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Scenario Based E-Learning in Electrical Engineering Education

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Abstract

The scenario based e-learning in Electrical Engineering Education Learning (EEEL) was developed by covering the scope and characteristics of all subjects and the competence unit of graduates in the field of pedagogy, professional, social and personality, with url addresed http://jpte-ft-unimed.edu20.org. The scenario incorporates the concept of Problem Based Learning (PBL) and Contextual Teaching Learning (CTL), by supporting of Information Communication Technology (ICT) to establish the competence of the students, from beginners to become proficient, as the teachers of electrical engineering, and the electrical technicians. Based on the analysis, it obtained the students' learning motivation, the lecturers' attitude in teaching, and the students' learning outcome are tend to be high, and the competence of the students who used the model are better than not use.

Keywords: competence, e-learning, scenario

1. Introduction

1.1 Background

Indonesia specifies a requirement for teachers to be competent in the field of pedagogy, professional, personal and social. Electrical Engineering Education Department of Engineering Faculty at State University of Medan, need to respond this by creating a new approach in the implementation of the course. Based on the state of the pitch, it was found that there are 62.32% of graduatese who teach in Vocational High School still have to learn again to be able to teach in the classroom, the Grade Point Average (GPA) of them during the last five years was 2.95 (not change significantly in each year), only 1.61% obtained a GPA above 3.5, and the average of time needed for completing the study is long = 4.7 years, and only 2.30% of them work in the industry.

The GPA of students obtained cannot reflect the competence of expertise, and they are less competent in teaching and mastery of teaching materials, particularly in the field of expertise. Although the learning process is carried out in the vary methods, there are 39% of the lecturers still use the lecture method, and most of them were centered on the lecturer (teacher-centered learning). The availability of the qualified human resource, Internet networks, and the basic ability of students in the use of Internet are the possibilty to make a better approach in learning. Likewise with the necessary software and hardware had been available in the market, which can be use in developping a new teaching and learning approach.

1.2 Literature Review

The findings of previous investigators still cause debate about the implementation of the most effective methods in inquiry-based learning. The rich exposure, the complex tasks based on the challenge, and the question or the issue is still doubtful for being authentic to foster high-level cognitive skills (Barrow, 2006; Barak & Shachar, 2008). The Inquiry-based learning is also still doubt to provide a positive learning outcomes (Endler & Bond, 2008). McWilliams et al. (2010) suggested the learning facilities are required to support the transition from novices to be experts. For delivering learner from novices to be experts, is needed the scenario based learning, which use the interactive scenarios for supporting the active learning strategies such as a problem-based or a case-based learning (Errington, 2003). It can be a promising tool to help students acquire knowledge in science (Muhamad et al., 2012). A familiar scenario based e-learning is a learning model that can accommodate a mix between PBL and CTL with the support of information and communications technology in developping domain knowledge, and a high level of knowledge procedures together (Meier et al., 2008; Haigh, 2007; Huang, 2013). The easy and fast to use, the power of interconnection exploration, deepening and expansion of material from various sources, to encourage the expression of the autonomy of learners, and to promote the creation of a

learning culture are the advantage of using it. And then it also can be used in sending teaching materials, supporting of the quality improvement of learning, assessing of learning, and distributing the learning materials which can be accessed in anywhere and anytime as well as anyone (Rosenberg, 2001).

