



DEVELOPMENT OF ANDROID-BASED EDUCATIONAL GAMES, LIGHT MATERIALS, AND OPTICAL TOOLS FOR CLASS VIII SMP/MTS

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Abstract

The purpose of this study is to describe the validity and response of students to android-based educational games Material Light and Optical Instruments for class VIII SMP/MTs through the Research and Development (R&D) method with the stages of research analysis, design, development, implementation, and evaluation. The trial subjects in this study consisted of two assessors of media experts, two assessors of material experts, two science teachers, and class VIII B students of Bondowoso 3 Public Junior High School, totaling 32 students. The instruments used are instruments or assessment sheets for media, material, science teachers, and student response sheets. The results obtained showed that the validity of the game based on the assessment of media experts got a feasibility percentage of 86.67% (very valid), the material expert assessment got a feasibility percentage of 91.29% (very valid), and user assessments (science teachers) got a feasibility percentage of 91, 79% (very valid). Judging from the students' responses with a small scale (6 students) that is getting a feasibility percentage of 82.13% (very valid) and students' responses with a small scale (32 students) getting a feasibility percentage of 81.1% (very valid). Therefore, it can be concluded that the development of android-based educational games for the material of Light and Optical Instruments for class VIII SMP/MTs is very valid for learning.

Keywords: Construct, COVID-19, educational games, light and optical devices, online learning

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INTRODUCTION

Science or natural science (IPA) is a science that studies nature and everyday life. Related to the learning process, science is expected to be taught in accordance with the characteristics of the material that is factual, both in the form of reality and cause and effect. One branch of science is physics. Physics includes the theory of matter, motion, and energy. The purpose of learning physics is to provide a qualitative and quantitative understanding of phenomena about nature and their application (Erlina et al., 2022; Mahdiannur & Romadhoni, 2020; Sugiarti & Ratnaningdyah, 2020). However, there are several obstacles experienced by students in learning physics. One of them is that students think physics is difficult to understand and learn (Damayanti et al., 2021; Fajar et al., 2022). Based on these problems, the solution that can be offered is to present relevant learning media (Fikriya & Fajar, 2020; Mayer, 2020; Rohani, 2019).

One learning media that can be developed according to these needs is android-based learning media. What is meant by Android-based learning media is an application that runs on the Android operating system on a smartphone (Pal & Vanijja, 2020; Rory & Sirait, 2020). Android-based learning media through smartphones becomes a strategic opportunity for teachers (Farida & Hasanah, 2022). Based on a survey from Hootsuite, smartphone users are currently dominated by productive age, including students. The utilization is dominated by social media and digital games (Apoki et al., 2020; Kümmel et al., 2020). The utilization is for social media (various types) with an average percentage of 91.6%, followed by the use of games at 59%, the use of music applications at 56%, and the use of online shopping applications at 55% (Simon Kemp, 2020). The development of learning media in the form of an Android-based educational game is an interesting idea.

Preliminary studies were conducted by researchers at Bondowoso 3 Public Junior High School through teacher and student interviews. Based on teacher interviews, it was found that, of the 32 students in class VIII B, 75% submitted assignments at the right time and with adequate and affordable smartphone conditions and facilities. However, for the remaining 25%, namely students who are late in submitting assignments, on average, it is due to the system being carried out in online learning or challenges (in the network or the internet) experiencing differences with face-to-face learning, which requires more special preparation, including in

terms of learning readiness, implementation in terms of online classroom management, more or extra evaluations or assessments, and technological science skills, so that teachers and students experience various adaptation processes. Not only that, the influence of student study time is wasted by playing digital games via smartphones (online and offline games). This description was obtained when the science teacher asked the student's guardian and the student concerned with different answers. Therefore it can be said that there are still obstacles experienced by teachers in the form of assignments (A. Rinasih, personal communication, November 9, 2020). For the interviews with class VIII B students, it was found that students tended to expect that the lessons presented were good and interesting so that learning was more enjoyable, such as reducing the level of boredom, adding animations, presenting quizzes more fun, adding videos, and so on. Based on the tendency and description of interviews with these students, it resulted in students understanding the material and carrying out the learning process online and carried out at home. As much as 58.3% agreed and 62.5% agreed if learning was carried out face to face because the majority of students studied online presented is less varied and requires face-to-face material explanation. Expectations from students in learning by displaying animations, quizzes, videos, and others can be integrated into an educational game, as the main reason that is the teacher's responsibility related to student delays in meeting assignments (C. V. B. students of B. 3 P. J. H. S. Class VIII B students of Bondowoso 3 Public Junior High School, personal communication, November 11, 2020). From this description, the researchers took the initiative to develop learning media in the form of Android-based educational games.

