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BLENDED LEARNING DESIGN FOR BLOCK SYSTEM PRACTICUM ON ELECTRICAL ENGINE COURSE AT STATE UNIVERSITY OF MALANG

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ABSTRACT
All this time, the form of web-based learning implementation has brought optimal learning process. Yet, it requires an instructional design as a learning model that can be liked by the students to engage in various learning activities such as discussions, frequently asked questions, and learning process requests that require face-to-face learning. The blended learning design is developed based on ten methods of learning model design of Gerlach and Ely. Furthermore, it can be developed into learning steps (syntax) of blended learning.

KEYWORDS
Blended Learning Design, Electrical Engine.

Introduction

Automotive Engineering Education Study Program (AEE) at State University of Malang (UM) in achieving its vision and mission continuously keeps doing improvement in various ways. These improvements include conducting automotive expertise lectures that must be followed by all AEE students starting the first semester (Bachelor Curriculum of AEE, 2015: 35). One of the automotive expertise subjects (AES) is electrical engine course.

Electrical engine learning course is conducted by using a block system, which is 10 times of meetings for 2 weeks, Monday - Friday, morning schedule is at 07.00 - 12.00 WIB or lunch hour schedule is at 12.00 - 17.00 WIB with 4 meetings (4 x 50 minutes) / meeting / day. Learning activities that have been done both in the classroom and in the laboratory contains explanations of material and practicum activities. Students are required to master the electrical material of the engine comprehensively and pass the practice exam. To achieve this, the student must be able to master the ability to identify the characteristics of the electrical system components of the engine, inspect the components of the engine electrical system, assemble the engine electrical system components, analyze the engine electrical circuit system, perform trouble shooting, and diagnose the damage and replacement components of the engine electrical system (Bachelor Curriculum of AEE, 2015: 35).

To support the achievement of learning outcomes (LO) of students, some lecturers add web-based learning model in electrical engine lectures. However, up until now, the implementation of web-based learning method only put the message of learning online, then, assign students to get (download) learning messages as a reading task. After that, they are asked to collect reports and assignments back to the lecturer also via the internet. This will not lead to an optimal learning process, because monitoring the process in web-based learning is more difficult than in the classroom (Rusman, 2010: 336). Thus, it takes an instructional design as a learning model that invites a number of students to engage in various learning activities such as discussion, question and answer, and learning process practicum that requires face to face. According to Riyana (2012: 21), learning model designed by integrating web-based learning in face-to-face learning programs called blended learning. Therefore this research is conducted to develop the blended learning design based on ten methods of learning model design of Gerlach and Ely. Furthermore, it can be developed into learning steps (syntax) of blended learning.

Literature Review

According to Thorne (2003: 16), "blended learning is a mix of: multimedia technology; CD ROM video streaming; virtual classrooms; voicemail, email and conference calls; online text animation and video-streaming ". All of this is combined with traditional forms of in-class training and individual training. Semler (2005) described blended learning combining the best aspects of online learning, structured face-to-face activities, and real-world practice. Online learning systems, in-class exercises, and on-the-job experience will provide a valuable experience for them. Blended learning uses an approach that empowers different sources of information.

The basic principles of blended learning are face to face communication and written communication online. The concept of blended learning seems simple but its application is more complex. The main assumptions of the blended learning design are: (1) the thought of combining face-to-face and online learning, (2) fundamental rethinking of course design to optimize learners' involvement, and (3) the reorganization of traditional classroom hours (Garrison and Vaughan, 2008: 5). So it can be concluded that blended learning is a combination of learning excellence that is done in virtual and face-to-face.

Blended learning as a result of the development of information and communication technology in the learning system has been widely applied to vocational education programs (Bliuc et al., 2012; Pohl et al., 2005; Yang et al., 2015; Yalcinkaya, 2015; Stapa et al. , 2014; Groschl et al., 2015). Given the technical education held at the Faculty of Engineering, State University of Malang including vocational education, the instructional design follows several indicators as follows such as: a) aspects of needs analysis, b) selection and order of competence, c) learning development, and d) evaluation of learning (Triyono, 2015: 61).

