International Journal of Engineering & Technology, 7 (4.9) (2018) 262-267

International Journal of Engineering & Technology

Website: www.sciencepubco.com/index.php/IJET

Research paper

Using Interactive Web-Based Learning Multimedia to Assess Competency Standards for Installing LAN Among Vocational High School Students in Padang, Indonesia

Karmila Suryani[1]*, Khairudin[2], Rini Widyastuti[3], Riska Amelia[4], S.M. Lulinda Riska[5]

[1]*Faculty of Teacher Training and Education, BungHatta University*
[2]*Faculty of Teacher Training and Education, BungHatta University*
[3]*Faculty of Teacher Training and Education, Bung Hatta University*
[4]*Faculty of Teacher Training and Education, Bung Hatta University*
[5]*Padang State University*
**Corresponding author E-mail:karmilasuryani.ptik@gmail.com*

Abstract

This research is aimed at creating an interactive, valid, practical and effective Web¬¬¬-Based Learning Multimedia for assisting the students to learn the school subject: Installation of Local Area Network (LAN), and to meet the competency standard in such subject. To create the learning multimedia the researchers adopted Cooper's Stage-Gate Method by applying product development phases, namely: Vision, Conception, Design, Prototype, and Production. After the design process had been completed, the multimedia was validated by a team of multimedia experts, and reached a score of 94.96% which is categorized as Highly Valid. For practicality analysis, the Researcher distributed questionnaires to relevant parties so as to know the level of students interest, the process of using, the increase of active learners, the sufficiency of time, and for evaluation purposes, and it resulted in a score of 87% which is categorized as Practical. Such validity and practicality analysis were done at the Phase of Prototype. Finally, the Researchers shared the Application to all students of Computer and Network Engineering Department in Padang, Indonesia, and the results were fairly encouraging in which the learning outcomes of the students can reach the figure of 87%, and the grades achieved by the students were Above Minimum Passing Criteria. In view of such results, it can be concluded that this learning multimedia has met the requirement for a mass application.

Keywords: *Interactive Multimedia, LAN, Vocational High School.*

1. Introduction

Elucidation of Law of the Republic of Indonesia number 20 of 2003, Article 15, prescribes that vocational education is a secondary education that prepares students to primarily work in particular fields. One of such fields is Information and Communication Technology (ICT) whereby students should learn various competency-based learning strategies related to the application of the competency standards in occupational and industrial world. To achieve the results of learning which shall meet the competency of graduates, it is necessary to meet the standard process of learning. Regulation of the Minister of Education and Culture of the Republic of Indonesia number 22 sets out that Standard Process is a criteria related to the implementation of learning process in an educational unit to achieve the Graduate Competency Standards.

There are three Principles in a Learning Process, namely: (1) the learning that takes place at home, at school, and in the community, (2) the learning that implements the principle that anyone is a teacher, anybody is a learner, and anywhere is a class, and (3) the utilization of information and communication technology to improve the efficiency and effectiveness of learning. To accommodate the three principles, it is very important to develop the learning strategy and the multimedia that can be accessed easily and which can stimulate the students to learn independently, either at home, at school and in the community, and at the same time they can treat themselves as the teacher and the learner anywhere and anytime by applying the information and communication technology. This is the essence of this Research.

In view of the rapid growth of the internet where almost all students spend their time browsing and using social networking sites like Facebook, Instagram, Twitter and Whatsapp thus significantly reduce their study time, it is necessary to create a learning innovation which also makes use of Internet as teaching platform and having performance which as as interesting as social media, and as easy as accessing the social networking sites.

Based on observations at several Vocational High Schools (SMK) in Padang, Indonesia, almost all students of Computer and Network Engineering class found it difficult to reach the competency standard in the Installation of Local Network Devices (LAN) subject. Some of the problems that make students to be less interested in and face difficulties to understand the lesson is the course materials which are perceived to be rather boring, delivered only by using simple multimedia presentation like Powerpoint with simple display and whiteboard, and limited sources ofknowledge since they only depend on the explanation of the teacher in the classroom. For example, in the Installation of LAN Devices subject, sub-competence of Principles of Subnetting Process, the fixing of IP Address is still done manually, particularly in the counting process using paper and pen. Such processes are quite troublesome and prone to error when building a network, especially when preparing a big scale network. This affects the learning achievement

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of the students by an average of 63.33%; which is below the Minimum Passing Criteria (MPC).To improve the effectiveness and efficiency of learning and the competence of the students in performing LAN installation, the researchers designed anInteractive Web-Based Learning Multimedia For Vocational High School Students to meet the competency standard in LAN Installation, especially for those majoring in Computer Engineering.

