

# Mobile Application with 3D to Improve Self-Determined Learning Interest : Student's Response and Challenge in Biology Class

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Abstract—. The limited choice of media to increase the learning interest of affordable middle school students encourages the importance of developing interactive learning media that are suitable for the needs of students. Gadgets technology that is increasingly developing becomes a benchmark for developing more interesting and varied media. Good media can stimulate students to learn, effectively and practically. Therefore, this study aims to develop interactive media with 3D to increase students' interest in learning. The method used is ADDIE with an R & D model so that the output produced is a learning media application with 3D that can be accessed using Android. The subjects of the study were the tenth-grade high school student. The process of developing this application for 5 months began with Analysis, product design, application development using Android Studio, an implementation which included testing of control groups and experimental groups, until evaluation by testing the equivalence to measure the effectiveness of applications. This learning media is highly recommended proven by increased student scores from 3.4 to 4.2 than expected to be developed later in terms of material, appearance, and interactive content.

Keywords: interactive media, Android, learning media, 3D, mobile application

# I. INTRODUCTION

Many factors influence the success of learning activities. First, factors that come from within students (internal factors) which include ability, interest, intelligence, physical condition, motivation, and so on. Second, factors that come from outside the student (external factors) which include the overall family condition, teaching methods, curriculum, school discipline, and school facilities and infrastructure. These two factors influence each other so that both must be fulfilled so that students can learn well. Learning objectives include three abilities, cognitive, affective, and psychomotor abilities. Cognitive abilities are related to changes in behavior from various mental processes that start from the level of knowledge to evaluation. Affective abilities relate to feelings, emotions, value systems, and heart attitudes that indicate acceptance or rejection of something. While psychomotor abilities are related to physical activities related to mental processes. To achieve effective and psychomotor abilities, good cognitive abilities are needed.

Based on observations that the state of the teaching and learning process is still less varied. In the learning process, the teacher still uses the lecture method, so that sometimes the students are not interested and just chatting with their friends. Students tend to feel bored with the lecture learning method.

Improving the quality of learning can be done by optimizing the components that directly contribute to the quality of the learning process and results. These components are learning resources, students, teachers, methods, facilities and infrastructure and costs. Appropriate techniques and strategies can help stimulate students to record the material being taught, by learning in the classroom and independent learning. Independent learning is learning done individually or in groups outside of face-to-face learning or tutorials. The implementation of independent learning refers to the stages of thorough preparation, coordinated implementation, and accurate results assessment process so that students learn to be able to achieve the expected competency standards.

Technology that is currently popular in the community is the Android Smartphone technology. Based on the statistics of the Mobile Operating System in 2015, 68.75% of all Smartphone users in Indonesia use smartphones with Android operating systems. Therefore, seeing a large number of users and opportunities can be made software that is able to support the teaching and learning process of students in schools into a positive realm. So from the survey and the conditions above, the media can be developed to support the implementation of independent learning so the media is needed to carry out self-determined learning.

Technology can be defined as the product or process minimizing the difficulties faced through science in human life. Parallel to the rapid development of information and communication technology, the demand for its use in schools and classroom is increasing [1] Many researchers state that technology is used both in everyday life and educational environments [2][3]). While digital technologies are used for fun and communication, they are also used in education and provide a learning process for both teachers and students [4]. In the study, discussed the concept of collaborative learning, explored learning environments to promote collaborative learning and investigated a general collaborative model and supporting technologies [5] [6] [7] [8] [9] [10]

What are media The media system, like the education system, is "one of society's key sets of institutions, industries, and cultural practices" [11]. The media are a central, if not primary, pedagogue. Children and youth spend time with media than any other institution, including schools [12]. Educational software application or online students cannot just reach a single classroom or across the state or country [13]. Media can help improve student learning outcomes [14].

Technologies available for classroom range from interactive whiteboards to 3D instruction. Given the state of 3D for classroom in its use of specialized goggles, projectors (TI instrument), and scarcity of published research [15], its value as teaching tool is being weighed by educators [16]. An Android-based 3D mobile application like an interactive game application, students can get material, questions, and objects to get feedback. Hew and Cheung (2010) educators in K-12 and higher education are often until 3D as spaces for communication, simulation, and experimental learning. Hew and his associates also reported that students in these studies had high satisfaction and attitude towards using 3D during their learning process. On empirical studies [17] and on 53 empirical studies.

