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# Android-Based Tutorial Mobile Development Equipped with Corrective and Constructive Feedback Materials for Data Transmission and Storage

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**Abstract**

This study aims to develop a mobile tutorial application on data transmission and storage material as a learning medium for high school students. The study employed a research and development approach with a 4D model (Define, Design, Develop, and Disseminate). However, the study was partly carried out using the Develop stage. Based on the results of research and development, the results of the validation of the entire product were obtained with an average score of 3.70 with valid criteria (without revision) and the results of the readability test were 94% with legibility criteria. This shows that the Android-based mobile tutorial equipped with corrective and constructive feedback on data transmission and storage materials for high school students can be used by teachers and students for independent learning.

**Keywords**: mobile tutorial, Android, corrective feedback, constructive feedback, data transmission and storage

**Abstrak**

Penelitian ini bertujuan untuk menghasilkan aplikasi mobile tutorial pada materi transmisi dan penyimpanan data sebagai media pembelajaran siswa SMA/MA. Penelitian ini merupakan penelitian dan pengembangan dengan model 4D (Define, Design, Develop, dan Disseminate) namun hanya dilakukan hingga tapah Develop. Berdasarkan hasil penelitian dan pengembangan, diperoleh hasil validasi keseluruhan produk dengan skor rata-rata sebesar 3,70 dengan kriteria valid (tanpa revisi) dan diperoleh hasil uji keterbacaan 94% dengan kriteria terbaca. Hal ini menunjukkan bahwa mobile tutorial berbasis android dilengkapi corrective dan constructive feedback pada materi transmisi dan penyimpanan data untuk siswa SMA/MA dapat digunakan oleh guru maupun siswa sebagai media pembelajaran untuk belajar mandiri.

**Kata Kunci:** Mobile learning, constructive feedback, induksi elektromagnetik, mobile tutorial, android, corrective feedback, constructive feedback, data transmission and storage

## 1. Preliminary

Physics is one of the subjects that must be studied by high school students majoring in science. Even though it is a compulsory subject, students' understanding of concepts in physics is still low [1]. One of the physics materials studied is data transmission and storage. This material is often missed by teachers because of the lack of teacher knowledge and skills along with the development of science and technology. Therefore, students are asked to study independently and research related to this material is still very rarely done [2].

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Students' understanding of information and communication technology which includes transmission and data storage material is still low [3]. This is indicated by the low learning outcomes and practical skills of students [4], [6]. Based on the results of previous research at the Independent Private Vocational High School majoring in TKJ, student learning outcomes in analog and digital materials which are part of data transmission and storage are still low and have not reached the minimum mastery criteria (for short in *Bahasa Indonesia*, KKM) set by the Ministry of National Education, namely 75. A total of 65% of students still have not reached the minimum mastery criteria and 35% have reached the minimum mastery criteria [4]. The low student learning outcomes in the field of technology are also shown in the achievement data of Indonesian students who took the PISA test in 2018 which experienced a decrease in scores in the field of science which included technology material. The score in 2015 was 403 and decreased in 2018 which was 396 [5].

Based on the results of previous observations, the practical skills of students in a state vocational high school based in West Sumatera in digital techniques related to logic gate assembly are still low. Logic gate is one of the sub-chapters of data transmission and storage material. Empirically, students experience difficulties during practice because they do not have sufficient knowledge about digital techniques [6]. These things indicate a problem with the low understanding of students in the field of information technology on data transmission and storage materials.

Several aspects that affect students' understanding of data transmission and storage materials include the low motivation of students to learn [3] and the availability of learning time. The material taught in class XII requires students to study many topics and prepare for exams [2]. Furthermore, the limitations of teaching materials in this material also affect students' understanding. This is supported by the results of observations at several bookstores in the Malang City area, it was found that the material was presented in the form of conventional books.