These reasons caused to be necessary in developing the cognitive processes, which support the transition from novice to expert in electrical engineering education. It can be begun before students plunging into the workforce. Graduates of electrical enginineering education are expected to have the knowledge of engineering and pedagogy (Fantz et al., 2011), which emphasized the acquisition of knowledge content depend on the development of the ability of organizing the information around the core concept, to identify patterns, and to apply the cognitive procedures effectively and efficiently, and to enable linkage of knowledge obtained for the transition from novice to expert (Bruning et al., 2004). The traditional approach is not appropriate anymore because only emphasizes on memorization and rigid, inflexible notion of scientific thought, and the limited equipment in making to be competent or to be capable of transferring skills and knowledge in professional education (Shen & Confrey, 2007). Technical competence is not the end point, but rather a stepping stone on the way to the capabilities and expertise (Hager et al., 1990). It requires learning method that emphasizes analytical skills and problem solving, but not detail of the techniques and methodologies (Kelly & Bell, 2000). The main essence is to identify the issues, which are the key strategies in solving the problem, and encouraging the learners to apply the settlement in real life actively (Iverson & Colky, 2004). In line of them, the features are required, such as (1) information lesson, notes the announcement and schedule, (2) map curriculum, (3) teaching materials such as slides, handouts, animation, audio, video, (4) communication via email and forums, (5) formative and summative assessment, (6) the student management tools (records, statistics, student tracking), (7) links to related sites internally and externally useful, such as libraries, online databases, and journals (Chinthaka, 2012). All of these elements are packed in a scenario in delivering the students from the beginners to the experts in the field of electrical engineering, and forming pedagogical. It is important to be able to combine the process of exploration, deepening, enrichment and expansion of information. Because the techniques teachers must have the ability in the field of engineering and management of learning in engineering, which includes knowledge of content, general pedagogical knowledge and pedagogical content knowledge (Viiri, 2003), in order to be able to work as a teacher of electrical engineering and in the field of electrical engineering. In connection with that matter, the content knowledge, the pedagogical knowledge, the content knowledge of engineering and technology, the content knowledge of learning, the learning knowledge in engineering and technology education, the technological content and the technical context must be possesed by a techniques teacher. Therefore it is important to make learning to accommodate the intended purpose, namely scenario based e-learning.

The scenario based e-learning has the potential to strengthen linkages between the range of pre-clinical study, and can save time in improving competence through experience in the workplace (Clark, 2009; Seddon, 2012). Constructivist approach puts learners as an independent, autonomous actors to get their own learning experience to solve the problem that the authentic (real world problems) (Jacobs & Newstead, 2000). It can meet the general education requirements that involve planting positive attitude and orientation to learn (Basu, 2008). Likewise, the development of high-level and complex reasoning and systematic thinking is part of conditions to be met. The learning model is a learning strategy associated with constructivist, cognitivist, and collaborative learning paradigm or a combination of several strategies from the perspective of pedagogical (Conrad, Kerri & Voris, Alvin C, 2002). Therefore, dealing with pedagogical values that could potentially affect the learning process. From the standpoint of content (content) that the implementation of computer-based learning of a particular subject is usually in accordance with the curriculum. Thus, learning in this model is the integration of (1) content, (2) technology, and (3) pedagogy, into a single unified system that supports learning.

In line of the above, the scenarios were developed for loading the useful concept mapping strategy for (1) analysis of the thought processes of students to emphasize key concepts or main ideas, (2) understanding of the relationship between different concepts, including the cause - effect and the relationship between the parts with overall, (3) assessment proposition, hierarchies and cross-ties in a scientific logic, and (4) repair structure concept linking theory and practice (Hsu, 2004). The new dimensions of the learning experience enrich aspects of these are (a) multimediality, learning easier because it helps students to focus and keep their attention on the content of the complex, (b) hypertextuality, which is structured as a manifold systems non-linear relationship between text, which allows students to follow their own path and to create new ones each time, (c) interactivity, which allows it to work with the material in the learning approach of learning by doing, which encourages higher engagement, understanding deeper, and better retention of the subjects (Lee, William W & Owens Diana L. 2000). Similarly, it is able to overcome the problems arising from the limitations of qualified teaching staff (Perrin & Mayhew, 2000).

Teaching materials are combined in the form of scenarios that lead students to achieve the expected competencies, which developed provide an opportunity for students to obtain, to compile, to store, and to manipulate data in various ways in producing information needed for learning. It is supplied in a global computer network (Internet) in the form of Text, Images, Audio, Video or Animation. This can be combined with media to enhance the quality of teaching and learning process (Gralbreath & Smith, 2000). It include of he principles of learning and instruction in the plan of study materials and learning activities (Smith et al., 2005). The scenario is developed to guide students in learning, encourage students to active, integrated and inquiry-based approach, realistic contextualization of learning.

