PE - 04

DEVELOPMENT OF BLENDED LEARNING MODEL FOR IMPROVING STUDENTS COMPETENCE IN THE ENGINEERING PHYSICS LEARNING

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ABSTRACT

Engineering Physics at the Faculty of Engineering, State University of Padang is supporting courses for expertise courses. The courses material of Engineering Physics is adapted to the needs of expertise courses in every department. The fact showed that the ability of students to master the concepts of physics is still low. Thus, they face difficulty in applying physics concepts to the relevant expertise courses. Therefore, the students are demanded more to be active and the lecturers are applying a variety of learning methods. The obstacles, face to face time in the classroom to be insufficient to meet these demands. One of learning model that can be applied is a blended learning model. This research aimed to develop a model of blended learning to improve student competencies in engineering physics learning. Research and development of research methods were refer to Borg and Gall models with four stages: a preliminary study, planning, development, and implementation. The development model of learning is done by combining face-to-face learning with a web-based learning (e-learning), so that students have the competence to master and apply the concepts of physics. E-learning programs are developed to support blended learning using e-learning software from Moodle, because it has a complete facility needed. The results showed that the developed learning model was valid, practical, and effective to improve the competence of physics and applied the physics concepts.

Keywords: blended learning, physical competence.

INTRODUCTION

The development of information and communication technology very quickly has influenced the education. Basically education is a process of communication and information from teachers to students that contain educational information, which has elements of teachers as a source of information, the media as a means of presenting ideas and subject matter, as well as the students themselves (Oetomo and Priyogutomo, 2004). Teachers can obtain a variety of information required to meet the needs of the learning materials on-line. Text, photographs, videos, animations, and simulations are some examples of instructional materials and media available on the websites of learning. By utilizing a variety of media, teachers can present subject matter in a variety methods that facilitate the students understand a subject matter. Internet technology makes it easy for students to get information in order to meet the demands of competence and enrichment. Availability of e-learning facility allows students attend classes on-line. Thus the development of information and communication technology has the potential to improve the quality of education and learning. Expected learning paradigm has shifted from teacher centered to student centered. Learning process that teacher centered no longer relevant with the rapid development of information and communication technology. Teacher need to provide opportunities for students to explore them by utilizing on-line technology. Besides being able to improve the dynamics of the learning process, the use of information and communication technology can train students to learn how to learn.

Engineering Physics courses in Faculty of Engineering, State University of Padang (FT UNP) serves as support courses for the relevant skills courses. Students are expected to master

the concepts of physics and be able to apply it to the skills courses. To improve students' ability in mastering the concepts of physics, research and development model of learning has been done, such as activity-based learning model laboratory (Usmeldi, 2008) and a model of activity-based learning laboratory with SAVI approach (Usmeldi, 2011). Application of the learning model can improve students' ability to master the concepts of physics. Limitations of the implementation of this learning model takes more time to discuss the subject matter, so the time is taken up to discuss other subject matter.

Results of a survey of engineering physics course for students in Electrical Engineering Department FT UNP in semester January-June 2013 show that: (1) Theoretical learning in engineering physics implemented in the first semester. (2) Practical engineering physics implemented in the third semester. (3) Lecturer of physics still tends to implemented conventional learning (teacher centered) because the limitations of time to discuss the learning materials. However, there are some learning materials carried by laboratory activity based learning model. (4) The computer with powerpoint has been used as the media of learning. (5) Exercises and tasks that must be done by students is still delivered manually (on the board, screen, or paper). (6) The internet networks to support the learning process engineering physics are available. (7) The practicum of engineering physics is like verification (testing theory or the laws of physics), because the material of physics already covered in the first semester. (8) The students mastery of physics concept is still low. This is demonstrated by the average value engineering physics of students is 49.48. (9) The student takes a long time to be able to master the physics concepts and applied physics concepts to solve the problem.

To improve students' ability in mastering the physics concepts, required a variety of learning methods. Application of a variety of learning methods require a longer time than the lecture method. To overcome the limitations of time in face-to-face learning, a learning model that can be used is a model of blended learning. Blended learning is a combination of internet-based learning with face-to-face learning. The use of blended learning aims to provide effective and efficient learning experience (Harriman, 2004; Williams, 2003; Vesisenaho, 2010). According to Graham (2005) blended learning has two types of learning environments, namely, traditional face-to-face learning environment and distributed learning environment that has begun to distribute communication and interaction.

