



# Developing Flash-Based Teaching Material "Energy Saving Using Zelio"

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## Abstract

The support of ICT in distance learning is absolutely required. Time and distance will not impede learning if it is supported by ICT. In the future, distance learning is very suitable to be developed in Indonesia provided that ICT supports be made available since educational facilities are not evenly distributed in addition to the insufficient number of educators especially in remote areas. Effective teaching material provides maximum learning accomplishment and fascinates students. This research elaborates on ICT-supported teaching material (multimedia web-based teaching material). One of the softwares which can be used for developing ICT-based teaching material is Macromedia Flash Player. This is applied to the topic of the use of smart relay periodically learned by students in the chapter of Energy Management. Data collection in the development of the teaching material is done by giving a questionnaire to media and material experts. 23 items are provided for media evaluation yielding the overall score of 154 (83.6%). Material evaluation which consists of 16 items yields the overall score of 128 (84.3%).

**Keywords:** *distance learning, energy saving, smart relay, Flash*

## 1. INTRODUCTION

### 1.1. Background

Due to the limited energy resources, the efforts in managing it, called energy saving, are required. One of the examples of energy saving application is electrical energy controlling for lighting in buildings, houses, school buildings, and industries. Controlling can be done by utilizing PC or smart relay. Smart relay is the replacement of the old controlling device by the means of a relay. A smart relay is able to transform its function without changing the wiring (when a relay is in use). When its function is to change what is to be done is merely changing the program.

Effective teaching material yields high learning accomplishment, increases students' motivation and can be very interesting. This research elaborates on ICT-supported teaching material (multimedia web-based teaching material). One of the softwares which can be used for developing ICT-based teaching material is Macromedia Flash Player. This is applied to the topic of the use of smart relay periodically learned by students in the Energy Management chapter. Students can learn the energy management system by the means of learning media in form of, among others, the application of smart relay (zelio)

The objective of electrical energy controlling is to minimize its consumption and to enable it to be used only when needed. The power controlling system is developed by the means



of smart relay. The use of smart relay is very effective and efficient in controlling power in multi stories buildings because smart relay can be easily added to other devices.

### **1.2. Statement of Problem**

The problem to be solved with the research is lack of understanding about lesson in *energy saving* that applied to university students and vocational students. The solution is developing the ICT-based learning material focusing on the utilization of instrumentation and control for energy saving.

### **1.3. Research Objective and Development**

The objective to be accomplished in the development of the teaching material is the availability of the teaching material concerning energy saving which can be accessed by public (vocational school students, university students and practitioners).

### **1.4. Urgency of Research**

The urgencies of the research are:

- The lack of availability of the teaching material that can enable people to self design good energy saving control for domestic use or industrial buildings.
- The lack of availability of teaching materials that can enriches distance learning literature, that can be accessed free of charge.
- It can be used as socialization media for energy saving.

## **2. LITERATURE REVIEW**

### **2.1. Learning Media and Teaching Material**

Media come from the Latin word *medium* which literally means middle, intermediate or mediator. Media, in general, are people, material or events that develop a condition in which students are able to obtain knowledge, skills or attitude (Arsyad, 2002). In this concept, teachers, textbooks and community are media. Specifically, in a learning process, media are inclined to mean graphic, photographic or electronic devices for capturing, processing and rearranging visual and verbal information.

The use of learning media serves several purposes: (a) to make teaching and learning process easier, (b) to increase teaching and learning efficiency, (c) to maintain the relevance of the learning objective, (d) to help with students' concentration, (e) to stimulate students to learn by the means of the learning source components (according to Gagne, 1985, 1987), (f) to be the physical medium containing instructional material (according to Briggs, 1977), (g) to be an information-bearing or instructional-message-bearing technology (according to Schramm, 1977), (h) to be something which can stimulate students' learning process (according to Miarso, 1984)

Teaching materials are a collection of learning materials which are systematically organized embodying the whole representation of the competence that will be accomplished by students



in the learning process. The development of the teaching material using Flash Macromedia program can help students understand energy saving, since the program offers advantages in presenting multimedia that can combine animation, sound and users' interactivity.

Distance learning takes place when learning process occurs without face-to-face interaction between educators and learners. In distance learning, direct two-way communication is bridged by media such as computer, television, radio, telephone, video and the like.

### **2.2. Energy Saving**

Energy saving can decrease power consumption and per-capita power demand. The increase in power demand is caused by population growth. Energy saving can decrease the energy cost and decrease the need of bigger power plants or imported energy. In addition to that it promotes emission reduction. Energy saving is a key element in the mitigation of climate change.

