Received : 2 September 2020
Revised : 7 November 2020
Accepted : 27 December 2020
Online : 31 December 2020
Published: 31 December 2020

DOI: doi.org/10.21009/1.06215

Android-Based Learning Media Using Problem Based Learning on Physics Learning of Senior High School Students

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Abstract

This study aims to determine Android-based physics learning media (ABLM) with developed Problem Based Learning (PBL) learning. This research uses R&D research. The research steps were guided by the 4D model (Define, Design, Develop, and Disseminate). The research data were obtained through the product feasibility assessment of expert validators (media experts and material experts) and questionnaire responses from class X students of SMA Negeri 1 Tempilang. Collecting research data using validation sheets and questionnaires. Data collected using descriptive analysis. The results of product feasibility by media experts with an average score of 3.72, product feasibility by material experts of 3.76, and student response results of 3.64. The results of expert validation analysis and student responses were in the "Very Good" category. The ABLM media with PBL learning was declared feasible and suitable for learning physics.

Keywords: android based learning media, problem based learning

INTRODUCTION

The industrial revolution 4.0 has had a significant influence on the field of education called Education 4.0. Education 4.0 responds to the need for the Industrial Revolution 4.0, where people and technology meet to create new opportunities creatively and innovatively. Education 4.0 responds to us during industry 4.0, where we are being integrated with technological advances in every aspect of life (Berawi 2020). Technological developments in the Industrial Revolution 4.0 era demanded educational development through the use of digital technology implementation in the learning process. Technology for learning is essential for students (Eliana et al. 2016). The technology that is often used and has progressed very rapidly is the smartphone. With advances in technology, the use of computers, smartphones, and tablets can attract students' interest in the learning process and be used in physics experiments (Abidin & Tho 2018).

Students use smartphones to access teaching materials or supporting information, which can usually be accessed via the internet (Anshari et al. 2017). Smartphones are used as learning tools. Smartphones for learning can be accessed at any time, and of course, it saves time and is more flexible (Darmaji et al. 2019). Smartphones used as learning technology for students are in Android (Sackstein & Slonimsky 2017). However, smartphones for student learning are still low, as is the interest in learning to use smartphones (Batmetan & Palilingan 2018), especially Android, which has not been optimally utilized in learning physics. Even though the use of Android makes it easier for students to learn physics

(Muqarrobin & Kuswanto 2016), the use of Android can also overcome problems and limitations in learning physics (Arista & Kuswanto 2018).

Physics learning contains abstract concepts, difficulty recognizing physics quantities, and difficulty using formulas (Fathiah, Kaniawati & Utari 2015). Students have difficulty understanding the subject matter (Arief et al. 2012). Physics material is one of the materials that still have many challenges due to lack of knowledge and mastery of concepts including friction, Newton's First Law, Newton's Second Law, and Newton's Third Law (Kaniawati 2019; Muna 2016). Lack of interest in learning physics (Shishigu et al. 2018; Erinosho 2013 et al. 2013) and the lack of seriousness of students in the learning process will also cause difficulties in learning physics even though every step in the learning process requires students to find shared knowledge (Afiatun & Putra 2015; Ulya et al. 2013; Shishigu et al. 2018). Thus there is a need for media to support understanding and provide learning according to the needs of technological developments or 21st-century learning. There is also a need for learning media that is attractive and able to increase students' interest, one of which is Android-assisted mobile learning, which uses unlimited space and time, and more flexible (Lubis & Ikhsan 2015). Physics learning requires media to explore material to present both facts, concepts, processes, and metacognitive knowledge to students (Hakim et al. 2019). This learning can be in the form of Android-based learning media (ABLM).

Android-based learning media can support students in the physics learning process or activities (Liliarti & Kuswanto 2018). The use of an android smartphone application can increase the learning independence and understanding of students 'concepts (Arista & Kuswanto 2018). It can improve students' creative thinking skills and problem-solving abilities (Shabrina & Kuswanto 2018). The development and use of Android-based learning media can improve students' understanding (Hakim et al. 2019). Android-based learning media was developed in line with the development of the internet and technology (Lu'mu 2017).

