Development of Android-base media on the point of glass and lens

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Abstract. Android gives a great revolution to the world of education to develop learning applications that facilitate its use to study anywhere and anytime. This study aims to make Android-based media using app-inventor on glass and lens material. The development of this media uses R & D (research and development) research and development methods which consist of 4 stages, namely the analysis phase, design stage, production stage, and evaluation stage. The results of using Android-based media have an average value of questionnaires from material experts, media experts, and small-scale trials categorized very well close to 50%. Based on these results it can be stated that the lens and glass media based on Android can be used as a medium of learning in the classroom. The development of this Android-Based Physics Application is expected to be an alternative for educational institutions or educators to develop learning media that use multimedia.

1. Introduction

Technology in the 21st century experienced a very large development, especially information and communication technology which was characterized by the use of the internet in various aspects of life. The internet as a global telecommunications media provides opportunities for users to access information widely [1–4]. This is further facilitated by the existence of devices that support the use of the internet with a high level of complexity in the form of an electronic operating system (OS). The operating system that is currently widely used by the public is the Android system. Android is popular with open source systems, allowing users to develop their own applications [5–7].

The population of smartphone users in Indonesia almost touches all aspects of age and background with the greatest dominance being school age. The results of a survey conducted by Opera in 2013 in Indonesia showed that 10% of Android users have an age range of 13-17 years [8]. The results of other surveys conducted by UNICEF in 2019 for respondents who have an age range of 10-19 years (middle school students) gave the results that more than 80% of respondents were active internet users with their Android gadgets [9]. This shows that students at the middle school level (Junior and Senior) are a large enough Android user segment.

Android is a device that can direct users in a positive direction if it is optimized for positive purposes and will have a negative impact when used for negative things. One of the positive goals of smartphone utilization is to support the learning process, especially learning physics by utilizing mobile learning [10]. Android-based digital learning media is a simple form of e-learning that uses a base of operations...
in the form of computers. Android media is a mix of complexes from OS, middleware and applications that can increase students' interest and attractiveness with multi-representative presentation [11].

Learning media using an Android system besides being more attractive is also flexible. This is because smartphone hardware is minimalist so students can carry material easily. The combination with the internet allows students to access other resources provided in the Android-based learning media [12].

2. Method
This research is a development research with physics content that is raised is cerin and lens. The flow of this research is found in Figure 1.

![Research flow](image)

**Figure 1.** Research flow.

Research begins with the stage of needs analysis and formulation of problem solutions that are part of the planning phase. The next stage is making a prototype medium that is tested on a small scale. The results of the small-scale development and testing were revised to then be carried out on a large scale test. Respondents' input and evaluation at the large-scale test phase are then revised until dissemination and implementation stages can be carried out as research products [13].

Media development is done using the APP-Inventor 2 platform. The choice of this platform is due to the high level of accessibility and programming that is quite simple so that it can be learned easily even without the basic programming. The media flowchart made in Figure 2.

![Flow chart media](image)

**Figure 2.** Flow chart media.
The media that was developed was then reviewed by media experts, material experts and asked for a response from the students. Assessment is done by using the Rating Scale Model with interpretation excellent, good, enough, bad, and worst [14].

3. Result and discussions
The analysis conducted on the characteristics of active smartphone users during learning activities shows that students tend to be cool with their respective smartphones. The results of studies conducted show that active smartphone users spend their time playing social media with an average usage time of 3.5 hours, browsing 9 hours, streaming 3 hours and using for an hour of entertainment. [15]. Hal ini dapat dioptimalkan dengan membuat media belajar berbasis Android dan terkoneksi dengan internet sehingga siswa merasakan belajar yang dekat dengan gadget mere. This can be optimized by making learning media based on Android and connected to the internet so students feel that learning is close to their gadgets.

Android-based media developed using the Inventor app platform which can be accessed on page http://appinventor.mit.edu/. The results of media development carried out are shown in figure 3 and 4.

![Figure 3](image1.png)
(a) Home view and (b) Example display.

![Figure 4](image2.png)
(a) Example display theme, (b) Display of sample flat mirror material problems.
The results of the development were validated by physical matter experts, media experts and users. The validation results are shown in figure 5.

Figure 5. Frequency of evaluation results of media expert.

Figure 5 indicates that the Android media developed available to be used is indicated by the average rating of media experts in the excel category. Based on the 17 aspects of media expert assessment, the distribution distribution in Table 1 shows.