An educator developing a learning model design should select a design model that is considered suitable to be developed in accordance with the characteristics of the course / lesson. Some models of instructional development include: 1) Dick & Carey Model (1990), 2) Glasser Model, 3) Gerlach & Ely Model (1971), 4) Jerold E. Kemp (1994). The design of the learning model used to design the blended learning model for the practicum of the engine electrical engineering block at State University of Malang is Model Gerlach & Ely (1971). This learning model is suitable for all circles including for technical education conducted in the college environment, because in it there is a determination of strategies suitable for students to receive the material to be delivered (Rusman, 2010: 155-156). In addition, the model also sets out the use of educational technology products as a medium for delivering materials.

Methodology

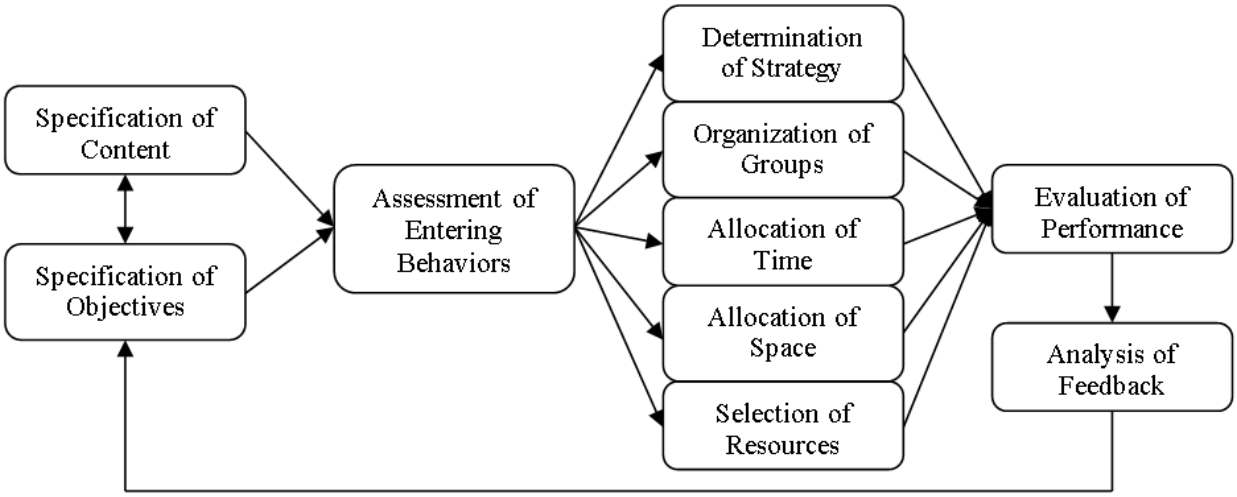
The design of blended learning for practicum of block program electrical engine in State University of Malang is developed based on ten elements of Gerlach and Ely learning model design (1971), namely: (1) specification of objectives, (2) specification of content, (3) the collection of students' assessment of entering behaviors, (4) determination of approaches, models, strategies, methods, techniques and tactics of teaching (determination of strategy), (5) grouping (6) allocation of time, (7) space arrangement (allocation of space), (8) selection of learning resources, (9) evaluation of performance), and (10) analysis of feedback. The development of the ten elements can be seen in Figure 1.

This research is the basis for developing blended learning model product for the course of electrical engineering practice as a whole. The product that has been produced from this research is blended learning design by using Edmodo (Balasubramanian et al., 2014) as learning management system (LMS) for practicum of engine electrical engineering block at State University of Malang.

