Bulletin of Educational Science and Technology
Vol 1 , No. 1, 2020, page 36 - 44
Available Online at http://bestjournal.id/index.php/BEST
ISSN 2722-9114 (online)

Development of Physics Game Learning Based on Android

P Purwandari[*1], Andista Candra Yusro[1], Endah Dwi Styani[1]
Universitas PGRI Madiun, Jl. Setiabudi No.85 Kota Madiun 63118, Indonesia
E-mail: * purwandari@unipma.ac.id

Abstract: This research is a research development which aims to 1) Develop a Physics game learning based on Android that is feasible to be used as a learning media on physics subjects. 2) Knowing students' responses to physics game learning based on Android as learning media 3) Knowing that physics game learning based on Android as learning media can improve students' ability to analyze in the chapter of momentum, impulse, and collision. This research uses the ADDIE development model. This research has been tested by 3 media experts and 3 material experts with the results of the assessment stating that the media is feasible to be used as a medium for physics learning. The subjects of this research were 11 students in class X of Industrial Chemistry at the Vocational School of Gula Rajawali Madiun. The results of this research development indicate that: 1) media physics game learning based on android meets the feasibility standard to be used as a learning medium on physics subjects. 2) The learning media of Physics game learning based on Android gets a very good response from students. 3) Physics game learning based on Android as learning media can improve students' analytical skills in the chapter of momentum, impulses, and collisions with an average N-Gain of 0.54 which is in the medium category.

Keywords: physics game learning; android

How to Purwandari, P., Yusro, A., & Styani, E. (2020). Development of Physics Game Learning Based on Android. *Bulletin of Educational Science and Technology*, 1(1), 36-44. https://doi.org/10.33292/best.v1i1.5

INTRODUCTION

The development of science and technology has a great influence on the field of education so that it demands the use of technology in the learning process. According to (Rosenberg & Foshay, 2002) with the development of technology, there are some shifts in the learning process, there are: (1) from the classroom to anywhere and anytime, (2) from paper to online, and (3) from physical facilities to a network facility. Learning process based on ICT can be realized if teachers as education providers play a role in it. One of the competencies that must be possessed by the teacher is pedagogic competence. In pedagogic competence, there are sub-competencies, namely teachers must have the ability to utilize ICT in the learning process. But in reality, until now there are still many teachers who use conventional methods or lecture method of teaching. Though the field of education should have entered the era of the media world, where the learning process prioritizes the media compared to the lecture method (Yanti & Ihsan, 2017).

The use of learning media in teaching and learning activities has a very large influence because it can arouse students' interest and motivation in learning and can have an influence on psychological matters towards students. In addition, the use of appropriate learning media can help explain material or objects that were originally abstract to concrete (WitaHarahap & Surya, 2017). One of the subjects that have been considered difficult to understand because it is abstract is physics. Physics is often seen as a difficult and boring subject. Physics is considered difficult because too many equations must be understood, calculating logical mathematical uses, and having to memorize and understand concepts related to the matter. In addition, physics is considered a difficult subject because many things in physics are difficult for students to imagine in concrete forms because they are still abstract for them.

Based on the results of observations and interviews conducted by researchers with students of grade X Vocational School Gula Rajawali Madiun it is known that the chapter in physics subject that is often considered difficult by students is momentum, impulse, and collision. Students have difficulty understanding questions related to the laws of conservation of energy and momentum because the questions are too long and the equations in this chapter are quite a lot. The opinion of students is evidenced by the results obtained from preliminary observations carried out by researchers that is by giving the pretest questions to students. The questions have given an amount to 5 items with cognitive levels C4 and C5. This question aims to test students' analytical skills on the chapter that they find difficult that is momentum, impulses, and collisions. From the results of the initial research conducted by the researchers obtained an average value of 30.91 out of 11 students who took the pretest. The average value was in less category. These results indicate that students have difficulty in analyzing the problem. The definition of analyzing the problem is to describe the purpose of the problem, draw conclusions and then use the data provided to solve the problem (Irwanto, Rohaeti, Widjajanti, & Suyanta, 2017).