The sense of presence, multi-sensor interaction, immersiveness, dynamic models, simulation, and visualization in 3D were the factors contributing to student learning [18]. This application also helps teachers interact with students because the teacher can provide case studies with examples of content in the application and students answer by submitting their respective opinions. Interactive learning media is very much needed especially with mobile media that cannot be separated from today's students. Thus this media is very important for its development. Formulating a problem that can be formulated is How to develop an Android-based with 3D application media to increase self-determined learning interest in biology class.

## II. METACOGNITIVE FRAMEWORK

Numerous researches have emphasized the role of metacognitive process and self-regulated learning in inquiry learning [19, 20, 21], as an example, White et all. Offer a framework for inquiry learning, the meta-knowledge framework, which contains four primary process: theorizing, questioning, and hypothesizing, investigating, analyzing and synthesizing [19, 22] as part of this framework, they claim there is a meta-processing level where one evaluates not only what process should be carried out but also how well it is being carried out. Similarity, research on 3D virtual environment suggest curricula delivered via these technology have the potential to offer more authentic science inquiry learning that reflect the process in White et al framework [23, 24, 25, 26]

# III. METHOD

Development Research Methods or commonly called R & D (Research and Development) are research methods that produce certain products, and then test the effectiveness of these products. The learning media development model was adapted from the development of the ADDIE model [27] which consisted of the analysis (Analyze), design (Design), development (Develop), implementation (Evaluate) and evaluation (Evaluate) stages. This model is an approach that helps instruct designers, any content developers, or even designs to apply the ADDIE models on any instructional product [28]

The analysis phase is carried out by applying the qualitative approach through two analyzes, problem analysis and analysis of learning components. At the stage of the Problem Analysis, an investigation of the problem issues that arise in biology learning activities is carried out and identifies possible solutions that can be used to overcome the problem. At this stage, interviews are conducted, collecting syllabus and lesson plans, and student learning outcomes. At the Learning Component Analysis stage analysis of learning objectives is conducted, analysis of learning situations, analysis of students, and analysis of learning content. This descriptive statistical analysis is used to analyze and describe the collected data.

The design phase includes the drafting phase of the application structure, determining the systematic presentation of material, illustrations, and visualization, then ending the drafting of the initial product learning application and making a flowchart. At this stage of product development, the application framework is made with Android Studio and Blender according to the design of the previous stage. After an internal analysis, the transformation will be carried out into an APK.

Furthermore, the implementation of the product feasibility test results was carried out, by one trial, experiment group, and control group, then final evaluation. The learning process that is used as the object of research in biology with the output of applications with interactive 3D that can be run on an Android system to be applied to biology learning.

## IV. RESULTS AND DISCUSSION

The target of the results of this development is that students can give attention to learning. This application is expected to be used in the teaching and learning process in the classroom and self-determined learning, because it is not only interactive but this application is designed to be accessible using a mobile phone so that it can be used for distance learning. Mobile learning is now a ubiquitous educational technology, one that introduces both exciting capabilities into learning design processes [29]. Shrinking application requirements in general, user needs, and product characteristics that will be produced must be able to run on an Android cellphone with a minimum of O.S Lollipops or Android version 5. This product is an application of suitable size and reliable to use. Content in the application is adapted to biology learning material.

The analysis phase is carried out by identifying the learning achievements in the biology learning outcomes, the first basic mastery of knowledge about seven biological principles (universality, structure, homeostasis, diversity, interaction, continuity, evolution), second Mastery of basic knowledge about applications in the field of biology (eg : the concept of applying compost to plants that don't thrive). Third, knowledge of the basic principles of device application for the purposes of analysis and synthesis in the field of Biology (eg, basic principles of microscope application), this initial analysis is used as a reference that students already know the general knowledge of biology about tools and objects around them are then given to test the initial independence learning and practice questions, the results show that students are lacking in exploring and do not feel confident in completing assignments and examinations, lack of learning motivation, and lack of awareness to learn.