Therefore, appropriate and appropriate learning media are needed to overcome these problems, namely mobile tutorials. Mobile tutorial is a combination of the use of mobile learning with a tutorial model. The use of mobile learning can provide flexible learning time and the opportunity to repeat learning materials independently outside the classroom [7]. Students can carry out the learning process anytime and anywhere by independently reviewing and continuing to build their knowledge. The ability of students to be active in building knowledge in the tutorial model will be more meaningful than the passive response of students in the latest learning approach [8]. Therefore, it is necessary to develop learning media in the form of mobile tutorials.

Mobile tutorials as learning media are supported by mobile devices such as smartphones. Based on the results of the 2017 ICT survey by the Center for Research and Development of Informatics and Information and Public Communication Applications, Ministry of Communication and Informatics, the percentage of smartphone users by high school students is 79.56% [9]. Smartphones will facilitate the development of mobile tutorials because they are equipped with the Android operating system. The advantage of this operating system is that it acts as software that can be distributed openly (open source) [10].

The characteristics of the tutorial model in learning media are the introduction, presentation of information, questions and answers, assessment responses, providing feedback on answers, corrections, learning arrangement segments and closings [11]. Giving feedback to students plays an important role in improving student achievement [12]. This mobile tutorial is accompanied by two types of feedback, namely corrective and constructive feedback. Corrective feedback is a type of feedback in the form of information about student errors or a clear explanation [13]. Furthermore, constructive feedback is a feedback that can provide the necessary information on student development [14].

Research to develop Android-based learning media on data transmission and storage materials accompanied by two types of feedback, namely corrective and constructive feedback, is still very rarely done. This is supported by previous research related to the development of Android-based learning media with feedback that had previously been carried out on circular motion material, but only used corrective feedback (without constructive feedback) [15]. Based on the problems that have been described previously, the researchers are interested in trying to develop studies related to the development of the Mobile Tutorial application with corrective and constructive feedback on data transmission and storage materials.

## 2. Research Methods

The research was conducted using the Research and Development (R&D) method with a 4D model. This research model consists of (a) Define, (b) Design, (c) Develop, and (d) Disseminate [16]. However, this research only reached the third stage, namely Develop because the aim is to develop and describe the feasibility of the product, as shown in Figure 1.

The types of data generated in this research and development were in the form of quantitative data and qualitative data. Quantitative data were obtained from the assessment of the validity test (Likert scale) by the validator and the product readability test (Guttman scale) by the XII grade students. Qualitative data is obtained based on comments and suggestions from validators and will be used as a reference in improving product development.

The qualitative data were in the forms of suggestions and comments from the validator was analyzed using qualitative descriptive techniques. Furthermore, quantitative data analysis techniques to calculate the results of the validity test are in the form of calculating the average score of the validator and to calculate the results of the readability test using the calculation of the average percentage.