The game development software or application used is Construct 3. Construct 3 is software for making games with a 2D platform developed by Scirra with the latest version. Construct does not use a special programming language, so for beginners in making games is not too complicated (Nuqisari & Sudarmilah, 2019; Saleem et al., 2022). As done by previous researchers, namely those carried out by Suddin and Deda, they have reported the results of research on media development in the form of math education android games as media that are feasible, practical, and received positive responses (Suddin & Deda, 2020). Pratama and Haryanto did the same thing and reported the results of research on the development of android-based educational games in the domain of educational technology,

stating that it was an appropriate media. The eligibility is stated as additional and alternative learning media based on the quality of the material, media, and potential users, as well as the utilization of media usability (Pratama & Haryanto, 2018). Sanusi, Septian, and Inayah reported the results of research on mathematical creative thinking skills using educational games with the help of androids in rows and rows as an effective medium. This means that students experience increase in creative thinking skills based on comparisons between educational game users with the help of Android with ordinary learning (Asri Muslim Sanusi et al., 2020).

The purpose of this study is to describe the validity and students' responses to the android-based educational game on Light and Optical Instruments for class VIII SMP/MTs.

METHOD

This research is a research and development (Research and Development or R&D) which aims to develop and determine the feasibility of a product or media that is new, efficient or effective, and profitable. The research model carried out by researchers on the Research and Development (R&D) method with the stages of research analysis, design, development, implementation, and evaluation which started from the development carried out by Robert Marible Branch (Al-Bulushi & Ismail, 2017; Chio & Li, 2022; Ruri Gusmiarni, 2021). The research flow can be seen in Figure 1.

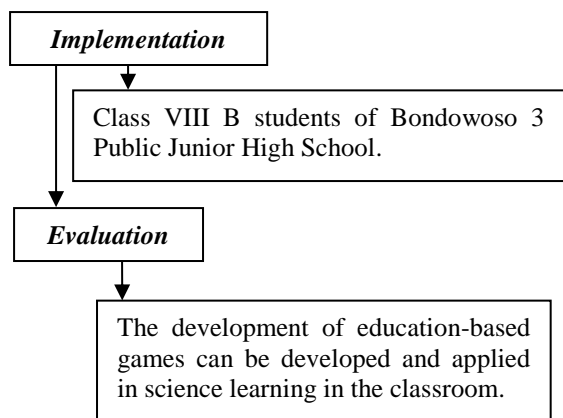
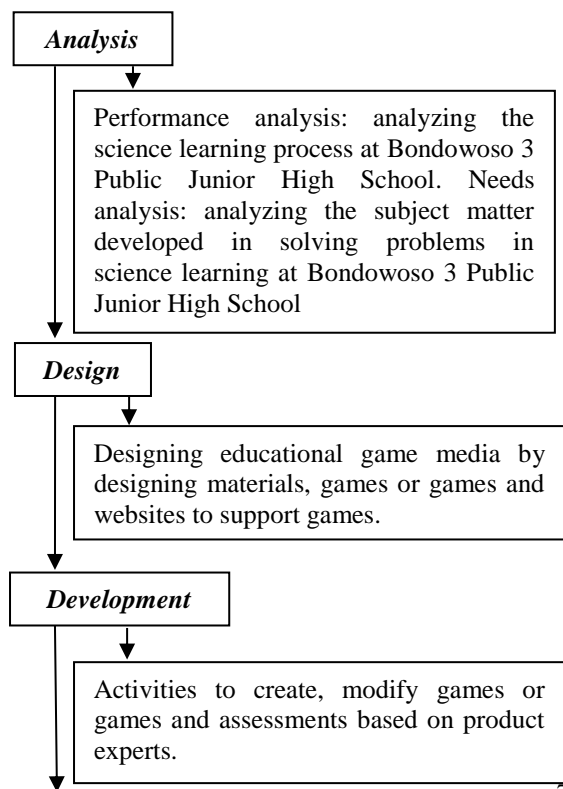


