

# **e-Learning: Multimedia Application on Digital Signal Processing**

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## **ABSTRACT**

*Keywords: Learning Model, DSP, Multimedia, e-Learning*

Traditional learning model implementation, especially for Digital Signal Processing (DSP) subject has caused difficult comprehension to the students. This problem has been yielded by uninteresting teaching method. Most of the DSP materials are taught in mathematical equations. Moreover most of the DSP textbooks are in English. As a result the students do not recognize the importance of DSP applications in real life.

The decline of students' interest in this subject has negative effects. These are lack of the students' motivation, the students' comprehension, the students' creativity and lack of the students' ability in analysis and design. Therefore the students are not interested in doing thesis research in DSP. That's why the new learning method is required to solve those problems.

E-learning model with multimedia simulation was proposed in DSP teaching. The simulations were created using Matlab tool. In addition the model was equipped by training in the Lab. The outcomes of the learning model showed good results, both in number of students who passed the subject and student's scores.

## **I. INTRODUCTION**

Traditional learning model was implemented in most subjects in electrical engineering department. This model used OHP (Over Head Projector) and has implemented discussion method in the class. However the model is not equipped by multimedia visualization and simulation which will gain the students understanding to the subject.

Most of the students have difficulties to understand Digital Signal Processing subject, because of the following reasons, such as most of text books are in English, most of DSP textbooks are described in math, and the learning method was not interesting and difficult to understand. As a result, the students' understanding and interest to the subject declined. Then they were not interested to do research in DSP subject. Moreover they have low scores.

DPS subject is one of non-favorite subjects because of most of the material are dominated by complex mathematic equations. Therefore this paper raises some issues. The issues are "how to gain the student's interest, comprehension, motivation, and creativity to the DSP subject?"; "how to make the students understand the benefit of the DSP subject in science and engineering?"; "how to increase the student's analysis ability?"; and "how to increase the students passing grade?".

Hence the paper proposed multimedia application on subject of digital signal processing. The aim of the method is to increase the successful of number of the students in the subject, to increase the student's scores, and to increase the students' skill in programming, ICT, and analysis.

## **II. LITERATURE REVIEW**

Learning material is one of important tool in self-learning process of the students. Then a good learning material can be a "self-learning module". According to (9), self-learning module is:

*A print learning material that is relatively easy to learn by a student without assistance from a teacher, tutor, or facilitator. A module must be self-contain or self-explanatory, which means that it must include all necessary information to achieve its objectives.*

Learning process also requires learning media that can be categorized as non-projection tool such as using real object as a learning media; projection tool such as using slide-projector; audio tool; video tool; and multimedia tool. In addition learning media selection should be based on the following factor; the aim of the learning process, character of the students, the availability of tools (hardware and software), and the learning material.

E-learning is stand for electronic learning. Its definition is a learning process aided by electronics' tools. According to Prof. Soekartawi (10), e-learning is

*"learning process which needs electronic equipment. It can be technology based learning such as audio and video or web-based learning such as computer aided learning and Internet".*

Hence e-learning can be implemented for face-to-face meeting or distant learning. Now computer is the most popular as a tool in e-learning method. Therefore it is

also known as computer-based learning and computer-assisted learning. Computer-based learning is learning process that fully uses computer. Computer-assisted learning is learning process with computer as a primary-aided tool.

### III. METHODOLOGY

Digital Signal Processing which is compulsory subject for Telecommunication students in Electrical Engineering Department, was proposed to be taught using e-learning method. The method, then was applied for one semester to the students. There are three stages in applying the learning method. The first is a preparation stage, then followed by an implementation stage, and finally is an evaluation stage.

#### 3.1. Preparation Stage

Preparation stage is an important stage, since in this stage many works should be done. Detail of works are preparing syllabus, preparing slides and assignments, designing learning media, designing exercise module, and designing learning process evaluation. The subject itself has three sks (unit credit per semester) which is equivalent with 150 minutes per meeting. Therefore syllabus is designed to satisfy the sks and for 12 times meeting and twice for examinations. Slides and learning media are in English and most of them in multimedia visualization. The visualizations employ signal processing toolbox from matlab and the students also did practicing using the toolbox.

