IJIE (Indonesian Journal of Informatics Education)

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

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Abstract:

This research is motivated by the use of learning media that still needs to meet the needs of students and raises several learning problems in the informatics learning process and fundamental programming material. Many students feel bored and need help understanding the material the teacher presents, so more learning hours are needed. This study aims to develop Android-based interactive learning media on Python primary 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 the application validation assessment by media experts were declared very feasible with a percentage score of 94.05%, and the results of the 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%, which students accepted. Based on these results, it can be concluded that Android-based interactive learning media on primary 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.

Introduction

The rapid development of technology and information significantly impacts various human activities, especially in education. In 2017, 79.56% of smartphone users were based in high school education in Indonesia (Finaka, 2018). This shows that most high school students in Indonesia have personal smartphones, so the opportunities to use smartphones in education are pretty extensive. One of them is using smartphones as a learning medium at school. According to Sulisworo, smartphones can be used as a learning medium (Teikuar et al., 2022). Using smartphones as learning media can provide students with access to study anytime and anywhere, be 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 will 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, 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, only a few teachers still use technology in designing learning media. According to Puspitarini and Hanif (2019), many teachers still have not optimised technology in the learning process. This is indicated by teachers' lack of knowledge and ability to understand and know the benefits of using technology as a learning medium. Teachers still rarely use smartphones as learning media (Sarmini, 2020). This can be caused by various factors, including the lack of facilities and infrastructure, so 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 that hinder the learning process, which can be related to the student's condition or an unfavourable environment. (Yuhana & Aminy, 2019).

Based on the results of interviews with an 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 primary Python programming material, so more hours of learning are needed. Many students expressed boredom during the theoretical learning process because the teacher still uses PowerPoint as a learning medium in the lecture method. This is similar to what happened in research conducted by Widada et al. (2022) some schools still use media for conventional learning that is less interesting, which can create boredom and cause a lack of student interest in learning. One effort that can be made to overcome this problem is to use exciting and innovative learning media, such as utilising information and communication technology as learning media. Therefore, learning media that are more fun and can be used anytime and anywhere.

Many information and communication-based technologies can be used as learning media for basic Python programming materials. Gumilar et al. (2021) who developed a progressive web app for learning Python, stated that the product meets users' primary needs; 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 and 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 in learning independently.

Based on the description above, developing Android-based interactive learning media on Python basic programming materials for grade 10 senior high school is necessary. This Android-based interactive multimedia is a learning media that can be run using a smartphone with the Android operating system. This media presents primary 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 10th-grade students.

Research Method

The research method used is the research and development (R&D) method. This research produced the final product: an Android-based interactive learning media application for primary Python programming material for grade 10 senior high school. The development procedure used is the ADDIE development model (Analysis, Design, Development, Implementation, and Evaluation). The steps taken are as follows: (1) Analysis is the stage of analysing the problems that occur to find solutions, including analysis of functional 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 using the flowcharts and storyboards designed at the design stage. Blackbox testing, which consists of functional and non-functional tests, is carried out, and 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 the 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 are 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 expert and student response assessment instruments for 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 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 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 four 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: 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 analysing 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 primary Python programming material, so more hours of learning were needed. During the theoretical learning process, many students feel bored because the teacher still uses the lecture method to use learning media in the form of text and PowerPoint. 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 primary 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 align with what has been designed. The interface is used as a reference for the application's visual appearance during the development process. The flowchart for Android-based learning media applications consists of the main and side menu presented in Figure 1 and Figure 2.
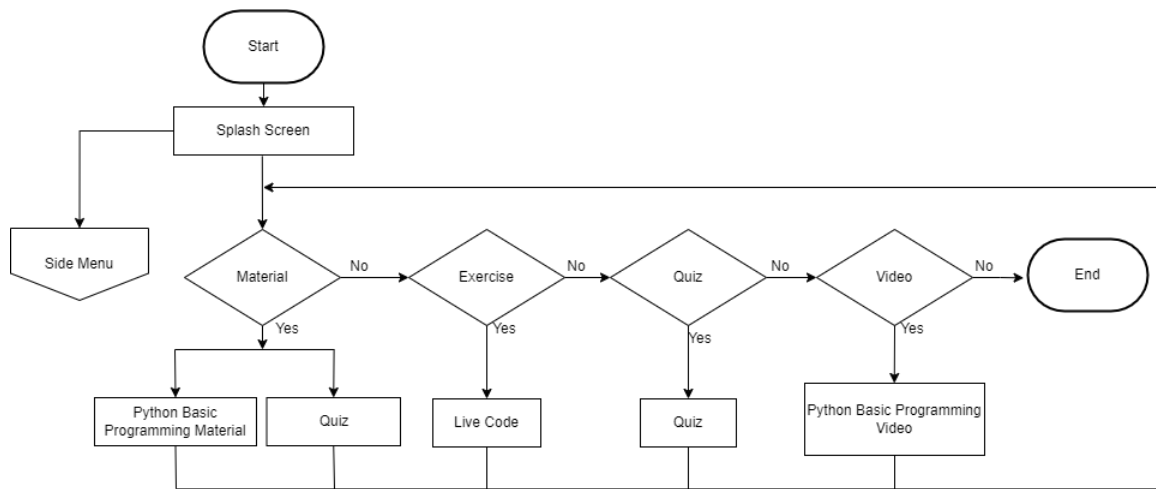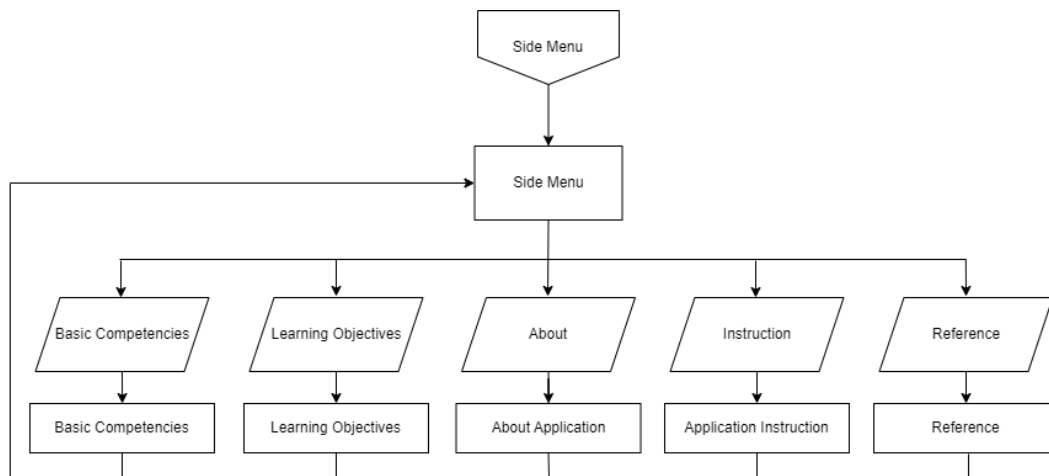
Figure 1. Main Menu Flowchart

