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Development Of Interactive Learning Multimedia With Challenge Based Learning To Empower Vocational Students' Problem-Solving Ability

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ABSTRACT

Based on the results of observations and interviews at SMK Negeri 12 Malang and several SMKs in Malang, it shows that, (1) Lack of adequate and easily accessible learning resources; (2) Learning resources only rely on material demonstrations with the help of .pdf and .ppt files; (3) The low problem solving ability of students in solving programming problems; (4) The material only refers to BSE whose competence is not in accordance with the current curriculum; and (5) Lack of use of smartphones by students in learning activities. This research and development aim to develop, test the feasibility, and determine the effect of PWDPB application learning media on students' problem-solving abilities. The research and development model adopts the ADDIE development model. The results of material validation by 2 experts obtained a percentage of 89.13%, the results of media validation by experts obtained a percentage of 92.73%, the results of small group trials obtained a percentage value of the media feasibility level of 78.32%, and 88.93% for In large groups, the level of media influence on students' problem solving abilities in small groups obtained a percentage of 74.42% and 85.69% in large groups. Based on the data from the validation and trial results, the PWDPB application learning media can be concluded. As follows: (1) the overall feasibility through the evaluation stage, the response criteria are quite feasible; (2) The effect of the product on the user's problem-solving ability obtained a response from the user with quite good criteria.

I. INTRODUCTION

Learning media has a close relationship with the success of achieving the goals of a learning [1]. Web and mobile programming subjects are included in the C3 category in the 2018 revised 2013 Curriculum structure, so it is important for RPL students to master the subject of expertise packages through adequate and easily accessible learning resources.

SMK Negeri 12 Malang is one of the schools that has implemented the 2013 revised 2018 curriculum in Malang City. The results of observations and interviews with teachers, as well as the authors know from the results of observations during the Field Practice Study activities at SMK Negeri 12 Malang. Information was obtained that in the learning process students were given material that was delivered directly by the teacher using whiteboard media and the help of files with pdf and ppt extensions. So that learning activities tend to be teacher-centered.

The policy of the principal of SMK Negeri 12 Malang allowing students to bring and use smartphones to school aims to make learning at school more innovative and students more independent in learning because students can study anywhere, but in practice the use of smartphones is only limited to searching for material via the internet. just. In addition, when browsing the subject matter, students find it difficult to find the desired subject matter, because the scope of the material found on the internet is less or too broad, so the teacher must provide time for students to make notes in their respective books about the material. has been presented through media with pdf and ppt extensions during class hours. The activity of

recording the material is not effective, because it takes time and is boring in learning activities.

II. Literature Review

One way that learning objectives can be achieved is to use learning media that can make students motivated. Interactive learning media can provide motivation and enthusiasm for students in the learning process [2]. Multimedia is a tool to help convey messages that combine several elements such as text, images, graphics, photos, sounds, films, and animations into a unified whole [3]. The use of multimedia in learning activities can support active learning and create student-centered learning and provide flexibility to improve the quality of student learning in the classroom [4]. Previous research produced an interactive multimedia product of technical measurement for vocational students and concluded that interactive media is very effective in improving students' understanding, compared to conventional media only [5].

Learning media needs to be supported by learning models that can make students active, the CBL (challenge-based learning) model is a new learning that combines problem-based learning, project-based learning, and contextual learning. The research that has been carried out by Mushawwir state that integrating the model into learning media produces a challenge-based learning-based digital web programming module for the Windows operating system that can foster learning activities [6]. According to Tajuddin, Challenge Based Learning is suitable for use by vocational education level students to improve vocational skills and soft skills that can help students solve problems in the real world [7]. The ability to solve problems in the context of learning is done to develop and sharpen knowledge, understanding and abilities [8]. Learning media can help students improve their problem-solving skills according to research that has been carried out, namely the development of interactive multimedia for problem solving in mathematics [9].