Lecturers as a facilitators need of the skills in guiding the discussion without becoming providers of learning content (content-provider), and skill in encouraging students to take responsibility and direct their own learning. The effectiveness of the model can be presented by the level of motivation of students have, through a learning environment that is disseminated to form students' beliefs (Wery & Thomson, 2013), and it can improve the achievement of students (Arunachalam, 2014). It is presented by (1) efficiency, which attempts to reduce the bonds of space and time learning process, learning to operate as a supplement to traditional education or learning, (2) effectiveness, i.e. efforts to enhance the learning process (Keeton, 2004).

The characteristics of the model are indicated by (1) it is based on the theory of learning/teaching and research areas of cognition, educational psychology, and problem solving; (2) it includes the analysis of learning needs and goals, the development of delivery systems and the learning environment, and organize learning resources; (3) it contains material plans, processes and activities that ensure learners achieve the learning outcomes (objectives) prescribed learning; (4) it does repeatedly that require evaluation and feedback on an ongoing basis (Beck & Schornack, 2003). By of these, the scenario is prepared by defining the performance objectives, the context, the goals, identifying barriers, outlining the scene, writing a description of the character, and eliminating things that are boring. Based on these, the scenario based e-learning in electrical engineering education is developed by adopting the concept of constructive learning, contextual learning, metacognitive learning and collaborative learning.

All of the obstacles that may arise during the conduct is also defined so that it can be minimized when the current implementation. The expected character woke up after the completion of the activities, which is presented by the learners, and the learner awareness of the objectives has been achieved. The availability of resources and support for learning, and the creation of students' motivation to learn is also part of the effectiveness of the model (Noesgaard & Ørngreen, 2015), and providing space for the conducive two-way interaction between learners and the facilitator, and also provide the opportunities to try learning materials through simulation for students, likewise the conditions to motivate students to participate in learning. This is evident from the relationship, directly or indirectly between students using the interactive functions of self-reported, students' perception of the usefulness of interactive functions on the performance of students in learning. Based on them, in this paper is presented the effectiveness of the scenario based learning used in electrical engineering education, which is shown by the level of students' motivation in learning, students' interested in using model, lecturers' motivation in using model, and students' learning outcome.

2. Method

Based on the Research and Development Methodology, the steps being taken in this research are (1) identifying organization goals, (2) analyzing performance gaps, (3) creating goals base scenario, (4) delivering and facilitating (5) implementing and evaluating. The products were refined based on input from experts and users (lecturers and students). The products are tested on a limited scale, beginning by involving small groups to larger groups. The effectiveness of the model is tested through an experiment.

The learning model which can be provided the competent graduates in teaching of electrical engineering and electrical engineering works, is the primary objective of the study. The electrical engineering education curriculum, the students competencies required, and the characteristics of the subjects are used as the basics in designing of the model. As the powers in order to support the development of this model are collected through instruments and direct observation. This information is used in deciding the need for developing the scenario.

The learning scenario for subjects allied (Technicality, Teacher) is developed which consisting of the module of the electrical engineering teaching and learning and the electrical technic learning material. They are packed in the learning management systems which be a scenario-based elearning. The features are developed which navigate the student to use the model accompanied by instructions, respectively. Presentation of the material in the internet, which has been through testing usability and reliability, which is an alternative learning patterns either independently or in collaboration for students. While the development is done, at the same time, the

improvements is done in accordance with the input of users and experts, when the limited scale test is done.

The effectiveness of the model is tested through an experiment involving two groups of students. The students' learning outcome, students' motivation and interest in learning, lectrurer's motivation, and the usefulness of interaction of students with lecturer become the main review factor. The student group is composed of two groups, each of them is the model used groups of 42 peoples and who do not use model is 50 peoples, and the lecturers of the various subjects involved in this test are 10 people.