From the perspective of course design, blended learning can be between fully-face learning and online learning (Singh, 2003). Kerres and De Witt (2003) states that 3C framework for teachers who want to design blended learning, which includes the content (learning materials), communication (communication between students and lecturer and among students), and construction (creation of student mental condition to help map their position in learning). From the perspective of lecture, blended learning models requires learning skills that students can absorb as many lessons are given. Martyn (2003) states that a successful blended learning which consist of an initial meeting wholly face to face, a weekly online assignment accompanied by communication (consultation) online and closed with a final exam in the form of face-to-face or a written test in class with the exams officer. Thus students will have more opportunities to develop themselves and be responsible for themselves (Saunders and Klemming, 2003), increasing social competence, increase student confidence (Byers, 2001), increased information skills and achievement (Kendall, 2001). Lecturer appreciates the differences in style and pace of learning of each student (Piskurich, 2004) as well as encourages communication, both between students themselves and between students and lecturer (Joliffe, 2001).

Blended learning can train students' ability to adapt to the internet-based learning. Hadjerrouit (2008) and Alonso (2005) in their study showed that blended learning has advantages compared to the face-to-face learning and e-learning. Blended learning can diversify learning and meet the learning characteristics of students. For example, students who are reluctant to discuss in class may be more active discussion in writing. Blended learning can enhance students' understanding in learning languages (Motteram and Sharma, 2009). Blended learning characteristics by Huang (2006) are: (1) provide a flexible learning resource, (2) supporting diversity learning, (3) enrich the e-learning experience.

Based on engineering physics course conditions outlined above it is necessary to do research to develop a model of blended learning in the engineering physics learning. Problems in the research are formulated as follows: How blended learning models that can enhance students' ability in mastering the physics concept? This research aims to develop a model of blended learning in Engineering Physics courses for students of FT UNP. This learning model is expected to improve the ability of students to master the physics concepts. With the mastery of physics concepts, students can apply the physics concepts to relevant course.

RESEARCH METHOD

The research used research and development methods which refer to the model of Borg and Gall (2008) with four stages: preliminary study, planning, development, and implementation. This research phase begins with a preliminary study of a literature study and field surveys. Preliminary study results are used to plan the design of the draft model, then developed through validation and trial. Trials are conducted on students Electrical Engineering Department FT UNP. Development model based on the results of validation and the findings in the draft model trial in every face to face. The next is revision of the draft model until obtainable the final model, the model used in the implementation phase of learning. The limited implementation of the final model using quasi-experimental methods to the design of pretest-posttest single-group (Creswell, 2008). Indicators of the success of the implementation of learning are there is an increasing student mastery of physics concepts, and students can implement learning models.

Instruments used in the research were; observation sheet, interview, validation sheet, psychomotor assessment, test mastery of physics concepts, lecturer and student questionnaires on the implementation of learning. Data analysis was performed to determine the validity, practicality, and effectiveness of the learning model. The results of validation of the expert judgement on learning model was analyzed with the percentage and compared with the validity criteria. Data of the practicality the learning model were analyzed with the percentage and compared with practicality criteria. Effectiveness of the learning model in terms of student competencies included cognitive and psychomotor domains. Learning outcomes in the cognitive and psychomotor seen from the percentage of students who achieved criteria for success in learning (scored minimum 66). Classically percentage of students who succeed in learning expected of 85%.

RESULT AND DISCUSSION

This research has developed model of blended learning in the engineering physics course. Development learning model consists of three stages: design of draft model, validation of draft model, and trial of model. Trial of model was conducted to determine the practicality and effectiveness of the learning model. Trial was done 9 times the face to face. During the trial, researchers is assisted by physics lecturer of FT UNP as an observer. Observer has duty to observe teaching practices and student activities in face-to-face learning.

Designed Draft Model

Draft model of blended learning is designed with a combination of proportional aspect between face to face learning (70 %) and e-learning (30 %). This learning model consists of four phases: (1) presenting information, (2) guiding the learner, (3) practicing, (4) assesing learning. Presenting information, guiding the learner, and assesing learning is conducted in face-to-face. The learning method used in face-to-face learning is problem solving, inquiry, experiment and discussion. Practicing (drills and exercises) is conducted online. Martyn (2003) states that a successful blended learning consists of the initial meeting is completely face to face, assignments online along a weekly with online consultations and closed with a final exam in the classroom.