The low analytical skills of students are caused by students not often practice working on the question based on questions that require analytical and problem-solving skills (Bhakti et al., 2020; Sasono, Huriawati, & Yusro, 2017). The material in physics requires more time in its delivery because physics material tends to be mathematical analysis so it requires extra understanding. But in reality, the hours of physics lessons at Vocational High Schools just a few while the material that must be delivered is quite a lot. This causes physics learning to run less optimally. Students cannot rely on the teacher as their main learning resource. Students need media that can help students in learning where the media is practical and also effective so that it can be used whenever and wherever.

One technology that is developing and can be used as a learning media that can be used whenever and wherever that is mobile learning (Styani, Purwandari, & Yusro, 2020). The development of mobile technology is currently so rapid, one of the mobile devices that are currently commonly used is a smartphone based on Android. Based on observations made by researchers at the Gula Rajawali Madiun Vocational School, almost 90% of students already have a smartphone based on Android but they have not used it

optimally. This provides a great opportunity to make this Smartphone based on Android as a medium for learning physics. Learning media using smartphone based on Android can train student learning independence. Students can repeat the subject matter more often and also do the problem exercises because the media can be used anywhere and anytime so that the frequent repetitions carried out are expected to increase students' analytical skills. In addition, the media is also equipped with moving animations that will help students analyze the problem.

Based on the potential and problems described above, the researchers intend to develop a physics game learning based on Android as a learning medium that is useful for improving students' analytical skills in the chapter of momentum, impulses and collisions with the following research hypotheses: (1) Media Physics game learning based on Android is feasible to be used as a medium for physics learning in the chapter of momentum, impulse and collision, (2) Media Physics game learning based on android obtain very good response from students so that it is feasible to be used as a medium for learning physics in the chapter of momentum, impulses, and collisions, (3) Media Physics game learning based on Android can improve students' analytical skills in the chapter of momentum, impulses, and collisions. From the research hypothesis above, it can be seen that the purpose of this study is to develop a physics game learning based on Android that is feasible to be used as a physics learning media and can improve students' analytical skills in the chapter of momentum, impulses, and collisions.

METHOD

This research and development use the ADDIE development model. Research and Development aim to create a product or develop an existing product and then the product is tested for feasibility and effectiveness (Suprianto, Ahmadi, & Suminar, 2019). Researchers chose to use the ADDIE development model because this development model was systematic. The series of stages is easy to understand because it is clear and sequential that starts from the analysis, design, development, implementation, and evaluation stages (Wang & Hsu, 2008). The final results of each development stage are very useful because they can be used as a base or initial product for the next stage. The subjects of this research and development are 11 students in grade X majoring in Industrial Chemistry at the Vocational School Gula Rajawali Madiun.

Data collection instruments used in this research include interviews, observation and documentation, expert validation sheets, product assessment sheets, questionnaires, and multiple-choice questions. Interviews and observations were conducted during preliminary research to find out the problems and potentials that underlie the development of Physics game learning application products. Data obtained from the results of the interview will be used as a material in analyzing the needs of the product being developed. The instrument in the form of an expert validation sheet was given to media experts and material experts. Product assessment sheets are given to physics subject teachers and students in small class tests. Questionnaires were given to students as respondents in large class tests to find out students' responses to the

developed media. Multiple-choice tests are used to test students' analytical skills on the material momentum, impulses, and collisions with cognitive levels C4 and C5, amounting to 5 questions.