2. Literature Review

To show your reader that you have read, and have a good grasp of, the main published work concerning a particular topic or question in your field. This work may be in any format, including online sources. In the latter cases in particular, the review will be guided by your research objective or by the issue or thesis you are arguing and will provide the framework for your further work.

3. Methods

3.1 Types of Research

This is an action research that adopts andmodifies the stage gate method developed by Cooper (2005). There are 5 phases to design the Interactive Web-Based Learning Multimedia For Vocational High School Students. (***See Annexure-A)***

R. G. Cooper in his book entitled "Stage-Gate ® New Product Development System : A Game Plan from Idea to Launch", pages 1 to 12 elaborates five phases to be taken in creating a new product. Since the product to be created in this research would be an application, the Researches applied the five phases as follows:

3.1.1 Phase I - Vision (Project Plan)

The multimedia to be produced shall contain video tutorials in MP3 type on installation of LAN network, including test and evaluation part in the form of objective questions which shall pop-up in random. The materials will be presented in.pdf, .pp and .doc formats with animation and pictures and combined with clear, concise and bold text so that the students will find the materials interesting, easy to read and easy to absorb. In addition, interesting background will also be used with blue shade so as to minimize boredom and tiring eyes when using the learning multimedia.

3.1.2 Phase II - Conception (Project Plan Update)

The software used in developing this interactive learning multimedia are PHP and MySQL. Corel Draw and Photoshop applications are also used for the background design of the front page of the multimedia. The computer used for developing this interactive multimedia has the following specification: Core i5 processor, 4GB RAM, and 1TB HDD.

3.1.3 Phase III - Design

Designing the interface and components of the interactive web-based multimedia is part of the design process. Initially the design is done on (1) Main page (view), (2) pages of Competency Standard and Basic Competence, (3) Pages containing learning material (Videos and Documents), (4) evaluation pages and (5) instruction pages.

3.1.4 Phase IV - Prototype

At this phase there are several stages to be passed, namely

a. Validation of product design

There are several aspects of assessment to validate the product design, among others: (1) substance of material, (2) visual communication display, (3) learning design, and (4) software utilization. Validation is conducted by multimedia experts whose respective expertise and experience cover the contents of the product, namely the expert in multimedia contents, the expert in teaching of multimedia, and the expert in language and writing of multimedia. The three experts are lecturers of Bung Hatta University in the Faculty of InformaticsEngineering and Computer Education.

b. Testing of the Product

Prior to mass product distribution, small-scale product testing was launched to some students of Class XI, Department of Computer Engineering and Network at five Vocational High Schools in Padang City, Indonesia.

3.1.5 Phase V - Production

The interactive learning multimedia which has been completely produced was then hosted and uploaded so as to make it online and ready to be used anywhere by students. The interactive learning multimedia may be used as a supplement of study for the students and as an alternative material for extra-curricular learning.

4. Research Instruments

The instruments for the research comprise of validity sheet, practicality sheet and Multimedia Quiz Sheet. Altogether, there were 30 students participated in the research.

4.1 Validity Sheet

To measure the validity of this learning multimedia, the Researchers made slight adjustment so as to comply with the assessment indicatorsas set out by the Ministry of Higher Education of Indonesia (2008) as seen in the following Table 1.