Android-based learning media makes students accept interactivity, accessibility, and comfort from the system (Hanafi & Samsudin 2012). Research on android media in the 21st century is very influential on student learning and is useful as a medium for learning physics. This is in line with the Android-based learning media for high school students of good quality for learning physics (Mardiana & Kuswanto 2017). This media can be used as a medium for learning physics both inside and outside the classroom (Liliarti & Kuswanto 2018). If students are interested and motivated in learning, they will play an active role in learning activities (Saregar 2016). So that learning will be centered on students following the objectives of the 2013 curriculum (Fadilah & Suparwoto 2016).

PBL is very relevant in the 21st century and is very suitable for implementing the 2013 curriculum where students are required to be more active in learning (Argaw et al. 2017). The PBL process is more than just requiring domain knowledge to be integrated and applied to find solutions to specific problems. The focus is also on developing skills essential to prepare students for the digital future (Kek & Hujser 2011). PBL is a learning-centered pedagogy of students where students learn about a subject by finding a solution to a problem openly (Phungsuk et al. 2017). PBL is more effective learning for physics topics than conventional learning. Therefore, PBL is learning that is an alternative to teaching in the classroom to improve students' academic achievement (Argaw et al. 2017). PBL-based media is suitable for use, seen from the media and material aspects, and shows proper criteria (Najah & Widiyatmoko 2015).

This learning media can be integrated with the PBL model to align with 21st-century learning and implementing the 2013 curriculum. This media is very efficient because it is easy to operate using Android anywhere and anytime, both online and offline. Android-based learning media with the PBL model are expected to be feasible for learning physics.

METHODS

This research will use the type of research, R & D (Research and Development). This research produced by this research is android based learning media with a PBL model with Newton's Law material. The instructional design procedure used is the 4D model development type (Andromeda 2018), which includes four steps: defining, designing, developing, and disseminating.

Data collection techniques are interviews, observation, the feasibility of the product being assessed (for product improvement), and student response questionnaires. Interviews and comments are used to obtain information about the needs of the school being studied. The feasibility test is used to get the feasibility results of ABLM products through media experts and material experts. The product feasibility assessment is validated according to the input and suggestions of experts. The ABLM feasibility assessment by media experts and content experts is validated by expert lecturers, physics teachers, and peers. Student response questionnaires were used to determine students' responses to ABLM products developed, which were implemented in class X SMA Negeri 1 Tempilang. The purpose of giving student response questionnaires was tried out to find out the response of students to the ABLM media that had been developed. The feasibility test and response questionnaire of students who are assessed are obtained from the percentage of:

$$P = \frac{f}{N} \times 100\% \quad (1)$$

P is the number of percentages, f is the percentage value of the frequency sought, and N is the total data. The percentage of the score is then stated in the eligibility criteria which can be seen in TABLE 1 (Astuti 2017).

TABLE 1. Product Eligibility Criteria

Assessment	Category
80 % - 100 %	Very good
60 % - 79.99 %	Good
50 % - 59.99 %	Enough
0 % - 49.99 %	Not good

RESULTS AND DISCUSSION

This research's product is in the form of Android Based Learning media (ABLM) with PBL learning. The product is developed through several stages using the 4D model, namely defining, designing, developing, and disseminating stages. The defined stage produces guidelines for preparing ABLM products. The design stage produces a draft or initial ABLM effect. The develop stage produces an ABLM finished product. The desseminate stage produces a report or article. Products that have been developed will be known for their feasibility based on material and media experts. The product was also tried out in learning to determine student responses to the media being developed. The following is a description of the product development stages' results according to the 4D model and the feasibility assessment results and student responses.