Figure 1. Research flow for the development of android-based educational games with light materials and optical devices for class VIII SMP/MTs.

The type of data developed by the researcher consists of qualitative data and quantitative data. Product trials were conducted with limited trials in small groups aimed at class VIII students, namely class VIII B of Bondowoso 3 Public Junior High School. The trial design carried out by researchers by testing the product to determine the validity of the product consisted of six assessors or experts: two media experts, two material experts, and two users. The data collection instrument carried out by the researcher was the use of research instruments in the form of a questionnaire for assessors and student responses. The measurement in the validity instrument uses a Likert scale which is usually used for quantitative analysis by scoring the answers (Hasanah et al., 2022; Jebb et al., 2021) as in Table 1.

Tabel 1. Likert Scale

Answer	Score
Strongly agree (SS)	5
Agree (ST)	4
Doubtful (RG)	3
Disagree (TS)	2
Strongly disagree (STS)	1

For the sampling technique, the trial was applied with a small-scale trial. Based on the needs analysis, the number of students in class VIII B is 32. The data analysis technique for qualitative data is carried out descriptively by analyzing the research process based on the results of interviews with teachers and students as well as analysis in developing products in the form of educational games. Quantitative data analysis techniques in the form of assessment results are descriptive statistics based on the results of assessments from experts (media, materials, and teachers). Data

analysis for quantitative data aims to measure product validity based on the intended questionnaire. The data is analyzed to assess the product based on expert judgment (media, material, and teacher appraisers) by looking for validity values (Ruijsenaars et al., 2020; van Atteveldt et al., 2021) with the following formula.

$$V(ah) = \frac{TSe}{TSh} \times 100\%$$

$$V(pg) = \frac{TSe}{TSh} \times 100\%$$

Keterangan:

V(ah) = expert validation

V(pg) = user validation (teacher)

TSe = total empirical score (expert assessment; teacher)

TSh = expected total score

For response analysis, data analysis is carried out using the following formula (Ruijsenaars et al., 2020; van Atteveldt et al., 2021)

$$V(au) = \frac{TSe}{TSh} \times 100\%$$

Keterangan:

V(au) = audience validation (students)

TSe = total empirical score (students)

TSh = expected total score

For the product category range, see the table below.

Tabel 2. Criteria for testing the validity of educational game media

Validity Criteria	Validity level
81,00% - 100,00%	Very valid, can be used without repair
61,00% - 80,00%	Fairly valid, usable but needs minor improvements
41,00% - 60,00%	Invalid, needs major improvement, it is recommended not to use
21,00% - 40,00%	Invalid, unusable
00,00% - 20,00%	Totally invalid, can't be used

RESULTS AND DISCUSSION

The development of an Android-based educational game with light materials and optical instruments for class VIII SMP/MTs was developed using the Analyze, Design, Development, Implementation, and Evaluation development model. The process can be described as follows.

A. Analyze

Analytical activities were carried out by researchers by analyzing and observing core competencies (KI), basic competencies (KD), and indicators of competency achievement to support the delivery of material in games and related to science learning for class VIII. The KI and KD analyzed are the latest KI and KD of the 2013 curriculum, namely the 2013 curriculum version of special conditions. KD applied in the research is KD 3.12. Analyzing the properties of light, the formation of shadows on flat and curved planes, and their application. The analysis phase continues by observing SMP Negeri 3 Bondowoso. The results of observations obtained show that students tend to expect learning that is presented as well as possible and interesting so that learning is more fun. The analysis phase continues with the analysis of the material. The analysis of the material in question is looking for literature and references related to the research and development of educational games based on android light materials and optical devices for class VIII SMP/MTs. Analysis of literature and references in the form of a previous thesis or educational journals, books on light materials and optical instruments for class VIII SMP/MTs as supporting content in light materials and optical instruments for games to be developed.

