

# Development of Learning Materials Based on Blended Learning in Telecommunication Courses for Students of Electrical Engineering Education

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Telecommunication is a compulsory subject for the students of Electrical Engineering Education, Universitas Negeri Malang. Based on the preliminary observation conducted in the Department of Electrical Engineering, pieces of information which were obtained that there were no structured and specific learning materials that is made for the learning of Telecommunication subjects. In accordance with the 4.0 industrial revolution, there is a need to adjust the effective strategies and learning materials in college courses. Blended learning is an effective alternative learning strategy to be implemented in current lectures. Therefore, research and development for blended learning materials is conducted in a Telecommunication course. The purpose of the research and development are to design, develop, and test the feasibility and expedience of the products. The blended learning material is developed using a research and development model that is referred to by Sadiman (2010:100). The resulted products are validated by material and media experts. The products trial was applied to 56 students divided into small group trials and field evaluations. In the

end, the results of the material validation that have been gathered is 89.1% and media validation is 89%. Then, the data gathered from the students have 86.13% in small group trials and 88.15% in field evaluations.

**Keywords:** development, learning material, blended learning, telecommunication

## 1. Introduction

Education is a high priority for the government as it is a basic need for every citizen, prevention of ignorance, and prevention of poverty (Sulistiyastuti, 2007). The purpose of education in Indonesia is to facilitate education for the nation. The Law of the Republic of Indonesia No. 12 of 2012 explains that in order to improve the nation in facing globalisation, education is needed that is able to develop science and technology and produce competitive graduates. Furthermore, in the Law of the Republic of Indonesia No. 12 of 2012 article 31, the seventh section discusses distance education. Distance education has the intended aims to 1) provide services for higher education to people who cannot attend to the learning place directly and 2) expand more easy access and give a facilitation to higher education services in terms of education and learning.

Today the historical stages of human civilisation have entered the era of the industrial revolution 4.0. One of the benefits of this technological development is the application of media development in the field of education and learning (Rani, 2015). Successful learning is the main goal of learning activity. Learning strategies are a series of learning activities, including the use of methods and resources that will be used to support learning success (Sanjaya, 2006: 126).

Siti Istiningsih (2015) said that one of the appropriate learning strategies to use today is blended learning. The blended learning strategy is a combination of two positive aspects of the learning environment, those are face-to-face learning and online learning (Sutopo, 2011: 168). Based on the results of observations in the Electrical Engineering Department by interviewing lecturers of Telecommunication Courses, and giving questionnaires to 22 students of Electrical

Engineering Education who had taken Telecommunication Courses, pieces of information were obtained that there were not teaching and learning materials specifically and structured for the need of learning in Telecommunication Courses. Students faced difficulties in learning because teaching materials have not been able to explain the material specifically, structured, and in accordance with the competencies of Telecommunication Courses. In addition, students also experience difficulties when learning independently (out of the class) because of the difficulty of finding effective learning materials to be used as independent teaching materials. The strategies used in learning Telecommunication Courses are conventional strategies, so that learning is limited to space and time when lectures are conducted. This led to the low motivation of students to study Telecommunication Courses, especially learning outside the class. Other information obtained is that the students of Universitas Negeri Malang have electronic devices that can access internet and also digital teaching and learning materials. In addition, the network facilities available at the Electrical Engineering Department of Universitas Negeri Malang are sufficient to access learning materials via the internet. Hence, there would be conducted research and development on blended learning materials. Research and development aims to design, develop, and test the feasibility of learning materials based on blended learning.

## **2. Methodology**

Research and development is a process or steps to develop either new products or revise the existing products, this was said by Sukmadinata (2016: 164). Blended learning materials are developed using the research and development model referred to by Sadiman (2010:100). Sadiman's research and development model has eight steps. The first step is the identification of needs. In this step, the activities carried out are observation and interviews. Observations were carried out by interviewing two lecturers of the Telecommunication Course and also by students who had taken Telecommunication Courses.

The second step is the permission objective. In this step, the objectives carried out are determining the purpose of the research and development to be carried out. The objectives of this research and development are: 1) designing teaching materials, 2) developing teaching materials, and 3) testing the feasibility of blended learning-based teaching materials for

Telecommunication Courses. The fourth step is the formulation of materials. The activities carried out in the formulation of the material items are determining the materials to be discussed in the teaching material. The materials were adjusted based on the competencies of the Telecommunication Course contained in the curriculum of Study Program of Electrical Engineering Education in Universitas Negeri Malang.