The defining stage is carried out to determine the problems and events encountered in physics learning and the needs in the learning process. This activity is carried out to provide a solution in making media development to overcome the problems of learning physics. The needs analysis in this study was obtained based on observations and interviews to determine the school's conditions. Observations obtained information that learning physics only emphasizes cognitive aspects, while aspects of attitude and process are still not optimally honed. The assessment carried out in physics learning is always stressed on the mental aspects, while independent education and critical thinking skills are still not optimal. During observations and interviews with some students, problems were also found, namely difficulties in understanding physics material and boring learning. In learning activities, students are less active and tend to accept what the teacher says. Students are less active in asking questions, even though they don't understand. Students are less active in looking for information about the material being studied, where the teacher still uses a lecture model that makes learning conditions less active. Teachers have not used learning technology-based media in delivering physics material. Teachers have never developed or used physics teaching media. These problems are the basis for developing ABLM using PBL learning, which is an alternative to solving problems. The result of other analyses is that the material used for making ABLM is Newton's Law material. Learning using the 2013 curriculum. The results of this stage analysis are then used to create guidelines for product preparation.

The next stage is the design stage. The results obtained at this design stage are the storyboard and also the initial ABLM product design. Making storyboards is useful as a guide in designing ABLM development. ABLM's initial product design was prepared following the storyboard guide design that had been made. ABLM's early product design had several components.

ABLM product components can be seen in TABLE 2.

TABLE 2. ABLM Product Components

ABLM components		**PBL Learning Activities**	
ABLM content	**ABLM Sub Content**		
Competence	Core Competencies Basic competencies Learning objectives Concept maps Reference	Orientation of students to learning	Offline (Face to Face)
Instructions	Instructions for Use ABLM Study Instructions		
PBL content	PBL activities	Problem Orientation Organizing for study Carry out an investigation Presenting Work Results Analyze and evaluate problems (Reflection)	Learning on PBL content can be accessed online (done by students in class during learning activities)
	Material (material and sample questions)		Offline (Face to Face)
	Real PBL	Problem Orientation and Investigation	Offline (Face to Face)
Evaluation	Exercises		Evaluations can be accessed online and done by students independently as homework
Developer			Offline (Face to Face)

The ABLM to be developed is named ABLM Newton. ABLM Newton associates material Newton's Law with real-life phenomena. ABLM also uses language that is easy to understand, which makes it easier for students to understand the material. The ABLM development stage uses the Android Studio program. This stage produces an application in the form of an app. The first step that students must take is to click on the ABLM application logo that has been installed in the form of an app on an Android smartphone. The menu display can be seen in FIGURE 1.

FIGURE 1. ABLM product menu display.

This stage results in the final product of the ABLM being developed. Figure 1 is the final result of the ABLM media display. This ABLM section has featured in the form of competencies, instructions, content, evaluation, and development.

This ABLM media has a PBL content component. PBL content consists of several sub-menus, one of which is Newton's Law. FIGURE 2 is an example of material perceptions for the initial encounter (Newton's First Law material). Apperception is related to everyday life, which directs to hone the critical thinking skills of students.

FIGURE 2. Newton's first law apperceptions view.

FIGURE 3 is an example of PBL content on ABLM media. This PBL content contains the syntax of the PBL model. At each phase, directing students to learn to solve problems actively. These problems are related to real problems.

(a)

(b)

FIGURE 3. (a) PBL content menu on ABLM media, (b) PBL phase problem orientation.

The dissemination stage is obtained in the development product, namely ABLM media, tested in schools. The disseminate stage is the final stage in the ABLM development research with this PBL model. A special distribution is given an application to teachers and students in the field of physics. Dissemination is carried out by distributing applications in APKs to teachers and students in the schools being studied and other schools. The results of using ABLM will be published in the form of articles in indexed journals.

ABLM Media Feasibility Assessment by Media Experts

ABLM media will be tested for its feasibility with media expert lecturers. The media questionnaire assessment was carried out by media expert lecturers, physics teachers (practitioners), and peers. The assessed aspects follow all sub aspects of the ABLM product display, including completeness of identity, animation design, the suitability of display design, the suitability of letters, and color suitability. The results of the ease of use aspect obtained a very good category with a score of 3.52.

Android-based learning media for high school students have good learning physics quality (Mardiana & Kuswanto 2017). The use of android based learning media (ABLM) is suitable for learning (Yektyastuti & Ikhsan 2016). Eveline et al. (2019) state that the Android-based Physics Cellular Learning Media product is appropriate and suitable for learning activities. Besides, android applications are also used for technology-based learning or mobile devices.

