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Research paper

Interactive Multimedia Learning on the Basis of Problem Based Learning (PBL) for Vocational High School (VHS) Students

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Abstract

This research is aimed at producing a valid, practical and effective interactive multimedia learning on the basis of problem-based learning. The product is designed to help teachers and students in better understanding of school subject: "Peripheral Functions and PC Installation". The study is conducted by applying research and development method with the following stages: potential problem localization, data collection, product designing, design validation, performance test, product revision, and final testing and commissioning. After performing content validity test by taking into account experts' theory, and conducting practicality test by distributing questionnaires to the users, as well as effectiveness test by giving examinations to the participants, it can be found the following percentages of the respective tests, namely: 88.06% for validity test; which is a good criterion, 85.03% for practicality test; which is a practical criterion, and 88.04% for effectiveness test; which is also a good criterion. Such results show that the interactive multimedia learning on the basis of problem-based learning may be said to have been valid, practical and effective

Keywords: *Interactive Multimedia Learning, Problem-Based Learning (PBL), Validity, Practicality and Effectiveness Tests*.

1. Introduction

Pursuant to the Presidential Instruction of the Republic of Indonesia Number 9 Year 2016 regarding Revitalization of Vocational High Schools (VHS) for Improving the Quality and Competitiveness of Human Resources in Indonesia, the Ministry of Research and Technology and Higher Education of the Republic of Indonesia is given mandate to speed up the supply of teachers for VHS by implementing education, equivalency and recognition programs, and by seeking better methods to produce good quality teachers which may be required by VHS. Therefore, it is necessary to make improvement efforts with regard to the quality of education of VHS in such a way that the target of better learning and education can be achieved optimally.

On the other hand, the number of students inter-ested in attending Vocational High Schoos tends to decrease, as seen in the data issued by National Statistic Agency (BPS) that there was a tendency of declining in the number of VHS students in some Provinces in the previous school years, particularly those in Sumatera Island, as shown in Table 1.

Table 1: Number of Students Registered in VHS under the Ministry of Education and Culture by Provinces School Years of 2012/2013 up to 2014/2015

Province	2013	2014	2015
Aceh	49 147	49 266	43 214
Sumatera Utara	325 588	341 406	276 980
Sumatera Barat	83 881	86 095	73 577
Riau	79 236	79 425	77 971
Jambi	39 757	40 854	41 403
Sumatera Selatan	90 440	91 164	90 410
Bengkulu	26 473	25 533	24 029
Lampung	112 146	108 405	114 038
Kepulauan Bangka Belitung	19 995	20 536	20 896
Kepulauan Riau	21 399	21 951	23 381
Source: National Statistic Agency			

Observation to several VHS in West Sumatera reveals that the lack of interest to study in VHS may be triggered by the image of VHS as just an ordinary school; the learning process which is still conventional, the lack of equipment and in-frastructure for supporting the learning process, and the teaching methods which are still monoto-nous and lack of variation, including the learning media which are still traditional, such as printed books, power points application, and other direct-learning media like blackboard, posters, etc. All the above contribute to the low attention and participation of the students in class and eventually affect the quality of the graduates.

Based on a pre-survey, it can be concluded that there are two main reasons why such conditions occur: curriculum and learning method. From curriculum perspective, most of schools do not apply the new curriculum (2013 Indonesia's cur-riculum). Interview result also indicates that the curriculum document does not follow the gov-ernment standard. For example, they do not have a learning outcome. In developing the curriculum, in fact, they do not involve VHS's stakeholders. In addition, most of schools practice conventional learning methods. For example, some school only use text book, and others take benefit of using power points. None of the schools applies any e-learning method, such as interactive CD.

To improve VHS graduate quality, there is a need to study and develop learning methods, especially learning media or learning aids to improve learning process so as to improve graduate quali-

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ty. Eventually, it is hoped that the interest of the society to go to VHS will increase. Eventually, it is hoped that the interest of the society to go to VHS will increase. Studies on learning aids has been done by many researchers,e.g. [i] to explore the effectiveness of the design of educational systems for work based learning (WBL) from the learner's perspective, [ii] to study the impact of a web-based constructivist learning environment, which was developed based on a course given to stu-dents in the Faculty of Creative Multimedia (FCM) on student learning, and [iii] studied on interactive media learning, however, they do not focus on interactive CD.

In view of the condition above, it is necessary to make innovations for improving the education component itself. One of the innovations is the use of interactive multimedia which shall make students participate actively in the learning pro-cess. Interactive multimedia is a media that com-bines text, graphics, audio, animation and video equipped with a controller for which makes it easy to be operated by the users.