Edmodo was chosen as a learning management system by considering the following points: 1) Edmodo was ranked 2nd in the top 20 most popular learning management software solutions by Capterra (http://www.capterra.com/learning-management-system-software, accessed on November 22nd, 2017); 2) when compared to social media or other LMS, Edmodo has several advantages as follows: a) similar to Facebook, easy to use; b) closed group collaboration: only those who have group code can follow the class; c) free, accessible online, and available for smart phone devices (both Android and Iphone); d) does not require server on campus; e) accessible wherever and whenever; f) Edmodo is always updated by developers; g) Edmodo can be applied in one class, one campus, between campuses in one city / district; h) Edmodo can be used for learners, educators, and parents; i) Edmodo used to communicate using social media models, learning materials, and evaluation; j) Edmodo supports team teaching, co-teacher, and teacher collaboration models; k) there is a notification; and l) badge features can be utilized to improve student motivation.

The design of blended learning for electrical engine subject by utilizing ten elements of Gerlach and Ely learning model design (1971) can then be developed into learning steps (syntax) blended learning. The syntax is an operational design of the implementation of practical learning of mechanical engine block system in State University of Malang, more details can be seen in Table 1. Before applied, blended learning design developed based on ten elements of Gerlach and Ely learning model design (1971) validation by the expert to request an assessment of the degree of usefulness, degree of ease of use, level of completeness, and degree of design legibility.

Figure 1. Design of Gerlach and Ely Learning Model



Result

Development Result of Blended Learning Design based on 10 element model of Gerlach & Ely

Specification of Objectives

Based on Bachelor Curriculum of AEE, 2015: 35 State University of Malang, the objectives of the electrical engine practicum course are students capable of: 1) understanding the electrical diagram of the charging, ignition and starter system; 2) understand how the charging, ignition and starter system works; 3) understand the characteristics of charging

system components, ignition and starter; 4) making measurement of charging system, ignition and starter on the vehicle; 5) overhauling component of filling system, ignition and starter; 6) performing measurement / inspection of filling system components, ignition and starter; 7) analyze the damage of filling system, ignition and starter, 8) making improvement of filling system, ignition and starter; and 9) diagnosing charging, ignition and starter systems.

Specification of Content

The contents of the course subject matter of electrical engineering based on the learning objectives to be achieved include: 1) electrical diagram of filling system, ignition and starter; 2) how the charging, ignition and starter system works; 3) characteristics of charging system components, ignition and starter; 4) measurement of filling system, ignition and starter on the vehicle; 5) overhaul component of charging system, ignition and starter; 6) measurement / inspection of filling system components, ignition and starter; 7) damage of filling system, ignition and starter, 8) repair of charging system, ignition and starter; and 9) diagnostics of charging, ignition and starter systems.

Assessment of Entering Behaviors

Data collection and filtering of learners is done by pretest and collecting personal data of the students (personal data) to measure the potential of learners.

Determination of Strategy

Judging from the way of presentation and how to manage it, the relevant strategies for improving face-to-face learning are indirect instructional strategies and relevant strategies to improve virtual learning is a deductive learning strategy.

Implementation of inductive instructional strategies in the field of electrical engineering practicum is that learners are directed to work on quizzes, download instructional videos (demonstration of troubleshooting practices), and search web resources packaged in Learning Management System (LMS), using Edmodo program.

While the implementation of deductive learning strategies (direct instruction) in the course of electrical engineering practicum is the learners directed to: 1) present the content of the subject packaged in the worksheet and videos that have been downloaded and learned from Learning Management System (LMS), using Edmodo program; 2) practice and finding trouble systems on the vehicle, and 3) discussion & review of learning activities.

Organization of Groups

In this research and development of learning grouping based on the number of learners aims to differentiate the learning outcomes of learners who implement learning using blended learning models and face-to-face models.

Allocation of Time

The study hours of the students in the face-to-face class are 4 meetings (4 x 50 minutes x 10 meetings), while the student study hours in the virtual classroom are 20 meetings (20 x 50 minutes x 10 meetings). Online learning is done after the learner completes the activities in the classroom face to face.