The term mobile learning (m-learning) is a form of learning that utilizes small electronic devices so that they can be put in a shirt or jacket pocket and easy to carry around such as mobile phones, portable digital assistants (PDAs) and iPods. Advances in technology are rapidly creating mobile learning (m-learning) which provides extraordinary opportunities in the field of education, namely collaboration during studies, the prospect of learning everywhere that is not limited by space and time and easy-to-use application design. M-learning gives students the opportunity to learn anywhere and anytime [10].

Mobile learning-based interactive multimedia-based learning media for programming language courses developed by Muchlis produces alternative learning media that are practical and effective for use by teachers [11]. Mobile learning can function as a complement (complement) in learning activities and help students to increase knowledge and overcome students' difficulties in understanding the material in books [12].

The development of learning media requires the help of software that is used to realize the design into a tool that can be operated. Ionic Framework is used to develop hybrid mobile applications with web technologies, such as CSS, HTML5 and AngularJS as engines. The use of the Ionic framework allows developers to create applications for several operating system platforms using only a web development language or called cross platform [13]. Ionic has stable and powerful characteristics so that application loading times are faster and lighter because it only requires small resources [14].

Based on this, this study will develop interactive multimedia-based learning media for the android platform in web programming and mobile devices by integrating challenge-based learning models and is expected to be able to grow students' problem-solving skills in programming, which is intended for class XI vocational students in the program. software engineering expertise. The author hopes that the development of learning media can be an alternative learning media that can be a solution to the problems above.

III. Methods

Research and development methods (Research and Development) are research methods used to produce certain products, and test the effectiveness of these products. Development research is a method used to produce a product and test the effectiveness of the product made [15]. In this study, the product that the author developed was in the form of interactive multimedia learning media based on Android containing challenge-based learning with the name "PWDPB Learning Application" with the hope of supporting the needs of students during the learning process and as long as students want to use it to study anywhere and anytime.

This PWDPB learning media development model adapts the ADDIE development model which consists of five stages which include analysis, design, development, implementation and evaluation [16]. The following is a chart of the stages of the ADDIE development model shown as in Fig. 1

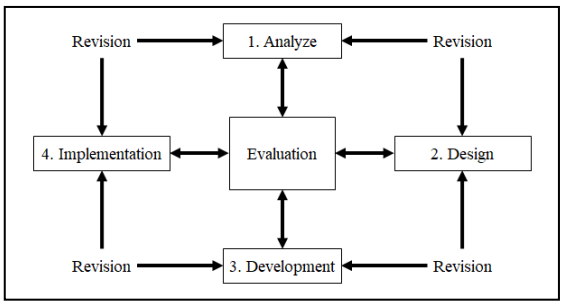

Fig. 1. ADDIE Development Model

The PWDPB application learning media before being declared valid and feasible to be used as learning media for web programming and mobile devices, of course, has gone through several stages of testing, namely:

Material Expert Validation

Material expert validation was carried out to determine whether or not the PWDPB application learning media was feasible and to find out the shortcomings and potential of the product that had not been maximized in terms of the quality of the material contained in the PWDPB application learning

media. Material expert validation is carried out by validators 2 material experts who have taught web programming and mobile devices for at least 1 year or have taught courses relevant to web and mobile programming lessons.

Media Expert Validation

Media expert validation was carried out to determine whether or not the PWDPB application learning media was feasible and to find out the shortcomings and potential of the product that had not been maximized in terms of the quality of the PWDPB application learning media. Media expert validation is carried out by media expert validators who have expertise in mobile learning and have taught mobile learning courses.

Test by User

The trial was carried out in 2 groups, namely a small group in class XII RPL-2 and a large group trial using 2 classes, XI RPL-1 and XI RPL-2 at SMK Negeri 12 Malang. The data collection instrument used by the author in research and development of learning media for the PWDPB application is in the form of a questionnaire. The results of data collection will be analyzed qualitatively and quantitatively.

