

# Developing Web-Enhanced Course in Basic Electronic Course

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## Developing Web-Enhanced Course in Basic Electronic Course

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**Abstract.** Lately the world is being enlivened by the era of industrial revolution 4.0. The era of industrial revolution 4.0 occurred due to the advancement of science and technology. Education needs to follow the development of the industrial revolution era 4.0. One of them is developing web learning media. This study developed a web of physics learning media with basic electronic material. The purpose of the study was to describe the feasibility and responses of students toward the web-enhanced course on basic electronics courses. The method used was adopted from Borg & Gall. Data collection techniques were carried out by conducting pre-research questionnaires, interviews and documentation. The web course development resulted in changes in terms of design such as color, structured layout, and to be more attractive. In terms of content, the material has been uploaded at each meeting. There is an attendance on-line and interesting supporting material for lectures. The developed web-enhanced course has also been integrated with the university and Department's web. Web-enhanced course based on the assessment of material expert validation, media experts, and IT experts who declared that the product as feasible. The respondents' assessment on the web of physics learning categorizes as very attractive and students felt enthusiastic when the web-enhanced course was used as a learning medium.

### 1. Introduction

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Recently the world is being enlivened with the era of industrial revolution 4.0 which will change the world instantaneously. The era of industrial revolution 4.0 occurred due to the advancement of science and technology [1]. The development of science and technology has an influence on each generation [2], especially in the field of education [3]. Education needs educators who are equipped with innovative learning, open-minded toward science and technology, and also to be proactive [4]. Then educators need to master the learning media.

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Media is one of the technologies that has been developed significantly and serves to increase the attractiveness of students in learning activities [5]. Even the current learning has used a lot of internet networks [6–8]. Internet networks can be used during the learning process and can be used whenever and wherever [9–11].

One internet application that is used in learning is the web. The web can improve learning [12]. Web-based learning consists of 3 types, namely web courses (does not require face-to-face



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meeting), web-centric course (combining face-to-face meeting and distance learning), and web-enhanced course (face-to-face)[13-14].

The web-enhanced course can be an alternative in learning on-line that allows interactive communication between lecturers and students, both individually and in groups [15-16]. The web-enhanced course is one of the media that is very well used as a medium for learning physics [13,17-18].

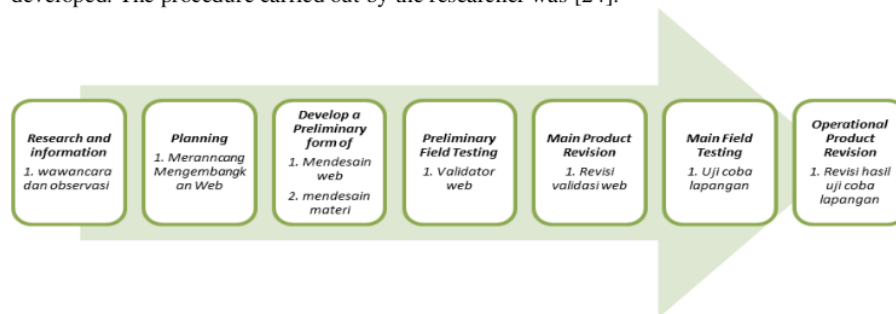
Physics is generally always related to formulas, calculations, thoughts, and abstracts things so that they are considered boring [19]. then it needs interactive learning [20]. Based on some recent research and interviews with educators, the implementation of a Web-enhanced course will greatly help the performance of educators in delivering material that cannot be sensed and requires visual clarity as well as electronic material.

Previous studies have been conducted on web learning including development of web-based learning that is designed and implemented with facilities including downloading material, assignments, quizzes, and open discussion forums for teachers and students to discuss among each other [21], developing webs learning by adding score information features [22] and the development of web learning with evaluation on-line that is practical in its assessment and scoring information for students [23].

In this study, the web developed is in the form of a web-enhanced course (face to face). This web is intended to be applied to physics learning especially Basic Electronics courses in college by providing complex and structured learning based on the course's needs and accompanied by media and evaluation according to the needs of students in learning independently so that it is easier to understand. The online questions evaluation could be utilized independently and practically in their use for either the educators or students. In addition, web learning is integrated with the web owned by the university and departments so that it can provide information needed by students.