Allocation of Space

Blended learning includes student activities in face-to-face classes and virtual classes. Student activities in the face-to-face classes include presentations by learners, practical exercises, troubleshooting, exams, and PBM evaluations. The learner's activities in the virtual class include doing the quiz about the competencies learned at the previous meeting, and

reviewing the references (text, video, web resources) about the competencies to be learned at the next meeting.

Selection of Resources

The selection of media / learning resources developed in this research and development includes: a) printed materials in the form of jobsheets, and b) video-based teaching materials packaged in Learning Management System (LMS), using Edmodo program.

Evaluation of Performance

Evaluation tool developed aim to know ability of learners in learning practice of diagnosis of machine disturbance. Evaluation tools include: (1) theoretical and pretest basic exams, (2) continuous assessment to improve the learning process (formative), (3) the ultimate theoretical and summative exams. The evaluation tools include an evaluation instrument of a type of test, an objective or subjective test of the theory (in a written test), whereas a basic, formative, summative skill exam is a check list, or a demonstration for performing certain performance (in the form of a performance test).

Analysis of Feedback

Feedback is the last stage of development of this instructional system. The feedback data obtained from the evaluation, tests, observations and responses on these instructional efforts determine whether the systems, methods, or media used in the instructional activities are appropriate for the objectives to be achieved or still need to be refined (Rusman, 2010 : 162). The feedback questionnaire for analyzing learners' comfort in using the blended learning model was adopted from the PBM questionnaire on the UM academic information system (siakad).

The Result of Syntax Blended Learning for Block System Practicum on Electrical Engine Course at State University of Malang

Based on the above explanation, the development of blended learning for the diagnosis of machine failure by utilizing ten elements of Gerlach and Ely model learning model can then be developed into blended learning steps (syntax). More detailed syntax blended learning can be seen in Table 1 below.

Table 1. Syntax Blended Learning for Block System Practicum on Electrical Engine Course

Phase	***Teachers' Behavior***	***Students' Behavior***
***Face-to-Face* Class/Practice**		
Phase I Introduction (meeting 1)	The teacher explains the orientation of the semester lecture plan.	Students understand the orientation and explanation of the semester lecture plan.
	The learner assesses the learner's initial ability.	Students work on a pretest and fill out a personal data questionnaire of Students (personal data) & learning motivation.
	Teachers explain to learners how to form learning groups and help each group to transition effectively.	Students form study groups.
Phase II Presentation (Meeting 2 – 8)	The teacher guides the study group during the presentation.	Each group presents their work.

Phase	***Teachers' Behavior***	***Students' Behavior***
Phase III Practice (Meeting 1 – 8)	The teacher guides the study group during the practice.	Each group carries out the practice according to the jobsheet standard
Phase IV *Troubleshoot* (Meeting 1 – 8)	The teacher guides the study group during diagnosing and fix the systems	Each group tries to find interference with vehicle systems.
		Each group diagnoses and corrects interference with vehicle systems.
Phase V Discussion &*Review* (Meeting 1 – 10)	The teacher checks whether the students have succeed the task well	Each group provides feedback.
E-learning Edmodo/Online Class		
Phase VI *Take Quiz* (Meeting 1 – 8)	The teacher evaluates the cognitive learning outcome about the material that has been given (in each meeting) by using *Edmodo* program.	Students work on a quiz about the material they have learned (each meeting) using the Edmodo program within the time limit specified by the teacher.
	The teacher gives information about quiz: 1) the tittle, 2) *time limit*), 3) quiz description, 4) *set quiz option*, 5) type of questions, and 6) the weight of each question.	
	The teacher give the questions in form of: 1) *multiple choice*, 2) *true false*, 3) *short answer*, and- 4) *fill in the blank*.	
Phase VII *Download Video* (Meeting 1 – 8)	The teacher upload the *jobsheet & video* by using *Edmodo* program.	Students download materials (jobsheets& videos) using the Edmodo program.
Phase VIII *Search Web Sources* (Meeting 1 – 8)	The teacher sends notes containing group assignments to make presentations about the material to be learned by including files, site addresses or reference collections using the Edmodo program.	Each group is doing group assignments making presentations on the material to be learned by reviewing the included learning resources (file, site address or reference collection, jobsheet& video) using the Edmodo program.
Face-to-Face class		
Phase IX Evaluation (Meeting 9 – 10)	The teacher evaluates learning outcomes (cognitive) about the material already studied (Meeting 1 - 8) on the paper-based.	Students undertake evaluation of learning outcomes (cognitive) about the material they have learned (Meeting 1 - 8) on the paper-based within the time limit specified by the teacher.

