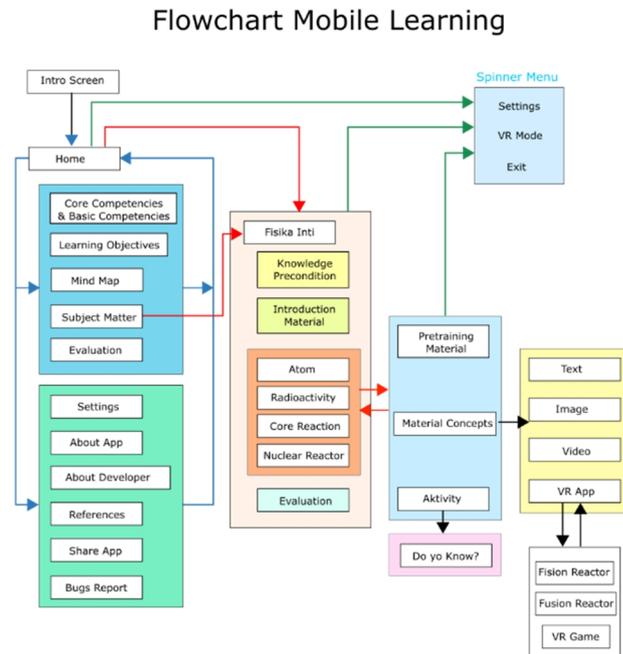
Multimedia mobile learning based on virtual reality that developed called ME Science (mobile learning for science education). The development of learning multimedia ME Science conducted using Alessi and Trollip development research model. Multimedia development with this model has three stages: (a) planning, (b) designing, (c) developing.

##### *4.1. The first stage is planning*

Analysis of physics science learning problems at the level of grade XII high school majoring in IPA is the lack of choice of instructional media that can be used to assist teachers in explaining the physics materials. One of the most difficult material for learning media is the fisika inti material that studies the microscopic phenomenon and learns how to use knowledge about nuclear reactions in the nuclear power plant (NPP). Based on these problems, it needs an alternative choice of learning media on fisika inti material which is easy to use by teachers and students in the learning process. In other words, students have been accustomed to using mobile phone technology through their own smartphones especially smartphone with android operating system to perform various activities such as social, play, and information seeking. Therefore, mobile phone based learning media is considered suitable with students in high school age. So, the development of mobile learning based on virtual reality will be developed on smartphone with android operating system.

##### *4.2. The second stage is designing*

In the designing stage, the first thing to do is to collect the various materials that will be used in building ME Science fisika inti. The materials used in ME Science accordance with the 2013 curriculum revision 2 The next step, which is designing material content that will be presented in the ME Science fisika inti. the material content presented in ME Science includes learning materials in text form, explanatory videos, quizzes, and virtual reality based learning materials. The virtual reality-based teaching materials that are developed present a simulation of nuclear power plants and how the core physics work in it. The simulated type of nuclear power plant consists of two that use nuclear fission and nuclear fusion reactions. The virtual reality-based material is selected on the simulation of nuclear power plants with the aim that students can understand how the role of nuclear physics reactions can be transformed into electrical energy. The next step is to change the material content design into the form of flowchart and storyboard as a visualization stage of the multimedia concept that will be developed that contains the user interface with a mix of material content that has been designed. The flowchart of ME Science development products can be seen in Figure 1.



**Figure 1.** Flowchart ME Science.

Some storyboards of ME Science can be seen in the following Figure 2.

	<p>The left image is an Intro screen design Intro</p> <ul style="list-style-type: none"> <li>• Icon is in the top center</li> <li>• The text on the intro screen displays titles and explanations</li> <li>• Skip button on the bottom left</li> <li>• Advanced button on the bottom right</li> <li>• There is an intro screen position indicator on the bottom center</li> </ul> <p>The right image is the design of the drawer menu</p> <ul style="list-style-type: none"> <li>• The menu will appear when the layer is pierced right</li> <li>• Menu can be scroll up and down</li> </ul>
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**Figure 2.** Storyboard intro screen and menu drawer items.

*4.3. The third stage is developing*

Development of ME Science based on virtual reality android using the Integrated Development Environment (IDE) is android studio powered by IntelliJ platform. Android studio is the official development tools based on IntelliJ IDEA which has powerful code editor and offers more features to build android apps [2]. Development of ME Science using android studio makes it possible to use various libraries that have been available through official android application source code as well as third party library. The programming language used is xml, java. Here is a ME Science development view using IDE android studio as showed in Figure 3.

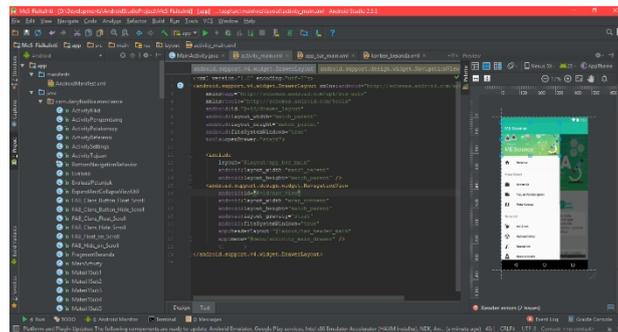


Figure 3. Develop ME Science using android studio.