Qualitative data were obtained from suggestions and comments on the product feasibility validation questionnaire instrument sheet for material experts and media experts, and the product feasibility validation questionnaire instrument sheet and student problem solving ability questionnaires.

Quantitative data in the form of assessment results from product feasibility validation questionnaires by material experts, product feasibility questionnaires by media experts, and product feasibility questionnaires and student problem solving abilities, were analyzed using percentage descriptive analysis techniques. The following is a quantitative data processing technique using a descriptive percentage formula (1) according to Akbar [17], as follows:

$$V = \frac{TSe}{TSh} \; x \; 100\% \qquad (1)$$

Information:
V = Validity
TSe = Total empirical score
TSh = Total maximum score

IV. Result and Discussion

The results of research and development produce a product in the form of interactive multimedia learning media that is run on a smartphone with an android operating system with the name "PWDPB Learning Application". The application contains three basic competencies or three materials from Web and Mobile Programming subjects, namely: (1) Web server application technology and server-side scripting programming; (2) control structure on the program; (3) Functions in the program. The PWDPB Learning Application is made with Ionic, which is an open source framework that can create hybrid mobile-based applications with web technology.

This PWDPB learning application can be run on android smartphones and computers with the help of an android emulator, this application requires an internet connection to be able to connect to the database as a place to store user information. The minimum required specifications of an android smartphone or the minimum configuration of an android emulator can be seen in Fig. 2.

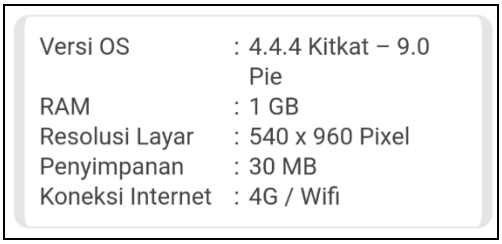

Fig. 2. Minimum Specifications for PWDPB Application

The PWPB Learning Application has points and ranks. The following below will discuss the points and ranks contained in the application.

Point Earning

Points can be earned by users when doing certain activities on the application, such as: completing challenges, reading materials, watching videos, doing test questions and quizzes. The point information can be seen by the user on the screen on the top left with a star symbol, as shown in Fig. 3.

Fig. 3. Display of Points Earned in Learning Media

Rank in Game

The illustration in Fig. 4 shows the rank that can be achieved by the user in this application. The rank level is determined based on the number of points collected by the user.

Fig. 4. The Rank in the PWDPB Learning Media

Application Interface

The following will show the appearance of the PWDPB learning application as shown in Fig. 5.

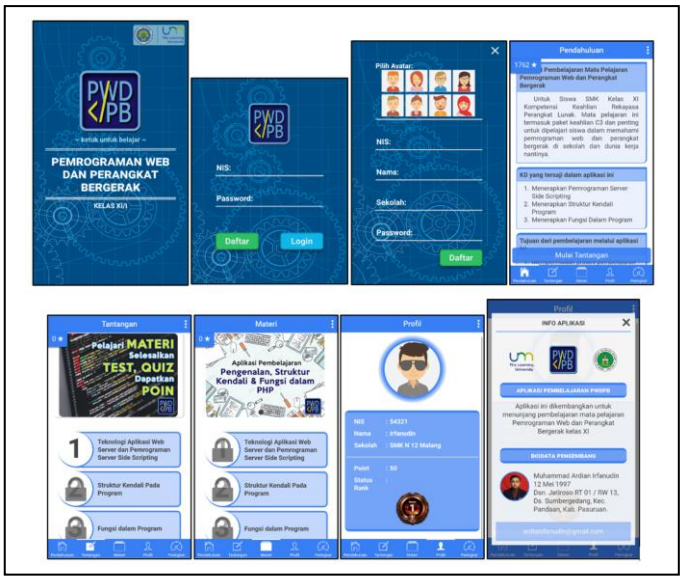

Fig. 5. Overall View of Learning Media

Application Test Data Serving

The presentation and results of data analysis are the presentation of the results of material expert validation data, media expert validation, and media testing. The data obtained in the form of quantitative data using percentage calculations [17] and qualitative data in the form of comments and suggestions. The following is a summary of the results of data analysis.

