IJIE (Indonesian Journal of Informatics Education)

Research Paper ISSN: 2549-0389

A Development of Android-based Interactive Multimedia in Python Basic Programming Material for Grade 10 Senior High School

***Tiara Nisya Gayatri, Dwi Maryono, Rosihan Ari Yuana**
Informatics and Computer Engineering Education, Faculty of Teacher Training and Education, Universitas Sebelas Maret, Indonesia
Corresponding Email: tiaranisyagayatri27@gmail.com

Abstract:

This research is motivated by the use of learning media that still does not meet the needs of students and raises several learning problems in the informatics learning process, especially basic programming material. Many students feel bored and have difficulty understanding the material presented by the teacher so more learning hours are needed. This study aims to develop Android-based interactive learning media on Python basic programming material for grade 10 senior high school. This study uses the Research and Development (R&D) method with the ADDIE development model. The ADDIE development model consists of 5 stages, namely: (1) Analysis, (2) Design, (3) Development (4) Implementation, and (5) Evaluation. Data collection techniques used were interviews, questionnaires, and literature studies. The analysis technique used is a quantitative descriptive analysis technique. The interactive features developed are interesting Python basic programming materials with learning videos, live code, and quizzes. The results of application validation assessment by media experts were declared very feasible with a percentage score of 94.05% and the results of validation assessment by material experts were declared feasible with a percentage score of 75%. Student response assessment results obtained a percentage score of 81.66% accepted by students. Based on these results, it can be concluded that Android-based interactive learning media on basic Python programming material is suitable for use as a learning media for informatics subjects and can be an alternative solution for student's learning problems.

Keywords: *Android, interactive learning media, Python basic programming*

IJIE (Indonesian Journal of Informatics Education)
Vol 8 Issue 1 2024
DOI: http://dx.doi.org/10.20961/ijie.v8i1.75959
Received: 04/07/23 Revised: 29/07/23 Accepted: 12/06/24 Online: 31/07/24

Introduction

The rapid development of technology and information has a major impact on various human activities, especially in the field of education. In 2017, there were 79.56% of smartphone users based in high school education in Indonesia (Finaka, 2018). This shows that the majority of high school students in Indonesia have personal smartphones, so the opportunities of using smartphones in education are quite large. One of them is using smartphones as a learning media at school. According to Sulisworo, smartphones have the potential to be used as a learning media (Teikuar et al., 2022). The utilization of smartphones as learning media can provide access for students to study anytime and anywhere, more flexible, and save time (Darmaji et al., 2019). Learning media can provide convenience to teachers in conveying messages from the subject material and students feel more effective in receiving the messages conveyed (Akrim, 2018). According to Malik, the use of media in the learning process can increase students' interest in learning something new, generate motivation and stimulate learning activities and even provide psychological influences on students so that learning media can be a solution to assist the teaching and learning process (Indriyani, 2019).

According to Sari and Ardianti (2021), the use of various learning methods and interactive learning media will help teachers create a fun learning environment to increase learning motivation and student activity in learning. Currently learning media has many variations according to technological developments. However, there are still only a few teachers who use technology in designing learning media. According to Puspitarini and Hanif (2019), there are still many teachers who have not utilized technology in the learning process optimally. This is indicated by the lack of knowledge and ability of teachers to understand and know the benefits that can be drawn from using technology as a learning media. Utilization of smartphones as learning media as well still rarely used by teachers (Sarmini, 2020). This can be caused by various factors, one of which is the lack of facilities and infrastructure so that teachers are not used to using the smartphone itself (Rahayuningsih & Muhtar, 2022). This can cause students learning problems. According to Prayitno and Amti, Learning problems are certain conditions experienced by students and hinder the learning process, which can be related to the student's condition or an unfavorable environment. (Yuhana & Aminy, 2019).