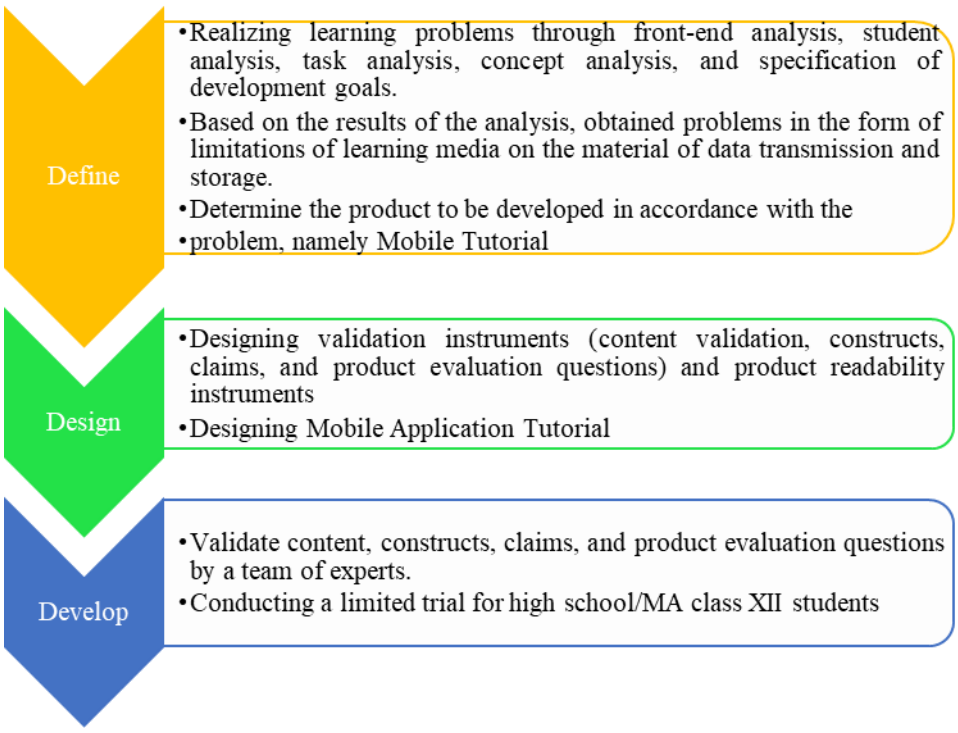



**Figure 1.** Research and Development Stages

## 3. Results and Discussion

This research has developed a product in the form of an Android-based mobile tutorial equipped with corrective and constructive feedback for data transmission and storage materials. This product is named "Mistor App". In each sub-chapter of material, there is a description of the material equipped with pictures, sample questions, and video tutorials that will make it easier for students to study independently. Here are some examples of the products developed, including:

1) Mistor App Opener Display, when the Mistor App application is opened, the opening screen appears as shown in Figure 2. This opener consists of Application Identity, Learning Materials, Class Identity, and the Start button.

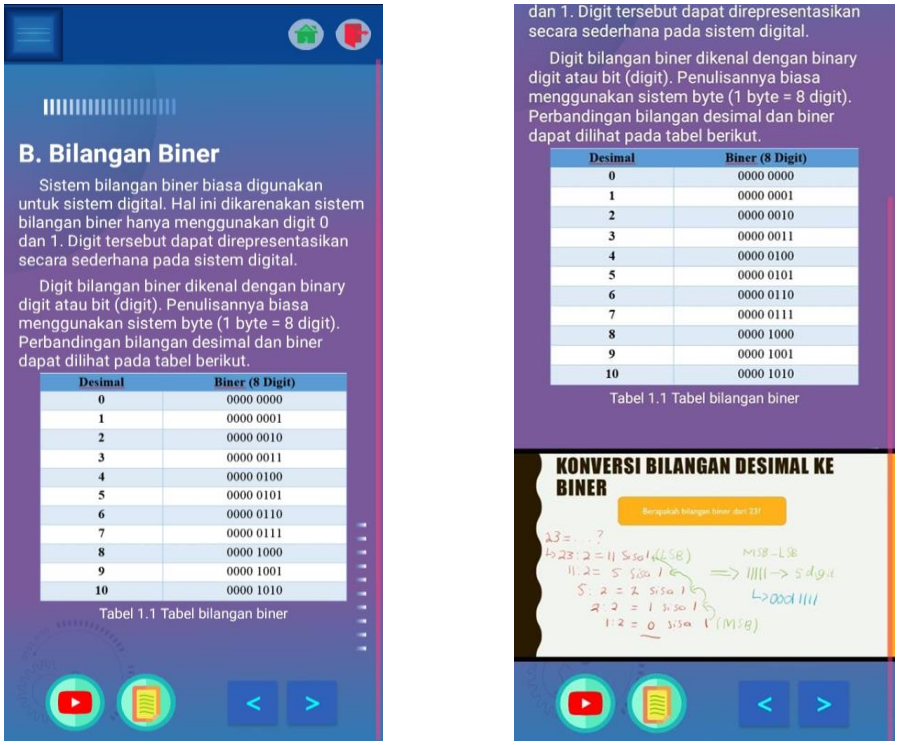
2) Display the Mistor App Main Menu, when the Start button is clicked, the Main Menu page appears as shown in Figure 3. Main Menu, contains buttons for instructions for use, learning objectives, concept maps, materials, projects, evaluations, reference lists, and profiles. Users can go to the desired page by clicking the icon button on the main menu.


