DEVELOPMENT OF *POWERDROID-BASED* EDUCATION GAME IN MATHEMATICS LEARNING FOR GRADE VIII JUNIOR HIGH SCHOOL STUDENTS

Gena Disa Pratami[1], Rita Desfitri[2], Niniwati[3], Puspa Amelia[4]
[1,2,3,4]Universitas Bung Hatta Padang Indonesia
Email: genadisa123@gmail.com

ABSTRACT

This study aims to produce learning media Education Game based on PowerDroid in learning valid and practical math for junior high school students. The type of research used is Research & Development (R&D) with the Borg & Gall development model modified by Sugiyono. There are 10 research steps, researchers limit the research steps to 7 steps, namely: 1) Potential and problems; 2) Data collection; 3) Product design; 4) Design validation; 5) Design revision; 6) Product trial; and 7) Product revision. 2 expert validators validated the developed product. The results of the material expert validation get a percentage of 100% with the criteria "very valid", the results of the media expert validation get a percentage of 87% with the criteria "valid". After the validation is complete, the student and teacher practicality test is continued, the practicality test is carried out at SMPS Yapphi Pasar Usang with 4 students and 1 math teacher to determine the feasibility level of learning media. The results of the student's practicality percentage get a percentage of 94.64% with the criteria "very practical", the results of the teacher's practicality get a percentage of 100% with the criteria "very practical". They are also supported by the results of positive teacher and student responses and the results of student evaluations that have met the passing score. It can be concluded that the development of PowerDroid-based Education Games in learning mathematics for grade VIII junior high school students is very feasible to use as learning media.

Keywords: *Education Game, PowerDroid, Microsoft PowerPoint, Passing Score*

INTRODUCTION

The COVID-19 pandemic has had various impacts on all aspects. Since the spread of COVID-19 in Indonesia on March 11, 2020, the Minister of Education and Culture in his decision emphasized that health and education are interconnected to make learning models in Indonesia, both elementary, junior high, high school and higher education have adapted, namely by using an online learning system. Online learning is one of the best solutions to keep learning to meet physically (Pakpahan &; Fitriani, 2020: 30). The implementation of online learning requires supporting facilities, such as *smartphones*, laptops, or tablets that can be used to access information anywhere and anytime (Gikas & Grant, 2013: 19).

The declining spread of Covid-19 in July 2021 made the Minister of Education and Culture issue a new policy: several schools in Indonesia have started face-to-face schooling but must continue implementing strict health protocols. The policy issued by the Minister of Education in learning today requires advanced science and technology to improve the quality of education. Teachers must be able to use technological tools per the developments and demands of the times (Oktaviani, 2021).

According to J Neweg (in Suardi, 2018) learning is a or series of activities experienced by a person through his interaction with the environment. The interaction may start from factors that come from within or from outside oneself. To improve the teaching

and learning process, learning media is needed. Media is essentially one component of the learning system. As a component, the media should be by the overall learning process (Nurrita, 2018: 173).

Other gains from (Pratomo &; Irawan, 2015) Media can be interpreted as a tool used in the learning process. Learning media is an important component in the teaching and learning process because it presents material and makes it easier for students to understand it (Rusli, 2017). Another opinion from (Kamil, 2018) Learning media is a tool that conveys learning messages.

According to Kemp &; Dayton (in Sri, 2008) there are 3 functions of learning media: 1) Motivating interest / action. 2) Present information. 3) Give instructions. Another opinion according to Sanjaya (in Nurita, 2018), the function of using learning media is to function as a learning resource for students to obtain messages and information provided by teachers so that learning materials can be further improved and form knowledge for students.

Before choosing the learning media to be used, there are several criteria that the teacher must consider. So that the selection of learning media is the right one according to the needs and learning objectives and students get good learning outcomes. There are various types of media that educators can use in delivering material. The use and selection of media must be adjusted to the material and learning objectives to be achieved.

