

Development of mooc-based learning plan in mathematical engineering 1 course in the polytechnic of banyuwangi

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Abstract. One of Poliwangi missionis improve quality education to produce graduates who are competent and professional. Industry Revolutionary Era 4.0 in 2018, these require changes in the organization of learning. Learning is implemented without any concept of time and space. Therefore it is necessary to change the provision of education, especially Engineering Mathematics 1. This course is selected in this research because previous studies showed results that students who join the Engineering Mathematics 1 course prefer learn by using the internet. This lesson plan is developed using Plomp Model. Plomp Model consists of five phases which investigations phase; the design phase; the construction phase; test, evaluation, and revision phase; the implementation phase. Validation is done by 3 experts. Results from this research is the Lesson Plan. Lesson Plan consists of two system. They are MOOC-based learningand direct learning system. MOOC-based learning material is consists of vector functions, differential and differential applications. Moreover, MOOC-based learning teaching methods are demonstration, inquiry and problem-based learning.

1. Introduction

MOOC (Massive Open Online Course) is a learning system in the form of an online course was massive and open in order to allow participants enjoy unlimited and can be accessed via the web. The first MOOCwas articulated by Manager of Web Communications and Innovations at the University of prince Edward Island in a Course organized by George Siemens [1]. In developed countries have implemented learning Massive Open Online Courses (MOOC) for a long time, where learning in Indonesia also continue to evolve in the direction of MOOC. That is because Indonesia has a large population, and to encourage equitable education and training to the community [1]. Besides the Industrial Revolution Era 4.0require changes in learning systems into blended learning [2]. Therefore

it is necessary to change the learning organization in Polytechnic of Banyuwangi, especially Mathematics Engineering 1.

Results of interview from many students. It showed that students would feel happy if the submitted materials related the application of learning by Internet. Moreover, students will be motivated to learn with their existing teaching materials on the internet. During this study, Engineering Mathematics 1 course is still use direct learning in the whole meeting. Therefore it is necessary to change course system in Engineering Mathematics 1. The change began with the development process of the learning device includes planning of the development of learning, instructional media development, module development, and development of assessment instruments.

Learning device is a set of teaching preparation tools which includes Lesson Plan, instructional media, until the process of assessment of learning through questions [3]. There are some useful things when developing a learning device, they are purpose of learning, teaching materials, teaching methods. Then it was developed methods or learning strategies, tools or media in teaching, learning and evaluation resources [4]. One of the learning device that is a lesson plan. Lesson Plan is the responsibility of educators to improve the quality of learning [5]. Development of the device first MOOC-based learning is the development of lesson plans. Development of this lesson plan refers to several things: the level of difficulty of understanding the material at the Polytechnic of Banyuwangi students and interactive learning model. The learning approach used to use a constructivist approach.

Constructivism approach is an approach to learning in which learners are actively and creatively. It is constructed by themselves. The principles of constructivism that knowledge is constructed by learners actively, the pressure in the process of learning lies in students, teacher helped students to learn, learning is more pressure on the process, not only the end result, and educators as facilitators [6].

2. Research Method

This research development method use Plomp Model [7 and 8]. Plomp Model have chosen for this research because it can be used to develop some of the learning device.

2.1. Preliminary investigation phase

In this phase, it gives information about the lecturers still teach with direct learning. So it is needed for the development of learning tools such as lesson plans, media, module, and MOOC-based assessment instruments. It facilitate interaction between students and lectures. Moreover, in this phase is to set boundaries, namely the development of the development of lesson plans using models of learning that leads to a constructivist approach. The learning model which have chosen also have to consider the level of difficulty of understanding the material experienced by students from the results of previous studies.

2.2. Design phase

From the information obtained in the phase of preliminary investigations, the learning model that will be used to develop a method of inquiry learning device, method demonstrations, and problem solving methods. The next activity in this phase is to set procedures for implementing the lesson plan development of MOOC-Based Learning in Engineering Mathematics 1. Semester Lesson Plan Development begins with determining the learning model, then it do the preparation of the Lesson Plan that uses two learning systems. They are direct learning and online learning (MOOC).

2.3 Construction phase

Some of the activities carried out in this phase are described as follows.