TABLE I. DATA ANALYSIS RESULTS

Data	Max. Score	Score	%
Material expert validation 1	28,5	28,75	99,13
Material expert validation 2	22,5	28,75	79,13
Media expert validation	51	55	92,73
Media testing in small groups	450,3	575	78,32
problem solving ability level (small group)	223,25	300	74,42
Media testing in large groups	1534	1725	88,93
problem solving ability level (large group)	771,25	900	85,69

Validation of the feasibility of the PWDPB learning application product in terms of material was carried out by 2 material experts, namely: material expert 1 and material expert 2. Validation by material expert 1 gets an average percentage value of 99.13% and validation by material expert 2 gets an average percentage value of 79.13%, so that the average percentage value of the two material experts gets 89.13%. According to the eligibility criteria, the validity of the percentage results is in the range of 85.01% - 100.00%, which means that the feasibility level of the PWDPB learning application product is included in the Very Eligible category or can be used without revision.

Validation of the feasibility of the PWDPB learning application product in terms of media was carried out by media experts. Validation of product feasibility by media experts gets an average percentage value of 92.73% According to the eligibility criteria for the validity of the results, the percentage is in the range of 85.01% - 100.00%, which means that the feasibility level of the PWDPB learning application product is included in the Very Eligible category. or can be used without revision.

A small group trial of the PWDPB learning application was conducted on 15 students of class XII RPL-2. The PWDPB application learning media trial was intended to obtain 2 assessments, namely: an assessment of the level of product feasibility and an assessment of the level of student problem solving abilities. The assessment of the product feasibility level gets an average percentage value of 78.32%. According to the eligibility criteria, the validity of the results of the percentage is in the range of 70.01% - 85.00%, which means that the feasibility level of the PWDPB learning application product is included in the category of Fairly Eligible or can be used with minor revisions.

The assessment of the level of problem-solving ability of students gets an average percentage value of 74.42%. According to the eligibility criteria, the validity of the percentage is in the range of 70.01% - 85.00%, which means that the level of influence of PWDPB learning applications on students' problem-solving abilities is included in the Good Enough category.

The large group trial of the PWDPB learning application was conducted on 45 students of class XI RPL-1 and XI RPL-2. The PWDPB application learning media trial was intended to obtain 2 assessments, namely: an assessment of the level of product feasibility and an assessment of the level of student problem solving abilities. The assessment of the product feasibility level gets an average percentage value of 88.93%. According to the eligibility criteria, the validity of the percentage results is in the range of 85.01% - 100.00%, which means the feasibility level of the PWDPB learning application product is in the Very Eligible category or can be used without the need for revision. The resulting learning media is easy to use, attractive, simple and can be used anywhere. These results are consistent with those found in Kuswanto's research which developed an android-based learning media for class XI class network operating system subjects. That, good visual communication aspects can improve (user friendly) or ease of use of the application [18].

Assessment of the level of problem solving ability of students to get an average value of 85.69% percentage. According to the eligibility criteria, the validity of the percentage is in the range of 85.01% - 100.00%, which means that the level of influence of PWDPB learning applications on students' problem solving abilities is included in the Very Good category. The findings of this study are relevant to previous research conducted by Hevy Risqi Maharani which concluded that the development of interactive multimedia in learning is practical and effective for improving students' problem solving abilities [19].

V. CONCLUSION

Based on the results of the research and discussion, it can be concluded that the products produced in this research and

development are interactive multimedia learning media for web programming subjects and android-based mobile devices containing challenge-based learning, suitable for use in learning activities to foster problem solving abilities of class XI RPL students. The results of developing PWDPB learning applications certainly still have limitations, namely the material developed is still limited to web programming. Therefore, it is necessary to develop PWDPB learning applications for web programming materials and other mobile devices.

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