The data obtained in this research are quantitative and qualitative. Qualitative data in the form of comments and suggestions from the validator are then analyzed descriptively qualitatively, while quantitative data obtained from expert validation sheets, product quality assessment questionnaires, and answers to multiple-choice questions are analyzed using quantitative analysis so that it can be known whether the media is suitable for use and whether the media can improve students' analytical skills on material momentum, impulses, and collisions

RESULTS AND DISCUSSION

Before starting to develop media, the researchers began to do some analysis to determine the potential and needs of students. Some analyses were conducted by researchers, namely requirements analysis, curriculum analysis, and student character analysis. From all analyzes conducted by researchers the following results are obtained: (1) through needs analysis, it can be concluded that students need practical and effective learning media that can be used anytime and anywhere. Besides, this work also conducted interviews with physics subject teachers to get suggestions related to features that must be filled in the media. (2) Through curriculum analysis, the researcher knows the curriculum currently used by the Vocational School Gula Rajawali Madiun, namely the 2013 revised curriculum. (3) Through character analysis of students, it is known that students of grade X students are 15-16 years old. Based on this range of age, it is included in the formal operational phase. In this phase, students can already understand abstract concepts within certain limits. So, this media can use as learning media.

In design stage, the researcher creates the design of media that will be made. First started by making a flow chart. The function of this flowchart is to facilitate researchers in developing the media because by making this flowchart will clarify the flow of making media. After making a flowchart then the researcher makes a storyboard. Storyboards are made to make media creation easier. If the flowchart is the plot, then this storyboard is the design. This design is made to know the overall picture of the media to be created. In this design, the researcher will also design a design that will be used in research. Flowcharts and storyboards that have been made before will be basic to make physics game learning that will be used as learning media. In addition, the instrument which will be used for application testing is also made in this step. The finished products of physics game learning are as follows:

Figure 1. product display example

After developing the product, the next step is to make a research instrument that will be given to the validator. The validators in this research are material experts and media experts. Besides instruments for validators, researchers also make evaluation sheets to evaluate a product that will be given to physics teachers and students in a small class. To find out students 'responses in the big class the researchers used a questionnaire consisting of two aspects related to media aspects and aspects related to students' analytical skills. The pretest and posttest were used to find out the students' analytical skills before and after using the media.

In implementation stage, the finished product is tested by using the product as learning media. Before being tested on the validator, the product is first given to the lecture supervisor to get the quality and feasibility. After the product is approved and declared eligible, it is then taken to the material expert and media expert. The results obtained from the validation by material experts and media experts are as follows:

Table 1. Material Expert Validation Results

No	Rated Aspect	Score	Criteria
1.	Learning Aspects	3,33	Very Good
2.	Material Aspects	3,48	Very Good
3.	Language Aspects	3,58	Very Good
	Average	3,47	Very Good

Table 2. Media/product Expert Validation Results

No	Rated Aspect	Skor	Criteria
1.	Display aspect	3,17	Good
2.	Aspect of implementation	3,27	Good
	Average	3,22	Good

The product is declared eligible if the minimum criteria obtained are good. After being tested and declared feasible by material experts and media experts, the product is given to physics teachers to assess its

quality. In addition to physics teachers, the product was also assessed by students in a small class of 6 students with the following results:

Table 3. Physics Teacher Assessment Results

No	Rated Aspect	Score	Criteria
1.	Learning aspects	3,22	Good
2.	Language aspects	3,67	Very Good
3.	Aspect of implementation	3,60	Very Good
4.	Display aspects	3,52	Very Good
	Average	3,51	Very Good

Table 4. Students Assessment Results (A Small Class)

No	Rated Aspect	Score	Criteria
1.	Learning aspects	3,83	Very Good
2.	Language aspects	3,96	Very Good
3.	Aspect of implementation	3,51	Very Good
4.	Display aspects	3,27	Very Good
	Average	3,64	Very Good

After getting a good rating from the physics teacher and also the students in the small class, the product is then tested on grade X with 11 students (large class) with the following results:

Table 5. Results of Students Questionnaire Responses to Physics Game Learning Media

No	Aspects	Score	Criteria
1.	Media	4,4	Very Good
2.	Effects of Media on Students' analytical skills	4,4	Very Good
	Average	4,4	Very Good

The product developed in the form of a physics learning media meets the proper and valid qualifications based on the results of the assessment conducted by the validator. Assessment is carried out by material experts, media experts, physics teachers, and students. Data on the assessment of learning media developed is presented in the following table 6.