The achievement test are used to evaluate the students' learning outcome which consist of 10 items. The score range is 0-100. The students' learning motivation questionare consist of 40 items, the questionare of students' interest in using the model consist of 30 items, and the questionnaire of lecturers' motivation to manage the course by using the model consist of 20 items. All of the questionare used Likert Scale, with 1= Strongly disagree, 2= Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree.

Quantitative and qualitative analysis are used to analyze data. The tendency of students' learning outcomes, students' learning motivation, students' interest in learning, and lecturers' motivation to implement learning was analyzed with descriptive statistics. The criteria of tendency are considered based on theoretical data in this analyze. The categories are Mean + 3 SD = High, Mean + 1.5 SD = Moderate, M – 1.5 SD = Enough, and Mean – 3 SD = Low. The t-test statistics at the level of $\alpha = 0.05$ was used to compare learning outcomes of students who use the model and the learning outcomes of students who do not use the model.

3. Result

3.1 The Development of Electrical Engineering Education E-Learning (EEEL) Model

The EEEL website was developed with URL addressed: http://www.jpte-ft-unimed.edu20.org. The access code is prepared for the student lecturers for signing up. Further filling the form of user data in activating the users account. There are several features are provided as navigation for the user namely Classes, Group, Dashboard, News, Welcome, Users, Resources Admin, My Class. All of these allowed users to ease of use the model.

3.2 EEEL Implementation

The materials accompanied by scenario are posted in the website by the team of lecturers, and then students follow the order as specified learning. The learning scenarios built is intended to teach students to be competent as the prospective teachers in teaching appliance and repair household electrical appliance. It is intended to form the students' skills in repairing electric appliances household, and build competence in teaching students repairing electric appliances household.

The scenario established for that purpose are (1) Students can realize the goal of learning to be followed, namely (a) Students are able to do appliance repair household electric appliances, (b) Student is competent in designing and implementing learning of students in the appliance of the electric household repair. (2) The Lecturers' team can work together in monitoring the implementation of learning which includes the Basic of Electrical, the Electrical Engineering, and the Microteaching. (3) The team of lecturers can provide feedback on all of the students involved in the learning process. (4) Students examine the material which presented in the form of video, namely (a) The concept of the changes of electrical energy into mechanical energy, (b) The process of the improvement of electrical household. In this case, it's the household electric fan, and (c) The constructivist and contextual learning process.

3.3 EEEL Evaluation

The effectiveness of EEEL is based on the level of students' learning motivation tendencies in using model, the tendency of lecturer's motivation in managing the lecture using model, the tendency of students' interests, and the level of students learning outcomes after using the model.

The students' learning motivations by using model are presented in Table 1. The average scores of 167.8 presents the tendency of students' learning motivation is high based on the criteria considered. It shows model can improve the students' learning motivation. Because of this, the model can be said is effective in managing the electrical engineering education.

Table 1. Students' learning motivation by using model

N	42
Mean	167,8095
Median	167,9000[a]
Mode	165,00[b]
Std. Deviation	6,40974
Variance	41,085
Range	36,00
Minimum	140,00
Maximum	176,00
Sum	7048,00

The students' attitude tendency level in using the learning model (Table 2) is also tend to be high category according to the criteria driven.

Table 2. Students' learning attitude

N	42
Mean	162,0476
Median	163,6429[a]
Mode	164,00
Std. Deviation	4,84870
Variance	23,510
Range	20,00
Minimum	148,00
Maximum	168,00
Sum	6806,00

The mean scores of students' learning interest on average are 162, present the model of learning can improve the students' atitude in learning. The results of the data analysis of the motivation of lecturers in teaching by using the model outlined in Table 3 below.