Table 1. Outlines of Learning Multimedia Validation Sheet

No	Variables of Validity	Indicators
1	Substances of Learning Materials for Installation of LAN	1. Authenticity
		2. Scope of the material
		3. Up-to-date
		4. Legibility
2	Visual Communication Display	1. Navigation
		2. Fonts
		3. Multimedia (video, sound, image, and animation)
		4. Colour
		5. Animation
		6. Layout
3	Design	1. Title
		2. Competency Standard – Basic Competence
		3. Learning objectives
		4. Materials
		5. Sample of questions
		6. Exercise / Simulation
		7. Compiler
		8. Reference
4	Utilization of Software	1. Interactivity (feedback from system to user)
		2. Supporting Software
		3. Originality

Source: Sungkono (2008)

4.2 Practicality Sheet

Collection of data by using practicality sheet or questionnaire is useful for finding information regarding student responses and compatibility between the students and the application. Outlines of the practicality sheet as set out bythe Ministry of Higher Education(2017) shall be as shown in table 2.

Table 2. Outline of Practicality Sheet of Learning Multimedia

No.	Variables of Practicality	Indicators
1.	Students Interest	1) Desire of the students to participate in the learning. 2) Interest of the students to use the interactive web-based learning multimedia. 3) Interest of the students to learn with designed multimedia. 4) Interest of the students in the image / animation of the multimedia. 5) Boredom in learning the multimedia
2.	Process of Using	1) Students are easy to absorb and understand the concept presented in the learning material 2) Students are easy to use the designed multimedia. 3) By using the multimedia learning the students find it easier to absorb the learning concept. 4) Students are easy to correlate the concepts being learned with the real context in everyday life.
3.	Increase of active learners	1) Improvement in student learning activities. 2) Stimulation of critical thinking. 3) Encouragement of self-learning. 4) Better understanding of course material.
4.	Sufficiency of Time	1) The time provided for using multimedia is sufficient. 2) The learning process is more effective and interactive.
5.	Evaluation	1) Exercise can help students to better understand the material. 2) Exercise can be used as a benchmark for the students in understanding learning material, such as subnetting IP Address.

Source: The Ministry of Higher Education (2017)

4.3 Multimedia Quiz Sheet

This sheet is an evaluation sheet for testing and measure the achievement of the students after learning and practicing with this application. It contains questions about the material that has been provided in the learning multimedia. This sheet will be useful to see how well the utilization of this multimedia by the students.

5. Method of Data Analysis

The methods used for data analysis are as follows:

5.1 Validity Analysis

Analysis of the validity of the interactive web-based learning multimedia to the subject: installation of local network devices (LAN) uses the following formula:

$$\text{Validity Score} = \frac{\text{Number of score obtained}}{\text{highest score}} \text{ x } 100\ \%$$

Criteria of validity score according to the Ministry of National Education of Indonesia (2008) as seen in Table 3 hereunder:

Table 3. Criteria of Validity Score

Level of Achievement	Category
< 51	Poor
51 – 70	Fair
71 – 90	Good
91 – 100	Very Good

5.2 Practical Analysis

Analysis of the practicality of the interactive web-based learning multimedia is applied by using the following formula:

$$\text{Practicality Score} = \frac{\text{Number of score obtained}}{\text{highest score}} \text{ x } 100\ \%$$

After percentage of the practicality score is obtained, the researchers categorized such results in accordance with the scale developed by Purwanto (2009) as seen in table 4:

Table 4: Score of the Answers under Purwanto Scale

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

5.3 Effectiveness

The aspect of effectiveness observed in the learning process using this multimedia is the study achievement reached by the student. The data is processed by using the formula developed by Trianto (2010);

$$\text{Effectiveness Score} = \frac{\text{Number of score obtained}}{\text{highest score}} \text{ x } 100\%$$

Criteria of the Effectiveness Score:

Table 5: Criteria of Effectiveness Score

No	Percentage	Criteria
1	76% - 100%	Good
2	51% - 75%	Fair
3	26% - 50%	Poor
4	0% - 25%	Very Poor

6. Results

6.1 Validation of Product Design

The validity test of this interactive web-based learning multimedia was conducted by way of making presentation before the Validators who thereafter filled in the validity sheet containing the assessment indicators as set out by the Ministry of National Education of Indonesia, with the results as shown in Table 6 below:

Table 6: Results of Validity Test

No	Aspect of Assessment	Validators			Amount	Validity Value	Criteria
		1	2	3			
1	Substance of Material	11	13	11	35	89.74%	Good
2	Visual Communication Display	19	19	19	38	100%	Very Good
3	Instructional Design	25	25	25	75	96.15 %	Very Good
4	Utilization of Software	11	10	10	31	93.93 %	Very Good
Total						379.82 %	Very Good
Average						94.96%	

In view of Table 6 above, the average value of validity test is 94.96% and categorized as very valid. This shows that the interactive web-based learning multimedia is "Very Good" in terms of

feasibility of material substance, visual communication display, instructional design, and software utilization aspects.

