Developing project based e-learning content for basic computer system course

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Abstract. This study aimed to develop E-learning content for the Basic Computer System course through project-based learning model. The present research was a research and development by using the Dick & Carey Model. There were five stages of development in the present research, namely: determining the course as object of the development, needs analysis, developing a draft, running the Universitas Pendidikan Ganesha E-learning software, and testing (content expert reviews and field trials). The result of the development was positive. It means that the content can facilitate lecturers and students during teaching and learning process. The content was also able to improve students’ level of mastery of basic computer systems material. Both students and lecturers were not limited by place and time because E-learning content of the Basic Computer System course can be accessed anytime and anywhere.

1. Introduction
Jay Caulfield [1] defines e-learning as a program that reduces the amount of classroom face-to-face interaction. The basic principle is that face-to-face oral communication and online "written" communication are optimally integrated so that their respective strengths are blended into a unique learning experience based on the intended goal and educational context. Graham [2] based on his research stated that E-learning was very effective if there was a combination between the face-to-face learning with computer-based learning. Learning design was using e-learning media in traditional face-to-face learning classes combined with web-based online learning and or computer-based learning or other smart devices.

Chiefly, e-learning combines both the strengths of face-to-face learning and online learning as well as covering up the weaknesses in each lesson. Face-to-face learning has advantages and cannot be replaced with distance learning, and vice versa. E-learning content is important in the online learning process. According to Dabbagh, Marra and Howland [3], successful e-learning consists of 3 criteria, namely meaningful content, effective learning design, and technology that works.

Meaningful content means that the content has great benefits for students or lecture, whether it is to improve their competence, to complete assignments / work or to be a requirement in increasing their work level. Effective learning design or effective learning plan is good learning design that can convey the content well so that the content can be well received by students.

Technology that works means that e-learning providers, especially lecturers or instructors, can present an e-learning platform that works optimally and able to provide a good learning experience for
its users. Universitas Pendidikan Ganesha has implemented online learning or e-learning in the teaching and learning process. However, e-learning activities are not optimally used by lecturers and students. There are still many issues faced in the e-learning activity, one of them is the availability of interactive material content.

Basic Computer Systems is a compulsory subject in the Informatics Engineering Education Department. This Basic Computer System course is taken on the first semester. The existing e-learning of Universitas Pendidikan Ganesha has not been used optimally in the teaching and learning process. Based on the user point of view, the system has been running very well, but it needs content that supports the teaching and learning process. For the Basic Computer System course, the teaching and learning materials must be related to problems around students and students need to work in group to solve them.

The implementation of e-learning in the teaching and learning process has been widely used. This is supported by the results of research conducted by Harahap [4] who studied the implementation of LCMS Moodle based E-learning as a learning medium for accounting information systems courses. The results obtained from this study were there is interaction observed between lecturers and students in the learning process. E-learning implemented in this study also functions as a discussion forum between lecturers and students, and can also be used as an online quiz, so that all learning activities are very effective. Other research done by Atmanegara [5] showed that the implementation of e-learning in the learning process is beneficial because students can easily access the materials provided. On the other hand, research conducted by Wijaya [6] shows that a web-based e-learning model with the principle of e-pedagogy can improve students’ ability to understand economic subject as proven by the increasing learning outcomes. According to Dabbagh, Marra, and Howland [3] successful e-learning consists of 3 criteria, namely meaningful content, effective learning design and technology that works.

Project-based learning (PBL) is designed to be used on complex problems. Through PBL, the inquiry process begins by raising a guiding question and guiding students in a collaborative project that integrates various subjects materials in the curriculum. When the questions are answered, students can see the main elements as well as the various principles in a discipline that is being studied directly. PBL is an in-depth investigation of a real-world topic; this will be valuable for the development of students critical thinking. The assessment system used in the project learning model is project assessment. This assessment is an assessment of a task that must be completed within a certain time. Project assessment can be used to determine understanding, application skills, investigative skill, and the ability to presenting the result of the project.

2. Method

The development model used in this research was the ADDIE model. This development model consisted of five stages, namely analysis, design, development, implementation, and evaluation. The development stages can be seen in Figure 1.

The analysis phase was the first step of the ADDIE design model. Analytical activities carried out were subject analysis, analysis of the availability of learning resources, and analysis of learner characteristics.

The design stage was the stage that was carried out based on the results of the analysis stage as a reference in developing independent learning materials in the form of E-modules.