In the opinion of Nana and Ahmad Rivai (in Kamil 2018: 65), namely: "There are several types of learning media, 1) grapis media (two-dimensional media), namely media that have a length and width. 2) three-dimensional media, namely in solid models, cross-sectional models, stacking models, working models, moek ups, dioramas; and 3) projection media, such as slides, film, stripe, film, use of OHP".

Various types of media that can be used in the learning process are audio media, visual media, audiovisual media, and multimedia, of the four media that are suitable for overcoming the problems found are multimedia, Multmedia is a media that can involve many senses and organs during the learning process. One form of multimedia utilization is computer-based, namely multimedia presentations, interactive multimedia programs, video learning, and e-learning (Tammu, 2017: 138). Warsita (in Tarigan &; Siagian, 2015) explained that interactive multimedia programs, one computer-based learning media that synergizes all media consisting of text, graphics, photos, videos, animation, music, narrative.

One of the tools that can be used to develop intercative learning media is Microsoft PowerPoint, Microsoft PowerPoint *is* one of the learning media that teachers often use. Meanwhile, according to Arsyad (in Marfuah, et al, 2016: 15) "*Microsoft PowerPoint* is one of the software specifically designed to display multimedia programs that are attractive, easy to make, easy to use".

The use of *PowerPoint* in learning can improve mathematics learning outcomes. Therefore, in learning mathematics, especially abstract concepts, you should use computer media such as *Microsoft PowerPoint* (Marfuah, et al, 2016: 15). The advantages of *Micrososft PowerPoint* according to (Kamil ,2018) from *Power Point* are as follows: 1) Practical; 2) Provide face-to-face possibilities and observe student responses; 4) Can present various combinations of *clipart, picture,* color, animation and sound to make students more interested.

One of the learning media that Microsoft Power Point can develop is *PowerDroid learning media*. *PowerDroid* is a Learning Media that combines *PowerPoint* and Android into a complete and sustainable media (Budi, 2017). *PowerDroid* stands for *PowerPoint* and *Android*.

PowerDroid *learning media* in learning activities can be used to observe images or videos, present material, watch cinema, evaluate students by doing cool problems, invite students to play *games* and invite students to do *ice breaking* (an activity carried out in order to break the existing atmosphere) through videos and music (Ikhwanuddin, 2019). According to Kasman (in Sitohang, 2021: 108) Android is a mobile phone operating system and touchscreen tablet computer *based* on Linux. Most Android users from kids, teenagers to adults spend time playing *games*. *Games* marketed through the Android market (*Play store*) number in the thousands and do not necessarily have a clear educational concept (Pratama &; Haryanto, 2017: 172).

To create *PowerDroid* learning media, Ispiring Suit is needed. iSpring Suite 9 is an additional application for *PowerPoint*, *where iSpring Suite 9* can convert presentations (PPT / PPS) into SWF (*Shockwave Flash). Pritakinanthi (in Ninawati, et al, 2021: 48) iSpring Suite 9* can be converted in flash, *PowerPoint, HTML5, and MP4* video formats or used as mobile-based media. One useful application to make it easier to convert WEB based applications to APK-based is *Web2Apk* Builder (Pamungkas, 2019)

From observations with 3 grade VIII students, as well as interviews with mathematics subject teachers from September 20 - December 20, 2021 at SMPS Yapphi Pasar Usang, potential and problems were found, namely the habit of students using *smartphones* makes student independence and activeness less directed, this is due to the lack of variation in the use of learning media so that students are bored and less interested in learning mathematics, Students also find it difficult to understand mathematics learning, one of which is straight-line equation material. Teachers realize the importance of using the right media will greatly help learning effectiveness. Teachers also expect the development of media that can facilitate users, attract students' learning interest, and be entertainment such as educational *games*.

Based on the description above, there is a need *for an Education Game* for students. According to Beck & Wade (in Ridoi, 2018: 1) explain that "*Games* are proven attention grabbers, *games* are a good training environment for the real world in organizations that demand collaborative problem solving. According to (Hanafri, et al 2015: 50) "*Education Game* is one type of media used to provide teaching, increase user knowledge through a unique and interesting media".