**Figure 2.** Mistor App Opener View


**Figure 3.** Mistor App Main Menu Display

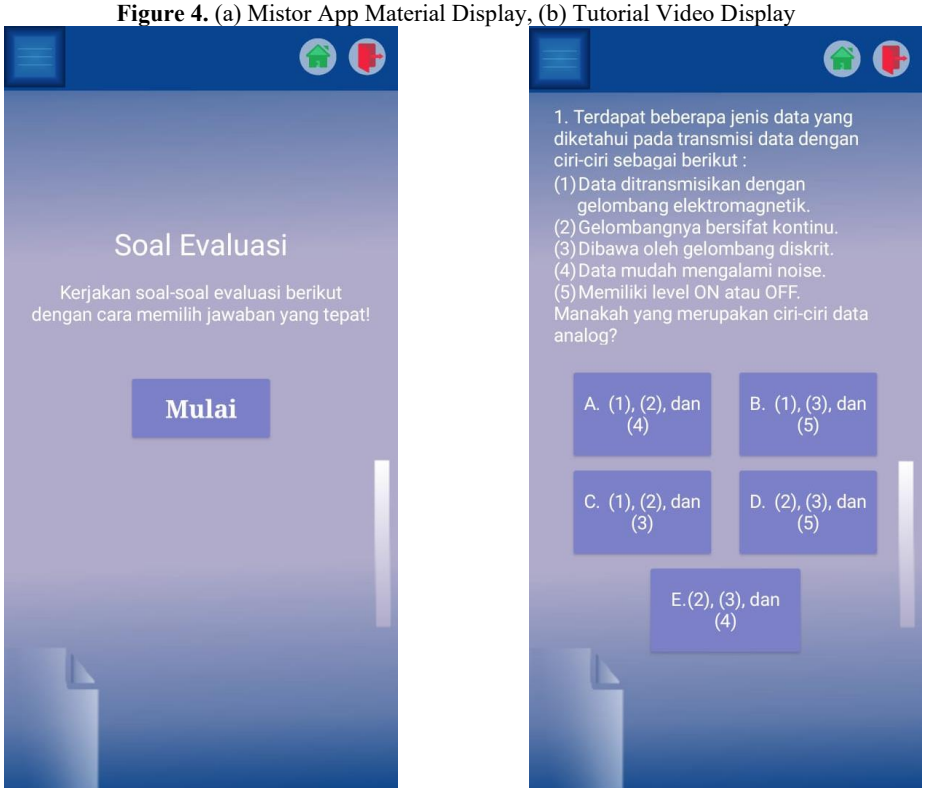
1) Display of the Mistor App Material, a description of one of the materials on the Mistor App can be seen in Figure 4 (a). The "<" button at the end of the description aims to go to the previous page and the ">" button to the next page. Each material description is equipped with pictures, sample questions,

and video tutorials. At the end of the description there is a button with a picture of the YouTube icon. When the icon is clicked, the tutorial video is displayed on the screen as shown in Figure 4 (b).




**(a)** **(b)**

**Figure 4.** (a) Mistor App Material Display, (b) Tutorial Video Display




**(a)** **(b)**

**Figure 5.** (a) Initial Display of Evaluation Questions, (b) Display of Evaluation Questions

2) Display of Mistor App Evaluation Questions, evaluation questions are given to measure the level of student understanding of the material that has been given. The initial view can be seen in Figure 5 (a). To start working on evaluation questions, the user must click the "Start" button. The questions given are multiple choice questions (Figure 5 (b)). When the user clicks on the answer, it will get a notification in the form of corrective feedback. Then, the user is given the choice to go to the discussion (constructive feedback) or the next question.