The fifth step is the formulation of a measuring tool for success. The instrument lattice made refers to the feasibility criteria of teaching materials according to Wahono (2006) and BNSP (2007: 21). The instrument was made for material respondents, media experts, and trial subjects. The sixth step is scriptwriting. In this step, the design conducted included the display design and content of the teaching material. The teaching module format was adopted from the teaching module format according to Daryanto (2013: 9). While the video format and presentation slides were adopted from the teaching video format according to Prastowo (2012: 70). The seventh step is the test or trial. The trials carried out were adjusted to the trials recruiting by Sadiman (2010: 100). The trials in this research and development were applied to two Telecommunications Subject lecturers and 56 FT-UM Electrical Engineering students who had taken Telecommunication Courses. Two Telecommunication Lecturers who act as material experts and media experts. While students of the FT-UM Electrical Engineering Department acted as trial subjects.

The eighth step is the revision. It was implemented at each step of the trial, both material validation, media validation and subject trials. The revisions made to the product are the addition of materials, the arrangement of images, and the structure of writing based on the results of the validation obtained from the validation test and the responses given by the test subjects. The last step is production. In this stage what is done is to submit teaching material products to the lecturers of Telecommunication Courses.

The procedure for testing instructional materials that has been developed is divided into three stages, namely: 1) validation of teaching materials (one to one), 2) trials of small groups, and 3) field evaluations. Validation was carried out by two lecturers of the Telecommunication Course as material validators and media validators. The small group test was applied to 15

students who had taken Telecommunication Courses. While the field evaluation was applied to 41 students. The formulation of the success measure used in the form of a questionnaire using a Likert scale according to Akbar (2013: 41) with four answer points. The calculation of the validity of teaching materials is done by calculating the validation score and feasibility trial using the formula according to Akbar (2013: 83) which is shown by the following equation.

$$V = TSe / TSh \times 100\%$$

Description:

V : Validity

TSe : Total empirical score achieved

TSh : Maximum total score

The validity criteria used in development research are adapted from Akbar (2013: 41). Table 1 shows the validity criteria used in the feasibility test of teaching materials.

Table 1. Validation Criteria

Value	Criteria Validity	Description
1	85.01% - 100.00%	Very valid (can be used without revision)
2	70.01% - 85.00%	Valid (can be used but needs minor revisions)
3	50.01% - 70.00%	Less valid (Need a lot of revisions)
4	01.00% - 50.00%	Invalid (may not be used)

(Source: Akbar, 2013: 41)

### 3. Results And Discussion

#### 3.1 Product Results

The results of the products developed consisted of three types, namely: 1) teaching modules, 2) teaching videos, and 3) presentation slides. The teaching module was developed as an independent student teaching material. The material contents that were developed are twelve, namely: 1) model of communication systems, 2) amplitude modulation, 3) frequency modulation, 4) digital modulation, 5) electromagnetic waves propagations, 6) multiplexing, 7) data communications, 8) telephone systems, 9) cellular communication systems, 10) television broadcasting, 11) satellite communication, and 12) optical communication. Teaching videos

were developed as online learning consisting of four videos. While presentation slides are developed as learning media in the classroom.

### 3.2 Product Validation Results

Product validation is carried out with the aim to determine the suitability and level of feasibility of products that have been developed. In the product validation stage, the activities carried out are material validation and media validation of the instructional materials that have been developed. Table 2 shows the results of material validation in the teaching materials that have been developed.