E-learning to support blended learning models is designed by using an open source software, namely, Moodle (Modular Object-Oriented Dynamic Learning Environment). Moodle is a Course Management System (CMS), also known as a Learning Managment System or Virtual Learning Environmental (Pusdiklat, 2010). CMS uses internet technology to manage the interaction between users and learning resources (Rivai dan Murni, 2009). Moodle provides a complete software package (Moodle + Apache + MySQL + PHP). The design of e-learning site called E-LEARNING JTE FT UNP, as shown in figure 1.

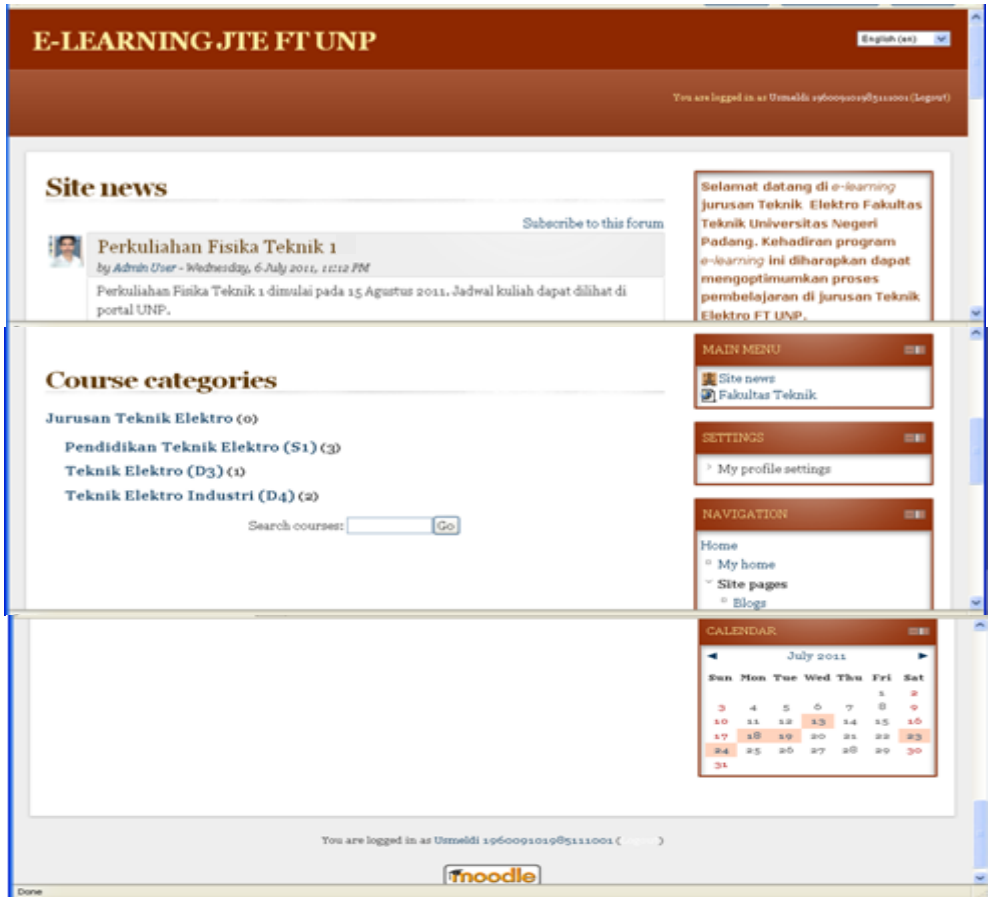

Figure 1. E-learning Design

Course categories for Electrical Engineering Department contain subjects courses of Technical Physics. Learning materials for each course is based on meeting each week (weekly outline) as shown in figure 2.

