# DEVELOPMENT OF ANDROID-BASED "MBARENGI" STATISTICS E-MODULE AS AN INNOVATION FOR STATISTICS LEARNING MEDIA WITH HYBRID LEARNING

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***Abstract.*** *The learning process is closely related to the interaction between educators and students. In order to facilitate the learning process, educators are required to make learning more innovative in order to be able to encourage students to study hard and be able to follow the learning process well. One of the innovations that can be done in the learning process is innovation in learning media. Learning media is one of the components of learning that has an important role in teaching and learning activities, especially in the transition after the Covid 19 pandemic. The use of smartphones can be one of the innovations of learning media by using Android-based e-modules. This research is development research or called Research and Development (R&D) using the ADDIE development model (Analyze, Design, development, Implementation, and Evaluation). The Android-based "MBARENGI" Statistics E-Module was validated by material experts, learning media experts, and tested on a limited scale sample. The results of the validation of material experts on the aspect of content material are 91.5% and on the language aspect are 93.2%. The results of media expert validation on the aspect of content quality are 92.3%, on design and audio aspects are 94.4% and the interaction and feedback aspects are 92.3%. In the test results, student responses obtained an average result are 88.8% which stated that the Android-based "MBARENGI" Statistics E-Module was feasible to be used in the learning process.*

***Keywords:*** *android, e-modul statistics, innovation learning media*

# 1. INTRODUCTION

One of factors that support effective learning is utilizing learning media. Learning media plays an important role in learning process carried out, especially during transition period after the Covid 19 pandemic. Learning media is a tool used by educators to convey information to students. Learning media plays an important role in process of teaching and learning activities, which can help students to easily understand the information received through various learning media, including visual media, audio-visual media, or teaching aids so that teaching and learning activities will take place effectively [1]. By carrying out a hybrid learning process, use of learning media has an important role in increasing students' understanding. One form of development information and communication technology is a smartphone. Smartphones in the world of education today can be used as a supporting tool in learning process. In their research by [2] argues that 87% of students have an Android-based smartphone, to optimize the use of Android, 93% agree to use a smartphone as a tool for mastering subject matter.

An Android-based e-module is one of teaching materials whose preparation process is in a digital form in a systematic and attractive manner that contains material content, video illustrations, animations, and interactive quizzes that can be used independently to achieve predetermined indicators and to improve learning effectiveness [3]. Android-based e-module is an arrangement of teaching materials consisting of images, videos, audio, text, and animations arranged in the form of Android files in an integrated manner and creates two-way communication or interaction between users and computers. The characteristics of Android-based E-modules according to[4] is a learning package that is self-instructional, recognizing the existence of individual differences in learning, formulating explicit learning objectives, associations, structures, and sequences of knowledge, use of various kinds media, active participation of students, direct reinforcement of student responses, and evaluation student mastery of learning outcomes [5].

The preparation of android-based e-modules is not only filled with material for information material, but most important thing in preparation of android-based e-modules is existence of two-way communication or interaction between users. In this e-module, students can receive feedback from the application, for example, when students work on evaluations, students can find out directly the results of the evaluation and also students can receive feedback by being given an introductory learning video [6]. With existence of android-based learning media, it can provide completeness in learning and provide opportunities for students to learn anywhere and anytime in mastering learning material. In the development of the Industrial Revolution 5.0, Android-based e-modules are a manifestation of the use of information technology. When compared to print e-modules, Android-based e-modules can be said to be more interactive because they can contain several features such as quizzes and videos [7].