Material content in the form of animated video and images were developed using inkscape application, adobe illustrator, and adobe after effect. Meanwhile, to develop virtual reality environment in the form of 3D field, the researcher used unity and blender application. The ME Science multimedia display that has been developed can be seen in Figure 4 dan Figure 5.

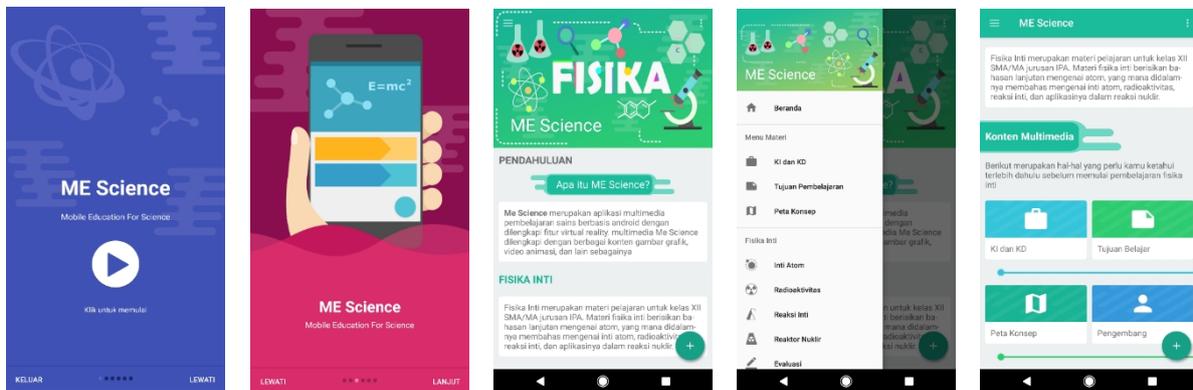


Figure 4. Intro scree of ME Science home and drawer menu item.

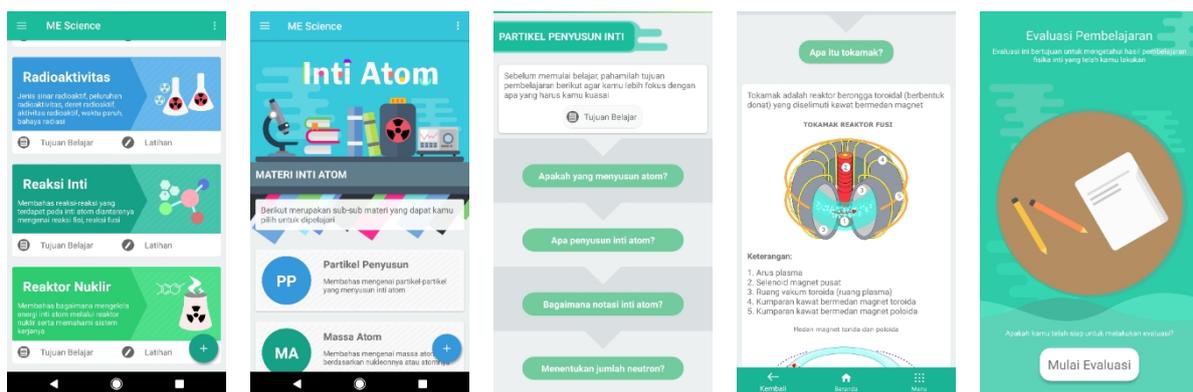


Figure 5. ME Science menu and learning material.

The material nuclear physics on nuclear reactor based on virtual reality is still in development stage, here is an figure of 3D object created by using blender application as exemplified in Figure 6:

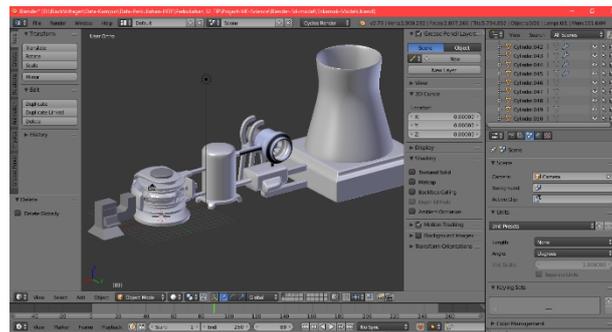


Figure 6. Develop object 3D fusion reactor using blender.

## 5. Conclusion

Multimedia mobile learning ME Science based on android virtual reality has been developed using Alessi and Trollip development model. According to these model, ME Science has reached the stage of development. After the development phase is complete, the mobile learning ME Science will enter the validation stage by media experts and material experts. Then ME Science will be tested to high school students of class XII IPA. Through the development of ME Science, it is expected that teachers and students can make mobile learning based on android virtual reality as one of the alternative choice of media in supporting and improving the quality of learning in class.

## Acknowledges

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