In this case, energy saving is the act of decreasing electric power consumption. Energy saving can be achieved through efficient energy consumption in which the same benefits of power consumption can be obtained with less energy or by decreasing the consumption and the activities which consume electrical power. Smart relay is a controlling device which almost resembles a PLC. However, technically, smart relay is lower than PLC. Smart relay is intended to replace the old controlling device using relay. A smart relay is able to transform its function without changing the wiring (when a relay is in use). Its function is to change what is to be done by merely changing the program.

Zelio smart relay consists of two models: compact model and modular model to which an additional I/O module can be added (expansion module). The I/O module can be both digital and analog, even in form of modbus and memory communication module. Those are the advantages of Zelio smart relay.

### **2.3. Learning Material Development Model**

Experts in educational technology have put forward various learning resources development models. Out of many learning resources development models, Borg and Gall Model (1983) is modified and used in this research.

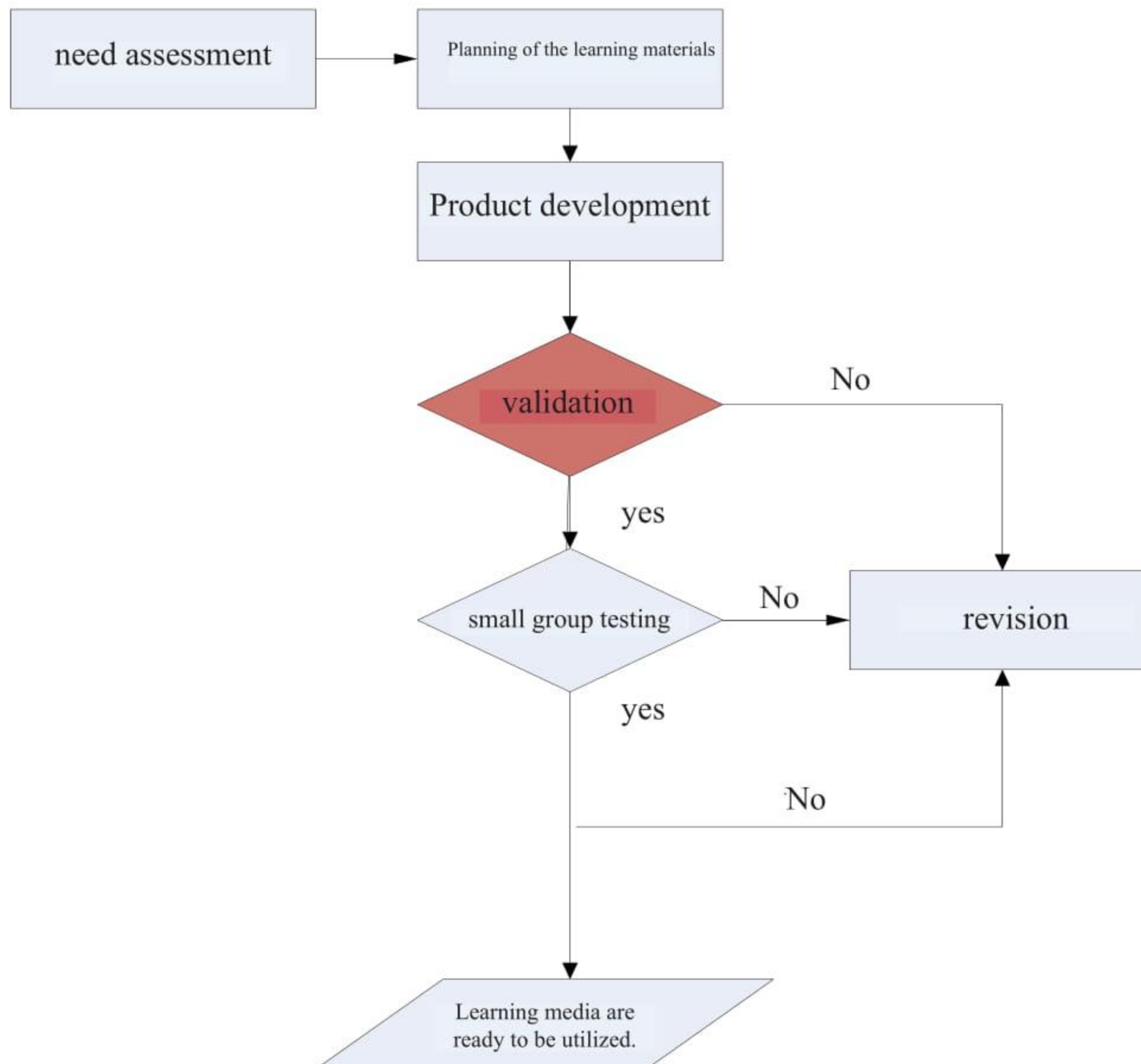
The following are steps in developing learning media based on the modification of Borg and Gall Model, that consist of: (1) need analysis, (2) planning of the learning materials, (3) product development, (4) validation, (5) revision (6) small-group testing, (7) revision, (8) learning materials are ready to be used. The last steps are distribution and reporting. In this model, Borg and Gall elaborate on steps taken in the testing of media to be developed. The most basic element in Borg and Gall Model is product testing and revision which are conducted consecutively in a continuum. The testing is conducted only on students. The role of an expert tends to be disregarded in the testing of the media to be developed.