### *3.1. Expert Validation*

The validation data were analyzed using a Likert scale. Validation was carried out by three validators consisting of a physics education lecturer and two high school physics teachers. The recapitulation of product validation results can be seen in Table 1.

**Table 1.** Recapitulation of Validation Results by Validator

| No | Aspect | Average value | Criteria |
|---|---|---|---|
| 1. | Content | 3.68 | Valid (without revision) |
| 2. | Construct | 3.79 | Valid (without revision) |
| 3. | Product Claim (Aspects of integration between materials, tutorials, and feedback as well as aspects of Android) | 3.67 | Valid (without revision) |
| 4. | Evaluation questions | 3.67 | Valid (without revision) |
| | **Overall Product** | 3.70 | Valid (without revision) |

Based on the results of the analysis of the average value of the validation data, the overall average value of the product was 3.70 with valid criteria (without revision). Even though it has been declared valid, product improvements are still being made in accordance with comments and suggestions from all validators. The recapitulation of comments and suggestions from the validators is shown in Table 2.

Based on content validation analysis, the application is declared valid because the content developed on the product is in accordance with the 2013 curriculum. The average value of content validation is 3.68. In accordance with the demands of the 2013 curriculum, good physics learning must of course be in accordance with the curriculum and requires other media, not only from books [17]. Therefore, product development in the form of a mobile tutorial is carried out on data transmission and storage materials.

Mobile tutorial is a combination of mobile learning media with tutorial learning models. Mobile learning with a tutorial model is a tutorial learning that is done without face to face with a mobile device. With the tutorial model, students find it easy to learn and clear in receiving learning information [18].

In the construct aspect, the average value is 3.79. The construct aspect has been declared valid (without revision), because the developed product is presented in an attractive, interactive, easy-to-understand, and independent way. Interesting and interactive learning media can certainly increase students' interest and motivation in learning [19], [20]. Motivation does not present itself, but needs to be built in students, one of which is through interesting learning media [21].

The hallmark of the tutorial model is the delivery of learning material which is divided into sub-materials and is accompanied by evaluation and providing feedback. The tutorial model will help students to solve physics problems, so they will be more interested in learning [22]. Validation of product claims which include aspects of integration and Android, obtained an average value of 3.67 with valid criteria (without revision). Aspects of product integration are in the form of material

integration, tutorials, and feedback. The material presented is not only in the form of text descriptions, but is also equipped with pictures, sample questions, and video tutorials.

**Table 2.** Recapitulation of Comments and Suggestions by validators

| Validator | Comments and Suggestions |
|---|---|
| V1 | 1. The concept map is not clear because the background is white. The background can be replaced with other colors to make it more attractive like on other screens.<br>2. The channel direction display, on my cellphone, the sentence doesn't look complete, the right side is cut off, for example the word more just looks like le.<br>3. In general, it looks good and attractive as a learning medium.<br>4. The questions are good. In accordance with the indicators and material presented. |
| V2 | 1. The Mobile Tutorial product is very good for understanding students' concepts, but it is necessary to pay attention to the limitations of media/links to access them. Media can only be used for Android-based mobile phones.<br>2. It is necessary to review the suitability of the question indicators with the questions, so that there is a match between the indicators, questions and feedback.<br>3. In general, products that have corrective feedback are good to define. |
| V3 | 1. Submission of material both written and video is very coherent. Use simple and easy to understand language.<br>2. Already described the mobile tutorial.<br>3. Color selection is still less striking.<br>4. Question number 1 can be revised so that it becomes a 'HOTS' question or analysis. |

Table 2 Description:
V1: Lecturer of Physics as validator 1
V2: Physics teacher as validator 2
V2: Physics teacher as validator 3

The mobile tutorial product that was developed is also accompanied by evaluation questions (Figure 5). Based on the analysis of the results of the validation of the evaluation questions, an average value of 3.67 was obtained with valid criteria (without revision). It is not only a matter of evaluation that is assessed but also the feedback. There are two types of feedback given, namely corrective and constructive feedback. The difference between corrective and constructive feedback lies in the provision of information. Corrective feedback is given to tell the student's answer is correct or not right, while constructive feedback is given to provide information that can build the right concept through discussion in accordance with the questions presented. Giving feedback has a positive impact in improving good academic quality [23]. Feedback is also useful for providing clear and correct ways to solve problems so as to improve learning outcomes [24].