The next stage of analysis is analyzing the characteristics and readiness of students by looking at several aspects, aspects of gadget types and specifications used, behavioral aspects of using gadgets as well as experiences and readiness of students to carry out learning in daily activities.

Looking at the ownership of any cellphone owned by students, it is known that all students already have and are accustomed to using mobile devices, laptops, and PCs. Looking at the multimedia possessed by students, it can be said that students are very ready to be given multimediabased learning media. Knowing the ownership of students from the mobile operating system, as many as 90% of students use the Android operating system, and 10% of students use the IOS operating system. An Android operating system used by version 5 students is 21% and the remaining 89% use operating system version 6.

Thus, to operate the development of this application it is recommended to use the minimum Android operating system version 5 and above with a minimum 5-inch screen. Where all students have used a screen with a minimum of 5 inches.

The use of gadgets or cellphones by students takes around 5-15 hours in daily activities. The application that is often open is social media, the second is the game application, the third is the internet explorer/browser. Students very rarely open applications for learning or exploring to study. The experience of students in the use of mobile phones for learning can be said to be lacking, students explore explorers when they have tasks that require describing.

After knowing the learning objectives, the readiness of students to use learning tools, then proceed to the application design stage. formed a flowchart as a basic guideline for the application flow.



Fig. 1. Application Development Flowchart

This flowchart is then described with the selection of letters, attractive colors, and selection of material content according to what will be included in the application. Selection of 3D images that will be included in the application to develop children's exploration interests.

The next stage is the stage of developing learning applications. This development begins by describing the flowchart, objectives and learning material in an application for biology subjects that can be developed on the Android platform. The selection of appropriate KD is compiled starting with introductory material, learning videos, questions along with answers and 3D images that can be rotated 360 degrees. To facilitate complex development, Android Studio was chosen to develop this learning application.

This software is known for startup application development, as the main application software that contains file module modules a) manifests: Contains the AndroidManifest.xml file b) java: Contains Java source code files, including the JUnit test code, c) res: Contains all resources not code, such as XML layout, UI strings, and bitmap images. What then for 3D development uses Blender and Cloud as a portal to insert videos in Android Studio.

After coding testing and compiling the template, the material is entered according to the SK and KD specified in the flowchart. Next, convert it so that it can be used for Android devices with the APK format. This application can be uploaded to Play-store or can be shared using the Share-It application and also by google drive share links.

The implementation phase is carried out by giving control group trials, experimental group trials, and product revisions. The population in this trial was the tenth-grade high school student. The research sample was taken two classes randomly as the experimental group and the control group. The number of students in 2 classes is 30 students. Students are included in the research subject if they follow all sets of treatments. Biology lessons every week are 2 x 40 minutes. The results of the control group trial, on average students, get a value of 3.4 (scale 1-5), this stage is passed by revising the sound effect of the button so that it can be done adding and reducing the sound output. Experimental trials of students get an average value of 4.2. This test is obtained after the Biology learning activity ends (3x face to face). The test is used as a comparison between students who are given instruction and applications with students who are not given instruction with the application. The questionnaire sheet is used to measure the feasibility of the learning stage and see the effectiveness of the application.

The next stage is the evaluation of this learning application that is tried out in 30 High School students. This test was carried out to see the level of effectiveness of the application by distributing product feasibility test questionnaires to students and teachers. After testing students generally, give a good rating and are very enthusiastic about using this application, because understanding the material is quite easy with text, 3D images, and videos that can be accessed in one touch and



can be accessed anytime and anywhere. 50 Diverse questions help students record new terms in biology. The score increase from 3.4 to 4.2 (scale 1-5) shows the effectiveness of the use of the application is very pronounced for students to improve self-determined learning.

#### V. CONCLUSION

Media applications with 3D are very effective to apply at school. Use of the application helps create selflearning or distance learning goals. The absence of affordable applications in learning can be solved with this application. This Android-based application can be downloaded, or shared offline. In the future, this application is very able to be developed both in terms of appearance, material coverage, as well as interactions between students and devices or feedback that can further stimulate students to increase creativity. The development of this application needs to be tested repeatedly on a scale basis because in the future effective development of such applications is needed.

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