### 3. METHODOLOGY

#### 3.1. Development Model

The teaching material development model used is Borg and Gall Model. Its flowchart is illustrated in Picture 1.



Picture 1: Modification of Borg and Gall Media Development Model  
(Source: Borg & Gall, 1983)

#### 3.2. Development Procedure

##### 3.2.1 Need Analysis

Need analysis is to identify the competencies which needs to be accomplished by studying the learning materials of smart relay. The output of this activity is a competencies map to be covered in the teaching material to be developed.



Table 1. Teaching Material Specification

No	Indicator	Teaching Material	Teach. Mat. Form		
			Text	Picture	Video
1	Comprehending <i>energy saving</i> concept	1. <i>Energy saving</i> concept	V		
		2. purposes of <i>energy saving</i>	V	V	
		3. how to do <i>energy saving</i>	V	V	V
3	Comprehending <i>smart relay</i>	2. lighting intensity	V	V	
		1. comprehending <i>smart relay</i>	V		
		2. <i>smart relay</i> features	V	V	
4	Designing control system	3. examples of smart relay application	V	V	V
		1. control system concept	V		
		2. designing control system	V	V	V

### 3.2.2 Development Result

Smart relay is chosen in the development of the control system. The teaching material is expected to be able to explain energy saving. The following is the development result.

Menus provided in the learning media are:

- Main Menu/Home (Explanation, Zelio Soft, Jobsheet)
- Concept Menu ( Home dan Jobsheet)
- Zelio Soft Menu (Home dan Jobsheet)
- Jobsheet Menu (Home)
- Tutorial Video (how to apply Zelio Soft)



Picture 2. Main Menu



Picture 3. Concept menu





Picture 4. Zelio Soft Menu



Picture 5. Jobsheet Menu



Picture 6. Jobsheet Menu



Picture 7. Tutorial Video

The learning contents are the key component in the system which is developed. The contents are the contents of the flash-based learning application. The learning material is general material intended for public who are interested in energy management. Three discussion points are elaborated in the content of the teaching material:

- a. Introduction to energy management and teaching material. The material elaborates on the basic concepts of energy management and teaching material discussion.
- b. Zelio Soft. This section emphasizes on the introduction to Zelio Soft.
- c. Jobsheet. This section specifically provides exercises which evaluate students' comprehension on the materials learned.

The example of the layout of one of learning contents which discuss energy management using Zelio is shown in Picture 8.





66  
67



Picture 8: Zelio Soft 1 Content

The content in Picture 8 enables students to understand parts of Zelio Soft and to make application ladder diagram.



Picture 9: Zelio Soft 2 Content

The content in Picture 9 elaborates on the selection of Zelio which is used for determining the number of I/Os to be used.