Table 6. Learning Media Assessment

No	Validator	Score Average	Criteria
1.	Material expert	3,47	Very Good
2.	Media expert	3,22	Good
3.	Physics teacher	3,51	Very Good
4.	Students (Small Class)	3,64	Very Good
	Average	3,46	Very Good

The overall average rated from the learning media developed was 3.46 with a good category. Thus, this media is very feasible to use for learning media. Proper criteria are the minimum criteria of a learning media product to proceed to the small class test (Astuti, Putra, & Bhakti, 2018; Fatimah & Mufti, 2014). Both media and Android-based modules are very relevant to learning at this time (Muliyati, Bakri, & Ambarwulan, 2018), as are their hopes for the learning media developed. Physics game learning as learning media meet the criteria both based on the results of the questionnaire responses of students and observations of

implementation. The questionnaire that shared contains positive and negative statements about aspects of the media and aspects of the effect of the media on students' analytical skills. Every aspect of the learning media reaches very good criteria. The results of the questionnaire responses of students showed an average score of 4.4 from a total score of 5.0. This shows that the learning media developed can help and facilitate students in helping and understanding the material momentum, impulses, and collisions. Besides, the learning media developed can also increase learning motivation and students interest in supporting the material of momentum, impulses, and collisions so that this also increases students' ability to analyze questions.

Media aspects get an average score of 4.4. This aspect includes display media, animation in media, button layout, and clarity of instructions for use. Although included in the very good category but there are some shortcomings in terms of appearance because there are some pictures and videos on some smartphones whose size is less proportional to the space on the screen. Nevertheless, this learning media has met the criteria well and is suitable to be used as a learning medium that can improve students' mastery of the concept. Besides this media is also suitable for use as a learning resource that can be used anytime and anywhere.

The aspect of the effect of the media on students' ability to analyze also obtained the same average score of 4.4 with a very good category. Students feel helped by the existence of this media because of the concept of physics which initially became clearer and easier to use this media because it provides animations that make it easier for students to understand the concept of material and analyze questions. Besides, the suitability of the language used in the developed learning media is also easily understood by students and there are no difficulties during use. The question and evaluation is an exercise feature that strongly supports learning because this feature supports learning and understands where students' abilities are. In this feature, students can help work on the problem and can learn the discussion of answer by activating the available button. Students can also know the scores they have obtained. Thus, the spirit of learning is increasing.

The study of learning result is conducted to knowing about improving students' analytical skills before and after using learning media. The study was conducted twice, there are pretest and posttest in grade X Industrial Chemistry at Gula Rajawali Vocational School Madiun. Pretest to know the initial ability of students so that the pretest is done at the beginning of the meeting. Pretest questions consist of 5 items that have been validated. The researcher gives 30 minutes to work on the pretest questions. The average value of students at the time of the pretest was 30.91. After the pretest is carried out, the students then install the developed learning media. The posttest aims to find out the ability to analyze after using the developed application. Posttest questions are the same as pretest questions. The researcher gives 30 minutes to work on the posttest questions. The average value of students at posttest was 65.45. This shows an increase in students' analytical skills before and after using media. The use of Physics game learning based on Android as a physics learning media can help students learn material momentum, impulses and collisions evidenced

by an increase in student learning outcomes from the average pretest score of 37.6 to 78.8 at posttest with a normalized gain score of 0.67 that fall into the medium category.

CONCLUSION

Based on the hypothesis, the aims and results of the research that have been described, the following conclusions can be drawn: (1) This research has produced a physics game learning media based on Android that is fit for use as a physics learning media for grade X on the chapter of momentum, impulses, and collisions by obtaining an average value of 3.46 out of a total score of 4.00 in the very feasible category; (2) The average score obtained from the student response questionnaire to the Physics Game Learning media was 4.4 from a total score of 5.0 in the excellent category; (3) Physics game learning based on Android as learning media can improve students' analytical skills on the chapter of momentum, impulses, and collisions with a normalized gain score of 0.54 in the medium category.