Many types of games have education in them, according to (Jasson, 2009) here are some types of *games* that have education can be classified as follows: *1) Maze Game; 2) Board Game; 3) Card Game; 4) Quiz Game; 5) Puzzle Games; 6) Sport Game; 7) Racing Game; 8) Simulation Game; 9) Third Person Shooter (TPS).*

The many benefits of *Education Game* according to (Sutopo, 2020) are: 1) Contribution to human abilities; 2) Cheap and flexible; 3) Increase motivation; 4) Feel involved in the scenario; 5) Assist in the achievement of learning objectives; 6) Provide various ways of evaluation.

From the background of the problem described, it is necessary to develop Android PowerPoint-based mathematics learning media accompanied by *math Education Game*. Which is expected to make it easier for students to understand poorly understood mathematical material and can increase students' enthusiasm and interest in learning mathematics so that the author conducted research on "**Development of PowerDroid-based Education Games in mathematics learning for grade VIII junior high school students".**

METHODS

The research method used is *Research & Development* (R&D) with the *Borg and Gall* development model modified by (Sugiyono, 2016). There are 10 research steps,

researchers limit the research steps to 7 steps. This is because it is by the needs and considerations of the length of research time. Here are the research steps: 1) Potential and problems; 2) Data collection; 3) Product design; 4) Design validation; 5) Design revision; 6) Product trials; and 7) Product revisions.

Trial subjects The research was conducted at SMPS Yapphi Pasar Usang involving 4 students and 1 teacher of mathematics subjects on July 6, 2022 to determine the feasibility level of learning media. Students as users or users of the development of this application and later students will provide assessments and suggestions for the application. This is carried out after the completion of expert tests where validators check the correctness of the concepts, forms, and appearance of learning media development to be made, suggestions from validators will be considered for researchers to revise before the media is tested to students.

The data collection instrument in this study used media validation sheets and practicality test questionnaires. The media validation sheet contains data regarding validators' assessments and opinions on learning learning media that are compiled to become guidelines and references in revising media. While the practicality test questionnaire was used to collect data on teacher responses and student responses to the products developed. The validation and practicality sheets will be arranged based on the Likert scale which consists of 5 scales as follows:

Table 1. Expert Validation Assessment Score

Information	Information	Shoes
SS	Very Agree	5
S	Agree	4
RG	Nervous	3
TS	Disagree	2
STS	Very Disagree	1

Source: Sugiyono (2019)

In the implementation of research and development (R & D) according to (Sugiyono, 2019) there are 2 types of data, namely: 1) Quantitative data, namely data processed by formulating numbers. Quantitative data were obtained from validator assessment questionnaire scores (validity test) and student assessment (practicality test). 2) Qualitative data, namely data in the form of descriptions and sentences. This qualitative data is in the form of validators' criticisms and suggestions on the products developed and descriptions of the implementation of small-scale product trials at SMPS Yapphi Pasar Usang.

The data analysis technique used is qualitative data in descriptive form that describes the validity and practicality questionnaire of *PowerDroid-based* Education Game *in* mathematics learning for grade VIII junior high school students, the analysis of the validity and practicality of this media is carried out in several steps as follows:

1. Scores answers with criteria based on Likert scales.
2. Determine the highest score.
3. Highest score = number of validators x number of indicators x maximum score.
4. Determine the sum of the scores of each validator by summing up all the scores obtained from each indicator.
5. Determination of validity and practicality values using the formula:

$$\text{Value} = \frac{jumlah\ skor\ yang\ diperoleh}{jumlah\ skor\ tertinggi} x\ 100\%. \tag{1}$$

6. Provides an validity assessment, and then calculates the number of scores obtained according to the indicators.

The following are the eligibility interpretation criteria from media and material experts' validation assessment.

Table 2.Eligibility interpretation criteria

Valuation	Interpretation Criteria
90% - 100%	Highly Valid
80% - 89%	Valid
65% - 79%	Quite Valid
55% - 64%	Less Valid
≤54%	Highly Invalid

Source: Purwanto (2012, 172)

We then calculated the number of scores obtained according to the indicator. The following is a table of interpretation criteria for the attractiveness of the practicality test proposed by Purwanto.

