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The feasibility of an Android-based pocketbook as mathematics learning media in senior high school

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Abstract. Learning media is a tool to deliver the materials to students during teaching and learning process and used as a source of learning like textbooks. However, textbooks are sometimes considered less practical and boring. The innovation that follows the technology advancement is undeniably needed. Nowadays, students are very creative using smartphones. The students’ creativity should be supported for better learning. One of the efforts is making use of a smartphone or mobile technology as a learning media. This study aims to develop an Android-based learning media called Trigonometry app and evaluate the validity and practicality of the learning media. This learning media is expected to help students learn mathematics. This study used the ADDIE development model. The learning media was validated by six experts and tested by 95 respondents. The results show that the learning media met the valid criteria with kappa value ranged from 0.562 to 0.843. The learning media was also considered practical based on the responses from the users. 86.32% of the users stated that the learning media was excellent and best imaginable. Therefore, the learning media is declared valid and practical to use in the classroom. It is necessary to conduct further research to investigate the use of the media in the classroom and its impact on students’ learning and teaching practices.

1. Introduction
Teachers should have the ability to plan, choose and use multiple sources and learning media to make the learning more effective [1]. Choosing a learning media that can support and facilitate students’ learning is a teacher’s responsibility. The role of the teacher in the learning process is crucial, especially in selecting instructional and design media to motivate students to learn. Learning media is a tool to deliver the materials in the learning process [2]. Utilizing an exciting, innovative, and creative learning media is an essential aspect of achieving successful learning in schools. Through the media, the expected learning will be easy to implement.

Learning media is also used as learning resources. Learning resources commonly used in the learning process are textbooks and worksheet [3]. Excellent textbooks make teachers easier to teach and provide learning materials that fit students’ interests. However, textbooks also have some shortcomings, especially in this technological era. Some students rarely use textbooks because they are lazy to carry large package books [4]. Textbooks sometimes cannot be used all the time and are considered boring by some students [5]. Textbooks should be interestingly designed so that students will feel comfortable and interested in reading the textbooks. Therefore, we need innovation for textbooks to follow the technological progress and students will be easier in learning. One of the
learning media that are often used to increase students’ interests in textbooks is the media in the form of a pocketbook. Pocketbook is a small printed book that contains information and can be stored in a pocket so easy to carry anywhere. The use of pocketbooks can encourage students to learn independently and improve students’ learning outcomes [5]. However, printed instructional media like a book sometimes make students challenging to open and receive course material quickly [6].

Pocketbooks can be generated through technology and information device in the form of mobile technology. Mobile technology is used not only for verbal communication among people but also for other things, such as recording and accessing sources of knowledge and information. Nowadays, students are very creative using smartphones. Some students even no longer take notes; instead, use a smartphone to photograph what written on the board. Since more students have smartphones, it is an excellent opportunity to use the phone for the learning process. Learning media using mobile technology is called mobile learning (m-learning). M-learning is a learning device with personal digital (PDA), tab, iPhone, or HP as the primary device [7,8]. M-learning is used as a complement to learning that can be used by students anytime and anywhere and gives students the opportunity to learn more about the topics they feel uncomfortable. One of the advantages of m-learning is that it can be used as an alternative to substitute a textbook, called mobile e-book [9]. Pocketbooks digital-based android application is one of the developments of mobile learning (m-learning) that can access the application of pocketbooks, and user-friendly. M-learning helps increase students’ interests, independence, participation, motivation, and achievements [10-12]. Therefore, the development of Android-based learning media designed effectively and practically for students is essential. The additional book is needed to facilitate students’ learning. Therefore, this present study aims to develop Android-based learning media to help students’ learning in mathematics.

