Development of Problem-Based Learning (PBL) Based Interactive Media in Basic Computer and Network Subjects

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ABSTRACT
This research is motivated by the limited learning media that students can use wherever they are, as well as limited learner time in class causing low student learning outcomes. The purpose of this study is to develop an interactive media based on problem-based learning at SMK Negeri 1 Bungo that is valid, practical and effective. This media is designed to assist students in learning by utilizing information and communication technology, so that learning can be done in class directly or outside the classroom independently without having to be tied to time and place. Design This research uses four-D whose steps consist of define, design, develop, and disseminate. This type of data is primary data where the data is obtained directly from the source, namely schools, teachers, experts and students. The data analysis technique used is a descriptive analysis technique, namely by describing the validity, practicality and effectiveness of the learning media developed. Based on the findings of 0.83 media validity values with valid categories, and 0.85 material validity. The media developed is practical with a practicality value from direct observation of 89.86 from the aspect of convenience, 86.28 from the aspect of time, and 87.46 from the aspect of use, from the teacher’s response of 89.55% and the student response of 87.17%, and is effective in improving student understanding obtained from the calculation of the gain score which was obtained by 0.69 with a moderate category. So that it can be implied that android-based interactive learning media is valid, practical, and effective to be used as a medium for basic computer and network learning.

Keywords: Media Interaktif, Problem Based Learning, Computers and Networks

INTRODUCTION
The development of technology is very rapid throughout the world, including the people of Indonesia. With the presence of technology, the creation of new ideas or ideas in every field, including the field of education. The benefits of technology in the field of education are to assist educators in the implementation of learning activities so that the output
produced is more competent, quality and the quality of education in Indonesia also increases.

In line with the National Education System Law Number 20 of 2003 article 3, article 15 states that the most important thing about vocational education is that students are equipped with vocational knowledge to be ready to work in certain fields. Based on the smk expertise curriculum in the field of Multimedia, in class X there are several productive subjects including Computers and Basic Networks (KDJD). This subject has 10 basic competencies that students master in semester 1, namely applying health, safety and the environment in the work environment (K3LH) (3.1), applying computer assembly (3.2), applying computer assembly testing (3.3), applying BIOS configuration (3.4), implementing operating system installation (3.5), applying *driver* installation computer hardware (3.6), implementing installation software installation (3.7), implementing computer hardware maintenance (3.8), analyzing hardware problems (3.9), analyzing problems with application software installation (3.10). To achieve the competence of these subjects, technology-based media is needed to help support the learning process, but in fact, problems are found that are obstacles to the learning process.

Based on the results of observations that researchers observed in the education unit of the State Vocational High School (SMK) 1 Bungo, in the Basic Computer and Network (KDJD) class X TKJ subjects, it was found that the media used by teachers in the teaching process was not optimal. The media used by teachers are reference books and *powerpoints*. The powerpoint media designed by the teacher makes the atmosphere in the learning process menoton and students are not motivated to actively engage in learning, because they are fixated with the exposure delivered by the teacher on the powerpoint and the learning time is also limited. Researchers know the problem after seeing the reaction of students when asked questions related to the material that has been discussed, there are some students who can answer, the rest do not respond or answer the questions. In the process of implementing learning carried out by teachers, it is also still not optimal. This is because, every teaching process, students listen to the teacher’s explanation and are tasked with making notes from the material explained by the teacher on the powerpoint, so that students are lazy to think and are not motivated to actively ask or respond to teacher questions because learning tends to be *teacher centered*. Whereas in the national education process standards, in the teaching process activities, it must be able to make students motivated and challenged, fun, inspirational, and interactive. Given this, it takes an action to foster students' interest in learning, not teacher-centered but more student-centered learning.
Tenology-based media has indeed been used by teachers, but the learning process is still not optimal because the media used is powerpoint. Powerpoint media in material packaging only contains images and text. Meanwhile, to foster interest in learning, teachers as educators must apply interactive learning media to learning activities, in addition to displaying images and text, interactive media can also display animations, simulations, videos and evaluations to measure students' understanding of the material. Therefore, interactive media can be a solution that can be done to create an alternative as a medium used in Basic Computer and Network learning activities with the Android Studio application Java programming language. The image produced from Android Studio is vector-shaped, which when the image is enlarged, the resulting image remains smooth. Besides being able to display smooth image quality, this media created with Android Studio can also display animations, videos, images, text, and plus an exercise feature to measure the extent of understanding captured by students (Sari et al., 2022).