Based on the results of interviews with Informatics teacher and 10th grade students from one of the senior high schools in Sukoharjo, it is known that students experience several learning problems, such as difficulties in understanding basic Python programming material, so more hours of learning are needed. During the theoretical learning process, many students feel bored because the teacher still uses PowerPoint as learning media with the lecture method. This is similar to what happened in research conducted by Widada et al. (2022) where some schools still use media conventional learning that is less interesting, which can arise boredom and cause lack of student interest in learning. One effort that can be done to overcome this problem is to use interesting and innovative learning media such as utilizing information and communication technology as a learning media. Therefore, learning media that are more fun and can be used anytime and anywhere.

There are many information and communication-based technologies that can be used as learning media for basic Python programming materials. Gumilar et al. (2021) who developed a progressive web app for learning the Python programming language stated that the product produced meets the main needs expected by users, learning can be done anywhere and anytime using smartphone technology. The advantages of this learning media are that it can be accessed using a laptop or smartphone, and has various features such as material, live code, and quizzes. The drawback of this learning media is that the material is presented only in text form. Slamet and Anistyasari (2021), who developed website-based Online Integrated Development Environment Tools and mobile applications for learning Python programming, stated that the products produced could improve student learning outcomes. The advantages of this learning media are that it can be used on laptops and smartphones, has various features such as code editors and materials. The disadvantages of this learning media are that it requires an internet connection so it cannot be accessed offline and does not have a quiz feature to evaluate students' abilities. Sarmini (2020), who developed Android-based learning media, stated that the use of the resulting media can encourage learning motivation and student curiosity. Anwari et al. (2020) who developed Android learning media stated that the resulting learning media was appropriate and supported independent learning and there were significant changes compared to learning without educational applications. The disadvantage of the two studies is that they do not have a live code feature. The advantages of Android-based learning media are that they are user-friendly, can be used offline, and can be used anytime and anywhere so that they can support students to learn independently.

Based on the description above, it is necessary to develop Android-based interactive learning media on Python basic programming materials for grade 10 senior high school. This Android-based interactive multimedia is a learning media that can be run using a smartphone with the Android operating system. This media presents basic Python programming material clearly and attractively with material, learning videos, live code, and quizzes. This media has the advantage that material can be accessed offline via student’s smartphones so that it can be used anytime and anywhere. This learning media is expected to be an alternative solution for learning problems experienced by 10 grade students.

Research Method

The research method used is the research and development (R&D) method. This research produced the final product, namely an Android-based interactive learning media application for basic Python programming material for grade 10 senior high school. The development procedure used is the ADDIE development model (Analysis, Design, Develop, Implement, and Evaluate). The steps taken are: (1) Analysis is the stage of analyzing the problems that occur to find solutions including analysis of functional requirements and non-functional requirements. (2) Design is the stage of designing learning media that will be developed, such as flowcharts and interfaces. (3) Development is the process of making interactive learning media by the flowcharts and storyboards that have been designed at the design stage, then blackbox testing is carried out which consists of functional and non-functional tests, then media expert and material expert assessments are carried out. (4) Implementation is the stage of conducting application trials by students to determine student responses to interactive learning media applications using a questionnaire instrument. (5) Evaluation

is the stage of product evaluation, namely discussing the results of the assessment that have been carried out, and whether the objectives of the final product have been achieved or not by conducting discussions, managing data, and drawing conclusions from the results of student response assessment so that feasibility can be determined. of Android-based interactive learning media that has been developed.

The subjects in this study consisted of a lecturer with qualifications in the multimedia field as a media expert, informatics teachers with qualifications in informatics field as a material expert, and 27 students of class X.1 from one of the senior high schools in Sukoharjo.

Data collection techniques used is interviews, questionnaires, and literature studies. Interviews were conducted with an Informatics teacher and three 10th grade students from one of the high schools in Sukoharjo. The interview aims to collect data about the existing problems. Questionnaires are used as an instrument of expert and student response assessment to the developed learning media. Media expert and material expert instruments are modifications of expert instruments according to Setiawan (2021). The media expert's instrument consists of aspects of ease of use and navigation, aesthetics, media integration, and technical quality as shown in Table 1.

Table 1. Media Expert Instrument Grid

Aspect	Item
Ease of Use and Navigation	1-6
Aesthetic	7-13
Media Integration	14-15
Technical Quality	16-18

The material expert instrument consists of aspects of suitability, content and objective quality, and instructional quality as shown in Table 2.