Problem-Based Learning which is abbreviated to as PBL is a learning approach which makes use of a problem to be the ground for the students to learn by solving the problem. PBL approach serves as a bridge for the students to be able to develop critical thinking, problem solving ability, and to increase motivation and curiosity. Problem-Based Learning (PBL) is a learning method initiated by the existence of problems, questions and assumptions in such a way that the students shall be motivated to seek answer and solve them. Many researchers have examined the application of PBL in the learning process; Yew & Goh (1) stated that PBL is an effective teaching and learning approach, especially when being evaluated in a long term. Neo (2) stated that PBL can be implemented and gives successful results in tertiary education. Meanwhile, the use of learning media has also been widely used nowadays, Yuniarta (3) uses MYOB for developing PBL in the subject: Computerized Accounting. While Tan & Ng (4) found that PBL gives many advantages if applied as a pedagogical strategy for entrepreneurship education because the strategy is built on the importance of active learning through problem solving in the "real world". Case studies that use PBL include the presentation of problems and stimulation of inquiry by stage; raising issues of learning, iteration of independence and collaboration in problem solving, integration of new knowledge, presentation of solutions and evaluation.

Furthermore, Interactive Multimedia (IMM) and PBL according to Albion & Gibson(5) are two significant contributions to the latest developments in professional education. Mcalpine & Clements(6) stated that PBL has a strong character as the basis for designing the material for multimedia and online technology. Lastly, Liu et al.(7) had created Multimedia to improve the PBL-Based Learning Environment in high school education. This paper discusses PBL-Based Multimedia Learning in the subject: Peripheral Functions and PC Installation in VHS.

2. Submission

This research is a research and development with output in the form of interactive multimedia designed to be valid, practical and effective, and with the stages of research as follows: i) potential problem localization, ii) data collection, iii) product designing, iv) design validation, v) performance test, vi) product revision, and vii) final testing and commissioning.

Potential problem anticipated by this research is the absence of PBL-Based Multimedia Learning in Vocational High Schools by focusing on the subject: Peripheral Functions and PC Installations as the research data. The design of this interactive multimedia learning begins with the making of storyboard equiped with navigation, the giving of description, and finally the presentation of interface. Design validation shall be done by multimedia learning experts, whereas material and language contents shall be examined by education experts. While the revision of design and product testing shall be done after this interactive multimedia learning is feasible to use.

The instruments being used in this research among others are validity sheets, students response questioners, and activity sheets. The content outline of the validity sheets of learning multimedia is shown in table 1.

Table 1: Content Outline of the Validity Sheets of Learning Multimedia

No	Validity Variables	Indicators
1.	Material Substances	1) Accuracy, 2) Scope of Material, 3) Up-to-date and 4) Readability
2.	Visual Communication Interface	1) Navigation, Fonts, Media (film, voice, image, and animation), Colour, Slide, Layout
3.	Learning Design	1) Title, 2) SK-KD, 3) Purpose of Learning, 4) Contents, 5) Sample of questions, 6) Quiz/test/simulation, 7) Authors, and 8) References
4.	Software Utilization	1) Interactivity (feedback from system to user), 2) Supporting Software, and 3) Originality

Analysis of the validity of learning multimedia shall use 1-4 scaling rule as provided for in the Regulation of the National Education Agency (2010:7) with a total score of 70 at the maximum. The Validity Score is computed by using the following formula:

$$\text{Validity Score} = \frac{\text{Amount of score obtained}}{\text{Highest score}} \text{ x } 100\%$$

Scoring Criteria can be seen in following table 2

Table 2: Scoring Criteria of Validity Test

Level of Achievement	Category
<51	Poor
51-70	Fair
71-90	Good
91-100	Excellent

As for practical analysis by way of distributing students response questioners on the learning multimedia, it shall be computed by applying the following formula.

$$\text{Practicality Score} = \frac{\textit{amount of all scores}}{\textbf{total number of students}} \textbf{X 100\%}$$

The scores are thereafter classified in accordance with the rule developed by Purwanto (8) as table 4:

Table 4: Scoring of Answers pursuant to Likert Scale

No	Level of Achievement	Category
1	90%-100%	Excellent
2	80%-89%	Good
3	65%-79%	Fair
4	55%-64%	Poor
5	0%-54%	Dissapointing

Meanwhile, the effectiveness analysis of the learning multimedia shall be computed based on the results of final examination given to the students, with the formula as follows:

$$\text{Effectiveness Score} = \frac{\text{amount of score obtained}}{\text{Maximum Score}} \; x \; 100\%$$

Scoring criteria of the effectiveness test of the multimedia shall refer to the opinion of Trianto (9) as seen in table 5.