Based on results of observations, it is known that many students have difficulties when attending lectures in statistics courses, especially in software applications used for the linear regression analysis process and testing the assumptions of regression analysis. So it takes an innovation of learning media that is able to make it easier for students to understand and carry out the stages of analysis correctly and carefully. Hybrid learning also requires practical and effective learning media because in the implementation of hybrid learning, students take turns doing face-to-face learning offline in class. Android-based e-module learning media is a solution that can be used to overcome these problems as a practical and effective learning media innovation in hybrid learning. Several previous studies related to development of android-based learning media also became the basis for the implementation of this research, including research by [8] on the development of android-based learning media in educational statistics courses. The results showed that the student's response to learning media was very good, indicated by an increase in learning effectiveness which had an average value of 3.4. Another study conducted by [9] regarding the development of e-statistics modules, the results showed that the e-modules for statistics courses that were developed with attractive designs could be an alternative to electronic-based teaching materials so that they are easily understood by students and can be used by students. motivate and support independent learning. Subsequent research was conducted by [10] on development of flipbook-assisted e-modules in statistics courses. The results showed that the developed flipbook-assisted interactive e-module was declared valid and feasible to use with an average percentage of material experts and media experts of 78.25%. In addition, the developed flipbook-assisted interactive e-module met the practical criteria with a percentage of 79. ,64%. Based on the rationale in the description above, the research entitled Development of Android-Based "MBARENGI" E-Modul as an Innovation of Statistics Learning Media with Hybrid Learning at Muhammadiyah University of Sidoarjo.

## 2. RESEARCH METHODS

This research is development research or known as Research and Development (R&D). Research Research and Development (R&D) is research stage in developing a new product or an existing product. With this research method, researchers will develop an interactive multimedia product for teaching aids. In development of this android-based e-module media using the ADDIE model because according to needs of researchers in developing interactive multimedia. ADDIE model consists of 5 stages, namely analyze, design, development, implementation, and evaluation. The description of the 5 stages in the ADDIE development model is as follows [11]:

### 2.1 Analysis

At this stage, analyze need for designing android-based e-module learning media. To be able to analyze these needs, researchers made observations to determine needs in the learning process. Based on the results of observations, researchers can obtain various kinds of information related to Android-based e-module media product that will be developed. The development of Android-based e-modules was carried out as an effort to innovate hybrid learning media during the Covid-19 pandemic transition.

### 2.2 Design

The design stage is stage in formulating what development of an Android-based e-module will look like. Making the workings of Android-based e-module feature flow starting from display of instructions for use, selecting materials, selecting the type of evaluation, designing the evaluation display, and designing the background display. At this design stage, the researcher will make a storyboard design first so that the media that will be created is in accordance with initial concept before being designed using a design application, namely Adobe Illustrator. The following is the initial design of Android-based "MBARENGI" Statistics E-Module which is shown using a storyboard in Figure 1. as follows:



**Figure 1. Android Based E-Module Storyboard**

In the Android-based "Mbarengi" statistics e-module, there are 7 sections, including loading page, main page, user guide page, material page, developer profile page, evaluation page and application exit panel page. The loading page is the start page when opening android-based "MBARENGI" statistics e-module. The main page contains navigation buttons for the menu of instructions for use, materials, developer profiles, instructions for use and evaluation. The user manual page contains menu options for access to material scenes, learning videos and evaluations. The content page contains various content buttons. Learning materials I is material about testing assumptions of regression analysis. Learning materials II is about linear regression analysis and multiple linear regression analysis. In addition to material in this android-based e-module, there is also a learning video containing the SPSS stages for testing the classical assumptions of regression analysis and the stages of simple linear regression analysis and multiple linear regression analysis. The developer profile page contains the identity of the e-module developer including name and field of knowledge of developer. The evaluation page contains practice questions related to regression analysis material. This page can be used to exit or stay on the selected page.

### 2.3 Development

The developments have been designed and described are starting to become real. At the stage of developing an Android-based e-module, it includes several steps, including collecting materials such as animation, sound, vector images, and others [12]. Then an Android-based e-module learning media was developed using some software with certain specifications. Some software with specifications described in detail in Table 1 as follows:

**Table 1. Specifications of the Android-Based "MBARENGI" Statistics E-Module**

| Software | Utility |
|---|---|
| Figma | Figma<br>Used to create Storyboards or Wireframes |
| Adobe Illustrator | Adobe Illustrator CC 2019<br>Used to create interface design or app design assets |
| Unity | Unity 3D Pro 2019 (Game Engine)<br>Used to assemble and combine designs or assets by providing source code into a series so that it can be used. |
| C# | C# Source Code |
| Android Studio | Android Studio 2020.3.1.22<br>Used to call Android components and functions that exist in Android Studio |