Table 2. Material Expert Instrument Grid

Aspect	Item
Suitability	1-5
Content and Objective Quality	6-10
Instructional Quality	11-15

The student response instrument is a modification of the student response instrument according to Lijana et al. (2018). The student response instrument consists of aspects of responses and reactions as shown in Table 3.

Table 3. Student Response Instrument Grid

Aspect	Indicator	Item
Response	Technical Quality	1-5
	Suitability	6-9
Reaction	Usefulness	10-17
	Interest	18-20

Assessment in a questionnaire using a Likert scale with 4 alternative answers, namely Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1).

Data analysis techniques used quantitative descriptive data analysis. To calculate the percentage of diligence results, the formula is:

$$\text{Feasibility percentage (\%)} = \frac{\text{Observed score}}{\text{Expected score}} \times 100\%$$

The results of the feasibility percentage will be used to determine the level of feasibility of the learning media by converting the percentage into the feasibility percentage category presented in Table 4.

Table 4. Feasibility Percentage Category

N.	Percentage (%)	Category
1.	81-100	Very Good/ Very Feasible
2.	61-80	Good/Feasible
3.	41-60	Fairly Good /Quite Feasible
4.	21-40	Not Good/ Less Feasible
5.	<21	Very Unfavorable/Very Unfeasible

Source: (Arikunto in Ernawati & Sukardiyono, 2017)

Result and Discussion

This research produced the final product, namely an Android-based interactive learning media application on basic Python programming material for grade 10th senior high school. The research method used is Research and Development (R&D) with the ADDIE development procedure. The steps taken are analysis, design, development, implementation, and evaluation.

In the analysis stage, an analysis of non-functional and functional requirements is carried out. Analysis of non-functional needs consists of an analysis of student characteristics, minimum smartphone specifications, and the scope of the material. Functional requirements analysis, namely analysis related to the functions needed in the application to be developed. At the analysis stage of student characteristics, problems were obtained, students experienced several learning problems, and difficulties in understanding basic Python programming material, so more hours of learning were needed. During the theoretical learning process, many students feel bored because the teacher still uses learning media in the form of text and PowerPoint using the lecture method. Students prefer learning media in the form of videos and direct practice. In the analysis phase of the minimum smartphone specifications, based on information from students, the minimum specifications used to run learning media applications are the Android operating system version 9 (Pie), a minimum storage space of 100MB, and a screen size of 720 x 1280 pixels. In the analysis stage of the material scope, the material used for the application of instructional media is based on the curriculum used at one of the senior high schools in Sukoharjo for grade 10th semester 2 Informatics subject, namely the topic of basic programming using the Python programming language. Next is the functional requirements analysis stage, based on non-functional requirements analysis, an Android-based interactive learning media application is needed that contains basic Python programming material for grade 10th senior high school. Applications can display materials, learning videos, live code, and quizzes.

The design stage is where the interactive learning media application design is developed. This stage consists of making flowcharts and interfaces of learning media. The flowchart is a reference to make learning media so that all processes can be in line with what has been designed. The interface is used as a reference for the visual appearance of the application during the development process. The flowchart for Android-based learning media applications consists of the main menu and side menu presented in Figure 1 and Figure 2.