Table 3.Criteria for Interpretation of attractiveness

Valuation	Interpretation Criteria
86% - 100%	Very Practical
76% - 85%	Practical
60% - 75%	Quite Practical
≤54%	Very impractical

Source: Purwanto (2012, 173)

RESULTS AND DISCUSSION

This study aims to produce *PowerDroid-based* Education Game *media* for grade VIII junior high school students in valid and practical mathematics learning. Before the product trial, *PowerDroid-based* Education Game *media* in mathematics learning for grade VIII junior high school students had been validated.

The validation of this product design was carried out by 2 lecturers of Mathematics Education at Hatta University. 1 material expert lecturer is Dra. Niniwati, M.Pd, and 1 media expert lecturer is Puspa Amelia, S.Si, M.Si. To see the feasibility of the product, it is assessed from the validity and practicality of the media developed. The results of the material validation analysis can be seen in the table below.

Table 4. Results of Material Expert Validation Analysis

No	Assessment Aspect	Shoes	Shoes Max	Value Validity	Criterion
1	Content Eligibility Aspect	50	50	100%	Highly Valid
2	Feasibility Aspects of Presentation	50	50	100%	Highly Valid
3	Language eligibility aspects	40	40	100%	Highly Valid
	Sum	**140**	**140**	**100%**	**Highly Valid**

Table 4. The results of the validator's assessment of the material are in the form of quantitative data. In the feasibility aspect, the content received a score of 50 with 4 assessment indicators and 10 items/statements. In the feasibility aspect, the presentation scored 50 with 4 research indicators and 10 items/statements. Language feasibility scored 40 with 4 assessment indicators and 8 items/statements. The

validator's general assessment of the material is Very valid with an average value of 100%. The media expert validation analysis results can be seen in the table below.

Table 5. Results of Media Expert Validation Analysis

No	Assessment Aspect	Shoes	Shoes Max	Value Validity	Criterion
1	Material	15	15	100%	Highly Valid
2	Illustration	8	10	80%	Valid
3	Media quality and display	10	10	100%	Highly Valid
4	Attraction	8	10	80%	Valid
5	Media efficiency	16	20	80%	Valid
6	Button functions	9	10	90%	Very valid
7	Physical qualities	8	10	80%	Valid
	Sum	**74**	**85**	**87%**	**Valid**

Table 5. The results of validators' assessment of the media are in the form of quantitative data. In the material aspect, it scores 8 with 2 items/statements. In the illustration aspect, it scores 10 with 2 items/statements. Regarding quality and appearance, the media scored 10 with 2 items/statements. In the aspect of attractiveness gets a score of 8 with 2 items/statements.

Regarding media efficiency, it scored 16 with 4 items/statements. In function, the button scores 9 with 2 items/statements. Regarding physical quality, it scored 8 with 2 items/statements. The general validator assessment of the media is valid with an average score of 87%.

Qualitative data from material and media experts are obtained based on suggestions and comments on the developed product. After getting suggestions and comments from experts, the next stage of design revision is carried out until the product is feasible and valid in field trials. After the product is valid, the next stage is product trials. Trials are carried out to determine the level of practicality of the product. The respondents in this small-scale trial amounted to 4 grade VIII students of SMPS Yapphi Pasar Usang and 1 teacher of mathematics subjects. Data obtained from the results of teacher and student assessments can be seen in the following table.

Table 6. Results of Student Practicality Analysis

No	Assessment Aspect	Shoes	Shoes Max	Value Validity	Criterion
1	Interest	78	80	97,5%	Very Practical
2	Material	152	160	95%	Very Practical
3	Language	35	40	87,5%	Practical
	Sum	**265**	**280**	**94,64%**	**Very Practical**

Based on table 6. the results of student assessment of the media in the form of quantitative data. In the aspect of interest gets a score of 78 with 4 items/statements. In the material aspect, it scored 152 with 8 items/statements. In the language aspect, it scored 35 with 2 items/statements. In general, the practicality test assessment by students against *PowerDroid-based* Education Game *media* is very practical with a practicality value of 94.64.09%. Furthermore, the results of student responses or qualitative data at this stage can be seen in table 7.