2.3.1 Creating a learning device validation sheet. Validator validation sheet made for MOOC-based learning plan. The validation process was done twice by 3 validators. The validator comes from

other universities who understand the development of learning tools of MOOC-based learning in Engineering Mathematics 1.

2.3.2 Develop a lesson plan. Activities in this step is to develop a Lesson Plan of MOOC-Based in Engineering Mathematics 1. Lesson plans are prepared by dividing the material presented to each meeting. Lesson Plan was developed in online learning as much as 12 meetings and two meetings in the classroom. Learning Materials in Engineering Mathematics 1 includes vector, function Systems of Linear Equations, matrices, geometry, limits, differential and differential application [9 dan 10].

2.3.3 Develop a questionnaire for students. This stage is to develop a questionnaire filled out by the students. The questionnaire consisted of several indicators of experience using the Internet as a medium of learning, online courses experience, time spent online learning, and student interest in doing online learning. The questionnaire was designed by the two categories of answers. They are yes and no choices, it can make students more easily to decision his choice.

2.4 Test, Evaluation, Revision Phase

Test, evaluation, and revision phase is the continuation of the construction phase. Some of the activities carried out in this phase are as follows:

2.4.1 Validate learning plans. Perform validation provided the validation sheet to expert / lecturer in Mathematics Education Department in Science and Mathematics and Education Faculty. There are 3 experts. It validated the Lesson Plan include conformance stages MOOC-based learning model and the suitability of the materials provided in the learning process.

2.4.2 Perform analysis validation sheet. Analyzing the data obtained from the validation result sheet to the experts (mathematics and mathematics education faculty). This was followed by revising the lesson plan.

2.4.3 FGD. Afterwards in this phase, FGD (Focus Group Discussion) is attended lecturers and teachers in Mathematics, Indonesian, and English around Banyuwangi. This purpose of FGD is dissemination the Lesson Plan which have made in this research, so the participants can give suggestion about it.

2.4.4 Perform analysis questionnaire. Questionnaire have been distributed in students. Then it was analyzed in the validity and reliability at first [11]. Analyzing data from questionnaires was distributed 2 times at three study programs. They are Mechanical Engineering, Manufacturing Ship Engineering, and Livestock Products Processing Technology Program.

2.5 Implementation phase

Conclusions from the evaluation and revision were done, so it get a lesson plan of MOOC-based in Engineering Mathematics 1 accordance with a predetermined limit. Lesson Plan can be used as well as development guidelines learning online Platform of Engineering Mathematics 1.

3. Results and Discussion

3.1 Design phase

The process of drafting Semester Lesson Plan attention to several things: Learning Outcomes Course, Specific Learning Outcomes at each meeting and then the indicator. The model developed online learning is through inquiry learning method, learning method demonstrations, and problem-based learning method. All three models have been learning since it can facilitate students to learn any

subject either direct communication with professors online and independent study. As well as problem-based learning model can be a learning model that fits KKNi curriculum which refers to the ability of students in higher-level thinking level.

3.2 Construction phase lesson plan

In the preparation of the construction process is done Lesson Plan. Lesson Plan which consists of several stages of classification of materials easy, quite difficult and hard to understand students (difficult). This category is based on the mathematical value over the last three years on each subject. The results of the classification can be seen in Table 1 below.

Table 1. Classification material in engineering mathematics 1 course

Category	Subject
Easy	Vectors, Matrices, Geometry
Quite difficult	Function, Differential
Difficult	Limit Functions and Applications of Differential

After the classification of the material, it will make decision of timing of the lesson. Category easily done on one meetings, while the category is quite difficult and difficult category in 1 to 2 meetings. For its consideration, students can understand the material in the category of quite difficult and difficult at the first meeting and then student conduct discussions at the second meeting.

Lesson Plan construction next step determine the learning method on each Topic. Determination of the learning method is based on the level of difficulty of the material and the time provided. Results of the determination of learning methods can be seen in Table 2.