To create an effective and efficient learning process using learning media, it is necessary to prepare learning plans in order to achieve graduate competency standards. Good learning process planning is also equipped with methods that are applied to learning activities. Because the method can be a point of view or a starting point of the learning process. By applying learning methods, teachers as educators are able to arouse the interest of students to be actively involved during the learning process. Learning methods are used to create a learning environment and involve teachers and students in the process (Pane & Darwis Dasopang, 2017). The learning method that is in accordance with the productive subjects of Computer and Basic Network matpel with the discussion of computer network installation material is the Problem Based Learning (PBL) learning method.

Problem Based Learning (PBL) is a problem-centered method, in the process, students can think critically and skillfully in solving problems so as to gain new knowledge in solving them (Herliani & Sibarani, 2017). In general, in learning activities with the Problem Based Learning method, teachers give a problem case to students to be discussed and sought for completion by looking for new information and knowledge. Through the Problem Based Learning (PBL) method, students are involved in an active, collaborative, student-centered learning process, and can develop students' problem-solving abilities. This is in line with the 2013 curriculum whose learning characteristics are more student-centered.

METHOD

This research uses research and development methods or called R&D (Research and Development). The development model that will be used in this study is the four-D
development model because the development model has a systematic procedure, according to the problems behind this research. The development of interactive learning media with the Problem Based Learning model uses primary and secondary data types. Primary data, namely validators, test questionnaires and practicality of learning media are filled in by teachers and students after conducting trials on the media, and the level of effectiveness is seen from the value of the evaluation / test results given to students. The secondary data that the researchers used in this study was data on the number of class X TKJ students at SMKN 1 Bungo. For practicality and effectiveness validity figures, researchers get it using questionnaires.

RESULTS AND DISCUSSION

Definement Stage
The defining stage is carried out to see an overview of how conditions in the field are related to the learning process of Computer and Basic Network class X Field of expertise in Computer and Network Engineering (TKJ) SMK Negeri 1 Bungo. At this stage, there are 4 things that are done, namely analysis of needs, analysis of students, analysis of tasks, and analysis of concepts.

Design Phase
At this stage, the preparation of the test is carried out, then the selection of media is in the form of Android and making an initial design. The results of the android-based interactive media display design consist of:

Splashscreen Display
The Splashscreen page is the first time the view when the media is run. The duration of the splashscreen display lasts for 5 seconds, after which it just enters the login menu.
Figure 1. Splashscreen Display

a. Login menu page

Figure 2. Login View

Before entering the home menu, the user first enters the login page, on this page the user must enter the username and password registered in the database, then press sign in, if the user has not been registered, then the user can register a new username and password on the sign up button.

b. Home menu page

Figure 3. Home Menu Display

The home page display is the opening display after the user has successfully logged in, the home view is also the main display that contains menus contained in the learning media. On this home page, there are several
button options, namely the material button, which sends the user to the material page, the KI&KD button which sends the user to the basic competency page presented on the media, the profile button that sends the user to the author's profile about page, the evaluation button that sends the user to the evaluation page, and the instruction button that will send the user to a page containing instructions for using the media.

c. Material menu page

**Figure 4. Display of Basic Competencies in the Material**

On the material page, the user is directed to choose which basic competency material to open, there are two options, namely basic competence 3.4 about BIOS configuration, and basic competency 3.5 about operating system installation. The following is a list of materials that can be selected if one of the basic competencies is opened.
In figure 5. There is a list of basic competency materials 3.4, each sub-material has an explanation in the form of a pdf file and a video display.

d. Evaluation Page

The evaluation page is a page that contains questions that will test students’ abilities consisting of 25 objective choice questions. The appearance of the evaluation page can be seen in figure 6.