In physics that tends to be abstract, the use of instructional media can have a great influence on students' analytical skills. Teachers must be innovative and creative in maximizing the use of instructional media that can support student learning. Besides, students must be more active and more often learn the material and work on questions to phone their ability to analyze the problems. For physics game learning media, it is intended to carry out further development so that the media can be accessed online, so there is a server that can save user data when logging in.

REFERENCES

Astuti, I. A. D., Putra, I. Y., & Bhakti, Y. B. (2018). Developing Practicum Module of Particle Dynamics Based on Scientific Methods to Improve Students' Science Process Skills. *Scientiae Educatia: Jurnal Pendidikan Sains, 7*(2), 183-196. doi:https://10.24235/sc.educatia.v7i2.2513

Bhakti, Y., Astuti, I., Okyranida, I., Asih, D., Marhento, G., Leonard, L., & Yusro, A. (2020). Integrated STEM Project Based Learning Implementation to Improve Student Science Process Skills. *Journal of Physics: Conference Series, 1464*(1), 012016. doi:https://doi.org/10.1088/1742-6596/1464/1/012016

Fatimah, S., & Mufti, Y. (2014). Pengembangan media pembelajaran IPA-fisika smartphone berbasis android sebagai penguat karakter sains siswa. *Jurnal Kaunia, 10*(1), 59-64. Retrieved from http://ejournal.uin-suka.ac.id/saintek/kaunia/article/view/1066

Irwanto, Rohaeti, E., Widjajanti, E., & Suyanta. (2017). *Students' science process skill and analytical thinking ability in chemistry learning.* Paper presented at the AIP Conference Proceedings.

Muliyati, D., Bakri, F., & Ambarwulan, D. (2018). Aplikasi Android Modul Digital Fisika Berbasis Discovery Learning. *WaPFi (Wahana Pendidikan Fisika), 3*(1), 74-79. doi:https://doi.org/10.17509/wapfi.v3i1.10944

Rosenberg, M. J., & Foshay, R. (2002). E ‐ learning: Strategies for delivering knowledge in the digital age. *Performance Improvement, 41*(5), 50-51. doi:https://doi.org/10.1002/pfi.4140410512

Sasono, M., Huriawati, F., & Yusro, A. C. (2017). Pengembangan Perangkat Pembelajaran Melalui Pendekatan Konstruktivistik dengan Metode Five E (5E) Stages Learning Cycle untuk

Meningkatkan Hasil Belajar dan Keterampilan Proses Sains. *Momentum: Physics Education Journal*, 45-55. doi: https://doi.org/10.21067/mpej.v1i1.1630

Styani, E. D., Purwandari, P., & Yusro, A. C. (2020). *Penggunaan Media Physics Game Learning Berbasis Android Untuk Siswa SMK*. Paper presented at the Prosiding SNPF (Seminar Nasional Pendidikan Fisika).

Suprianto, A., Ahmadi, F., & Suminar, T. (2019). The development of mathematics mobile learning media to improve students' autonomous and learning outcomes. *Journal of Primary Education, 8*(1), 84-91. Retrieved from https://journal.unnes.ac.id/sju/index.php/jpe/article/view/19641

Wang, S.-K., & Hsu, H.-Y. (2008). *Using ADDIE model to design Second Life activities for online learners.* Paper presented at the E-Learn: World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education.

WitaHarahap, L., & Surya, E. (2017). Development of Learning Media in Mathematics for Students with Special Needs. *International Journal of Sciences: Basic and Applied Research (IJSBAR), 33*(3), 1-12. Retrieved from https://core.ac.uk/download/pdf/249335803.pdf

Yanti, M., & Ihsan, N. (2017). Development of Interactive Learning Media on Kinetic Gas Theory at SMAN 2 Takalar. *Journal of Physics: Conference Series, 812*(1), 012029. doi:https://doi.org/10.1088/1742-6596/755/1/011001