Table 5: Scoring Criteria of Effectiveness Test

No	Level of Achievement	Criteria
1	80%-100%	Good
2	51%-75%	Fair
3	26%-50%	Poor
4	0%-25%	Dissapointing

3. Important Information

The results obtained from this reseach is a product in the form a valid, practical and effective interactive multimedia.

This PBL-Based Interactive Learning Multimedia has been revised several times in accordance with the direction given by the validators, and the end results shall be as follows:

3.1 Main Page

In this page there are menu buttons as follows: Learning Media, Direction, Reference and Profile. The blue background is chosen in order to stimulate the students to be confident to express themselves and to be able to develop a critical thinking ini solving the problems found when learning the subject: Peripheral Functions and PC Installation.
This page is also equipped with exit navigation in the form of symbol . A picture of Personal Computer is exposed in this front page to ilustrate that the problem to be solved in this interactive multimedia learning shall be relevant to that picture, namely installation process know-how and peripheral functions of the unit. Image of the main page shall be as follows:

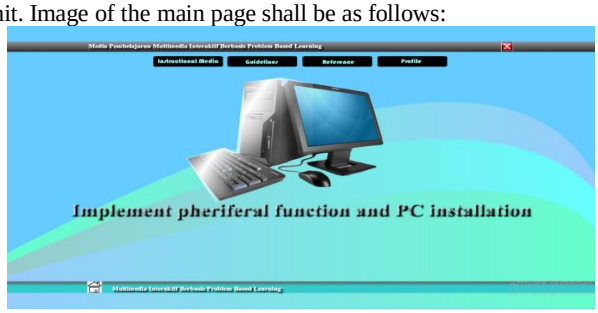


Image 1. Main Page

3.2 Learning Media Menu

This menu consists of sub-menu called *SK/KD* wherein *SK* stands for *Standar Kompetensi* (Competency Standard) and *KD* stands for *Kompetensi Dasar* (Basic Competency). In this menu there is also a tutorial menu for guiding the students of the material to be learned and explanation with regard to the evaluation to be done so as to obtain the effectiveness score of the learning multimedia. In this menu the learning process shall be executed in accordance with the steps of PBL learning as follows:

1. Developing students orientation to the problem by discussing the purposes of studying a particular issue, encouraging them to be actively involved in problem solving activities relevant to the issue and showing them the problems to be solved related to the material having been learned, as seen in image 2.

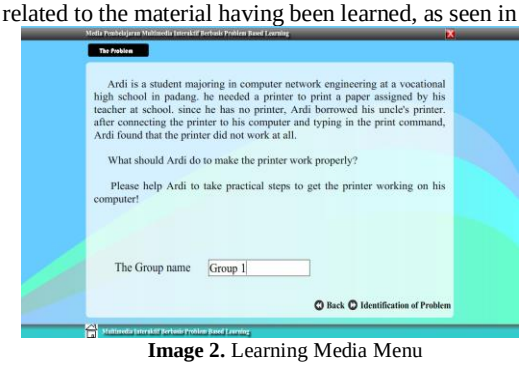


Image 2. Learning Media Menu

2. Organizing the students to be involved in an active learning by identifying all problems occured, as seen in image 3.

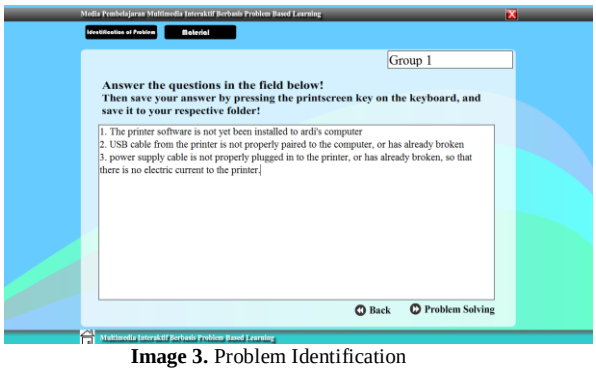


Image 3. Problem Identification

3. Guiding group study experience by way of leading the students to gather relevant information, and then make experiment or field practice so as to know the answer and get knowledge thereto and thereafter solve the problem. This step can be seen in Image 4.