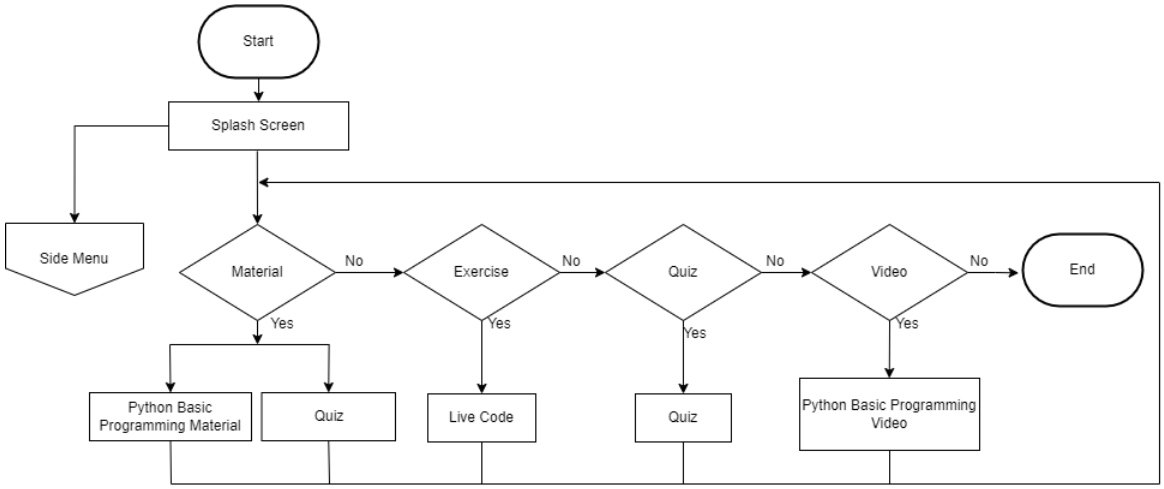

Figure 1. Main Menu Flowchart

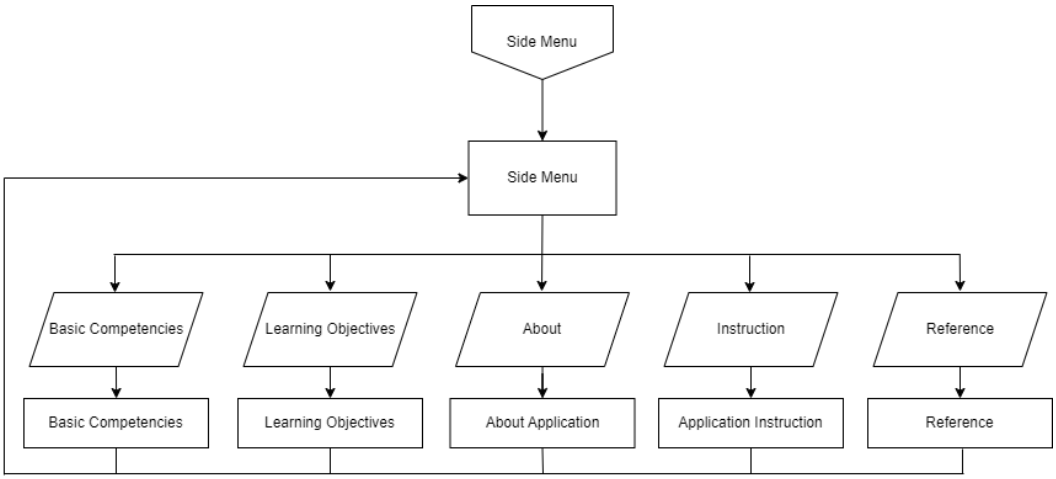

Figure 2. Side Menu Flowchart

When the application is open, it will display a splash screen for a few seconds and then enter the main menu which contains materials, quizzes, exercises and videos. The material menu will display material and quizzes according to the chapter. The quiz menu will display a quiz about the entire material. The exercise will display the live code. The video will display learning videos. The side menu will display several menus namely basic competencies, learning objectives, about, instructions and references.

The development stage is when learning media applications are developed according to the flowchart and interfaces that have been made at the design stage. At this stage, assets are made using Adobe Illustrator, learning videos are made using Canva, and application scripts are made using Flutter resulting an Android-based learning media application with the .apk format.

In interactive learning media applications, there are material pages that contain material in the form of text with illustrations that can make it easier for students to understand the material and quizzes are presented per chapter to evaluate student knowledge. The practice page contains live code which is an embed from the Python compiler webpage, namely Trinket.io so that students can practice coding skills. The quiz page contains multiple-choice quizzes to evaluate student's abilities regarding the basic Python programming material as a whole. The video page contains material in the form of learning videos. The side menu page contains basic competencies, learning objectives, application information, application instructions and references. The display of learning media that has been developed is presented in Figure 3.