Phase	***Teachers' Behavior***	***Students' Behavior***
	The teacher makes information about the evaluation of learning outcomes (cognitive).	Students undertake evaluation of learning outcomes (psychomotor) about the material that has been studied (meeting 1 - 8) with teaching aid in the form of 4 cylinder petrol motor trainer, 4 step in time limit which has been determined by the teacher .
	The teacher presents questions as 1) multiple *choice*, 2) *true false*, 3) *short answer*, and 4) *fill in the blank*.	
	The teacher evaluates the learning outcomes (psychomotor) about the material that has been studied (Meeting 1 - 8) with teaching aid in the form of a 4 cylinder 4-cylinder gasoline trainer, 4 steps.	
	The teacher makes information about the evaluation of learning outcomes (psychomotor).	
	The teacher checks Students' affective on when they are doing evaluation of learning outcomes (psychomotor).	
Phase X Closing (Meeting 10)	The teacher Provide evaluation questionnaire of teaching and learning process.	Students fill in the evaluation questionnaire about teaching and learning process.

Based on Table 1 above, Phase I is held at meeting 1 in the face-to-face classroom, the general activities at meeting 1 are 1) the orientation of the lecture plan, 2) the assessment of the students' initial ability, 3) the formation of the learning group, and 4) the remaining time is used for Tune-up engine stand that will be used for practice.

Phase II through Phase V takes place at meetings 2 to 8 in face-to-face classes. The general activities of this meeting are 1) group study presentations for 1 lesson (1 x 50 minutes), 2) practical exercises as well as troubleshooting for 2 lessons (2 x 50 minutes); and 3) ends with discussions and reviews between educators and learners For 1 lesson (1 x 50 minutes). The next Phase VI through Phase VIII is conducted at meetings 1 through 8 in virtual classrooms. Common activities at this meeting are 1) doing quiz, 2) searching and downloading learning resources. Stage VI up to Stage VIII is implemented after the learner completes the activities in the classroom face to face.

Phase IX and Phase X are evaluations conducted at meetings 9 and 10 meetings. Evaluations of cognitive, affective, and psychomotor and comprehensive competency tests are developed by utilizing competence theory and measurement.

Blended Learning Design Validation Result Based on 10 Elements of Gerlach & Ely Model

The result of data validation of blended learning design by expert of complete learning model is exposed in Table 2.

Table 2. Syntax Blended Learning for Block System Practicum on Electrical Engine Course

Factor	***Score***			
	Utility	***Ease of Use***	***Completeness***	***Legibility***
Specification of Objectives	80	80	60	60
Specification of Content	80	80	60	80
Assessment of Entering Behaviors	80	80	60	60
Determination of Strategy	60	80	60	60
Organization of Groups	60	80	60	80
Allocation of Time	60	80	60	60
Allocation of Space	80	80	60	60
Selection of Resources	80	80	60	80
Evaluation of Performance	80	80	60	60
Analysis of Feedback	60	80	60	60
Average	72	80	60	66
Average rating	69,5			

Based on Table 2, it is known that the total assessment of expert model of learning on blended learning design = 69.5%. If it is associated with a score classification: 0% -20% = Very Low; 21% -40% = Low; 41% -60% = Enough; 61% -80% = Height; and 81% -100% = Very High, the total assessment given by the expert of the learning model on the blended learning design product is in the "High" category, so it can be concluded that the quality of blended learning design is in the "High" category and can be used as the basis for implementing trials of small & large scale field trial data collection through experiments to determine the level of design effectiveness.