Table 7. Feedback and Suggestions from Students

Small group test subjects	Assessment Aspect
Student 1	This application is good, because the material is easy to understand and there are learning videos

Student 2	This app is good, on *puzzle games* using mobile legends music which makes it more interesting
Student 3	The appearance of the application is already good, and the use of colors from the application is also interesting
Student 4	The application is very fun, the *games* on the application are also very interesting and the use of music matches the application

From student responses, researchers can analyze that students can understand the material presented in the media, because the material presented has been arranged in a structured manner, in the media also provided learning videos that increase student understanding when drawing straight-line equations. From the students' responses, it can also be seen that students like the use of music and the look and color in the media. Based on the results of responses in the small group trials above, it is known that overall students give positive responses and are interested in using the media that researchers develop—furthermore, the results of teacher practicality. The following is an assessment table on the practicality of media use by 1 mathematics teacher. The data acquisition results at this stage can be seen in table 8.

Table 8. Results of Teacher Practicality Analysis

No	Assessment Aspect	Shoes	Shoes Max	Value Validity	Criterion
1	Interest	15	15	100%	Very Practical
2	Media efficiency	20	20	100%	Very Practical
3	Material	10	10	100%	Very Practical
4	Motivation	5	5	100%	Very Practical
Sum		**50**	**50**	**100%%**	**Very Practical**

Based on table 8, the results of the Master's assessment of the media are quantitative data. In the aspect of interest gets a score of 15 with 3 items/statement In the aspect of media efficiency gets a score of 20 with 4 items/statement. In the material aspect, it scores 10 with 2 items/statements. In the motivation aspect, it scores 5 with 1 item/statement. In general, the assessment of teacher practicality tests on *PowerDroid-based* Education Game *media* is very practical with a practicality value of 100%. We can see the results of teacher responses or qualitative data at this stage in table 9.

Table 9. Teacher's Feedback and Suggestions

Teacher's Name	Assessment Aspect
Rina Oktapianis, S.Pd	There is no improvement, the material is good, and can be used as a learning medium in schools

Based on the teacher's response above, it is known that teachers give positive responses and teachers are interested in using the media that researchers develop in schools. After discussing the results of the trial, then the researcher discussed the advantages of the *developed Media Education* Game, this Media *Education Game* has advantages. Some of the advantages of *PowerDroid-based* Education Game *media* can be seen in table 10.

Table 10. Media *Education Game Excellence*

No	Superiority
1	This media can be used *offline* or *online.*
2	This media display screen can be enlarged and reduced.
3	*Volume* on media can be controlled through the user's android.

| 4 | Data that has been done can be reopened or restarted to the beginning by clicking the home button at the top of the media. |
| 5 | There are 4 different types of *games*, namely, *Galaxy Math Space* which is an *airplane game that is played by sticking one* of the answers, then Quizz game 1 with time and evaluation that can be sent directly to email, *Quizz game* 2 which is not limited by time, and *Puzzle* game in the form of questions that are answered by arranging words / sentences until correct. |