## 2. Research Methods

This study uses research and development methods (Research and Development). Research and development methods are research methods used to produce certain products, and test the effectiveness of these products. The research and development proposed by Borg & Gall contained ten steps but the researchers limited it to seven steps because the modified steps are already able to answer the formulation of research. The researcher did not test the effectiveness of the products developed. The procedure carried out by the researcher was [24]:



**Figure 1** The Modified Steps of Borg & Gall Research Design

The research data collected was in the form of expert validation sheets, lecturer response sheets, lecturer and student response sheets. The data analysis was done using a Likert scale with the following formula [24]:

$$x_i = \frac{\sum s}{s_{max}} \times 100 \% \quad \dots\dots\dots(1)$$

Description:

$s_{max}$  = Maximum score

$\sum s$  = Total scores

$x_i$  = The score of feasibility for each aspect of the questionnaire

The questionnaire responses toward the use of product contain 5 choices in accordance with the content of the question. Interpreting the results of assessment by media experts, material experts, lecturers and students' responses from letters format to scores format with the provisions in the following table:

**Table 1** Scoring Procedure

Category	Score
Excellent	5
High	4
Moderate	3
Low	2
Bad	1

The questionnaire responses were used to find out the interest toward the product. The final score was done by analyzing the average score for each item through the calculation of the feasibility score for each aspect divided by the number of statements.

The percentage score results obtained from the study was interpreted based on the criteria in table 2 [25]:

**Table 2** Scale of Learning Media Feasibility

Interval	Criteria
$0\% < \bar{x} \leq 20\%$	Highly Feasible/ Attractive
$20\% < \bar{x} \leq 40\%$	Less feasible / Attractive
$40\% < \bar{x} \leq 60\%$	Moderately feasible / Attractive
$60\% < \bar{x} \leq 80\%$	Feasible / Attractive
$80\% < \bar{x} \leq 100\%$	Highly Feasible / Attractive

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### 3. Results and Discussion

The details of the research and development of the learning media web are as follows. In the research and information stage, the researchers conducted pre-research by interviews and observations. The planning stage was based on the pre-research or field observation data so product specifications that would be developed could help the lecturers and the students in the learning process and students' self-learning in the form of web. In the developing stage, the preliminary form of Product was developed by the researchers in terms of design such as color and structured layout to be more attractive in terms of content. The materials uploaded at each meeting were in accordance with the curriculum of the course. There is an on-line attendance to facilitate the students and lecturers when they cannot meet face-to-face as well as interesting supporting materials such as PhET Simulation, learning videos, power points, and an on-line evaluation. The developed product is also integrated with the university and department's web such as lecturers and students' academic system.



**Figure 2** Home Page of the web

Figure 2 shows the home page of the web which consists of several parts, namely home, information, Physics University, publications and students. The Information section consists of Physics Education Department, the latest UIN news, student and lecturer's academic system. The Physics University section consists of quantum physics and basic electronics. The publication section consists of scientific journals, reputable journals, and the latest articles. In the student section, the guidance consisted of a list of lecturers' academic guidance students.

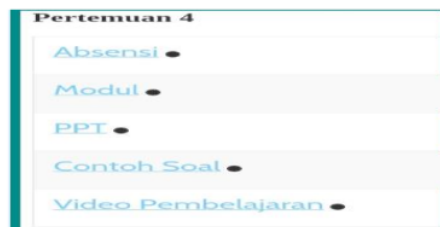
Figure 3 shows the Basic Electronics learning in the form of study contracts, learning concept maps, learning syllabus, learning specifications, materials, and grades which include 16 meetings.



**Figure 3** The Display of basic electronics



**Figure 4** The Display of Basic Electronic Part



**Figure 5** The Display of Basic Electronic Material

Figure shows the Basic Electronics course which includes 16 meetings in one semester. Direct current Electrical Circuit Material based on the syllabus covers 5 meetings in for 1 semester. Based on this, the researchers only include 5 options in the web.

Basic Electronics Lecture in Direct Current Electrical Circuits includes 5 meetings. Lecturing materials are presented in the form of modules, Power Point, Phet Simulation, learning videos, and sample questions. The display is shown in figure 5-9.



**Figure 6** Display of Attendance



**Figure 7** Display of Material



Figure 8 Display of PPT



Figure 9 Display of Sample Questions

The Preliminary Field Testing stage is the validation of Web-enhanced course on Basic Electronics courses conducted by 8 experts that consisted of 3 material expert, 3 media experts, and 2 IT experts. After validation by experts was done, the next step was revision of the media and then tested the product on physics Education students of UIN Raden Intan Lampung in sixth semester. The Main Product Revision stage was to revise the validated product. The following are the results of the validation and revision of material experts, media experts, and IT experts.