The implementation stage was the implementation of the learning system that is being developed. At this stage, the e-modules that had been developed were tested to determine the benefits of the product being developed. The product trials that were carried out during the implementation stage consisted of content expert testing, learning design testing, learning media testing, individual trials, small group trials, and field trials.

The evaluation stage was the stage that was carried out to evaluate the product development process based on the model used. Formative evaluation was used to collect data on the effectiveness and efficiency of the product in achieving the intended goals. The data were intended to improve the
product concerned so that it is more effective and efficient. Formative evaluation consisted of expert reviews, individual evaluations, small group evaluations, and field tests.

![ADDIE Model Development Stages](image)

**Figure 1.** ADDIE Model Development Stages.

The experts consisted of one content expert, one learning design expert, and one instructional media expert. Questionnaires and interviews were the instruments used for the review of content experts, media experts and learning designs. The types of interviews used were unstructured and structured interview (questions that have been formulated in advance).

The qualitative descriptive analysis technique was used to process data gathered from content experts, media experts, and learning designs. This analysis technique was carried out by grouping information from qualitative data in the form of input, response, criticism, and suggestions for improvement taken from the questionnaire and interview results. The results of this data analysis were then used to revise the product.

3. Result and Discussion
The research final product was e-learning content for basic computer system courses with Project Based Learning Model. In developing e-learning content for basic computer system course, there were two stages of development employed, namely the development stage of the basic computer system course teaching module and the development stage of e-learning content for the basic computer system course with the project-based learning model. The e-learning used is the Moodle version of e-learning which is available at Universitas Pendidikan Ganesha. The model used in the development of e-learning content in this basic computer system course is the ADDIE development design which consists of 5 stages.

The first stage was the analysis done by determining the course to be used as the objects of development. Moreover, the course that being used as object of development was analysed. Course used as the object of the development in the current research was Basic Computer Systems courses. The course expected the students to understand the history of computers, explain and operate computer hardware, operate the BIOS, operate the operating system, understand software, understand open source, understand software maintenance and health and safety working with computer.

Learning indicators and contents of the course were determined based on the indicators stated in the syllabus. The basic computer systems course consisted of 9 basic competencies. Seven learning activities were formulated with project-based learning syntax that were relevant with the learning objectives.

The title of each learning activity referred to the basic competencies. The strategy for organizing learning content used in learning included selecting content, structuring content, and making summaries. Selection of contents was done based on the learning objectives, learning indicators, and learning activities stated on the syllabus. The learning content was arranged from specific to general materials. Making a summary was done by taking the important points from the material described, so that it would represent the entire content of the material that has been learned.
The strategies for organizing learning content were arranged on the strategy table for organizing learning content referred to content selection, content structuring, and summary creation. Selection of contents was based on the learning objectives, learning indicators, and learning activities stated on the syllabus.

Strategy to deliver the teaching and learning is based on the components namely media, student interaction with media, and learning forms. In delivering learning content, the writer used practicum, assignment, and presentation methods.

The learning strategy used was group learning while media used for presenting the learning material was project-based e-Learning content. The learning media was in the form of video tutorials and simulations, interactive questions, presentations, and a set of laptops.

The management strategy of the teaching and learning process that was carried out includes scheduling in the teaching and learning process. Schedule in organizing and delivering material was based on the time allocation that has been stated on competency standard in the syllabus. Each time allocation was adjusted to the lesson plan design. Questions were given to motivate students during their learning.

The second stage was the analysis of the need for the availability of learning resources, and the analysis of the characteristics of the learners. There are three dimensions that were considered, namely (1) desired values and current values in learning (2) characteristics needed by students and existing current characteristics; and (3) the characteristics desired by education institution.

Based on observations on the basic computer system course, it is known that the learning resources used in the teaching and learning process are mostly material taken from the internet and computer books that are collected and adjusted to the needs of the syllabus. This is because lack of electronic books (e-books) or other books that are well structured according to the curriculum and syllabus need on the basic computer system course.

Analysis of student characteristics aims to determine student needs for teaching materials in the form of e-learning content. Based on the results of observations obtained from the first semester students, students were interested in learning using images, simulations, and video media, and also, they liked to use website-based learning because it is easier to understand the material.

The third stage is the draft development process. The e-learning developed in this study was designed on a web basis using the Moodle version 3.0.2 application. The project-based learning model in e-Learning will be implemented in each learning activity. And for the Computer Assisted Instruction (CAI) feature, the complete learning system will be applied at each stage of the project based learning with the condition that each student is required to follow one by one the stages of the project based learning model.

