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## Adaptive multimedia with android e-assessment to improve assessment efficiency

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**Abstract.** One of the strategies used to facilitate assessment and instructional media implementation is by using information and communication technology in learning. The main objective of this study was to develop adaptive learning module with Android-based e-assessment. This study employed DDD-E Model (Decide, Design, Develop, and Evaluate). The result was android-based e-assessment adaptive multimedia applicable in learning process. The system used Kotlin programming language. The advantage of this media is that it is integrated with the cloud service so that it can synchronize itself in realtime and can be accessed anywhere and anytime; it holds many multimedia formats; and it is equipped with its main assessment system with formative and summative functions.

### 1. Introduction

Multimedia-based learning has been indispensable in this era [1]. It can facilitate teaching-learning process to be more efficiently carried out. Adaptive multimedia is one of multimedia that can adapt to students' learning style. This type of multimedia is so effective that it can help solve students learning problem [2]. Through adaptive multimedia teachers can also leverage their creativity in preparing their multimedia-based teaching materials [3]

The growth of online learning in higher education has led to developments in e-assessment[4]. An online-based assessment (E-Assessment) is one of the most effective assessment tools for both lecturers and students[5][6]. E-Assessment [7] provides support for the creation of automated and practical assessment reports[7]. In addition, the use of android-based learning has also penetrated the learning process [8][9]. This is very supportive in the efficiency of learning [10].



However, the use of adaptive multimedia with android e-assessment devices is still rarely done. So this research tries to combine adaptive multimedia and android e-assessment to improve assessment efficiency in learning process.

## 2. Methods

The development model used in this multimedia learning development study is the DDD-E model. Learning multimedia development procedure using DDD-E model consists of the following steps: (1) Decide the program objective and contents, (2) Design, in which the structure of the program is built (3) Develop is to produce media elements and create a media display, (4) evaluate is to conduct evaluation on the whole process of decide, design, and develop [11]. The following Figure 1, is a research diagram of the development of multimedia learning based on DDD-E model.

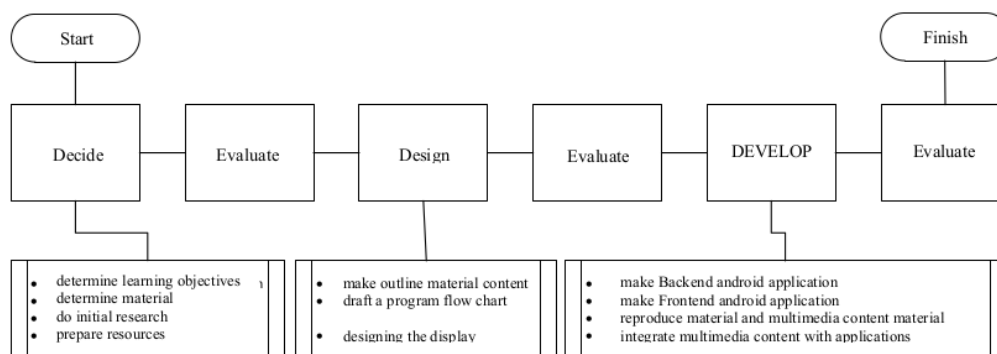


Figure 1. DDD-E Model Step Diagram

The Decide stage is performed with the following terms of reference. (a) establish the objectives of physics learning to be achieved; (b) determine the theme and scope of the multimedia to be applied; (c) measuring and developing the prerequisite of multimedia usage to the students; (d) establish project measurement limits; (e) prepare resources such as computers, smartphones, stationery, software (Android studio, Microsoft Office Visio, Google Cloud SDK, NodeJs, Adobe XD and Visual Studio Code).

In the design stage, the visual thinking stage includes the following activities: (a) determining the application / media system scheme, (b) creating outline content in terms of the title, purpose, and outline of the content; (c) create a flowchart or UX usage flow; (d) create a display design / UX (user interfaces); (e) create blueprint or instructional media design.

Activities undertaken in the development stage (Develop) namely: (a) the manufacture and preparation of materials; (b) the creation of multimedia content (text, graphics, audio, photography, animation, simulation, and video) in accordance with the needs and materials; (c) code creation and application backend configuration in Firebase, Cloud Function, Cloud Firestore, and Cloud Storage services, the service serves as a processor and data store; (d) development of the android app frontend using the Kotlin programming language with Android Studio IDE; (e) integration of multimedia content (integration of all learning multimedia components).

Evaluation is done at each stage of development (formative evaluation) ie evaluation is done starting phase of decide, design, and develop. At the Decide stage, an assessment of the accuracy of the topic with multimedia and the feasibility of the results of the research was conducted At the Design stage, assessment of design elements such as outline of material, flowchart, user experience, and user interfaces are carried out. In the develop stage, an assessment of multimedia elements of text, graphics, audio, photos, animation, simulation, video, android software, and product trials were undertaken.

### 3. Results and Discussion

The mechanism of the application is that the android application serves as a medium that interact directly with users (students and teachers) as the main media, while web applications are just another alternative. Google cloud services that are applied in this media are firebase, cloud function, cloud firestore, and cloud storage. Firebase service serves as an intermediary medium that handles the interaction of android apps with other cloud services. Some of the functions that are implemented are user authentication services, messaging services, and analytics. Cloud storage service serves as a media storage media in the form of files such as photos, videos, music, pictures and others online. And cloud firestore services function as database storage. The detailed description is shown in Figure 2.



Figure 2. The android-based learning media scheme.

Android studio is an IDE (Integrated Development Environment) provided specifically by google to develop android applications. The advantages of using android studio that it is created specifically for the development of android apps by google, is free, has a smart code editor, integrates with feature fast emulator and feature rich, optimize can support all android devices, support 3 programming language that is java language, C ++, and kotlin, and integrated with google firebase and google cloud services.

The kotlin programming language is a JVM programming language created by jet brain as an alternative to the java programming language. It is shorter than java programming language. But this language can work for all devices and programming will be done faster.

With multimedia content, students will more easily understand the learning materials. When associated with learning styles, the learning styles that students have are various; visual learning style, auditory, and kinestetik. The right solution to solve this problem is with adaptive multimedia learning content [12]. For example, students of auditory style learning style will be more easily adjusted if the learning process audio and or video learning contents. Learning content in multimedia (text, images, animation, video, and audio) are available in this module.

The adaptive multimedia in this module is based on the level of knowledge achieved by the students on the material being studied. Students study materials according to the order of the available content. So students learn in a gradual way and can not pass certain material when the material is not understood yet. This can be determined by diagnostic tests at the end of each sub-chapter. When the learning ends the test is redone to find out the results of students' achievement. Other research results also confirm that students are more effective in completing the exercises by applying the adaptive elements in school [13][14]. In addition, adaptive multimedia also significantly improves student learning outcomes [15].

#### 4. Conclusion

Adaptive Multimedia with Android E-Assessment is integrated with cloud services so it can sync in real time and can be accessed anytime and anywhere and supports multiple types of assessment 1) attitudes (teacher observation, self-assessment and peer evaluation) 2) type knowledge problem (multiple choice, right wrong, short description, and description), 2) psychomotor (skill / performance score, product assessment). However this application can only run on android minimum version 4.1 (jelly bean) and maximum android 8.1 (oreo).

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