The specifications used to use the software in Table 1 include the following:

a. Minimum OS: Windows 7 x64 bit – Recommendation Windows 10 x64bit until the latest version
b. Processor: Minimum intel® Pentium® 4 or AMD Athlon® 64 processor
c. Graphic Card: Nvidia or AMD
d. RAM: Minimum 4GB – Recommendation16/8 GB
e. GPU: OpenGL 4.x

The specifications for the "MBARENGI" statistics e-module application include:

a. Versi Android: Support minimum 8.0 "OREO" (API Level 26), until the latest version
b. RAM: minimum 1 GB
c. Processor: Minimum Intel Quad Core
d. Screen: Support Screen Responsive (Can be used for all screen sizes with a minimum size of 720x1280 pixels (9:16 inch) up to the size above)

After the product is made, product validation is then carried out. Validation is carried out when development of  Android-based e-module media is completed, then it is consulted with material experts and media experts to get information and input from the products made, then Android-based e-module can be repaired according to the input from media and material experts, after being done product revisions in consultation with media experts and materials related to the results of the revision.

### 2.4 Implementation

Implementation is an application on the Android-based e-module media that has been developed. The process of implementing Android-based e-modules is intended for students to be able to apply Android-based e-module in the teaching and learning process. At the implementation stage, a socialization process can be carried out to students regarding Android-based e-module media that has been created [13].

### 2.5 Evaluation

At the evaluation stage, which is to give value to development of android-based e-modules and to see effectiveness of learning using android-based e-modules. At evaluation stage, it can also be seen level of success of learning media made and conformity with initial design. The research instrument used to

determine level of media feasibility is a questionnaire. The calculation of criteria for the validity of material expert and validity of media expert is carried out using the following equation:

$$P = \frac{\sum_{i=0}^{n} X_i}{N} \; x \; 100\%$$

(1)

Description:

P     : Score Percentage

ΣX    : Total Score

N     : Total Score

The assessment criteria to determine feasibility of an Android-based E-Modul are shown in the following Table 2, [14]:

**Table 2. Validation Criteria**

| Percentage | Category |
|------------|----------|
| 81%-100% | Very Feasibility |
| 61%-80% | Feasibility |
| 41%-60% | Enough Feasibility |
| 21%-40% | Less Feasibility |
| 0%-20% | Not Feasibility |

## 3.  RESULTS AND DISCUSSION

The results of this development research are Android-based "MBARENGI" Statistics E-Module in the form of a file with the extension ".apk" which can be accessed on Android smartphones. The development process of Android-based "MBARENGI" Statistics E-Module is carried out using ADDIE model which consists of 5 stages, namely analyze, design, development, implementation, and evaluation. At the stage of development results, it will also discuss the results of the validation of material experts and media experts as well as the results of the feasibility of media that have been tested on a small sample. The results of development of Android-based "MBARENGI" Statistics E-Module are described in the following discussion:

### 3.1 Analysis

At analysis stage, researcher conducted a needs analysis based on results of problem identification. Problem identification is carried out based on results of observations. Based on observations, it is known that students experience difficulties when attending lectures in statistics courses, especially in software applications used for the linear regression analysis process and testing assumptions for linear regression analysis (normality assumptions, non-autocorrelation assumptions, non-heteroscedasticity assumptions and non-multicollinearity assumptions). The stages in testing assumptions and linear regression analysis are quite long, making students feel difficult in the analysis stages. So it takes an innovation of learning media that is able to make it easier for students to understand and carry out the stages of analysis correctly and carefully. The innovative learning media solution provided is to develop an Android-based "MBARENGI" Statistics E-Module.