2. Method
This study is development research that used the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). At the analysis stage, the students' needs and characteristics were identified. After that, the standard and basic competencies were analyzed to match the curriculum. At the design stage, the researchers designed a media, set topics, composed questions and answers, and collected background and image. At the development stage, the product was created using the Android Studio app. Once the product finished, then it was validated by experts who master the content of the topic chosen (called subject experts) and who understand the media developed in this study (called media experts). At the implementation stage, trials were conducted to test the practicality of the product that had been developed. At the evaluation stage, the practicality of the products was analyzed and administered based on the evaluation in the trials. However, this study only focuses on the validity and practicality criteria of the product.

This study used a questionnaire to obtain data from three media experts, three subject experts, and respondents. The validation of the product was done by the experts. After the experts validated the product, the analysis of the validation is also strengthened by inter-rater test to assess the agreement among the validators. The data were analyzed by calculating the average score given by the experts. Then, the average score was categorized into the criteria guideline presented in Table 1 [13].

| Score Interval | Criteria   |
|---------------|------------|
| \( \bar{x} > 4,2 \) | Very good |
| \( 3,4 < \bar{x} \leq 4,2 \) | Good |
| \( 2,6 < \bar{x} \leq 3,4 \) | Sufficient |
| \( 1,8 < \bar{x} \leq 2,6 \) | Poor |
| \( \bar{x} \leq 1,8 \) | Very bad |
Moreover, data about the practicality were obtained from the opinions of the respondents on the product. To get the data, two stages of trials were conducted. The first stage is the small-scale trial that involved 10 senior high school students as the respondents. The second stage is the large-scale trial conducted using an online questionnaire from Google Forms. In this trial, respondents could try the application more conveniently at any time. The number of respondents in this large-scale trial was 95 respondents that consist of senior high school students, teachers, and college students.

The questionnaire used for the respondents was designed based on System Usability User (SUS) developed by Brooke [14]. SUS is a survey tool that can be used to test the usability of various kinds of products [15]. SUS’s questionnaire is highly appropriate for a small scale of respondents [16]. SUS consists of 10 general statements regarding a respondent’s response after using a new application or product. This questionnaire used the Likert scale with five options: strongly disagree, disagree, neutral, agree, and strongly agree. The responses were then converted to a scale with interval 0 to 4 [14]. After that, the sum of the conversion results was calculated, and then multiplied by 2.5 to get the usability score. The score was then categorized based on the assessment criteria in Table 2.

Table 2. Assessment criteria for the usability.

| Score Range            | Qualification        |
|------------------------|----------------------|
| \( V_{\text{SUS}} > 85.00 \) | Best imaginable     |
| 73.50 \(< \ V_{\text{SUS}} \leq 85.00 \) | Excellent            |
| 52.50 \(< \ V_{\text{SUS}} \leq 73.50 \) | Good                 |
| 38.00 \(< \ V_{\text{SUS}} \leq 52.50 \) | Ok                   |
| 25.00 \(< \ V_{\text{SUS}} \leq 38.00 \) | Poor                 |
| \( V_{\text{SUS}} \leq 25.00 \)   | Worst imaginable    |

3. Results and discussion

The product of this study is an Android-based learning media called Trigonometry app. It contains trigonometric materials, examples of trigonometric problems in the form of videos and exercises. This Trigonometry app was developed using Android Studio software assisted with Adobe Dreamweaver software and the videos in the application were made using Video Scribe software. In the Trigonometry app, there are nine menus, and each has different functions. The menu are: (1) Introduction; (2) The size of the angle (degrees and radians); (3) Comparison of trigonometry in a right triangle; (4) Special Angles; (5) Relation angle; (6) Identity of trigonometry; (7) Rules of sine and cosine; (8) Exercise 1; and (9) Exercise 2. The screenshot of the application can be seen in Figure 1 below.

![Figure 1. The appearance of Trigonometry app: (a) Main menu, (b) Main menu (continued), (c) Menu information](image-url)
The validation of Trigonometry app is obtained through a questionnaire given to the subject and media experts. The results of the validation can be seen in Figure 2.