Table 2. Quantitative data on material validation

Learning Materials	Rating Aspect	$\Sigma TSe$	$\Sigma TSh$	Validity %
Teaching Module	Content	15	16	93.75
	Language	21	24	87.50
	Presentation	36	40	90.00
	Total	72	80	271.25
	Average	-	-	90.00
Teaching Video	Learning Design	14	16	87.50
	Content	4	4	100.00
	Language	10	12	83.33
	Presentation	8	8	100.00
	Total	36	40	370.83
	Average	-	-	90.00
Presentation Slide	Learning Design	14	16	87.50
	Content	8	8	100.00
	Presentation	10	12	83.33
	Total	32	36	270.83
	Average	-	-	88.88
Total		140	156	912.91

Based on Table 2, it can be seen that Telecommunication teaching materials are very valid. In the teaching module, the average value obtained is 90%. Then in the teaching video, the average score of the material validity score is 90%. On the presentation slide, the average material validity is 88.88%. The overall material validity reached 89.74%. While Table 3 shows the results of qualitative data validation process material experts.

Table 3. Qualitative data on material validation

Teaching Materials	Notes / Comments / Suggestions
Teaching Module	The teaching module is ready to be tested
Teaching Videos	The teaching videos ready to be tested
Presentation Slides	The presentation slides are ready to be tested

Based on the criteria for the validity of teaching materials according to Akbar (2013) shown in Table 3, the results of the validation of teaching materials in the form of quantitative data in Table 3, it can be concluded that the teaching material is very valid. Table 4 shows the results of media validation in teaching modules, videos, and slides presentations.

Table 4. Quantitative data on media validation

Learning Materials	Rating Aspect	$\Sigma TSe$	$\Sigma TSh$	Validity %
Teachings Module	Graphic	37	40	92.50
	Total	37	40	92.50
	Average	-	-	92.50
Teaching Videos	Software	11	12	91.66
	Visual Communication	21	24	87.50
	Total	32	36	179.16
	Average	-	-	88.89
Presentation Slide	Software	7	8	87.50
	Visual Communication	13	16	81.25
	Total	20	24	168.75

	Average	-	-	83.33
Total		89	100	440.41
Average		-	-	89.00

Based on the data in Table 4, it can be seen that Telecommunication teaching materials in terms of learning media are very valid. The score of the overall media validity score reached 89%. So, it was valid. Table 5 shows the results of qualitative data on media validation for Telecommunication teaching materials.

Table 5. Qualitative data on media validation

Teaching Materials	Notes / Comments / Suggestions
Teaching Modules	Adjust the views and layout for making it better
Teaching Videos	Add animation to add to the attractiveness of the video
Presentation Slides	Maintain the size of the title and contents of the slide

Based on quantitative data from the results of the validation shown in Table 5, it can be concluded that the teaching material in terms of learning media is very valid, but still requires a little improvement. Repairs are carried out in accordance with the notes, comments, and suggestions shown in Table 6. Improvements were made before small group trials were carried out. After the repairs have been completed, the teaching materials are ready to be applied to the small group trials.

#### 4.2 Field Evaluation Results

After a small group trial, the next is field evaluation. Field evaluation was applied to 41 students of the FT-UM Electrical Engineering Department who had taken Telecommunication Courses. The trial subjects in the field evaluation differed from the small group trial subjects. Table 8 shows the results of field evaluation trials.

Table 6. Results of field trials

Product	Rating Aspects	$\Sigma TSe$	$\Sigma TSh$	Validity %
Teaching Module	Language	1182	1312	90.09
	Presentation	283	328	86.28
	Graphic	574	656	87.50
	Implementation	285	328	86.89
	Total	2324	2624	350.76
	Average	-	-	88.57
Teaching Video	Software	146	164	89.00
	Learning Design	153	164	93.29
	Visual Communication	569	656	86.70
	Total	868	984	268.99
	Average	-	-	88.21
Presentation Slide	Software	153	164	93.29
	Learning Design	151	164	92.07
	Visual Communication	582	656	88.78
	Total	886	984	274.14
	Average	-	-	90.04
Total		4048	4592	893.89
Average		-	-	88.15

Based on the data in Table 6, it can be seen that the validity of teaching materials in the field evaluation is also very valid. The overall validity of teaching materials reaches 88.15%. Based on the validity criteria of teaching materials in Table 2, it can be concluded that overall teaching materials are very valid and can be used without the need for revisions.



## **5. Conclusions And Recommendations**

The conclusions of the blended learning based teaching materials in the Telecommunication Course are: the design and development were in accordance with the format and strategy that have been planned before. Furthermore, the learning materials based on blended learning have obtained very valid feasibility test results both in terms of material and media, so that they can be used in Telecommunication lectures.

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