After students answer all the questions, the problem-based learning-based interactive learning media will display the scores obtained by students after doing the evaluation, and each user can see the ranking order of the highest and lowest scores of all media users.
Development Stage

Validity test data is obtained from instrument data filled in by validators who are media experts and learning material experts. The results of the input from the validator can be used as a revision for this problem-based learning-based interactive learning media until finally this problem-based learning-based interactive learning media is declared valid and suitable for research. The following are the results of the questionnaire data from the results of expert validation testing.

1) Validity of media experts

The assessment results of each aspect given by the validator were analyzed using the statistical formula Aiken's V. Results obtained were validation values against the design of the resulting product. The results of the validation recapitulation are summarized from the aspects of the assessed learning media as shown in the following table.

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>didactic terms</td>
<td>0,79 Valid</td>
<td></td>
<td>0,88 Valid</td>
<td></td>
<td>0,88 Valid</td>
</tr>
<tr>
<td>2.</td>
<td>Construction Requirement</td>
<td>0,72 Valid</td>
<td></td>
<td>0,88 Valid</td>
<td></td>
<td>0,84 Valid</td>
</tr>
<tr>
<td>3.</td>
<td>Technical Terms</td>
<td>0,78 Valid</td>
<td></td>
<td>0,86 Valid</td>
<td></td>
<td>0,86 Valid</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>0,76 Valid</td>
<td>0,87 Valid</td>
<td>0,86 Valid</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 7. User Score Ranking Page
Based on table 1, it shows the validation results from media experts on problem-based learning-based interactive learning media. The validation results show that this problem-based learning-based interactive learning media has a validity value of 0.76>0.66 given by the 1st validator, a validity value of 0.87>0.66 given by the 2nd validator, and a validity value of 0.86>0.66 given by the 3rd validator, then the learning media a Interactive ran berbasi android termasuk on the valid category.

2) Material expert validation
Validation carried out by material experts is reviewed from the aspects of material quality, and learning quality. In carrying out its validity, material experts review the material in this problem-based learning-based interactive learning media and then validators provide value to the material in the problem-based learning-based interactive learning media, Table 2. Material Validation Data against Problem-based Interactive Learning Media

<table>
<thead>
<tr>
<th>No</th>
<th>Validator</th>
<th>Valuation</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Validator 1</td>
<td>0.85</td>
<td>Valid</td>
</tr>
<tr>
<td>2</td>
<td>Validator 2</td>
<td>0.88</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>0.86</td>
<td>Valid</td>
</tr>
</tbody>
</table>

Based on table 2, it shows that the validation results of problem-based learning-based interactive learning media materials have a validity value of 0.85>0.66 given by the 1st validator, and a validity value of 0.88>0.66 given by the 2nd validator, then the material on the interactive learning media is based on the Problem Based Learning termasUK in the valid category.

3) Practicality test
a) Teacher’s Response to the Practicality of Problem-Based Learning-Based Interactive Learning Media
Practicality data was obtained from questionnaires filled out by teachers of Basic Computer and Network subjects. The results of the teacher’s response to problem-based learning-based interactive learning media can be seen in table 3. the following.

<table>
<thead>
<tr>
<th>No</th>
<th>Aspects</th>
<th>(%) Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Facilities</td>
<td>94</td>
</tr>
<tr>
<td>2</td>
<td>Time</td>
<td>88</td>
</tr>
<tr>
<td>3</td>
<td>Use</td>
<td>86,6</td>
</tr>
</tbody>
</table>
The results of the analysis obtained the average test results of the practicality of problem-based learning-based interactive learning media according to the teacher, namely obtained a percentage value of 89.5 with a very practical interpretation.

**Student Response to the Practicality of Problem-Based Learning-Based Interactive Learning Media**

The practicality of this problem-based learning-based interactive learning media is also seen from the provision of student response questionnaires. This data is obtained after learning through a practicality questionnaire given to students. The assessment data on the results of student responses to this problem-based learning-based interactive learning media can be seen in table 4.

<table>
<thead>
<tr>
<th>Table 4. Student Response Practicality Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
</tr>
<tr>
<td>-----</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td></td>
</tr>
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<td></td>
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</tbody>
</table>

Berdasarkan tabel 4, rata-rata hasil tes praktis media interaktif berdasarkan pembelajaran masalah berdasarkan data pendidik yang diperoleh adalah 89,5% dan berdasarkan data pengambilan siswa siswa, rata-rata 87,41% dari waktu. Dapat diimplikasikan bahwa media pembelajaran interaktif berbasis masalah memang sangat praktis.