The Computer Assisted Instruction (CAI) system in e-learning requires students to do a checklist (manually or automatically by the system) to ensure that students read / follow the contents of each learning stage of e-Learning. Students are also required to access every activity in the form of text material, videos, interactive quizzes, forums, and other activities available on the e-module.

The stages of e-Learning project-based learning content are problem orientation, project planning, investigations, reports planning, report presentations, and evaluation. In the evaluation stage students evaluate the solution in hand in the form of essay questions. If the student gets a score above the criteria of mastery learning, they will be allowed to continue the next learning activity. If they did not succeed, students must undergo remedial process.

The fourth stage is the implementation of the content of basic computer system course with a project-based learning model using a modified Universitas Pendidikan Ganesha e-learning. The results of the e-learning sitemap design in the Moodle application can be seen in Figure 2, Figure 3, Figure 4, Figure 5, Figure 6, Figure 7, Figure 8, and Figure 9.
Figure 2. E-Front Page Display Learning Project Based Learning.

Figure 3. Syntax Display of Learning Activities.

Figure 4. Discussion Page.

Figure 5. Project Planning Page.

Figure 6. Investigation of the Project Problems.

Figure 7. Report Planning.
The lecture page contained a list of course material terms and their definition, student attendance list and a basic computer system course contract. The lecture page section contained a class menu for the 1st to 7th meetings. Each class had six syntaxes of the project-based learning model consisting of problem orientation, project plans, investigations, reports planning, report presentation, and evaluation. Each teaching and learning topic that uses 6 syntaxes was carried out for two meetings, so that the total class meeting was fourteen. In this e-learning system, there were downloadable materials and several videos that support the content or material being discussed. Before using e-learning, students first formed groups for e-learning group discussions. After the discussion process and the learning material had been studied, students were given a test to measure the level of understanding of the material during the teaching and learning process.

The fifth stage was testing. The results of e-learning content that had been developed were tested according to their role and function in the teaching and learning process to determine the advantage of the developed product. The test of the product was done by reviewing the product done by the content experts, learning design experts and media experts. After calculating and examining the result of test done by the learning content experts, media experts and design experts, the e-learning content was "appropriate". This indicated that the e-Learning content was suitable to be used in Computer System Basics courses. This is supported by the results of research conducted by Emery and Morgan [7] stating that the project-based learning can improve students understanding of the courses material. Atmanegara [5] in his research revealed that the use of e-Learning in the learning process is beneficial to be used because with this media students can easily access various materials and knowledge.

Researchers in conducting response tests gave questionnaires to nineteen first semester students who had previously used e-Learning content on Basic Computer System courses in teaching and learning activities.

Student responses on the development of e-learning content of the basic computer system course with the PBL model were used in data analysis. The analysis was carried out using the Nurkancana and Sunartana [8] formula. The results of the calculation to determine the \( \bar{x} \) average of the response are as follows.

The mean score of the responses given by students

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\bar{x} = \frac{\sum x}{N} = \frac{1290}{19} = 67.89
\]

After being converted into the response classification criteria table, the results of student responses with an average of 67.89 was categorized as very positive. This shows that the development of E-learning content in the basic computer system course with the PBL model was successful, proven by
the results of the questionnaire comments such as the motivation and satisfaction of students using e-Learning and the convenience of students in using e-learning in the learning process. Based on the results of data analysis on the development of e-learning content for the Basic Computer System course with the PBL model, which was on very positive criteria, there was no input or suggestion from students. Broadly speaking, respondents felt satisfied in using e-learning. Also, the e-learning could facilitate students in understanding the materials of Basic Computer Systems course.

4. Conclusion
The research final product was E-learning content for the basic computer system course with a project-based learning model. In the development process of E-Learning content on the Basic Computer System course, there were two stages of developments carried out, namely developing basic computer system course teaching module and developing basic computer system course content development stage for the E-learning course with the project-based learning model. The e-learning used was the Moodle version of E-learning which was available at Universitas Pendidikan Ganesha. In accordance with the previous description, the model used in the development of e-Learning content for basic computer system course was the ADDIE development design consisting of five stages. The five stages were determining subjects to be used as the object of development, needs analysis, draft development process, implementation of basic computer system course content with a project-based learning model using Universitas Pendidikan Ganesha e-learning and finally testing. At the testing stage that has been carried out, there are three experts used consisting of content experts, media experts, and design experts.

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