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Needs Analysis of Designing Online Computer-Assisted Training to Improve Pedagogical Competencies in Engineering Education

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Abstract*: This research aims to describe the analysis of the need for computer-based training in improving the educational competence of graduates of engineering education. The online method of developing computer-assisted training is carried out in 3 stages, namely: Phase I needs analysis and model design, Phase II develops with validity and practicality, and Phase III will do the model testing. In this study, it will only be focused on phase I, namely the analysis of needs and design of the model, involving 50 students who take pedagogic learning in engineering education at the University in Padang, Indonesia. The instrument to collect information was used a questionnaire and analyzed the data with descriptive statistics. The results of the needs analysis and description of the research found that the level of ability of graduates of engineering education was categorized at a good level, which is seen from the aspect of pedagogical competence. Competence of education educator graduates is categorized at a sufficient level, which is seen from the aspects of designing learning tools and aspects of classroom mastery in the learning process running. Besides that, the information obtained from the results of interviews and observations in several schools, shows the educational competence of graduates of engineering education at a sufficient level. Other facts are also obtained from the results of the needs analysis by engineering education graduates, stating that graduates of engineering education graduates still have low educational competence, besides that the competencies of graduates are still low, and do not answer the needs of the workforce. It is time for graduates of engineering education to carry out upgrading, training and workshops to improve skills, competence and education through continuous online computer-assisted training.

***Keywords* : Online Computer-Assisted Training, Pedagogical Competencies, Engineering Education.**

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I. INTRODUCTION

Competence contains aspects of knowledge, skills and abilities or personality characteristics that affect performance. Thus, a person's characteristics are related to one's work and competence. So interpreted as basic competence is a basic ability possessed by someone in completing work and problems. Not only that, with competence like someone is able to predict behavior and performance [1]. In the field of engineering education graduates, the learning process is more dominant with the process of delivering information or communication. Submitting information or communication is one of the competencies possessed by a graduate of engineering education. Competencies of engineering education graduates are an inseparable part of the campus of engineering education graduates. The competence of an engineering graduate education is the ability to communicate so that the delivery of information that suits students' needs. The quality of graduates of engineering education graduates is assessed from the learning achievements of engineering education graduates, namely 34% in developing countries, and 36% in industrialized countries [2].

A graduate of engineering education has a role as a determining factor for the success of organizational goals and the quality of engineering education graduates. The performance of engineering education graduates must always be improved given the challenges of the world of work in the increasingly competitive global era. The performance of graduates of engineering education is the result achieved by graduates of engineering education in carrying out the tasks assigned to them that are based on skills, experience and sincerity as well as the use of time. An engineering education graduate is said to be professional if he has the expertise, skills or skills that meet certain quality standards or norms. Engineering education graduates are said to be learning agents whose role is to facilitate students to be able to learn comfortably and successfully master the competencies that have been determined. For this reason, engineering education graduates need to design so that the learning process of learning runs smoothly with optimal results [3].

Competencies that must be mastered by graduates of engineering education are personality competence, pedagogical competence, professional competence and social competence.

In carrying out their duties as graduates of engineering education, they must have the skills and ability to deliver learning materials properly. The ability of graduates of engineering education in managing learning is called pedagogical ability. Where this ability includes the ability to develop curriculum and syllabus including the design and implementation of learning. Competence of engineering education graduates is a dominant factor in determining the quality of learning, meaning that if engineering education graduates involved in learning activities, have good competence, engineering education graduates will be able to increase student motivation. Increasing the quality of learning, will be able to improve student learning outcomes [4]. Competencies of graduates of engineering education are expected to be able to master pedagogical competencies in guiding and managing students [5].

Engineering education graduates do not have the ability to manage students so that it becomes a problem on the campus of engineering education graduation. This problem needs a solution to find out to what extent prospective graduates of education have pedagogical competence. To find out the problem, an analysis of the pedagogical competency needs of prospective engineering education graduates is carried out. Competence possessed by each graduate of engineering education will demonstrate the professional quality of a graduate of engineering education. The Indonesian government has made reference criteria about competencies that must be mastered by graduates of engineering education so it deserves to be called a professional engineering education graduate. Engineering education graduates as professional staff means that the work of engineering education graduates can only be done by someone who has academic qualifications, competencies, and engineering education graduate certificates in accordance with the requirements for each type and graduates of certain engineering education.