At the time of the product trial, researchers chose one of *the games* that students would play simultaneously. This aims to see if students understand the material presented in the learning media. The results of student learning evaluation are one of the advantages of the *Education Game media* from *quizz game* 1 with time because it has randomized questions. To answer 1 question is given 5 minutes, and the results of student evaluations can be sent directly to the researcher's email so that students can do the questions independently. The following results from one of the student answers sent to *email* can be seen in figure 1 below.
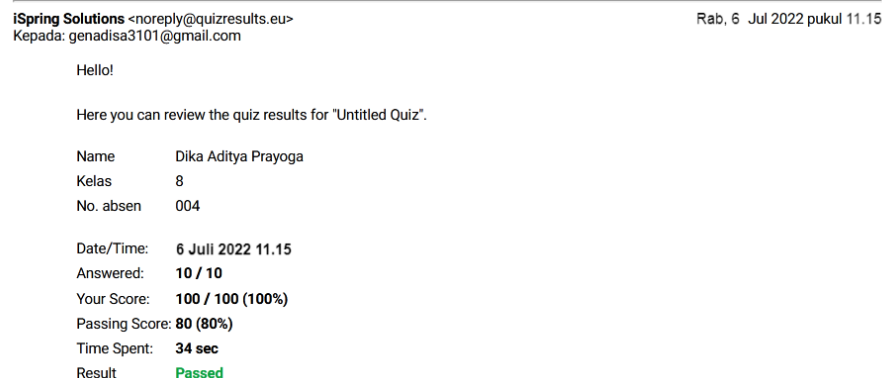

Figure 1. Student evaluation results sent to email

Based on the results of student evaluation, it can be seen from the results *of Time speed* (the fastest time students solve one of the questions) obtained the fastest result of 34 *sec* (seconds), when researchers observe students directly, one of the fastest questions solved is problem number 6, which is to find the gradient (m) of the equation line $y = -5x - 3$, the average student answered correctly with an answer of -5. After the researcher observed, the question that was answered incorrectly by many students was question no. 4, it can be seen the results of one of the students' answers in figure 2 below.

Figure 2. Student results S at no 4

From the work of student S, it can be seen that S entered the wrong value from x1 so that the final result obtained did not match the answer. The researcher also saw error no. 4 from the work of student Y, the following work of student Y can be seen in figure 3 below:

Figure 3. Student Outcome Y at no 5

Based on the work of student Y, it can be seen that student Y is wrong in completing the final stage, namely the value x which is moved to the right segment to −x which should remain positive. This question has a *passing* score of 80, by the KKM score (minimum completeness criteria) at SMPS Yapphi Pasar Usang. If *the score is ≥80, then the result of the student* evaluation is passed*, and vice versa if the passing score is ≤80, the result of the student evaluation fails* . Based on the results of student evaluations when trying learning media, it is known that the *percentage of passing scores* obtained by students on average is ≥ 80, and 1 student gets the highest score of 100.

CONCLUSIONS

Based on the research results, it can be concluded that the development of *PowerDroid-based* Education Games in mathematics learning for grade VIII junior high school students is very feasible to be used as a learning medium in schools and independent student learning. The results of material expert validation obtained a percentage of *100% with "very valid" criteria, the results of media expert validation obtained a* percentage of 87% with "valid" criteria. After the validation was completed, the practicality test of students and teachers continued, the results of student practicality obtained a percentage of *94.64% with the criterion of "very practical", the results of teacher practicality obtained a* percentage of 100% categorized as "very practical". It is also supported by the results of positive teacher and student responses and the results of student evaluations that have met the passing score.

REFERENCES

Budi, Sugeng Setiyo. (2017, Maret 27), *PowerDroid, Multimedia Pembelajaran Interaktif Pendidikan Agama Islam*: http://PowerDroidpai.blospot.com, [13 maret 2022]

Gikas, J., & Grant, M. M. (2013). *Mobile computing devices in higher education: Student perspectives on learning with cellphones, smartphones & social media*. The Internet and Higher Education, 19, 18-26.

Hanafri, M. I., Budiman, A., & Akbar, N. A. (2015). *Game Edukasi Tebak Gambar Bahasa Jawa Menggunakan Adobe Flash CS6 Berbasis Android*. Jurnal Sisfotek Global, 5(2).

Ikhwanuddin, Muhammad (2019) *Penggunaan media pembelajaran PowerDroid dalam kegiatan pembelajaran di SD Hanura Bina Putra Surabaya.* Undergraduate thesis, UIN Sunan Ampel Surabaya.

Jasson. 2009. *Role Playing Game (RPG) Maker – Software Penampung Kreativitas, Inovasi, dan Imajinas Bagi Game Designer*. Yogyakarta: C.V Andi Offset.