Table 2. Division of learning methods

Learning methods	Subject
Demonstration Video (Content)	Vectors, Matrices, Functions
Demonstration Video (Tutor)	Limit, Differential
Inquiry (Direct Assignment)	SPL
Inquiry (Assignment Indirect)	Geometry
Problem Solving (Direct Assignment)	Maximum and Minimum Values
Problem Solving (Assignment Indirect)	Straight and Circular Motion Motion

After preparation of the Lesson Plan, then it had been made the validation sheet which consists of four aspects: Aspects of Learning Achievement formulation, Aspect Content Served, Aspect language used, and the aspect of Time. Aspects of Learning Outcomes formulation consists of 5 statements, Content Served aspect consists of three statements, Aspects of Language Used consisted of two statements, and the aspect of Time consists of two statements. Each statement consists of four answer choices is not good, quite good, good, and excellent.

It is needed to be undertaken distributing questionnaires to students, learners can provide input to the MOOC based learning in Engineering Mathematics 1. Distribution of the questionnaire indicators and point statement can be seen in Table 3.

Table 3. Item division of student questionnaire based indicators.

Indicator	Item number
Experience Using the Internet As Media Education	1, 2, 3, 8, 9, 10

Course Experience through Internet	7, 11, 12, 13, 14
Amount of Time which they were used for Study in Internet	4, 5, 6
Interest in Learning Students with Internet	15, 16, 17, 18, 19, 20

3.3 Test, Evaluation and Revision Phase

Lesson Plan validation process were performed by 3 experts with two validation. After the first validation, it was repaired then it do a second validation. Average validation in Lesson Plan were performed by 3 experts in each aspect can be seen in Table 4.

Table 4. Average value expert validation results

Aspect	expert 1	expert 2	expert 3
Formulation of Learning Outcomes	3.7	2.8	2.9
The contents presented	3.8	2.3	3.2
The language used	3.5	3	2.5
Time	4	3	3

After the validation process, there are several revisions of the first matrix material composition is taught earlier than Systems of Linear Equations. Engineering Mathematics 1 Learning taught online (MOOC-based learning method) and directly with the proportion of two to three. Then revised in Division method learning. The division revised can be seen in Table 5.

Table 5. Division learning method based on direct and MOOC based learning system

Learning system	Learning methods	Subject
Online (Based Learning MOOC)	Demonstration Video	Vectors, Function
	Demonstration Video by Tutor	Differential
	Problem Based Learning	Applications Differential

After arranging the Lesson Plan. The next step develop MOOC platform that suits the character of the student. So it is needed to do a survey. The survey was conducted by distributing questionnaires. The result of validity and reliability questionnaires are illustrated by cronbachalpha value ($\alpha = 0,65$). Questionnaires were distributed to the three programs with the total number of students as many as 210 students. Graph results of questionnaires can be seen in Figure 1.

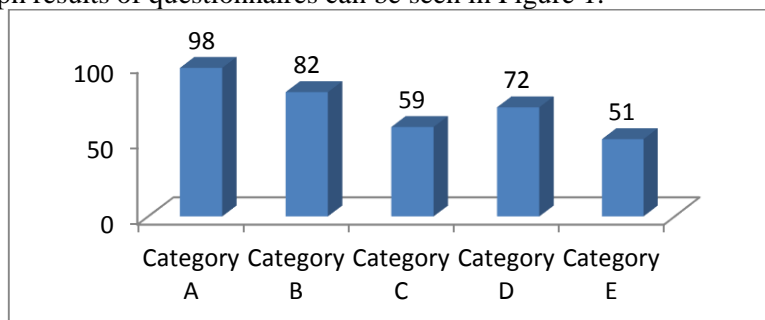


Figure 1. Distribution of questionnaire results learning through internet ever experienced students

In the Bar Chart can be explained in Category A as many as 98% of students use the Internet as a medium of learning, Category B, namely 82% of students study materials or task via youtube or video, Category C 59% of students study the teaching material to the article as a pdf or word, Category D is as much as 72% of students prefer online learning, and Category E as many as 51% students believe online learning is more effective and efficient.

4. Conclusion

This research is the development research, where the resulting product is a Lesson Plan of Engineering Mathematics. Engineering Mathematics 1 Lesson Plan uses two learning systems that MOOC-based learning systems and direct learning systems. In making the Lesson Plan, there are a few things to consider such as the level of difficulty of the material, time available, and learning methods.

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