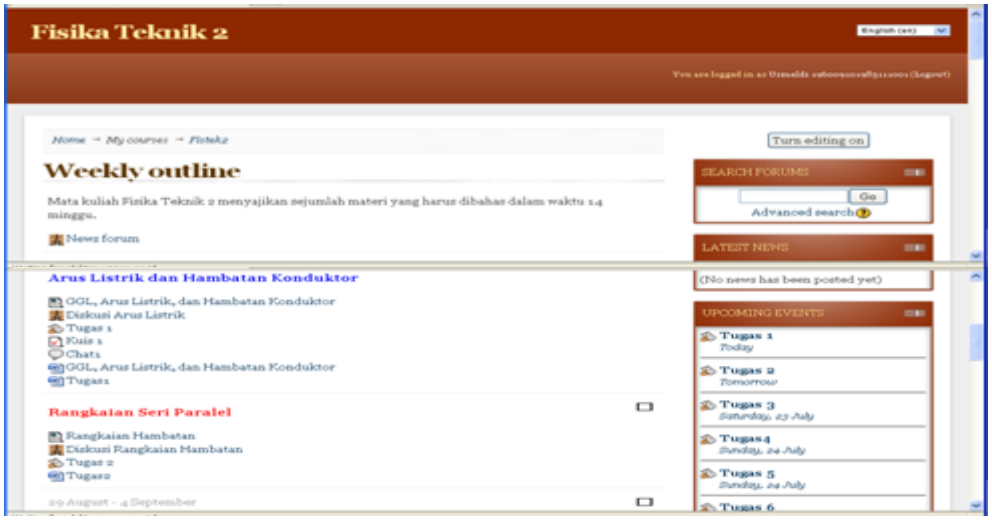

Figure 2. E-learning Display for Weekly Outline

Preparation of learning materials based e-learning includes the program maps, handouts, assignments, discussions, quizzes, and evaluation. Program map for internet-based learning is analogous to the outlines of the syllabus in face to face learning. Program map is a manifestation or result of instructional design activities. Format of program map includes several components: (1) identity of the course (name, code, SKS). (2) Learning objective (competency standards, basic competencies, and indicators). (3) Instructional design results are presented in tabular form, including the columns of the basic competencies, indicators, learning materials, media (textbook, images, photo, video, animation, simulation, test), communication / interaction of lecturer-student and student-student, student learning activities, learning resources, and time allocation.

Instructions for program map: (1) Name of course: write the names of the courses according to the curriculum. (2) Course code: write code according to the curriculum subjects. (3) SKS: write subject SKS according to the curriculum. (4) Competence courses: write competency courses (goals to be achieved by the students after completion of the course). (5) Basic competence: write a list of basic competencies to achieve the course learning objectives. (6) Columns of KD numbers: write the number of basic competence. (7) Column of indicators: write the indicators related to the achievement of basic competencies. (8) Column of material: write down the subjects and sub subjects related to the topic of learning to achieve basic competency. (9) Text column: write the title or content of learning materials and the site address of text. (10) Column of images/photos: write a short description of image/photo will be used in the study to the topic concerned, and the title and address of the site from the image (if the picture is taken from another site). (11) Columns of audio: write a short description of the audio or sound to be used in the study to the topic concerned, and the title as well as audio clips from the site address (if the audio clip is taken from another site). (12) Columns of video / animation: write a brief description of the video / animation to be used in the study to the topic concerned, and the title and address of the site from the video / animation (if the video / animation is taken from another site). (13) Columns of simulation: write a short description of the simulation (such as simulated process induced emf in the electric generator) that will be used in the study to the

topic concerned. (14) Columns of assessment: write a brief description of the form / type of assessment (type, number of questions, content questions) that will be used for the assessment of learning (as quizzes, assignments, or tests) on the topic in question. (15) Column of interaction (communication): write a short description of interaction and communication (eg. email, forums, chat) that will be used in the study to the topic concerned. (16) Columns of student learning activities: write a short description of learning activities for students who do study the topic in question. For example; read, do assignments, answering quizzes, look for learning materials on the internet. (17) Columns of learning resources: write learning resources on the internet that was relevant to the topic concerned. (18) Columns of time allocation: enter the time allocation required by students to study topics relevant.

Validity of Learning Model

Model of learning, e-learning design, unit lesson, labsheet that designed based on learning model is validated by three expert judgment. The aspects assessed by the experts judgment are the content feasibility, construction feasibility, and language feasibility. The validation results of learning model and learning materials can be seen in Table 1.

Table 1. The Validation Results of Learning Model and Learning Materials

No	Aspects assessed	Expert Judgement			Average	Maximum Score	Percentage (%)	Category
		1	2	3				
1	Contents feasibility	51	42	54	49	60	81.7	Very valid
2	Construction feasibility	44	45	46	45	55	81.8	Very valid
3	Language feasibility	35	35	33	34.3	40	85.8	Very valid

The validation results show that learning model and learning materials are very valid category.

Practicality of Learning Model

Practicality of the learning model and learning materials gained through the trial. Practicality learning model assesed from the learning feasibility and student responses to learning. From observation of the learning feasibility shows that the model of face-to-face learning in blended learning was practical category (average 75.3%). The response of students to the implementation of learning was practical category (average 79.5%). This may imply that the developed learning model can be implemented by students

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Effectiveness of Learning Model

Learning outcomes in the cognitive domain showed a good progress. The average of student learning outcomes in the cognitive domain was 75.52 and the percentage of success was 86.7%. The average of student learning outcomes in the psychomotor domain was 78.9 and the percentage of success was 88.5%. More than 85% of students have met the success criteria value. Thus it can be stated that the developed learning model is effective in improving student competence in engineering physics learning.