Figure 2. Side Menu Flowchart

When the application is open, it will display a splash screen for a few seconds. 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: basic competencies, learning objectives, about, instructions and references.

The development stage is when learning media applications are developed according to the flowchart and interfaces 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 in 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 embedded in the Python compiler webpage, namely Trinket.io, so that students can practice coding skills. The quiz page contains multiple-choice quizzes to evaluate students' abilities regarding the primary Python programming material. The video page contains material in the form of learning videos. The side menu page contains essential competencies, learning objectives, application information, instructions, and references. The display of learning media that has been developed is presented in Figure 3.
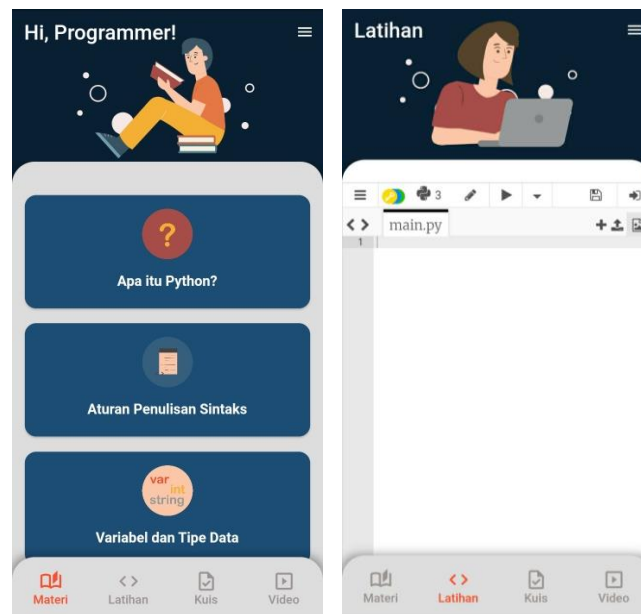
Figure 3. Display of Interactive Learning Media

After the learning media has been developed, black box 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 types. 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 test. Lecturers with qualifications in the multimedia field carried out the media expert validation test. The media expert validation questionnaire 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 is 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, the Informatics teacher with qualifications in the informatics field carried out a material expert validation test. 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 follows learning objectives, but there is no report on the results of the quiz section. Based on the results of this assessment, it can be seen that learning media is feasible to use in the learning process of primary Python programming material.

The implementation stage is 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 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

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, 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 do not 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 by student needs", the percentage score obtained was 78.7%, which was in the "Good" category. There are several comments: the application of learning media is good and exciting, and the material is suitable and easy to understand. Then the suggestions from students were that application displays such as colours and image illustrations could be more varied, games to make learning more fun, and application tutorials should be placed at the beginning.

The evaluation stage is discussion, data management, and conclusion. Based on the results of the research, it can be concluded that the Android-based interactive learning media that has been developed is 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 primary Python programming material. As Chuang stated, technology-based learning media makes learning more fun and positively impacts 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 research results, 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 of 94.05%, which is included in the "Very Feasible" category, and a material expert validation score of 75%, which is included in the "Feasible" category. Then, the student response test obtained a percentage of 81.66%, which students accepted. 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.

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