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Android-based SAKLAR Application: An Alternative Learning Media for Lorentz Force

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Abstract

This study aims to develop and evaluate the feasibility of the Android-based learning application, SAKLAR, as a learning media for Lorentz Force material for junior high school / MTs students. The research uses the Research and Development (R&D) method with the 3D model (define, design, development). At the define stage, needs analysis was conducted through interviews and observations, while the design stage involved designing the application with Canva. At the development stage, the application was developed using Smart Application Creator (SAC) and validated by media and material experts. The validation results showed a feasibility level of 97.1% for the material and 96.2% for the media. A limited trial with 26 students showed that the app improved students' understanding and motivation to learn. This app is expected to be an innovative alternative to technology-based science learning.

INTRODUCTION

Technological, increasingly modern, and sophisticated advances encourage humans to keep up with the times. The advancement of information and communication technology on mobile phones is now in great demand by the community, especially in education.

Information and communication technology (ICT) development has presented tremendous opportunities in education, especially with the presence of Android-based devices. This technology-based learning media allows students to learn anytime and anywhere, which is relevant to the needs of learning in the modern era. [1].

Learning media itself is a tool that serves to convey material given by the teacher to students to support success and enthusiasm in learning. [2]. Learning media must be packaged very interestingly in its development so that students are enthusiastic about learning material. There are several categories of learning media, including electronic, non-electronic, audio, audio-visual, and interactive media.

Learning media often used in schools include PowerPoint presentations, learning videos, LKS/package books, and modules. Teachers can choose learning media according to the learning style of students at school. The practicality of learning media is essential for students so that students do not experience difficulties accessing learning media. The development of information and communication technology, combined with the advantages of Android, has produced learning media that are interactive and useful for students. [3].

Android is a media platform with interesting features that can support students' practicality in the teaching and learning process. Using Android-based interactive media can increase understanding of the material being studied. The Android-based media can be used repeatedly with the readiness and willingness of students to clarify material that is still difficult for them to understand. [4].

Android media is a *Linux-based* operating system designed for touchscreen mobile devices such as smartphones, laptops, computers, and tablets. The use of Android media has the power to transform the learning experience. This type of learning media is flexible because students can learn anytime and anywhere. [5]. Although many learning media have been developed, field research at MTs shows that students still have difficulty understanding abstract concepts such as the Lorentz Force. This is exacerbated by the limited learning media, such as textbooks and the lecture method [6].

Effective and efficient learning media makes it easier for teachers to deliver learning materials, especially in learning Natural Sciences (IPA), which is one of the main subjects in Indonesia's education curriculum. Science itself is a combination of physics, biology, and chemistry. [7]. In its application, science material seems abstract and cannot be learned only by theory. Experimental or practical activities are needed to prove existing concepts and theories so that they are easier to understand. An Android-based application is required as a learning media that supports the flexibility aspect of students in accessing learning media. Android-based learning media is expected to help students understand and learn motivation. [8].

Based on interviews with science teachers, MTs. Thamrinut Thullab obtained obstacles in the learning process, namely 1) students like to play around in learning, 2) students are less active in learning, 3) the learning media used are not effective with students' learning styles, 4) like challenges and curiosity about science, 5) learning does not support the existence of science labs, 6) the methods used in presenting material are less effective.

Based on the above constraints, the science teacher said science material requires effective learning media, especially physics. According to him, the material that is still abstract is the Lorentz Force material. It takes learning media that can guide students who have difficulty understanding the material. This research aims to develop an Android application to facilitate Lorentz Force learning. With interactive features, this application is expected to improve students' understanding significantly.

Based on the description above, students can understand the material related to Lorentz Force by making learning media such as Android-based applications. Through the application, students can easily understand Lorentz Force material. The application has material, images, animations, audio-visuals, and quizzes. This application can be accessed *anytime and anywhere* (Yeni R. L., 2019). This application offers easy access and integrates various learning elements such as practicum videos, quizzes, and relevant Al-Qur'an verses. This innovation is expected to contribute to the development of physics learning media.

RESEARCH METHODS

The type of research used is research and development (R&D) research, which is research used in producing certain products and testing the effectiveness of these products. [9]. The development model in this study uses the 4D model developed by Thiagarajan (1974), consisting of 4 steps, which include (1) *define* or define, (2) *design* or design, (3) development or development, and (4) *dissemination* or dissemination. The development model used in this study is 4D but modified to 3D (Kristina Novita et al., 2022). The development procedure was done by changing the 4D model from 4 steps to 3 steps into 3D. This modification is because it does not require the spread of the area to save time. The 3D procedure is *define*d, *design*ed, *and developed* as follows:

1. Define stage

   This stage helps determine and define the needs in the learning process and collects various information related to the product to be developed (Bayu Aji W., 2017). This stage is divided into several steps, including:

   a. Initial analysis

      An initial analysis was carried out to identify the fundamental problems in the learning process at school during observation of this problem at MTs. Thamrinut Thullab, namely, the media used are only packages and worksheets without any props; the method used is inefficient because it only uses the lecture method, and students have difficulty understanding the Lorentz Force material.

   b. Student analysis

Student analysis is conducted at the beginning of planning by observing the characteristics of students. This analysis considers students' characteristics, abilities, and experiences. Student characteristics on observation: students prefer to play with friends, talk to friends, and ignore the teacher when teaching.

c. Task analysis

Task analysis to identify the main tasks performed by learners. The task analysis analyzes the Core Competencies (KI) and Basic Competencies (KD) related to Lorentz force material.

d. Concept analysis

Concept analysis aims to determine the content of the material in the Android application media developed. Concept analysis is made in an Android application used to achieve competence.