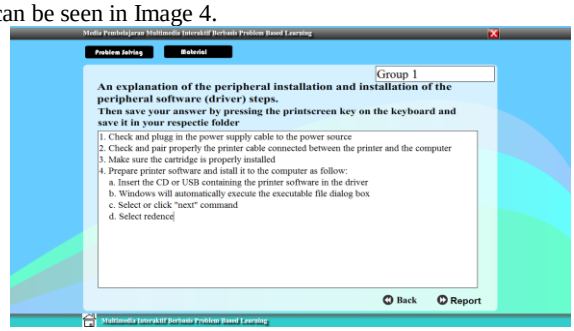


Image 4. Guiding a Learning Experience

4. Giving assignment to the students to prepare and present their report regarding the results of their activities, as seen in image 5.

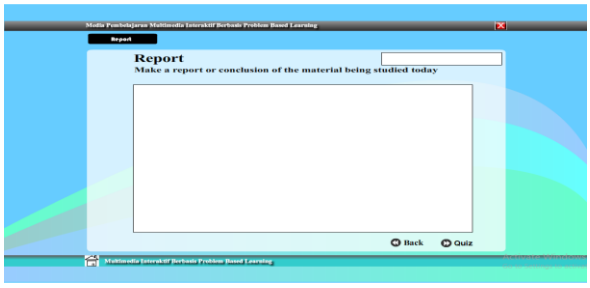


Image 5. Student's Report

5. Analyzing and evaluating the problem solving process. This process can be evaluated from the score achieved by the students after answering the quizzes given to them after participating in the activities. Sample of the quizzes and results obtained by the students can be seen in image 6 and 7.

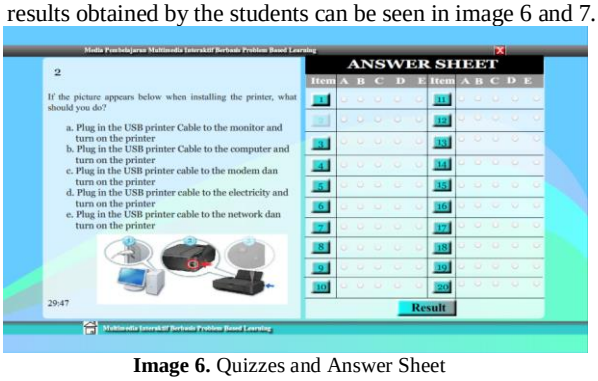


Image 6. Quizzes and Answer Sheet

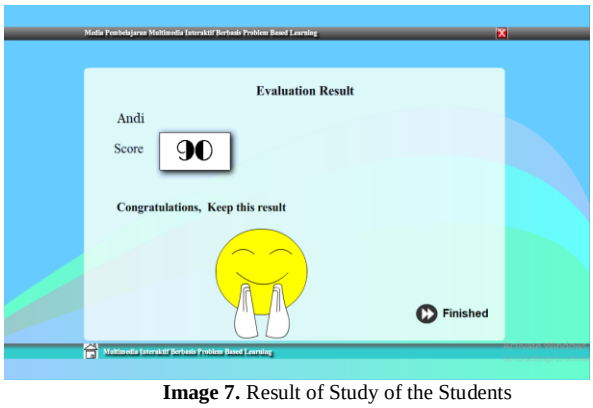


Image 7. Result of Study of the Students

3.3 Guidance Menu

This menu consists of the sub-menues which shall guide the users of how to use the interactive learning multimedia, either in the form of tutorial video or text. All sub-menues are facilitated with the direction for use of the application. The sample shown below is the sub-menu of Evaluation.

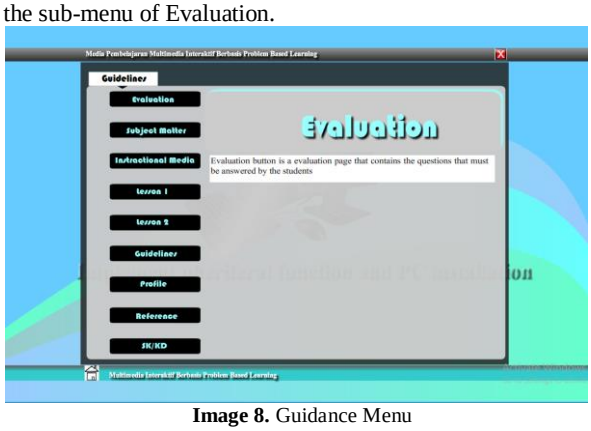


Image 8. Guidance Menu

3.4 Reference Menu

This menu consists of the references being used relevant to the learning materials in this application, as shown in image 9.