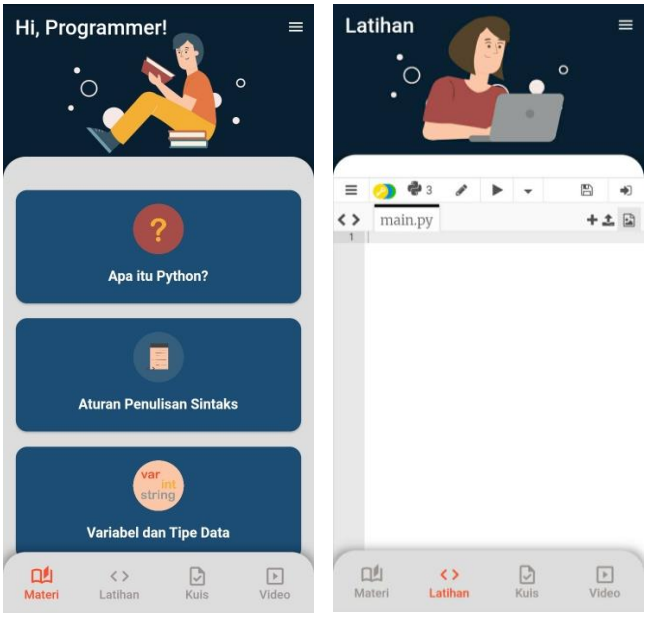

Figure 3. Display of Interactive Learning Media

After the learning media has been developed, blackbox testing is carried out which consists of functional and non-functional tests to find out whether the application can work well on several different device type. Then a media expert and material expert validation test was carried out to find out whether the application that had been developed was feasible to be tested. The media expert validation test was carried out by lecturers with qualifications in the multimedia field. The media expert validation questionnaire instrument consists of 4 aspects with 18 statement items. The results of the media expert validation test are presented in Table 5.

Table 5. Media Expert Validation Results

N.	Aspect	Percentage	Category
1.	Ease of Use and Navigation	95,83%	Very Feasible
2.	Aesthetic	92,86%	Very Feasible
3.	Media Integration	87,5%	Very Feasible
4.	Technical Quality	100%	Very Feasible
Total		94,05%	Very Feasible

In the media expert validation, the final result was 94.05% which was included in the "Very Feasible" category. Media experts provide comments or suggestions to improve the sound of one of the learning videos that are too small and provide a fade-out effect at the end of the background music in each learning video. Based on the results of this assessment, it can be seen that learning media is suitable for the learning process with revisions according to comments and suggestions from media experts.

Furthermore, a material expert validation test was carried out by the Informatics teacher with qualifications in the informatics field. The material expert validation instrument consists of 3 aspects with 15 statement items. The results of the material expert validation test are presented in Table 6.

In the validation of media experts, the final result was 75% which was included in the "Feasible" category. Media experts provide comments or suggestions that the application of learning media is good and in accordance with learning objectives but there is no report on the results for the quiz section. Based on the results of this assessment, it can be seen that learning media is feasible to be used in the learning process of basic Python programming material.

Table 6. Material Expert Validation Results

N.	Aspect	Percentage	Category
1.	Suitability	75%	Feasible
2.	Content and Objective Quality	75%	Feasible
3.	Instructional Quality	75%	Feasible
Total		75%	Feasible

The implementation stage is the stage where the student response test is carried out. The trial was carried out by class X.1 from one of the senior high schools in Sukoharjo with a total of 27 students in class X.1. This trial aims to determine student responses to interactive learning media based on Android that has been developed. During the trial, students were asked to download the learning media application file via the link provided. Then students try to operate the features in the learning media application. The features of the learning media application consist of materials, exercises, quizzes, and learning videos. After students have finished trying all the features of the learning media application, students are asked to fill out a student response questionnaire. The student response test questionnaire instrument consists of 2 aspects, namely the response and reaction aspects with 20 statement items. The results of the student response test are presented in Table 7.