#### a. Material Expert Validation

The material expert assessment results on the product are presented in Table 3 as follows:

Table 3 Material Expert Validation

Aspects	Percentage
Contents Feasibility	87.27%
Presentation Feasibility	89.62%
Language	83.70%
Contextual	81.11%
<b>Average</b>	<b>85.43%</b>

Table 3 contains the results of the assessment by three material experts with the the result of 82.27% for content feasibility aspect, 89.62% for presentation feasibility aspect, 83.70% for language aspect, and 81.11% for contextual assessments. The average score for all aspects obtained is 85.43% within feasible category.

#### Media Expert Validation

The results of media expert validation assessment on the products are presented in table 4 as follows:

Table 4 Results of Media Experts Validation

Aspect of Assessment	Percentage
Visual Communication	75.55%
Software Engineering	76.66%
<b>Average</b>	<b>76.11%</b>

Table 4 shows the results of the three media experts validation. The percentage of the results of the validation for the visual communication aspects is 75.55% with a highly feasible category and



76.66% in the aspect of software engineering with a highly feasible category. So that the average scores of the two aspects is 76.11%, which means that the web learning is in feasible category.

#### 9 IT Expert Validation

The results of IT expert validation are presented in table 5 as follows:

**Table 5. Results of IT Expert Validation**

Aspect of Assessment	Percentage
Quality of Content	67.50%
Display	83.30%
Coloration	73.33%
Letter	76.66%
Picture	82.50%
Menu	70.00%
Sound Quality	80.00%
User Ease	80.00%
<b>Average</b>	<b>76.66%</b>

Table 5 is the result of the assessment from two IT experts. The percentage of the results of the content quality aspect assessment is 67.50%, the display (lay-out) is 83.30%, the coloration is 73.33%, the font is 76.66%, the image is 82.50%, the menu (icon) is 70.00%, the sound quality is 80.00%, and the ease of usage aspect is 80.00%. So that the average scores of these aspects is 76.66% which means that the Web-enhanced course is in a feasible category based on the validation of IT experts.

#### d. Product

The main field testing stage is to try out the learning media after the revision. It was carried out in the Physics Education Department of UIN Raden Intan Lampung. The field testing consisted of small-group testing and field testing. The testings were carried out when the lecturing activity took place. After learning with the web that was developed, the students were asked to fill out the questionnaire. The results obtained from the testings are explained as follows:

**Table 6 Results of Small- Group Testing**

Aspects of Assessment	Percentage
Visual Communication	84.83%
Software Engineering	81.00%
Learning Design	81.33%
<b>Average</b>	<b>82.39%</b>

Table 6 shows the results of small-group testing conducted to 10 students by giving questionnaires to get the data. The percentage of the visual communication aspect is 84.83% in the highly feasible category, the percentage of software engineering aspect is 81.00%, and the learning design is 81.33% in the highly feasible category. From these three aspects, it can be seen that the average of overall aspect is 82.39% with the very attractive criteria.



**Table 7** The Results of Field Testing

Aspects of Assessment	Percentage
Visual Communication	82.66%
Software engineering	82.33%
Learning design	82.44%
<b>Average</b>	<b>82.48%</b>

Table 7 shows the results of field testing conducted at UIN Raden Intan Lampung to 30 sixth semester students of Physics Education Department through questionnaire. The result of field testing shows that the percentage of the visual communication aspect assessment is 82.66% with a highly feasible category. The percentage of the software engineering aspect is 82.33%, and the percentage of the learning design is 83.44% with a highly feasible category. From these three aspects, it can be seen that the average overall aspects is 82.48% with a very attractive category. The Operational Product Revision stage is to revise the product in accordance with the suggestions from the small-group testing and field testing. After revision, the final product of this study was obtained.

Based on several stages carried out in this study, this learning media has very good qualities and is worthy of being used for learning media. This is in line with previous research that the development of web learning media is more interesting and motivated to be used in learning [13], [15], [26], [27]. A new finding in this study is that the material that is difficult to see or touch with the human senses is better to be simulated, through videos or things that depict the material.

#### 4. Conclusion and Suggestions

##### Conclusion

Web-enhanced course that the researchers developed in the Basic Electronics course are suitable to be used in the learning process. Product's feasibility is based on the assessment of material experts, media experts, and IT experts. The assessment of material experts, media experts, and IT experts is categorized as highly feasible. The results of the testings carried out in the small-group testings and field testing obtained a highly feasible category for the developed product. The research conducted supports several previous studies. New findings in this study are that the material that is difficult to see or touch with the human senses are better to be simulated, presented through videos, or things that depict the material.

##### Suggestion

Based on the experience of the researchers, the web learning should be designed according to the needs in the field. The researchers expect for the further research to develop a physics learning media with a more interesting material display and to develop a web physics learning with more updated and underdeveloped materials.

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