Picture 10. Jobsheet content

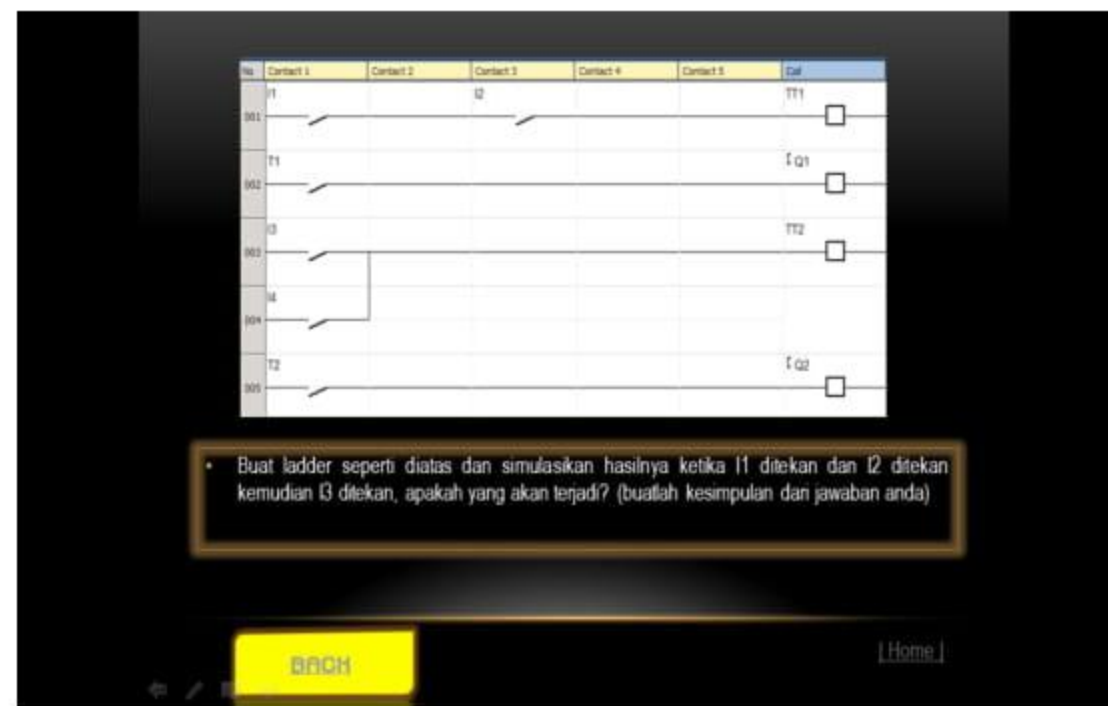
The content in Picture 10 elaborates on Jobsheet which is used for users' evaluation to be more familiar with the use of Zelio Soft and to know how to develop energy saving application.





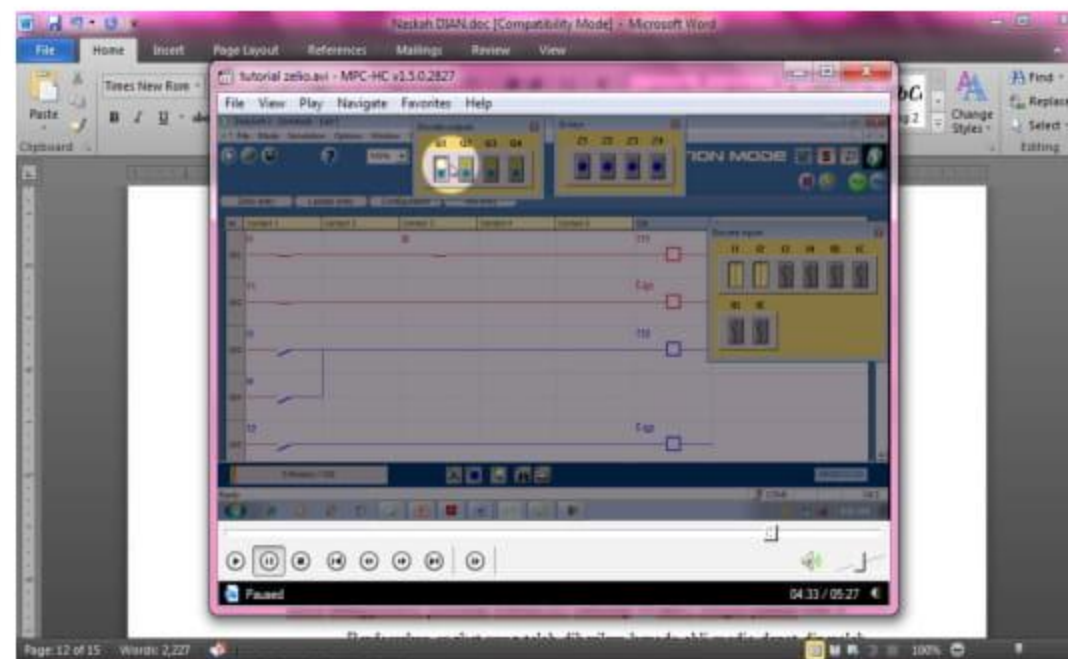


The layout in Picture 11 is the continuation of the Jobsheet content that includes the ladder diagram as a guideline for designing ladder diagrams



Picture 11: Jobsheet content

The layout in Picture 12 shows the already-run Zelio Soft which is executable.