2. Design stage

After analyzing a problem from the defining stage, the design stage continues. This design stage aims to design a SAKLAR Android application media used in science learning. The design stage consists of several steps, which include:

a. Test Preparation

This instrument test is based on preparing learning objectives that measure student abilities in the form of products and processes in the application media in the form of quizzes.

b. Media preparation

This media selection is done to identify learning media suitable for students' characteristics and learning styles. Media is selected following student analysis, concept analysis, and task analysis. The choice of media is based on Android applications.

c. Format selection

Format selection is carried out in the initial step, and this selection must follow the learning material. The selection of the form of presentation is adjusted to the learning media used. The format selection is done to design learning content selection of
approach and learning resources. This format selection includes layout design, images, and learning media objectives.

d. Initial design

The initial design is the design of the SAKLAR Android application that the researcher made, which was then given input by the supervisor. The supervisor's input is to improve the media before production. After, the media was improved and validated.

3. Development stage

The development stage aims to produce SAKLAR Android application media that has been revised based on expert input (media validation test) and limited trials (trials to junior high school / MTs students). There are two steps in this stage which include:

a. Expert validation

Expert validation in the SAKLAR application media was carried out by one media validator lecturer and one material validator lecturer. The validation results were used to revise the initial product. The SAKLAR Android application media that has been prepared will then be assessed by media expert lecturers and material experts. This is done to determine the feasibility of the media and the application of the media developed. The results of this validation are used to refine or improve SAKLAR media for further testing for junior high school / MTs students.

b. Product trial

This test is carried out after experts validate it. Then, a field trial (limited trial) is conducted to determine the results of applying the SAKLAR Android application media in classroom learning, including increased student understanding and media feasibility. The results obtained from this stage are in the form of an andrroid application media called SAKLAR. The assessment criteria in the validation sheet are as follows:

Table 1. Criteria for Rating the Validation Sheet

Value Validation	Criteria
1	Very Less
2	Less

Value Validation	Criteria
3	Simply
4	Good
5	Very good

Table 2. Percentage of Student Response Results [10]

Value Validation	Criteria
0%-20%	Very unfavourable
21%-40%	Less good
41%-60%	Good enough
61%-80%	Good
81%-100%	Very good

The next stage after the validation stage is completed is the improvement and review of the media based on the input provided by the media and material validators. Applications that have been made improvements and then tested in limited trials by students in grade IX SMP / MTs. In this limited trial, probability sampling or random samples were used. In this trial, students operated the SAKLAR application following the features listed. At the next stage, students were directed to provide an assessment related to the SAKLAR application developed through a Google Form questionnaire.

RESULTS AND DISCUSSION

The media used in this study is a learning application designed explicitly for Android-based devices called *Smart Application Creator* (SAC), focusing on Lorentz Force material. The following are some explanations of the procedures researchers use before producing products ready for research using the 4D approach.

1. Define stage

   Based on the results of field studies and interviews with science subject teachers at MTs. Thamrinut Thullab Undaan Kudus, it is suggested that the Lorentz Force material be the focus of this research. The reason is that some students have difficulty understanding the material, while no learning media is available to support Lorentz Force learning. The findings from this field study encouraged researchers to design a learning media that could fulfill these needs at MTs. Thamrinut Thullab Undaan Kudus.

2. Design stage

   The developed learning media is SAKLAR (SAyangnya Kita Lupa GAya Lorentz). This application has several features included. Here are the results of the Lorentz Force learning media development:

   a. Splash page

      The spash page is the initial display in the learning application, which is displayed for a few seconds before entering the main page.

Figure 1. Spash Page View

b. Main menu page

The menu page consists of 6 features with some complementary features in it. These features include instructions for use, learning objectives, materials, practicum, Al-Qur'an verses, and Quiz.

Figure 2. Main Menu Display

The explanation of each feature displayed on the main menu page is as follows:

1) The *home* button is used to return to the splash page.
2) The *back* button is used to return to the previous page.
3) *The next* button is used to continue to the next page.
4) The user manual feature contains steps to operate the SAKLAR application.
5) The learning objectives feature contains learning objectives in the form of Core Competencies (KI) and Basic Competencies (KD).
6) The material feature contains learning videos and discussions related to Lorentz Force material.
7) The practicum feature contains a practicum video about the steps of a simple Lorentz Force practicum.
8) The Al-Qur'an verse feature contains Al-Qur'an verses that match the Lorentz Force material.
9) The *Quiz* feature contains multiple choice questions as evaluation material to find out how well students understand the Lorentz Force material using the SAKLAR application.

