Establishing an android-based physics glossary for junior high school students

I Hardiyanto, J R Pangestuti and A Billah

Institut Agama Islam Negeri (IAIN) Salatiga, Indonesia

*Corresponding author: arifbillahbadr@iainsalatiga.ac.id

Abstract. Understanding Physics term accurately is exceedingly essential in supporting the achievement of Physics learning objectives. Android-based software has many advantages starting from a large number of users, practicality, to the ease in the spread of the application as a means of pinning learning media. The purpose of this study was to develop an Android-based physics glossary. The research steps referred to the Four-D (Define, Design, Develop and Disseminate). The finished product has been declared valid and practical by material experts, media experts, and teachers. The product’s validity value was 4.25 and categorised as “excellent” while the practicality score was 4.53 and categorised as “excellent”. The product testing was carried out through three stages, namely One-to-One Trial involving 3 students, Small-Scale Trial including 12 students, and Field Trial involving 28 students. The developed product, “Physics Glossary”, is in an Application Package File (.apk) format and has been published so that it can be downloaded for free through the Google Play Store. The glossary was designed interactively, making it easier for users to search for physical terms and explanations. Another plus is that the application includes explanations in two languages, Indonesian and English.

1. Introduction

According to Indonesia’s 2013 Curriculum, physics belongs to the part of the integrated sciences course taught in junior high schools. Physics is a discipline containing laws, theories, and concepts of natural phenomena. To comprehend physics well, students have to analyse concepts systematically, and it depends on their understanding of terms.

The researchers concerned a preliminary observation which showed that high school students’ understanding of physics terms was lacking and it has been an obstacle in science learnings. They were unfamiliar with new terms they have never found before. Therefore, a medium providing lists of physics term was demanded. A discussion with several high school teachers has strengthened this necessity who stated that they needed a learning media that: (1) could facilitate students’ independent learning; (2) is convenient for external classroom use; (3) could support the enhancement of the 21st century skills.

One crucial element to achieve learning objectives is learning media [1][2]. It may be functioned as an information transmitter or a means of communication in both inside and outside learning process. Learning media are needed in learning so that information can be conveyed properly. Media involvement is difficult to escape from the teaching and learning situation. Learning includes verbal and visual information, such as text and images that must be continuously analyzed and processed by students[3].

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Advances in technology, especially mobile device technology can be an opportunity for educators to develop learning media. Mobile devices have become known as smartphones[4]. Mobile devices are now able to provide computing, multimedia and communication capabilities and information storage[5][4][6]; and facilitate communication with other people everywhere [7]. The use of cellular technology in learning facilitates the fulfillment of individual student needs. Students can personalize learning activities[8]; and allows for virtual learning anywhere, anytime, and has an effect on improving student learning [9].

One operating system that has been widely used on smartphones is Android. Android smartphone and internet advancement is the result of the latest technology development. The collaboration between those two has facilitated us to obtain information just in a flash. Up to now, Android has been the most significant operating system in the world. Not only aiding people to be application user, but it also allows us to be an application developer. This opportunity is an alternative solution for education activist to disseminate educational content by developing the application. Therefore, it would optimise the benefit of a smartphone as an effort to increase students’ academic achievement [10].

Several Research and Developmental studies concluded that Android, as the basis of development, affected positively to the learning results [11][12]. An Android-based learning media has attracted students to learn [13]; facilitated their self-regulated learning [14]; improve their critical thinking and conceptual understanding [15]; as well as boost their creative thinking and problem-solving skills [16]; and allows students to access content anywhere and anytime so that efficient learning takes place [17].This research intended to establish a valid and practical Android application of Physics glossary to be used as one of the integrated sciences learning media.

2. Methods
This research followed the Four-D (Define, Design, Develop and Disseminate) method. Firstly, the define stage consisted of determination of requirements required in the media development. It covered the selection and collection of materials based on the students’ need. Secondly, the design phase comprised flowchart and storyboard making, layout design, and content preparation. Thirdly, the develop stage included media establishment, validation, and trial. Fourthly, the disseminate phase was when the application was uploaded on Google Play Store.