Picture 12. Additional content for tutorial videos

### 3.3. Data Collection Instrument

Phases in the evaluation of the learning media developed in this research, which elaborates on energy saving using Zelio, are (a) experts' judgement phase, (b) individual testing phase, and (c) field testing phase. The first phase is evaluation by the experts. Media experts are individuals who possess intensive experience in learning media. Media experts are chosen as the evaluators to provide evaluation in form of responses and input towards the use of media in learning.

Learning material experts are individuals who possess intensive experience in presenting the topic of Zelio Soft application. Learning material experts are chosen as the evaluators to provide responses and input towards the learning material concerning energy saving using Zelio Soft.



### 3.4. Data and Instruments

Data collected in the development of the teaching media are primary in the forms of quantitative as well as qualitative data from the respondents. The data are collected by the means of questionnaires. Questionnaire is used in the data collection as all respondent are literate and can easily understand the contents of the questionnaire. In addition to that, respondents have time to think and thoroughly read the contents of the questionnaire. The objective of the questionnaire is to collect data and to find out what sorts of responses obtained concerning the media. The questionnaire has lickert scales as the following:

- Scale of 4 : SS or strongly agree
- Scale of 3 : S or agree
- Scale of 2 : TS or disagree
- Scale of 1 : STS or strongly disagree

#### 3.4.1 Data analysis technique

The collected data obtained from the product testing are analyzed by the means of descriptive quantitative analysis. The formula used for processing each data item is:

$$P = \frac{x}{xi} x 100\%$$

Where:

- P : Percentage
- x : Respondents' answer in each item
- xi : Ideal score in one item

The formula used for processing the overall data is

$$P = \frac{\sum x}{\sum xi} x 100\%$$

Where:

- P : Percentage
- $\sum x$  : The number of all of respondents' answers in all items
- $\sum xi$  : The overall ideal scores in one item

The decision making norms in data analysis use the qualification scale to draw a conclusion. The interpretation norms are as follows:





Table 2. Interpretation Norms

Category	Percentage	Indicator
A	80%-100%	Very Good
B	60%-79%	Good
C	50%-59%	Not So Good
D	<49%	Poor

Explanation:

- When the validated learning media yield 80%-100%, the media are qualified as Very Good.
- When the validated learning media yield 60%-79%, the media are qualified as Good.
- When the validated learning media yield 50%-59%, the media are qualified as Not So Good.
- When the validated learning media yield 0%-49%, the media are qualified as Poor.

The data collection in the development of the teaching material concerning the use of Zelio is done by the means of questionnaire given to media experts and material experts. There are 23 items provided to evaluate the media with the overall score of 154 (83.6%). From those 23 items, 16 are provided to evaluate the material with the overall score of 128 (84.3%). Data obtained from the students are obtained by the means of interview to 14 students asking similar questions as in the questionnaire for the experts.

#### 4. FINDING AND DISCUSSION

Based on the questionnaire, the first media expert concludes that the learning media are usable with the suitable strategy for the learning of Zelio in year 9 of vocational high school. The second media expert suggests that the learning media should be operable on computers with any specification so as to make it easier for students to use.

Based on the questionnaire, the first material expert suggests that the media be developed further so as to augment them and make them more complex. The second material expert suggests that the learning media be able to assist teacher in presenting the topic of energy saving in the learning process.



## 5. CONCLUSION AND SUGGESTION

### 5.1. Conclusion

The development of the teaching material concerning Zelio helps students learn how to apply Zelio. In addition to that, it may serve as an alternative in the learning process so that boredom can be prevented. The media are expected to be able to motivate students in their learning. The media are designed utilizing the research and development approach which is modified in conformity with the need analysis. The learning development model utilized is Borg and Gall Model (1983).

The result of the media development is validated by media experts and material experts who respectively confer 84.2% and 84.3% to the appropriateness of the media for learning the topic of energy saving. This proves that the media are valid and appropriate to be used as learning media. The testing conducted on the students of a vocational high school in Wes Java shows that most of them are in favor of “game” learning methods. The media will be stored in CDs for learning.

### 5.2. Suggestion

To optimize the use of the teaching material, it is suggested that: (a) teachers should be given guidance in the use of the teaching material, and (b) before learning through playing the game in the media, students should be encouraged to read the guidelines or view the demo video so as to make them not confused. They can also seek for assistance from their teachers. One consideration should be taken into account if the teaching material concerning Zelio is used in a wider scale that the product is intended for year 2 of vocational high school students.



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