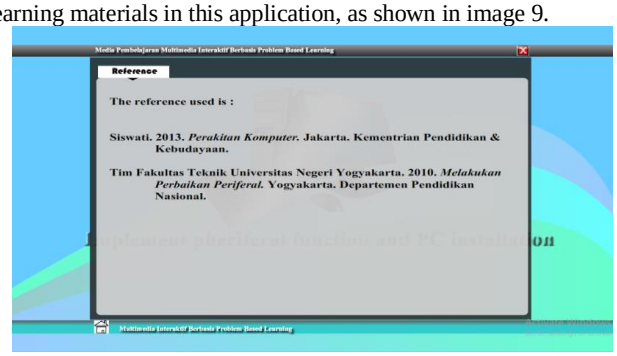
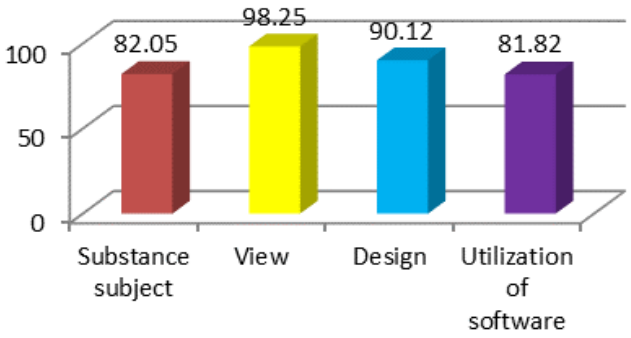


Image 9. Reference Menu

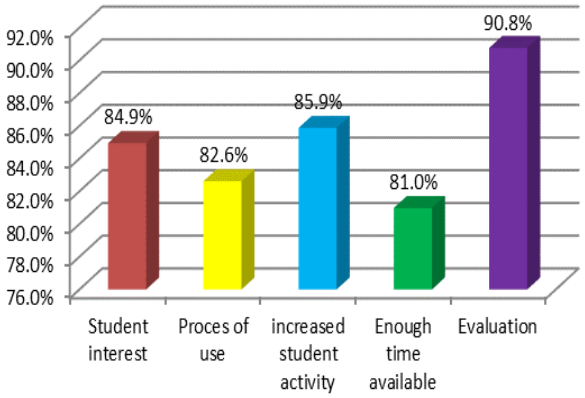
Validity Test of this learning multimedia was conducted by 2 multimedia experts, namely Dr. Hendra Hidayat, M.Pd dan Dr. Eril Syahmaidi, M.Pd and by 1 instructional design expert, Nur Afni, S. Kom with the results as shown in the following Graphic 1:



Graphic 1: Result of Validity Test

As seen in Graphic 1 above the result of validity test from Material Aspect reaches 82.05% which is a good criterion, from Visual Communication Interface Aspect it reaches 98.25% which is an excellent criterion, from Instructional Design Aspect it reaches 90.12% which is also an excellent criterion, and from Software Utilization Aspect it reaches 81.82% which is a good criterion.

Practicality Test was conducted to 23 students of grade X TKJ with the results as shown in Graphic 2 below:



Graphic 2: Result of Practicality Test

Based on graphic 2 it is known that the practicality value of the learning multimedia resulting from this research reaches a percentage of 84.94% which is a good criterion, application process value reaches 82.61% which is good criterion, student activity improvement value reaches 85.87% which is a good criterion, time management value reaches 80.98% which is also a good criterion, and evaluation result value reaches 90.79% which is an excellent criterion.

Meanwhile the Effectiveness Test was conducted by way of examining the students' achievement taken from the Evaluation Menu in the Learning Multimedia software which reaches a percentage of 88.04% which is a good criterion.

The PBL-Based Learning Multimedia produced herein in the form of an Interactive CD for the school subject: Peripheral Function and PC Installation is proven to be valid, in which the average results of validity test thereof reaches 88.06%. It is also practical, as shown in the result of practicality test which reaches 85.03% in average, which is a good criterion. And finally, it is also effective for use for and by VHS students, as seen from the result of evaluation to students' achievement which reaches a percentage of 88.04%, which is a good category. But in this medium there is no database for every user who uses it, all the actions and treatment in the CD only serves as temporary, so it is advisable to continue this research for a more compatible media with a wider range.

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