Furthermore, the validation of product claims on the Android aspect obtained an average value of 3.67. Mobile tutorial products can be operated with Android-based smartphones. Android is an open operating system (open source) that is used on mobile devices such as mobile phones, tablets, smartphones, and other devices [25]. The use of Android-based smartphones is very appropriate because almost everyone has and needs an Android smartphone [26].

Based on the results of the analysis of all aspects, the average value of the entire product was 3.70 with valid criteria (without revision). This shows that the mobile tutorial product is feasible to be used as a learning medium for students.

### *3.2. Readability Test Results*

The data from the readability test results were obtained fromstudents of class XII. The readability test was carried out through student response questionnaires given online via Google Form. The data analysis of the readability test results was carried out by calculating the average percentage (Table 3). Based on the results of the analysis, the average percentage value of the readability of the product was 94% with legibility criteria. Thus, Android-based mobile tutorial products equipped with corrective and constructive feedback on data transmission and storage materials can be used easily by high school students as independent learning media.

**Table 3.** Product Readability Test Results

| No. | Statement | Percentage (%) |
|---|---|---|
| 1. | Application is easy to install. | 97 |
| 2. | Application is easy to open. | 97 |
| 3. | The instructions for use are easy to understand. | 90 |
| 4. | Each menu is easy to access | 90 |
| 5. | Navigation buttons are easy to operate as desired. | 90 |
| 6. | Data transmission and storage materials are easy to access. | 97 |
| 7. | The text presented is easy to read. | 97 |
| 8. | The images and videos presented are clearly visible. | 94 |
| 9. | Sample questions are easy to access. | 100 |
| 10 | Feedback is easy to find. | 87 |
| | **Average Percentage** | 94 |

The advantages of mobile tutorial products include (1) more efficient learning time because learning is carried out with the help of media so that it allows learning to be done anytime and anywhere (flexible), (2) presented in an interesting and interactive way through a good design display, (3) each sub material presented is not only in the form of text descriptions, but is also equipped with pictures, sample questions, and video tutorials, (4) equipped with evaluation questions (5) equipped with corrective and constructive feedback every time the user does a question, (6) makes it easier for students to learn efficiently and (7) does not require large storage space [27], [28], [29]. In addition to the advantages, the mobile tutorial product certainly has disadvantages including (1) The material presented is only limited to one topic, namely the transmission and data storage material (2) can only be used on Android-based smartphones, (3) some features must be accessed online, namely video tutorials and project assignment collection, (4) mobile tutorials are a free medium of learning, where teachers cannot monitor student activities when using this application, (5) its use limits the interaction between students and teachers and (6) its use depends on the device battery , so that when the power runs out it will hinder learning activities [28], [30].

## 4. Conclusions and suggestions

This research has developed a product in the form of an Android-based mobile tutorial equipped with corrective and constructive feedback for data transmission and storage materials. Based on the validation results, the average value of product feasibility is 3.70 with valid criteria and the results of the readability test with an average percentage value of 94%. Based on the results of research and development, it can be concluded that the mobile tutorial is declared valid and can be used by both teachers and students as an independent learning medium.

Future research is encouraged to develop similar products from the aspect of the operating system which does not only apply to Android. Furthermore, this application can be further developed

from the material aspect, so that users can understand other physics materials. The provision of video tutorials is better if they are integrated into the application so that users do not need to be connected to the internet to access them. Furthermore, this application is better developed into a bound application so that teachers can monitor all student activities while using the application.

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