3. Development stage

Before being used by students of class IX MTs, Thamrinut Thullab Undaan Kudus, this media has passed the validation stage by two expert validators: a media expert lecturer and a physics expert lecturer. Validation is done to evaluate the level of suitability of Android learning media that has been developed. The validation results in terms of material and media can be found in Table 2 and Table 3.

Table 3. Material Validation Results

Aspects	Rating Scale	Product Assessment Criteria
Clarity of learning objectives	5	Very good
Clarity of the material presented	5	Very good
Relevance of title and content	5	Very good
Word suitability of the material	5	Very good
Appropriateness of material to interests and needs	5	Very good
Ease of access to materials	5	Very good
Clarity of language used	5	Very good
Structured presentation of material	4	Good

Aspects	Rating Scale	Product Assessment Criteria
Coverage (depth of material)	5	Very good
Presentation of material can increase student activeness	5	Very good
Presentation of material increases student knowledge	5	Very good
Presentation of the material makes students listen well	5	Very good
Presentation of the material increases student curiosity	4	Good
Game-based Quiz presentation increases student interest	5	Very good

Table 4. Media Validation Results

Aspects	Rating Scale	Assessment Criteria
Clarity of learning objectives in the media	5	Very good
Suitability of learning objectives with the curriculum	5	Very good
Appropriateness of media content and learning objectives	4	Good
Clarity of operation guide	5	Very good
Appropriateness of supporting images	5	Very good
Video suitability to the material	5	Very good
Ease of access	4	Good
Accuracy of control sequence	5	Very good
Ease of use of buttons	5	Very good
Ease of access to the application menu	5	Very good
Clarity of application menu	5	Very good
Background precision	5	Very good
Accuracy of sound or audio presentation	4	Good
Appropriate use of colors, fonts, and text types	5	Very good
Suitability of media to students' learning needs and interests	5	Very good
Ease of understanding the material	5	Very good
Completeness of information	4	Good
Interest in the information presented	5	Very good
Application access can be done repeatedly	5	Very good
Media can be learned independently	5	Very good
Applications can be run on a variety of hardware and software	5	Very good

Both the material and media evaluation results were outstanding. The media and material expert validators recommended several suggestions related to media development, namely emphasizing the concept and practice of Lorentz Force in real life so that the material does not seem abstract. Researchers made improvements before proceeding to the next stage. After these improvements were made, a limited trial was conducted with 26 children in class IX at the junior high school / MTs level through Google form, and the results are as follows:

Table 5. Limited Trial Results

Aspects	Rating Scale	Assessment Criteria
Clarity of material can attract students' interest in learning	89%	Very good
Student interest in using the app	86%	Very good
Student difficulties in accessing the application	54%	Good
Improve student concentration	80%	Very good
Increase student knowledge	90%	Very good
Ease of understanding the material	87%	Very good
Ease of access	58%	Good

Aspects	Rating Scale	Assessment Criteria
Students' interest in using learning media other than apps	50%	Good
Student mismatch listening to the app	53%	Good
Ease of learning using the app	86%	Very good
Completeness of material	90%	Very good
Student agreement to develop further applications	88%	Very good

The validation results showed that the SAKLAR application scored 97.1% from the material expert and 96.2% from the media expert, both of which were "very feasible." This indicates that the app fulfills the eligibility criteria for material presentation, interactive design, and ease of use. This score aligns with research by Reichenbach et al. (2019), which showed that Android-based learning media increased students' accessibility and interest in learning.

The pilot test results with 26 students showed that this application improved students' understanding of the Lorentz Force material, with an average understanding score of 87%. In addition, the interactive quiz feature and learning videos were considered interesting by 86% of students. However, the app's accessibility was still an issue for some students, with a score of 58% in the "ease of access" category.

These results show that the SAKLAR app can be an effective alternative for learning abstract material, such as the Lorentz Force. The app helps students understand the material visually and interactively and provides the flexibility of learning outside the classroom. [11]. This finding supports constructivist learning theory, emphasizing interactive media's importance in learning. This study has some limitations, such as the small sample size and limited features of the app. More in-depth features, such as 3D simulation or integration with online learning tools, can be added for future development.

CONCLUSIONS

This research shows that the Android-based learning application, SAKLAR, is very feasible to use as a learning media for Lorentz Force material. Expert validation gave results of 97.1% for the material and 96.2% for the media, while a limited trial on grade IX students resulted in an 87% increase in understanding. This application provides learning flexibility, increases student interest, and supports technology-based learning.

However, this study has limitations, such as a small sample size and limited app features. Therefore, further research is recommended to expand the sample coverage and develop additional features, such as interactive simulations or integration with online learning platforms. SAKLAR application is expected to be an innovative alternative to improve the quality of learning abstract material at various levels of education.

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