Discussion

Referring to the above expert evaluation, the researcher is willing to describe some evaluation on blended learning design which is developed based on 10 elements of Gerlach & Ely model.

According to Handayani (2014: 10) learning objectives are 1) benchmark of learning success, 2) direction / guidance in learning process, 3) statement about what will be achieved, generated at the end of learning, and 4) formulated clearly and operational. According to

Rusman (2010: 157) the practical guidance of formulating learning objectives can be summarized as follows: 1) formulate in operational form (easily measured), 2) formulate in the form of learning products, 3) formulate in the behavior of learners, not the behavior of educators , 4) formulate in such a way that clearly indicates the intended behavior, 5) try to have only one learning objective (one ability), 6) formulate the objectives in the appropriate area level, 7) formulate the conditions of the desired behavior, and 8) list acceptable standards of conduct.

According to Sudjimat (2009: 58) materials consist of written information or information presented through selected learning media, or a combination of the two, which will be used learners to achieve competence or learning objectives that have been determined. Therefore, what will be taught to learners should be chosen more specific subjects.

According to Rusman (2010: 157-158), the content of the subject matter must be specific because a subject with the same subject matter may be different from one school to another. The same subject matter is certainly different when taught in a higher or lower grade. Even between one teacher may be different from one teacher to another because of possible interpretations, priorities, emphases or different interests even within the same grade or school level. This is especially true in high education.

According to Rusman (2010: 158) the initial ability of learners is determined by giving the initial test. According to Ahyan (2012: 3) pretest test is a test conducted before the lesson material is given to the students with the aim to know the extent to which the material or lesson material that will be taught can be mastered by the students. Knowledge of the learner's early abilities is important for educators in order to provide an appropriate portion of the lesson (not too difficult and not too easy). Knowledge of early skills is also useful for taking the necessary steps, such as whether to prepare for learning or using a particular method.

Blended learning is basically a combination of learning excellence that is done face to face and virtually (Husamah, 2014: 11). According to Sudjimat (2009: 49) learning strategy describes the common components of a learning materials and procedures that will be used on the material to generate learning processes and learning outcomes in the learners.

The reasons for choosing an indirect instruction strategy as a face-to-face strategy are: a) this strategy is more centered on students centered, and b) this strategy is designed to provide a flexible learning system . The reason for choosing a deductive learning strategy (direct instruction) as a virtual learning strategy is the lesson material presented to learners in the form so and learners are required to master the material (exposure).

The selection of strategies and techniques to use the blended learning model will force teachers to think about the use of time. Whether most of the time be allocated for presentation or provision of information, for laboratory practice or for discussion. According to Gerlach and Elly (1971), the time-use plan will be different based on the subject matter, the objectives formulated, the space available, the administration patterns and the abilities and interests of the learners.

Conclusion

This research is the basis for developing blended learning model products for electrical engine practicum course as a whole. The product that has been produced from this research is blended learning design by using Edmodo as learning management system (LMS) for practicum of electrical engine by using block system at State University of Malang.

Therefore, it can be concluded that:

- The design of blended learning for the practicum of engineering engine block system in State University of Malang was developed based on ten elements of Gerlach and Ely learning model design (1971) that is: (1) specification of objectives, (2) specification of

content, (5) allocation of space, (8) selection of resources, (9) evaluation of performance, (4) determination of strategy, and (10) analysis of feedback.

- Blended learning design for the diagnosis of machine failure by utilizing ten elements of Gerlach and Ely model learning model can then be developed into blended learning steps (syntax).
- The total assessment given by the expert of the learning model to the blended learning design product is considered as "High" category, so it can be concluded that the quality of blended learning design is in "High" category and has been used as the basis for conducting pilot test of small & big scale through an experiment to find out the level of the design's effectiveness.

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