Based on Figure 2a, the average score of 4.38 was obtained from Validator 1, 4.54 from Validator 2 and 4.62 from Validator 3. The total average for the subject validation is 4.51 which indicates the validity of the content was considered very good criteria. Based on Figure 2b, the average score of 4.36 was obtained from Validator 1, 4.21 from Validator 2 and 3. The total average for media validation reached 4.26, categorized under very good criteria.

Based on the inter-rater test results for the subject validation, Validator 1 and 2 obtained kappa’s coefficient of 0.698, Validator 1 and 3 got kappa’s coefficient of 0.562, and Validator 2 and 3 obtained kappa’s coefficient of 0.843. All of those coefficients were considered in the criteria of a very good agreement. Based on the results, it can be concluded that the perceptions or assessments from the three validators were categorized well.

Regarding the inter-rater reliability test for the media, the results found that Validator 1 and 2 obtained the kappa's coefficient of 0.705. Similarly, Validator 1 and 3 gained the kappa's coefficient of 0.705 while kappa's coefficient obtained from Validator 2 and 3 is 0.714. Similar to the results of the subject validation, those coefficients indicated good agreement among the validators. Therefore, it can be concluded that the perceptions or assessments from the three validators were categorized well. After the experts validated the application, then the researchers conducted trials to evaluate the practicality of the application. Trials were conducted twice: a small-scale trial and a large-scale trial. The results of the small-scale and large-scale trials are shown in Figure 3.

The results of a small-scale trial (see Figure 3a) show that 10% of respondents considered the usability of the application in the best imaginable criteria and 60% of respondents gave excellent criteria. Meanwhile, the rest of the respondents found the application was good. Based on the assessment from the respondents in a small-scale trial, it can be concluded that in general, the Trigonometry app has a good quality.
Furthermore, based on the results of the large-scale trial as seen in Figure 3b, 48.42% of the respondents stated that the usability of the application is best imaginable. Then, 37.89% of the respondents gave excellent criteria, 12.63% of the respondents provided good criteria, and the rest, 1.05% of the respondents, considered poor criteria. From those findings, it can be concluded that generally, the Trigonometry app has a good quality.

Trigonometry app, the final product of this study, is in the form of a pocketbook application that can be installed in Android-based smartphones. This application is a learning media that contains materials, video and exercise questions. The materials in this application cannot be added directly. If users want to add some materials, they have to unpack this application and re-edit the program. It is different from the Google Classroom app developed by Google LLC that can add contents without editing the program. The Google Classroom app is more like an online class with all the materials provided by the teacher. While the application that the researchers developed contains materials, examples of problems and exercises already. Thus, teachers do not need to prepare the materials again.

In her study, Purbasari also developed an Android-based application on the topic of three-dimensional objects [17]. In her application, there is an evaluation menu used to assess students' understanding after using the application. Similarly, in the Trigonometry app that the researchers developed, it can be found in the evaluation menu in the form of exercises with multiple-choice questions. However, the application developed by Purbasari is considered less interactive because there is no animation used in it. Thus, the researchers added videos in the Trigonometry app to make it more interesting for the users. Another study that developed an android application is a study by Astra [18]. That is, an application for ideal gas simulation and the target users are senior high school students. To install the application, users should install Adobe AIR on the smartphone first, which is different from the application developed in this study. The Trigonometry app can be directly installed without requiring additional applications beforehand.

4. Conclusion
The learning media, The Trigonometry app, developed in this study has a very good quality based on the validation from the experts. The subject validation obtained 4.51, and the media validation obtained 4.26 for the total average. These findings indicate that the validity of the learning media was considered very good. Furthermore, the results of the practicality of the learning media show that 86.32% of respondents believed the learning media is excellent and best imaginable. Therefore, the learning media in the form of the Android-based pocketbook is declared valid and practical. It is recommended for further research to apply the Trigonometry app in the learning process and investigate its effects on students' learning and teachers' teaching practices.

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