6.2 Practicality Test

The results of testing of this product are represented by the practicality value of the learning multimedia as seen in Table 7 below:

Table 7: Results of Multimedia Practicality Test

No	Variables of Practicality	Amount	Practical Value	Criteria
1	Students Interest	736	87.61%	Good
2	Process of Using	421	87.70%	Good
3	Increase of Active Learners	517	86.17%	Good
4	Sufficiency of Time	194	80.83%	Good
5	Evaluation	220	91.67%	Very Good
Total			2610%	Good
Average			87%	

Source: Practicality Sheet, March 30, 2016

In view of table 7, the evaluation section is included in very practical category with percentage of 91.67%, it shows that the students understand the material of how to process the subneting calculation in each existing IP class. As for the sections of students interest, process of using, increase of active learners and sufficiency of time, all of which show a practical category with the average practicality of 85.57%.

6.3 Effectiveness Test

The effectiveness test is done by observing how many students get the learning outcomes which are above the Minimum Passing Criteria (76). The results being obtained are as in the following table.

Table 8: Results of Effectiveness Test

No	Grade	Students	Category	Percentage of Passing
1	100	12	Good	80%
2	90	6	Good	
3	80	6	Good	
4	70	3	Fair	20%
5	60	3	Satisfactory	
Total		30		

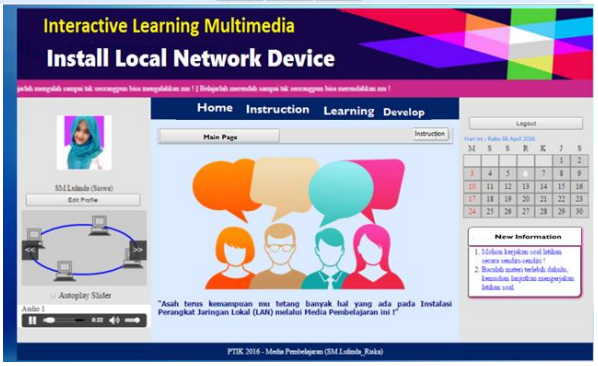
Source: Evaluation Result to the Students of Class XI of Computer Network Engineering Department on Using Multimedia

In view of table 8 above, 80% of the students managed to achieve the grade which are above Minimum Passing Criteria (76). 12 of the students successfully reached the highest grade, namely 100. This achievement is in line with the results of practicality at evaluation section of the learning multimedia. Therefore, this learning multimedia is proven to be useful for the students of Computer Network Engineering in Padang, Indonesia.