B. Design

In the design phase, the researcher designs the media according to the indicators that have been formulated in the analysis phase. The design in question is in the form of a design grid that will be displayed in educational game media. The design grid includes the game display, game material, media instruments, material instruments, user instruments (teachers), and student response instruments.

C. Development

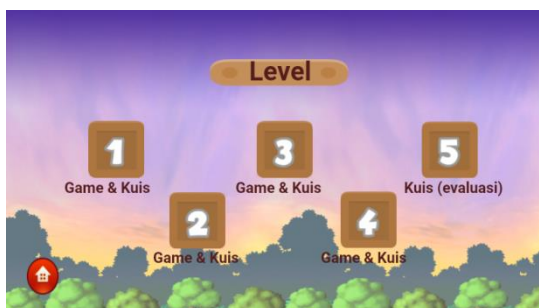
The development stage includes developing and creating game applications based on the grid that has been designed at the design stage. The results of the developed educational game media can be seen in Figure 2 below.



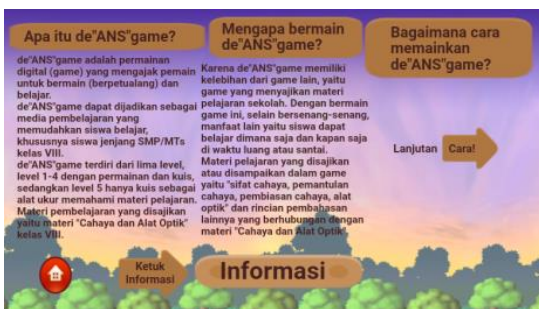
(a)



(b)



(c)



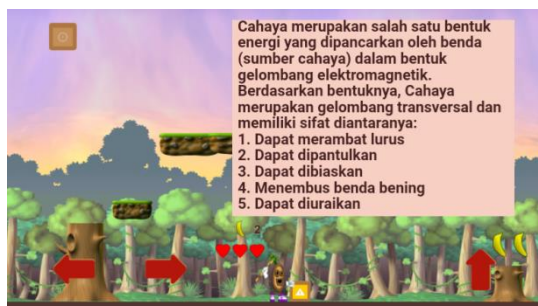
(d)



(e)



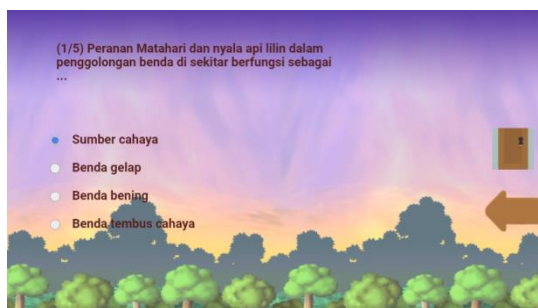
(f)



(g)



(h)



(i)



(j)

Figure 2. Display on android-based educational games. (a) Initial game display (loading); (b) Menu display; (c) “Start” display; (d) Display of “Information” (1); (e) Display of “Information” (2); (f) Display of “Encyclopedia”; (g) Display of material delivery at one of the levels; (h) Display menu on quiz; (i) Quiz display (1); (j) Quiz display (2).

The media developed were then assessed by six expert assessors: two media expert appraisers, two material expert appraisers, and two assessors from science teachers at SMP Negeri 3 Bondowoso. Here are the results of the data analysis based on validity.

Based on the results of the analysis of the media validity calculation, it is known that the media validity value is 86.67%, which means that games based on media are categorized as very valid. The validity of each aspect or component can be seen in Figure 3.