Table 3. Lecturers' motivation

N	10
Mean	89,7000
Median	89,0000[a]
Mode	88,00[b]
Std. Deviation	4,78539
Variance	22,900
Range	16,00
Minimum	80,00
Maximum	96,00
Sum	897,00

The lecturers' motivation in conducting lectures using the model is tend to be high. It is presented by the average score obtained was 89.7. Based on these, it can be said that the model is effective in motivating lecturers in managing the lecture. Data obtained through achievement test presented the electrical appliance repair, and the ways of teaching and learning materials household electrical appliance repair is shown in Table 4. The mean value of achievement score of the student used model is 83.4, and the unused 77.5. By the average value, It appears that the students' learning outcomes who use models are higher than the student unused models significantly.

Table 4. Students' learning outcome

	Group	N	Mean	Std. Deviasi	Std. Error Mean
Learning outcome	Use model	42	83.4762	6.20479	.95742
	Unuse model	50	77.5000	4.82870	.68288

By looking at the t-test results as presented in Table 5, it appears that the learning outcomes of the students who use the model is higher than the learning outcomes of the unuse the model.

Table 5. The difference of the learning outcome of students

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Learning outcome	Equal variances assumed	.706	.403	5.193	90	.000	5.97619	1.15087	3.68979	8.26259
	Equal variances not assumed			5.082	76.714	.000	5.97619	1.17600	3.63433	8.31805

The analysis shows that there are significant differences between the average learning outcomes of students who used the model with an average of learning outcomes which do not use models (Fhit = 0.706> Ftab = 0.403). In average, the students' results using model are higher than the student results who not use the models. By looking at in terms of the students' learning motivation and lecturers' teaching motivation, as well as the learning outcomes of students who use the model turns the model is effectively used in teaching students of electrical engineering education.

4. Discussion

The development of the learning model is aimed to get a better result than the previous situation. The scenario based e-learning is to facilitate the users (students and lecturers) for greater ease in learning activities by students, and teaching by lecturers. It appears that the implementation of learning model is effective in improving learning motivation and interest of student in learning, also lecturers' motivation in teaching. Likewise, the results of student learning can be better. Motivation and interest is an incentive for someone to do something in accordance with the objectives to be achieved. The use of scenario based e-learning model can trigger learning motivation of students to be more accomplished, according to the scenario constructed, which raises awareness of students about the goals to be achieved in learning. It is caused by the students involved in learning that is able to see the performance itself and the performance of the others. This can give rise to competition situation among students involved that triggers the motivation to learn. Given the situation for the better race will give better results. It is in line with Worm and Buch (2014), that the students are conditioned to work in competition will give the better results. It is driven by the superior creation of the students' motivation. The high students' motivation in learning is a capital base in the formation of competence. When someone of students has the motivation to become a superior technician then will be encouraged to learn better, and if the student has a high motivation to become a teacher of technique after a teacher someday it will establish itself for the better.

An important role of the person's motivation is to choose to fix a number of skills in a particular moment to focus on things that are more urgent that the scenario based elearning allow the establishment of better learning outcomes (Stout & Barto, 2010; Lyman, 2013; Bedard-Voorhees, 2013). The model developed has fulfiled the expectation because it can make student learning better. To obtain a better student learning, it takes a common perception of lecturers to use the model to ensure the teams are success in designing scenarios in forming student competence both as a technician and a teacher. The implementation of learning in a good of technique teacher education, it makes students happy and enthusiastic in learning and training, and enables to create a standard of academic and subject specific lessons (Seung, 2010). Duhu et al. (2014) stated that the perception of electrical engineering teacher determines the success of the learning tasks is performed. In line with this, the need to further study on the perception of lecturers to use models of scenario based elearning on the education of electrical engineering, because it is became a limitation of this study, which has not assessed the relationship between the perception of lecturers of the learning model based electronic scenario used in lectures and the

learning styles of students yet.

5. Conclusion

Scenario Based E-learning Model in EEEL can be developed and utilized in learning with a charge, which facilitated the learning for students, and managed the learning of the course by lecturers. Based on the findings, the model is effective in the implementation of lectures in electrical engineering educational, which can increase student learning motivation, learning interest of students, as well as teaching faculty and motivation can improve student success. With the findings of this research, the electrical engineering education department is expected to implement this model for a broader scope, and the need for socialization for all students in order to achieve maximum results.

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