There were three experts acted as the validator; they are the material expert, media expert, and educational practitioner (teacher). Furthermore, three students joined the one-to-one trial, twelve students attended the small-scale trial, and twenty-eight students participated in the field trial. All of the subjects joined in this research were VII grade students of SMP Islam Ar-Rahmah Suruh, Semarang Regency, Indonesia. Questionnaires and documentation were employed as the instrument for collecting data. The data were descriptive-quantitative obtained from the experts’ assessment and the students’ responses. The research variable was the development of an Android-based physics glossary. “Good” was the minimum score the product might get for the validity and practicality. The score conversion is seen in Table 1.

| Interval | Category |
|----------|----------|
| X> 4,2   | excellent|
| 3,4 <X≤ 4,2 | very good|
| 2,6 <X≤ 3,4 | good|
| 1,8 <X≤ 2,6 | fair|
| X< 1,8   | poor     |

Information: X = Actual Score
3. Results and Discussion

3.1. The Product Development

The application entitled “Physics Glossary” has been uploaded on Google Play Store. The icon is presented in Figure 1.

![Figure 1. The app’s icon](image)

The product was packed in a 4.4 MB Application Package File (.apk) format. The app’s size is relatively small so that it will lighten up the users. Besides, it could be operated either online or offline as a result of efficiency consideration. Moreover, it is free-downloaded.

There were 333 terms contained in the application equipped with bilingual (Indonesian and English) explanation. The app was designed modestly for the ease of use. Navigation panel was added to search for the decided term. The opening page display was shown in Figure 2 while the main page consisting of the term list is presented in Figure 3. The users may see the explanations by clicking the term.

![Figure 2. The opening page](image)

![Figure 3. The display of term list](image)

3.2. The Product Validation

The validation test obtained the product’s validity and practicality score of 4.25 and 4.53 respectively. Both were classified as “excellent”. Therefore, the application has been declared valid and practical. The following Table 2 and 3 show the validity and practicality average scores assessed by the three validators.

| Table 2. The average validity scores |
|-------------------------------------|
| Aspect | Criterion | Validator | Score | Average |
| Validity | Presentation Appropriateness | Material expert | 4.18 | 4.22 |
| | Appropriateness | Teacher | 4.26 | |
| Content | Appropriateness | Material expert | 4.24 | 4.27 |
| | | Teacher | 4.30 | |
| Average | | | | 4.25 |
Table 3. The average practicality scores

| Aspect                        | Criterion   | Validator  | Score | Average |
|-------------------------------|-------------|------------|-------|---------|
| Graphic design and aesthetic | Media expert| 4.30       |       | 4.31    |
|                               | Teacher     | 4.32       |       |         |
| Pracicality                   |             |            |       |         |
| Easy of use                   | Media expert| 4.82       |       | 4.84    |
|                               | Teacher     | 4.86       |       |         |
| Quality of program           | Media expert| 4.41       |       | 4.43    |
|                               | Teacher     | 4.45       |       |         |
| Average                      |             |            |       | 4.53    |

Several improvements were made as a response to the validators’ suggestions for the initial product, they were: (1) the terms should not thoroughly refer to the textbooks, instead, use the primary book reference; (2) the number of term must be augmented; (3) the application should not be targeted for junior high school users, it has to be beneficial for people in general.

Figure 4 informs the average of the students’ responses to the product on each trial that was 4.46, 4.50, and 4.51 respectively and classified as “excellent”.

![Figure 4. The results of one-to-one, small-scale, and field trial](image)

The students think that the application is light and easy to use, has helped them comprehend physics terms, can support their independent learning and may be used for any topic. Moreover, the teachers argue that the application facilitates either school or independent learning, assists them in providing proper learning media, is beneficial for higher education level, and suits the demand of the 21st-century skills.

4. Conclusion
The application has been declared valid and practical referring to the assessment done by the material expert, media expert, and teacher. The validity got 4.25 while the practicality scored 4.53, both were categorised as “excellent”. The students’ responses obtained 4.46, 4.50, and 4.51 orderly from the one-to-one, small-scale, and field test. All were classified as “excellent”.

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The characteristics of the Android-based physics glossary are: (1) entitled “Physics Glossary”; (2) free for download on Google Play Store; (3) offline-friendly; (4) packed in application Package File (.apk) format; (5) 4.4 MB in size; (6) currently having 333 physics terms; and (7) equipped with bilingual explanations, English and Indonesian.

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