Table 7. Student Response Test Results

N.	Aspect	Indicator	Percentage	Category
1.	Response	Technical Quality	82,04%	Very good
2.		Suitability	89,12%	Very good
3.	Reaction	Usefulness	80,79%	Good
4.		Interest	74,69%	Good
Total			81,66%	Very good

In the student response test, a result of 81.66% was obtained which was included in the "Very Good" category. There are several statement items on the usefulness indicator that refer to the problems experienced by students. In the statement item, "Application can help students more effectively to understand basic programming material", the percentage score obtained was 86.11% which was in the "Very Good" category. In the statement item "Students don't feel bored when learning using the application", the percentage score obtained was 82.41% which was in the "Very Good" category. In the statement item "Applications can motivate students to learn basic programming material", the percentage score obtained was 76.85% which was in the "Good" category. In the statement item "The application is in accordance with student needs", the percentage score obtained was 78.7% which was in the "Good" category. There are several comments, that is the application of learning media is good and interesting, and the material is suitable and easy to understand. Then the suggestions from students were that application displays such as colors and image illustrations could be more varied, Adding games to make learning more fun, and application tutorials should be placed at the beginning.

The evaluation stage is the stage of discussion, data management, and conclusion. Based on the results of the research as a whole, it can be concluded that the Android-based interactive learning media that has been developed is very feasible and accepted by students to use in learning basic Python programming. This learning media can be an alternative solution to student's learning problems because it is easy to use and the material is easy to understand so it can help students who have difficulty understanding the material, interesting and fun media can reduce student boredom during the learning process and can provide motivation to increase student's interest in learning basic Python programming material. As Chuang stated, technology-based learning media makes learning more fun and has a positive impact on student learning motivation (Cahyana et al., 2021). The advantages of the developed learning media application are that it can be operated easily, has an attractive appearance, and can be used anywhere and anytime. The lack of this application is that the material is only limited to basic Python programming, and the application does not yet have a database system

Conclusion

Based on the results of the research conducted, the conclusions obtained are that interactive learning media based on Android have been produced on basic Python programming material for grade 10th senior high school students that are feasible to use. The results of the learning media feasibility test obtained a media expert validation score with a percentage of 94.05% which is included in the "Very Feasible" category and a material expert validation score with a percentage of 75% which is included in the "Feasible" category. Then the student response test obtained a percentage of 81.66% accepted by students. Therefore, Android-based interactive learning media on Python basic programming materials is feasible to be used as learning media on Python basic programming materials and can be an alternative solution to overcome learning problems experienced by students.

References

Akrim, M. (2018). Media Learning in Digital Era. *Proceedings of the 5th International Conference on Community Development (AMCA 2018)*. https://doi.org/10.2991/amca-18.2018.127

Anwari, T., Shodiqin, A., & Priyolistiyanto, A. (2020). Pengembangan Media Pembelajaran Berbasis Android pada Pemrograman Dasar Pascal. *Jurnal Penelitian dan Pengembangan Pendidikan*, *4*(1), 123–134. https://doi.org/10.23887/JPPP.V4I1.24782

Cahyana, U., Fitriani, E., & Utari, W. (2021). Development of mobile learning integration with scientific approaches on electrolyte solution and redox reaction. *Journal of Physics: Conference Series*, *1869*(1). https://doi.org/10.1088/1742-6596/1869/1/012036

Darmaji, Kurniawan, D. A., Astalini, Lumbantoruan, A., & Samosir, S. C. (2019). Mobile learning in higher education for the industrial revolution 4.0: Perception and response of physics practicum. *International Journal of Interactive Mobile Technologies*, *13*(9). https://doi.org/10.3991/ijim.v13i09.10948

Ernawati, I., & Sukardiyono, T. (2017). Uji Kelayakan Media Pembelajaran Interaktif pada Mata Pelajaran Administrasi Server. *Elinvo (Electronics, Informatics, and Vocational Education)*, *2*(2), 204–210. https://doi.org/10.21831/ELINVO.V2I2.17315

Finaka, A. W. (2018). *66,3% masyarakat Indonesia Memiliki Smartphone*. IndonesiaBaik.id. https://indonesiabaik.id/infografis/663-masyarakat-indonesia-memiliki-smartphone-8