Kamil, P. M. (2018). *Perbedaan Hasil Belajar Siswa Pada Materi Sistem Pencernaan Pada Manusia Dengan Menggunakan Media Power Point Dan Media Torso. Bioedusiana*: Jurnal Pendidikan Biologi, 3(2), 64-68.

Marfuah, S., Zulkardi, Z., & Aisyah, N. (2016). *Pengembangan media pembelajaran menggunakan PowerPoint disertai visual basic for application materi jarak pada bangun ruang kelas X*. Jurnal Gantang, 1(1), 45-53.

Ninawati, M., Burhendi, F. C. A., & Wulandari, W. (2021). *Pengembangan E-Modul Berbasis Software iSpring Suite 9.* Jurnal Educatio FKIP UNMA,7(1), 47-54.

Nurita, T. (2018). *Pengembangan media pembelajaran untuk meningkatkan hasil belajar siswa. MISYKAT*: Jurnal Ilmu-ilmu Al-Quran, Hadist, Syari'ah dan Tarbiyah, 3(1), 171-210.

Oktaviani, ignatia (2021) "*Pengembangan Media Pembelajaran Interaktif Berbasis Android Menggunakan Microsoft PowerPoint Terintegrasi Inspiring Suite Pada Materi Koordinasi Manusia kelas XI SMA*". Skripsi. Yogyakarta. Universitas Sanata Dharma

Pakpahan, R., & Fitriani, Y. (2020). *Analisa pemanfaatan teknologi informasi dalam pembelajaran jarak jauh di tengah pandemi virus corona covid-19.* Journal of Information System, Applied, Management, Accounting and Research, 4(2), 30-36.

Pamungkas, C. A. (2019). *Aplikasi penghitung jarak koordinat berdasarkan latitude dan longitude dengan metode euclidean distance dan metode haversine*. Jurnal Informa: Jurnal Penelitian dan Pengabdian Masyarakat, 5(2), 8-13.

Pratama, U. N., & Haryanto, H. (2017). *Pengembangan game edukasi berbasis android tentang domain teknologi pendidikan*. Jurnal Inovasi Teknologi Pendidikan, 4(2), 167-184.

Pratomo, A., & Irawan, A. (2015). *Pengembangan media pembelajaran interaktif berbasis web menggunakan metode Hannafin dan Peck*. Positif, 1(1), 159673.

Purwanto. 2012. *Metodologi Penelitian Kualitatif untuk Psikologi dan Pendidikan*. Yogyakarta: Pustaka Pelajar Offset.

Ridoi, M. (2018). *Cara mudah membuat game edukasi dengan Construct 2*: tutorial sederhana Construct 2.

Rusli, M., Hermawan, D., Supuwiningsih, N. N., & Bali, S. T. I. K. O. M. (2017). *Multimedia pembelajaran yang inovatif: Prinsip dasar dan model pengembangan*. Penerbit Andi.

Sitohang, H. (2021). *Aplikasi E-Learning Berbasis Web untuk Pembelajaran Jarak Jauh*. JSAI (Journal Scientific and Applied Informatics), 4(1), 106-115.

Suardi, M. (2018). *Belajar & pembelajaran*. Deepublish

Sugiyono. (2016). *Metode penelitian kuantitatif, kualitatif dan R&D*. Bandung: Alfabeta.
_____. (2019). *Metode Penelitian & Pengembangan*. Bandung: Alfabeta.

Sutopo, A. H. (2020). *Pengembangan Educational Game*. Topazarta

Tammu, Reisky Megawati. "*Keterkaitan metode dan media bervariasi dengan minat siswa dalam pembelajaran biologi tingkat SMP."* JP (Jurnal Pendidikan): Teori dan Praktik 2.2 (2018): 134-142.

Tarigan, D., & Siagian, S. (2015). *Pengembangan Media Pembelajaran Interaktif Pada Pembelajaran Ekonomi.* Jurnal Teknologi Informasi & Komunikasi dalam Pendidikan, 2(2).