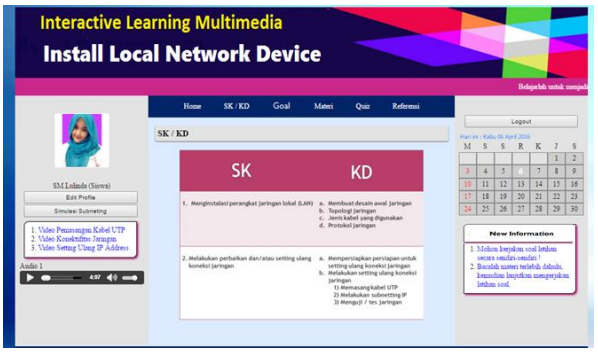
7. The Product

7.1 Main Pages



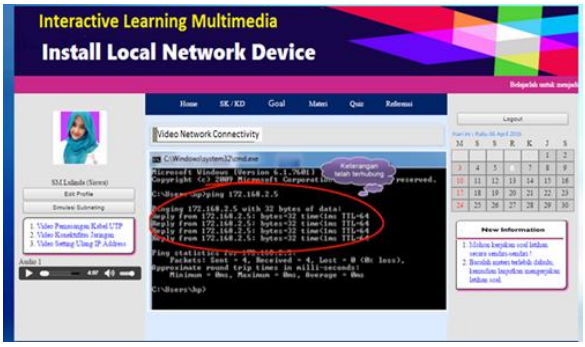


7.2 Competency Standard – Basic Competence Page

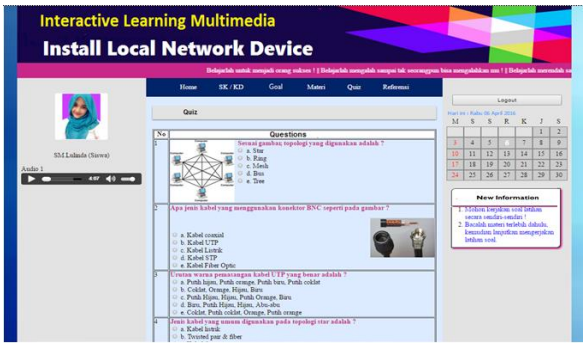


7.3 Materials Pages (video & pdf)

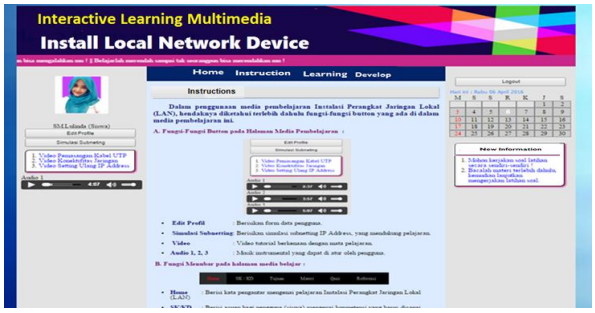




7.4 Evaluation Page



7.5 Instruction Page



8. Discussion

This Learning Multimedia needs to be further developed at its database section for keeping the data on the grades already achieved by the students after taking the test and evaluation. This is particularly necessary in order to provide the students with an accessible database for them to conduct self-evaluation with regard to the progress of their knowledge upon the materials already given.

9. Conclusion and Recommendation

Based on the results of research already conducted, the Researchers conclude that they have successfully create a web-based learning multimedia which is interactive, valid, practical, and effective for the students to learn the subject: Installation of Local Area Network (LAN). The average score resulting from validity testing reached 94.96%; which is a very valid category, the score of practicality testing reached 87% in average; which is categorized as practical, while the score of effectiveness testing successfully reached a good category, namely 87% in average.

Conflict of Interest

The authors declare no conflict of interest.

Acknowledgments

The authors acknowledge the support of Bung Hatta University, especially the lecturers in the Faculty of Teacher Training and Education who have validated the multimedia, and the students of Class XI, Department of Computer Engineering and Network at five Vocational High Schools in Padang City, Indonesia.

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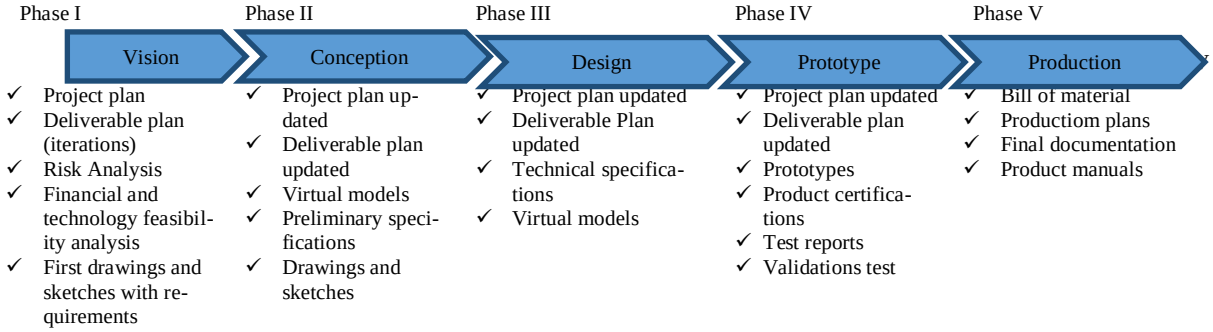
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Annexure-A



Source: Cooper (2005) ***Figure1.*** Product Development Phases and Main Deliverables