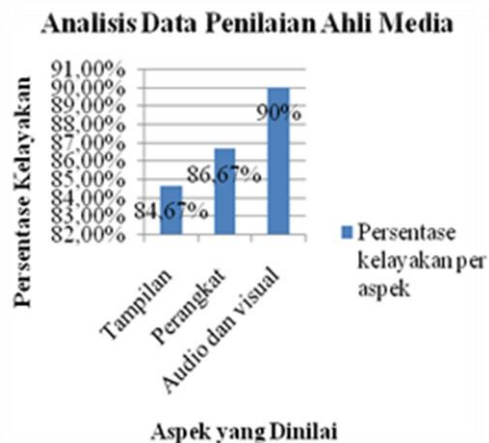


Figure 3. Analysis of Media Expert Assessment Data

For the validity of the display component, the score is 84.67%, with a very valid category. The device component obtained a score of 86.67%, with a very valid category. Audio and visual

components get a score of 90%, with a very valid category.

Based on the results of the analysis of the calculation of material validity, it is known that the value of material validity is 91.29%, which means that the game is categorized as very valid. The validity of each aspect or component can be seen in Figure 4.



Figure 4. Analysis of Material Expert Assessment Data.

For the validity of the material components, the score is 91%, with a very valid category. The question component got a score of 91.67%, with a very valid category. The language component scored 91.33%, with a very valid category.

Based on the results of the analysis of the validity calculations and graphs from the science teacher assessment that the user validity value is 91.79%, which means that games based on users (science teachers) are categorized as very valid. The validity of each aspect or component can be seen in Figure 5.



Figure 5. Analysis of Science Teacher Assessment Data

In Figure 5, it is shown that the practicality component gets a value of 93.33% with a very valid category. The media component got a score of 91.0526%, with a very valid category.

D. Implementation

The implementation stage is carrying out class VIII B learning at SMP Negeri 3 Bondowoso. At the end of the learning process, it was continued with the submission of student response sheets to class VIII B students, which was carried out offline (face to face). The data obtained from the student response sheets were analyzed using a formula to determine the validity of the student responses. Based on the analysis results from the calculation of the validity of the small-scale student responses (6 students) that the value of the student response validity is 82.13%, which means that games based on student responses are categorized as very valid. For the results of the analysis of the validity calculations and graphs of small-scale student responses (32 students) that the value of student response validity is 81.1%, which means that games based on student responses are categorized as very valid.

E. Evaluation

The evaluation stage is carried out with the aim of evaluating the results of the products developed. From the questionnaire given to students, there were additional questions related to statements about educational games, advantages, and disadvantages. The statements in these additional questions are analyzed and presented in Figure 6 in the form of the following word cloud, which consists of an analysis of small-scale student responses with six students and an analysis of small-scale student responses with 32 students.



(a)



(b)

Figure 6. Data analysis (word cloud) of student responses. (a) Data analysis (Word cloud) response 6 Students and (b) Data analysis (Word cloud) response 32 Students

From the observations obtained from the analysis of wordcloud on the response of 6 students that the word that often appears is "interesting", with a word frequency of 8. For the analysis of the word cloud on the response of 32 students that the word that often appears is "game", followed by "me", "less", and "attractive", with each having a word frequency of 42, 33, 26, and 26. From this analysis, it was found that the findings on the educational games that were developed needed to be re-examined to obtain better media.

CONCLUSIONS AND SUGGESTIONS

Conclusion

Based on the research and development applied by the researchers, it can be concluded that the validity of the Android-based educational game on Light and Optical Instruments for class VIII SMP/MTs based on the assessment of media experts gets a percentage of 86.67% with very valid criteria. Based on the assessment of material experts, the percentage is 91.29%, with very valid criteria. Based on user ratings (science teachers), the percentage is 91.79%, with very valid criteria. In terms of student responses to android-based educational games with Light and Optical Instruments for class VIII SMP/MTs with a small scale (6 students), that is, getting a percentage of 82.13% with very valid criteria and student responses on a small scale (32 students), namely getting percentage worth 81.1% with very valid criteria.

Suggestion

The material developed needs to have concepts that are observed and analyzed, as well as reduce theoretical material and questions.

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