Discussion

Implementation of blended learning models in engineering physics learning does not mean reducing the number of face-to-face in the classroom, but to overcome the limitations of time to discuss the subject matter in the classroom of face-to-face learning. Students can learn and interact with lecturer or their friends by online. The results of research showed that blended learning is more effective than face-to-face learning. This results are consistent with the research blended learning Noraharja (2011).

The results revealed that the blended learning model contributed more to the students' achievement than traditional teaching methods. Thanks to blended learning model: (1) The students get prepared for the course before coming to the class. They found the opportunity to make revision at any time as much as they wanted and understood the subject better via such activities as videos and animations. (2) They were allowed to test themselves and to determine the subjects they were inefficient in via the quizzes in the web site. (3) They tried to overcome their inefficiencies by directing questions via the web site that they could not ask to the teacher during the lesson and by discussing with their friends. (4) They found the opportunity to learn on their own pace. It can be stated that all of these opportunities increased the achievements of the students. In a number of studies (Tuckman, 2002; Boyle et. al.,2003; Dowling, Godfrey and Gyles, 2003; O'Toole and Absalom, 2003; Garrison and Kanuka, 2004; Pereira et. al., 2007; EL-Deghaidy and Nouby, 2008; Aladejena, 2009) similar findings were obtained. It can also be stated that blended learning has positive effect on the students' attitudes towards the internet; especially use of the internet for education, research and information sharing.

Blended learning endeavors to purposefully integrate online and traditional learning in order to create an innovative approach with its own merits (Allen, Seaman, & Garrett, 2007). According to the Centre for Educational Research and Innovation (CERI, 2005) blended learning courses are becoming increasingly significant to complement, not replace, traditional forms of teaching (Mitchell & Forer, 2010). While blended learning has been recognized as having a number of advantages, insufficient learning satisfaction is still an obstacle to its successful adoption (So & Brush, 2008). It has been suggested from the literature review that interaction between student and student through tasks, and activities in and out of class would be increased in a blended learning. inovative approach with its own merits. Results indicated that the levels of students' perceived course interaction was quite high. Students seemed to have quite positive perceptions of their interaction in this course. Specifically, when implementing the blended learning, lecturers should motivate the positive interaction publicly to encourage collaborative learning interaction. This increase in the inte raction could lead to higher level of satisfaction and learning (Swan, 2001; Chen et al, 2007). In conclusion blended learning environment has been presented as a promising alternative learning approach (Graham, 2006) and may be capable of improving, expanding and even transforming face to face learning (Donnelly, 2010). Teachers should embrace it and help students develop the necessary skills in order to demonstrate higher levels of interaction. Furthermore, obtaining student feedback about student's perceptions of blended learning is crucial for the successful design and implementation of the educational process.

Some of the advantages of the blended learning are: (1) students are free to study the course materials independently use the materials available on-line. (2) Students will have discussions time with teachers or other students outside the face-to-face learning. (3) Student's learning activities that conducted outside the hours of face-to-face learning can be properly administered and controlled by the lecturer. (4) Lecturers can add enrichment materials through the internet facility. (5) Lecturers may ask students to read the materials or work performed prior to the learning test. (6) Students are able to share files with other students.

CONCLUSION

Development of blended learning models in order to meet the needs of lecturer and students to vary way students learn, overcome the shortage of time to deliver learning materials, and help students understand the learning materials by utilizing the facilities available. Based on the development model that has been done, it can be concluded that the model of blended learning (a combination of 70 % face-to -face learning and 30 % e-learning) can be used as an alternative learning effective and engage the student because there is intensive interaction between lecturer and students , students and students , lecturer / student with learning materials . E-learning to support blended learning models developed using moodle software because according to the learning needs of engineering physics. Blended learning model has four phases: (1) presenting information in face to face, (2) guiding the learner in face-to-face and e-learning, (3) practicing face-to-face and e-learning, (4) assesing learning in the face to face.

Blended learning model developed in the Engineering Physics courses is very valid, practical, and effective to increase student competence. The validity based on the opinion of expert judgment. Practicality of the model was seen from learning feasibility and student response to blended learning models. The effectiveness of blended learning model was seen from student learning outcomes in the cognitive and psychomotor domains. Recommended to the lecturer of physics to apply this learning model. Further research may apply to develop a model of blended learning according to the facilities available.

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