TABLE 3. Results of ABLM Media Assessment by Media Experts

Rated aspect	Average Score	Percentage of Average Score (%)	Interpretation
Display	3.86	96.43	Very good
Software engineering	3.72	92.86	Very good
Implementation	3.72	92.86	Very good
Ease of use	3.52	89.28	Very good
Total	3.72	92.85	Very good

The results of the assessment shown in TABLE 3 contain the average score of all aspects of the assessment of 3.72, so it can be said that the results of the ABLM media assessment are categorized as very good.

ABLM Media Feasibility Assessment by Material Experts

This view is the result of the revision of the first product design after being validated. The results of the improvements are in the form of input and suggestions from experts. Android-based smartphones can be used not only for communication but also for learning. One example is the implementation of exciting learning media (Zatulifa 2018). ABLM Newton, which developed then tested between devices. This test is intended to obtain information about Newton's ABLM input that must be corrected. After being revised, a feasibility assessment was carried out on material and media experts.

TABLE 4. Results of the Analysis of Newton's ABLM Assessment by a Material Expert

Rated aspect	Average Score	Percentage of Average Score (%)	Interpretation
Theory	3.72	92.86	Very good
Language	3.78	96.64	Very good
Presentation of Material	3.78	96.64	Very good
Total	3.76	95.38	Very good

The media questionnaire assessment was carried out by media expert lecturers, physics teachers (practitioners), and peers. The evaluation of the ABLM media aspects is divided into several parts of the evaluation: learning material, presentation, language, and readability. The analysis of the ABLM feasibility assessment results shown in TABLE 4. The result is very good for all aspects, with a score of 3.76. Suggestions and notes obtained from experts are fixing the acceleration symbol, distinguishing formulas that have direction, the material must present coherently. Aspects that are assessed are following all parts, namely material, language, and material presentation. The result of the material aspect with a value of 3.72 is categorized as very good. Language aspect of 3.78 with a very good category. The aspect of presenting the material with a very good category.

The results of the assessment shown in TABLE 3 contain the average score of all aspects of the evaluations of 3.76, so it can be said that the results of the ABLM media assessment are categorized as very good. So that it can be obtained that the evaluation conducted by media experts, physics teachers, and peers is said to be suitable for use in learning physics.

Analysis of Student Response Results

The results of using ABLM products with the PBL model obtained the results of student response questionnaires in class X MIA 1 SMA Negeri 1 Tempilang. The end of the learning process using ABLM products with the PBL model, a student response questionnaire was conducted to assess ABLM products with the PBL model. TABLE 5 shows the acquisition of student response results obtained from field tests with an average of 3.64 in the very good category. It can be concluded that students practically use the ABLM products developed.

TABLE 5. Results of Student Response Questionnaire Analysis

Aspect	Rating result	Criteria
Learning / Material	3.64	Very good
Display	3.65	Very good
Language	3.67	Very good
Interest in Media	3.61	Very good
Average Rating	3.64	Very good

The use of android-based learning to adapt to 21st-century students (Calimag 2014). This media can be used as a medium for learning physics both inside and outside the classroom (Liliarti & Kuswanto 2018). Android can support learning anywhere and anytime without being limited by classrooms, as well as a breakthrough in 21st-century education learning media. ABLM in this study is a learning media whose learning activities use the PBL model. ABLM contains content, one of which is PBL content on the media so that learning activities refer to PBL learning. ABLM content also includes animations or Newton's Law videos that direct students to be active in learning. PBL emphasizes integrating knowledge and skills, and PBL is assumed to encourage deep learning (Dolmans et al. 2016). A learning model that makes students active in their education and encourages participants to do independent learning activities, namely a learning model that requires students to be involved in learning activities using the PBL model.

CONCLUSION

ABLM with the PBL model is suitable for use in learning physics. The product feasibility based on the material expert is in the very good category; the media expert is very good. The product feasibility results by media experts with an average score of 3.72 and product feasibility by material experts 3.76. Likewise, student responses are included in the very good category with a score of 3.64. The expert validation analysis results and student responses using ABLM media with PBL learning were declared feasible for learning physics. The PBL model is integrated into ABLM media, which can encourage students to be more active in learning physics.

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