### 3.2 Design

At the design stage, researchers design features up to Android-based E-module user interface. The design is made using a storyboard in accordance with the concept of learning media that will be created, then design stage is carried out using Adobe Illustrator design application. Design of the Android-based "MBARENGI" Statistics E-Module is shown using a storyboard stage 2 in Figure 2.  as follows:
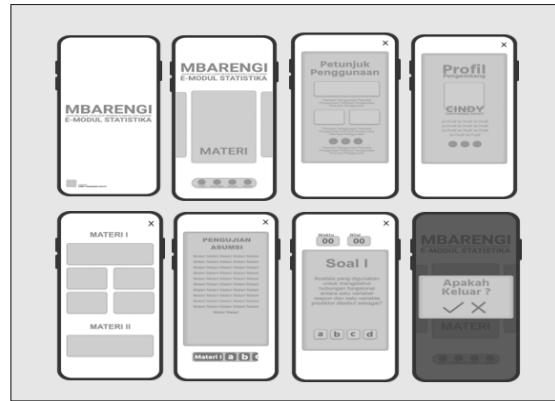
**Figure 2. Android Based E-Module Storyboard Stage 2**

### 3.3 Development

At this development stage, it produces a product in the form of Android-based "MBARENGI" Statistics E-Modul which has been developed at design stage. The software used at this development stage is Adobe Illustrator CC 2019 software using Unity 3D Pro 2019 (Game Engine) to assemble and combine designs. The appearance of Android-based "MBARENGI" Statistics E-Module is as follows:

### 3.3.1 Loading Page

The loading page is page that first appears when user opens the Android-based "MBARENGI" Statistics E-Module. The loading page is displayed before entering main menu page. The loading page display is presented in Figure 3 as follows:



**Figure 3. Loading Page**

### 3.3.2 Main Page

The main page contains navigation buttons to get user guide page, material page, developer profile page, user guide page and evaluation page. The main page views are presented in Figure 4, as follows:



**Figure 4. Main Page**

### 3.3.3 Developer Profile Page

The developer profile page contains identity of developer Android-based "MBARENGI" Statistics E-Module which includes the name and field of knowledge. The view of developer profile page is presented in Figure 5 as follows:

**Figure 5. Developer Profile Page**

### 3.3.4 User Guide Page

The user guide page contains menu options make it easier for users to access material page, evaluation page and learning video page. On the usage instructions page, there is also an alternative button to move sub-material page found on each material page. The user manual page display is presented in Figure 6 as follows:
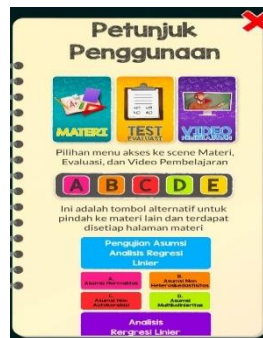


**Figure 6. User Guide Page**

### 3.3.5 Learning Material Page

The Learning Material Page contains various material selection buttons, namely learning material I and learning material II. Learning material I is material about testing the assumptions of regression analysis which includes assumptions of normality, non-heteroscedasticity assumptions, non-autocorrelation assumptions and non-multicollinearity assumptions. Learning material II is material about simple linear regression analysis and multiple linear regression analysis. In addition to the material in this android-based e-module, there is also a learning video containing the SPSS stages for testing the classical assumptions of regression analysis and the stages of simple linear regression analysis and multiple linear regression analysis. The view of the developer profile page is presented in Figure 7 as follows:
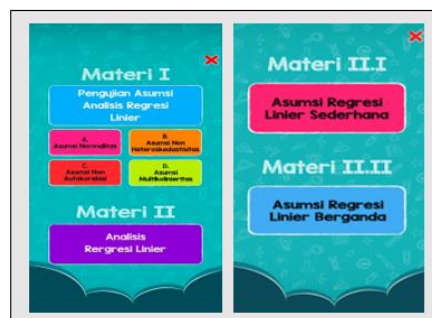


**Figure 7. Learning Material Page**

### 3.3.6 Evaluation page

The evaluation page contains practice questions related to linear regression analysis, both simple linear regression analysis and multiple linear regression and assumption testing. On the evaluation page there is also a value column that appears after user answers practice questions. The evaluation page display is presented in Figure 8. as follows:
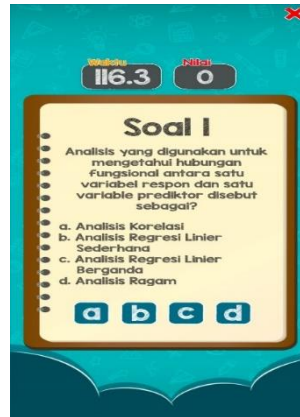