Gumilar, M. D., Sembiring, F., & Erfina, A. (2021). Implementasi Progressive Web App pada Sistem Informasi E-learning untuk Pembelajaran Bahasa Pemrograman Python. *Jutisi : Jurnal Ilmiah Teknik Informatika dan Sistem Informasi*, *10*(2), 309–318. https://doi.org/10.35889/JUTISI.V10I2.658

Indriyani, L. (2019). Pemanfaatan Media Pembelajaran Dalam Proses Belajar Untuk Meningkatkan Kemampuan Berpikir Kognitif Siswa. *Prosiding Seminar Nasional Pendidikan FKIP*, *2*(1), 17–26. https://jurnal.untirta.ac.id/index.php/psnp/article/view/5682

Lijana, L., Panjaitan, R. G. P., & Wahyuni, E. S. (2018). Respon Siswa terhadap Media Pembelajaran Komik pada Materi Ekologi di Kelas X SMA. *Jurnal Pendidikan dan Pembelajaran Khatulistiwa (JPPK)*, *7*(3). https://doi.org/10.26418/JPPK.V7I3.24511

Puspitarini, Y. D., & Hanif, M. (2019). Using Learning Media to Increase Learning Motivation in Elementary School. *Anatolian Journal of Education*, *4*(2), 53–60. https://doi.org/10.29333/aje.2019.426a

Rahayuningsih, Y. S., & Muhtar, T. (2022). Pedagogik Digital Sebagai Upaya untuk Meningkatkan Kompetensi Guru Abad 21. *Jurnal Basicedu*, *6*(4). https://doi.org/10.31004/basicedu.v6i4.3433

Sari, P. P., & Ardianti, D. (2021). Implementation of Problem Based Learning (PBL) on Interactive Learning Media. *Journal of Technology and Humanities*, *2*(2). https://doi.org/https://doi.org/10.53797/jthkkss.v2i2.4.2021

Sarmini, A. (2020). Pengembangan media pembelajaran interaktif mata pelajaran pemrograman dasar pada siswa kelas X di SMK N 1 Batam. *Technical and Vocational Education International Journal Vol. 1 No. 1*, *1*(1), 11–16. https://www.mand-ycmm.org/index.php/taveij/article/view/4

Setiawan, W. (2021). Pengembangan Media Pembelajaran Berbasis Android dengan App Inventor pada Materi Perangkat Lunak Pengolah Kata. *JUWARA: Jurnal Wawasan Dan Aksara*, *1*(1), 37–46. http://jurnal.smpharapanananda.sch.id/index.php/juwara/article/view/8

Slamet, J., & Anistyasari, Y. (2021). Pengembangan NiceRoom Sebagai Online Integrated Development Environment

Tools untuk Meningkatkan Hasil Belajar Siswa pada Pembelajaran Python Programming di SMKN 1 Cerme. *IT-Edu : Jurnal Information Technology and Education*, *6*(2), 128–138. https://ejournal.unesa.ac.id/index.php/it-edu/article/view/45994

Teikuar, Y. J., Nenohai, J. M. H., & Samo, D. D. (2022). Pengembangan Media Pembelajaran Berbasis Android Pada Materi Sistem Persamaan Linier Dua Variabel Untuk Siswa Kelas VIII SPMN 2 Kupang. *Fraktal: Jurnal Matematika dan Pendidikan Matematika*, *3*(1), 25–38. https://doi.org/10.35508/FRACTAL.V3I1.5629

Widada, Rosyidi, A., & Handoko. (2022). Multimedia Interaktif Pembelajaran Matematika Bangun Ruang Berbasis Adobe Flash. *Jurnal Teknologi Informasi*, *8*(2), 167–176. https://ejournal.urindo.ac.id/index.php/TI/article/view/2773

Yuhana, A. N., & Aminy, F. A. (2019). Optimalisasi Peran Guru Pendidikan Agama Islam Sebagai Konselor dalam Mengatasi Masalah Belajar Siswa. *Jurnal Penelitian Pendidikan Islam*, *7*(1), 79. https://doi.org/10.36667/JPPI.V7I1.357