#### 3.2. Implementation Stage

The implementation stage is last for one semester of 12 times meeting in the class. Besides face to face meeting, the Internet media is utilized for interaction and communication between the students and the lecture. Every meeting is started with an explanation of benefit and application of each topic. Then it is followed by an explanation of important tools in gaining the understanding to the subject, such as math, programming, simulation tool, and hardware tool. In this stage, the visualization and simulation are applied five times, and then followed by training in the laboratory in week 7 and week 10.

#### 3.3. Evaluation Stage

The last stage is evaluation stage. In this stage, the students' progress is evaluated from their assignment results and examinations. There are two assignments and two examinations. The students have to use math and simulation tools in completing all of the assignments. In addition, they have to describe an idea or a topic related to the subject for their thesis. Table 1 shows assessment weight. Hence the evaluation method is a combination of the following: computer adaptive testing with Group performance assessment, multiple choice test, individual performance assessment, and short-answer, open-ended assessment.

Table 1.  
Assessment Weight

| Assessment  | Frequency/Semester | Weight |
|-------------|--------------------|--------|
| Presence    | 14 x               | 5%     |
| Assignment  | 2 x                | 30%    |
| Mid. Exam.  | 1 x                | 30%    |
| Examination | 1 x                | 35%    |

Generally, the learning process is evaluated at the end of the semester by assessing feedback forms. The forms involve input and the learning process. The input is the students, the subject, facilities, lecturer, and curriculum. Learning strategies, method of lecturer's transfer knowledge, and learning method of the students are categorized as the learning process. This evaluation intends to increase the quality of the learning method.

### IV. IMPLEMENTATION RESULTS

The learning method was applied for one semester with total number of students took the subject was 25. The method implementation showed good results. The first result was the score of the students increased compared to the previous students. Sixty four percent of students has got score "A" and the rest has got score "B". There were no score below than B, as shown in Figure 1.

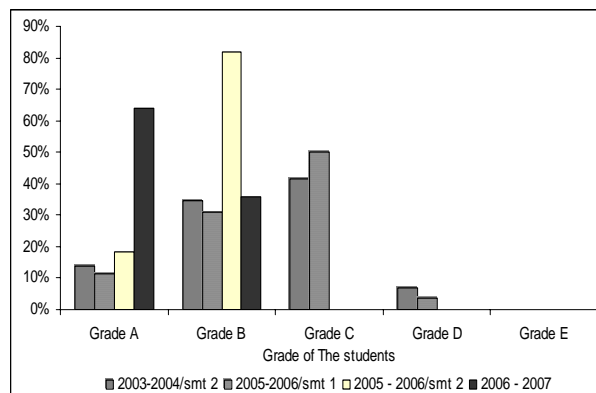


Figure 1.  
Scores comparison of the students from year 2003 to 2007

Feedback forms that were filled by the students, also showed good results. There were some significant results as shown in table 2, such as most of the students gained understanding to the subject. In addition, all of the students agreed that learning media in multimedia visualization improved the quality of learning process for subject DSP.

Table 2.  
Feedback results of the learning method

| No | Students Opinions                                   | - | - | 0  | +  | ++ |
|----|---|---|---|----|----|----|
| 1  | Students are interested to the subject              |   | 3 | 11 | 11 |    |
| 2  | Students understanding to the subject               |   | 2 | 17 | 6  |    |
| 3  | Benefit of the subject                              |   |   | 9  | 16 |    |
| 4  | Students motivation in the learning process         |   | 1 | 18 | 6  |    |
| 5  | Students ability in theory application              |   | 6 | 19 |    |    |
| 6  | Students interest to have project in DSP subject    |   |   | 22 | 3  |    |
| 7  | Students ability in identifying DSP problems        |   |   | 17 | 8  |    |
| 8  | Lecturer gives uptodate references                  |   |   |    | 24 | 1  |
| 9  | The quality of assignments and training             |   |   |    | 25 |    |
| 10 | The quality of examination questions                |   |   | 5  | 20 |    |
| 11 | The lecturer capability of the subject              |   |   |    | 24 | 1  |
| 12 | The lecturer capability in explaining the subject   |   |   |    | 25 |    |
| 13 | The lecturer capability in utilizing learning media |   |   |    | 25 |    |

## V. CONCLUSION

The implementation of the e-learning method of DSP subject to the students showed optimistic results. The score of the students increased when was compared to the score of previous students. Moreover most of the students expressed their interest to the subject, their understanding of the subject benefit in science and engineering, and their approval of utilizing learning media.

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