**Figure 8. Evaluation Page**

### 3.3.7 Application Exit Panel Page

The application exit panel page can be used to opt out or stay on the pre-selected page. The application exit panel page display is presented in Figure 9, as follows:



**Figure 9. Application Exit Panel Page**

In the next stage, after process of development of Android-based "MBARENGI" Statistics E-Modul has been completed, validation process is carried out to determine product feasibility in terms of materials and media. Validation was carried out by material expert validator and media expert validator. The results of validation material experts and media experts are presented in Table 3 as follows:

**Table 3. Expert Validation Results**

| Validator | Indicator | Percentage (%) |
|---|---|---|
| Material Expert | Contents | 91.5 |
| | Language | 93.2 |
| Media Expert | Content Quality | 92.3 |
| | Design and Audio | 94.4 |
| | Interaction and Feedback | 92.3 |

Based on Table 3, it is known that results material expert validation include aspects of material content and language, and the results media expert validation include aspects of content quality, design and audio as well as interaction and feedback. The results of validation material experts on material content aspect are 91.5%

and on language aspect of 93.2%. The results of media expert validation on aspect of content quality are 92.3%, on the design and audio aspects are  94.4% and on interaction and feedback aspects are 92.3%. Based on validation results, it can be stated that  Android-based "MBARENGI" Statistics E-Module is feasible to use, so it can be continued in a limited-scale trial process. Suggestions based on assessment of validator are used as revision material to improve prototype of Android-based "MBARENGI" Statistics E-Module that has been made.

The next stage is testing the Android-based "MBARENGI" Statistics E-Module on research subjects with a limited scale, namely 6th semester PTI students with a total of 10 students who have received linear regression analysis material in previous semester. The results of sample trial with a limited scale obtained in the form of student responses are presented in Table 4. as follows:

**Tabel 4. Test Results**

| No. | Name | Percentage (%) | Category |
|-----|------|----------------|----------|
| 1. | KZ | 90 | Very Feasible |
| 2 | CPP | 86.6 | Very Feasible |
| 3 | IAD | 83.3 | Very Feasible |
| 4 | KN | 98.3 | Very Feasible |
| 5 | ABR | 91.6 | Very Feasible |
| 6 | WDP | 90 | Very Feasible |
| 7 | AFF | 86.6 | Very Feasible |
| 8 | AO | 88.3 | Very Feasible |
| 9 | NPP | 83.3 | Very Feasible |
| 10 | EA | 90 | Very Feasible |
| **Average** | | **88.8%** | |

Based on Table 4, the results of student responses on Android-based "MBARENGI" Statistics E-Module trial were obtained. The average student response result is 88.8% with a very feasible category. So it can be concluded that trying Android-based "MBARENGI" Statistics E-Module is feasible and can be used in learning process. This is in line with results of research [15] which states that the use of Android-based E-Modules is one of the learning media innovations that can improve student learning outcomes. Another relevant research result is a study by [16] which states that in addition to improving student learning outcomes, the use of Android-based E-Modules can also increase learning motivation and make the learning atmosphere more enjoyable.

## 4.  CONCLUSIONS

Results of this development research are Android-based "MBARENGI" Statistics E-Module which is carried out using the ADDIE model which consists of 5 stages, namely analyze, design, development, implementation, and evaluation. The development of Android-based "MBARENGI" Statistics E-Module was declared feasible after going through the validation process of material experts and media experts. The results of the validation of material experts on the aspect of content material are 91.5% and on language aspect are 93.2%. The results of media expert validation on aspect of content quality are 92.3%, on design and audio aspects are 94.4% and on the interaction and feedback aspects are 92.3%. In the test results, student responses obtained an average result are 88.8% which stated that Android-based "MBARENGI" Statistics E-Module was feasible to be used in the learning process.

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