Table 1. Distribution of media expert assessments.

| Rated aspect                             | Validator points (people) |
|------------------------------------------|---------------------------|
|                                          | 1 | 2 | 3 | 4 | 5 |
| Selection of fonts                       | 0 | 0 | 0 | 0 | 3 |
| Font size selection                      | 0 | 0 | 0 | 0 | 3 |
| Color                                    | 0 | 0 | 0 | 1 | 2 |
| Graphic                                  | 0 | 0 | 1 | 0 | 2 |
| Accuracy of background selection         | 0 | 0 | 1 | 2 | 0 |
| Image Display                            | 0 | 0 | 0 | 1 | 2 |
| Animation                                | 0 | 0 | 0 | 0 | 3 |
| Musical accompaniment                    | 0 | 0 | 0 | 1 | 2 |
| Sound                                    | 0 | 0 | 1 | 1 | 1 |
| Screen design                            | 0 | 0 | 0 | 1 | 2 |
| Use of language                          | 0 | 0 | 1 | 1 | 1 |
| Navigation                               | 0 | 0 | 0 | 1 | 2 |
| Consistency of Button                    | 0 | 0 | 0 | 2 | 1 |
| Clarity of instructions for use          | 0 | 0 | 0 | 0 | 3 |
| Ease of use                              | 0 | 0 | 0 | 1 | 2 |
| Efficient use of layers                  | 0 | 0 | 1 | 1 | 1 |
| Efficiency of text                       | 0 | 0 | 0 | 1 | 2 |
| Speed                                    | 0 | 0 | 1 | 1 | 1 |

Based on the data in table 1, it can be seen that the media developed has components that have not been perfect. However, the media has perfect points on the aspects of font, font size, animation and clarity of instructions. Factors that are still not optimal open opportunities for subsequent research for the media optimization phase.
The next assessment relates to the physical content contained in the media. Assessment of physics content is based on learning material needs at school. Based on figure 6, it can be seen that the media developed contains adequate material for learning needs with an average expert rating of 87.18% with very good interpretation [4]. The final assessment is based on the responses of students at SMAN 1 Madiun as a public test. The results of the respondents' assessment are in table 2.

![Figure 6. Frequency of evaluation results of physicists.](chart)

**Table 2.** Distribution of respondents' ratings.

| Indicator                                                                 | Assessment (Student) | Final score |
|--------------------------------------------------------------------------|----------------------|-------------|
| Clarity of program usage instructions                                     | 0 0 1 4 15           | 94,0%       |
| Text readability                                                          | 0 0 1 5 14           | 93,0%       |
| Quality of image display                                                 | 0 0 1 3 16           | 95,0%       |
| Animated presentation                                                     | 0 0 2 5 13           | 91,0%       |
| Color composition                                                         | 0 0 2 6 12           | 90,0%       |
| Accuracy of background selection.                                         | 0 0 3 5 12           | 89,0%       |
| Music support                                                            | 0 0 2 4 14           | 92,0%       |
| Navigation                                                               | 0 0 2 5 13           | 91,0%       |
| Clarity of standard competencies and basic competencies that must be mastered | 0 0 2 6 12           | 90,0%       |
| Clarity of learning instructions                                          | 0 0 3 4 13           | 90,0%       |
| The ease of understanding sentences in the text                           | 0 0 2 5 13           | 91,0%       |
| Ease of understanding the material / content of the lesson               | 0 0 2 4 14           | 92,0%       |
| The accuracy of the order of presentation                                 | 0 0 1 3 16           | 95,0%       |
| Coverage of training / delivery quiz                                     | 0 0 1 4 15           | 94,0%       |
| The role of learning media to add insight and knowledge                  | 0 0 2 4 14           | 92,0%       |
| Clarity of feedback / response                                           | 0 0 1 5 14           | 93,0%       |
| Increase interest in learning                                            | 0 0 2 5 13           | 91,0%       |

Table 2 shows how the views of users regarding the media developed. Overall the respondents stated that this media is very good for use in schools. This is indicated by the final average of the given value of 91.9%.
The results of the development of Android-based media have several advantages including 1) This learning media can be used by students anytime and anywhere, 2) The material is displayed by displaying several animated images and animations, examples of questions, and material summaries so that it becomes an attraction for students to learn, 3) Has an interactive and consistent navigation button making it easier for students to easily explore each layer, 4) File size is very small and has been published to the .Apk format, so it can be very installed on Android, 5) Publish in .Aia and HTML so that it can be run on a computer, and 6) Students can use as independent learning.

4. Conclusion
The quality of Android-based physics learning media on optical instrument material from the results of physicists, media expert, and trials of students testing is included in the excellent category, so learning media products are worthy of being used in the classroom learning process.

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