4) Effectiveness Test

The effectiveness of the use of interactive learning media based on problems based learning is reviewed in two ways, namely looking at the achievement of the
Minimum Requirements (KKM) criteria for curls and by comparing the data of pretest and postest by using analysis is gain score.

a) Classical Completeness

Classical completeness is seen from the percentage of the number of students who are completed after using problem-based learning-based interactive learning media. The basis for determining the effectiveness of problem-based learning-based interactive learning media is that if the percentage of students’ classical completion is greater than or equal to 85%, then problem-based learning-based interactive learning media is effectively used. On the contrary, the percentage of classical completion of students is smaller with 85% of problem-based learning-based interactive learning media not effectively used. The following average results of learners’ grades on basic computer and network subjects are presented in table 5.

<table>
<thead>
<tr>
<th>No.</th>
<th>KKM</th>
<th>Number of Students</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>&lt; 75</td>
<td>4</td>
<td>13.3</td>
</tr>
<tr>
<td>2.</td>
<td>≥ 75</td>
<td>26</td>
<td>86.7</td>
</tr>
<tr>
<td>Sum</td>
<td></td>
<td>30</td>
<td>100</td>
</tr>
</tbody>
</table>

Based on the results of the analysis described in table 5, data on the number of completed students was obtained as many as 26 students (86.7%), this shows that classical completeness has been achieved, it can be concluded that problem-based learning-based interactive learning media is effectively used when viewed from classical completeness.

b) Test Gain Score

Improvement of student learning outcomes after pretest and postest is calculated with a gain score. Learning media is said to be effective if the gain score obtained ≥ 0.3 or at least in the medium category. The gain score obtained is 0.68 which is in the medium category. The results of the gain score analysis can be seen in table 6.

<table>
<thead>
<tr>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Gein</th>
</tr>
</thead>
</table>
Based on classical completeness which reached 86.7% and a gain score of 0.69 with a moderate category, it can be concluded that problem-based learning-based interactive learning media is declared effective.

**Disseminate Stage**
The problem-based learning-based interactive learning media developed has been valid, practical and effective, this is obtained from the results of validity, practicality and effectiveness tests that have been carried out on problem-based learning-based interactive learning media. At this stage, the learning media developed is ready to be used by educators and students in computer subjects and dassar networks. Already valid media. Practically, it is also effectively promoted to other schools in classes that have the same subjects as class X Multimedia at SMKN 8 Bungo. This dissemination is carried out with the aim of determining the implementation of the use of learning media by teachers and students, so that the media can be used by schools as part of tools that can be used to improve student learning outcomes through quality learning.

**CONCLUSION**
Based on the results of research on the development of problem-based learning-based interactive learning media that has been carried out, the following conclusions were obtained:

1. This research has produced basic computer and network teaching materials with problem-based learning-based interactive learning media in class X in the Field of Computer and Network Engineering expertise. The process of developing basic computer and network teaching materials with problem-based learning-based interactive learning media was developed referring to the Thiagarajan 4-D development model, namely Define, Design, Develop, and Dessiminate.

2. Basic computer and network teaching materials with problem-based learning-based interactive learning media developed have been declared valid after being validated by 5 validators, 3 people for media validation and 2 people for material validation.
The assessment results for media validation are declared valid and the assessment results for material validation are also declared valid by validators.

3. Basic computer and network teaching materials with problem-based learning-based interactive learning media developed can be said to be practical after trials are carried out on teachers of Basic Computer and Network subjects and students. The results of the teacher and student’s assessment of the practicality of problem-based learning-based interactive learning media state that problem-based learning-based interactive learning media is in the very practical category.

4. Basic computer and network teaching materials with problem-based learning-based interactive learning media have gone through the effectiveness test stage through student learning outcomes tests, namely in the form of pretests and postest. The results of the effectiveness test state that this problem-based learning-based interactive learning media is in the effective category. Evidenced by improved student learning outcomes.

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