One of the urgent competencies that must be mastered by graduates of engineering education is pedagogical competence. Pedagogic competence is a specific competency that will distinguish the profession of graduates of engineering education with other professions and will determine the level of success of the process and learning outcomes. National Standards Indonesian engineering education graduates, argued that pedagogical competence is the ability to manage learners' learning which includes understanding of students, designing and implementing learning, evaluating learning outcomes, and developing learners to actualize their various potentials. Efforts to improve and develop qualifications and pedagogical competencies for graduates of engineering education are through planned and systematic training activities, which will have an impact on knowledge, skills and positive attitudes.

Engineering education graduates are required to continuously improve and develop academic qualifications and competencies in line with the development of science, technology and the arts. In this regard, efforts are needed to improve and improve the quality of learning of engineering education graduates so that the objectives of engineering education graduates can be achieved optimally. According to [6] explains that systemic elements that can contribute to the quality of engineering education graduates include at least: curriculum and learning material, engineering education graduates and other engineering education graduates, students, supporting facilities and infrastructure, teaching and learning processes, assessment system and guidance of management of engineering education graduate programs.

Based on the above facts, it is necessary to develop training programs that can improve the quality of training so that training runs effectively in achieving goals. The training program developed must be able to meet the needs of engineering education graduates who have diverse competency characteristics. Thus, the training program developed must be structured. The development of computer-based training for prospective engineering education graduates is closely related to efforts to improve the quality of the engineering education learning process [7]. Computer-based training plays a very important role in achieving the success of the training process, meaning that if a computer-based training design is developed properly and through the right stages, it will have a great chance of being used to its full potential and can improve the quality of training. If the quality of training is improved it is expected to be able to increase the competency of graduates of engineering education [8], [3].

The importance of engineering education graduates getting computer-based training, so that they can balance between graduates of engineering education and needs in the world of work. Computer-based training needs to be developed in accordance with the character and abilities of prospective graduates of engineering education, have a clear conceptual and operational foundation. Computer-based training must also be able to: 1) spark enthusiasm for learning so as to have independence and self-development in learning; 2) encourage creativity to create media in learning; and 3) fun, so that a graduate of engineering education will have the level of ability needed by the world of work. Computer-based training that is developed must be able to increase creativity and innovation by a graduate of engineering education in implementing computer-based training. So it is important to analyze the needs of the level of achievement of computer-based training on pedagogical competencies of graduates of engineering education.

II. LITERATURE REVIEW

A. Training Needs Analysis

Needs analysis is an important part of the beginning of the learning process, especially in higher education graduates [9]. Training needs analysis is a tool for mapping training and developing needs to grow and meet training needs.

Training needs analysis is the first step in the cycle process that contributes to the training and strategy of graduate engineering education employees in an organization or professional group. The cycle begins with a systematic consultation to identify the learning needs of the community considered, followed by program planning, delivery and evaluation [10]. The analysis carried out at the initial stage is an important starting point for knowing the training needs to be carried out. This analysis can help to identify the best source of information about training needs.

B. Overview of Training Concepts

According to [11] Training meant formal training that was planned in advanced and had a structured format. This shows that the training meant here is formal training that is planned carefully and has a structured training format. Training is defined as a variety of introductory efforts to develop the performance of employees or graduates of engineering education on the work they bear or also something related to their work. This usually means making specific or specific changes in behavior, attitudes, expertise, and knowledge. And for training to be effective then in training must include learning of experiences, training must be an organizational activity that is planned and designed in response to identified needs. Training is a planned process to facilitate learning so that people are more effective in carrying out their work. Planned training must be adapted to adult learning styles [12], [13]. Training is carried out to improve employee knowledge and skills in this case graduates of engineering education in a relatively short time. Training is given to improve the performance of engineering education graduates, both new and old. The training given to graduates of engineering education will increase their competence if the training can make them have a skill.

C. Competence

Competence is the nature that is owned or a part of personality that is deep and attached to someone and behavior that can be predicted in various circumstances and work tasks as an impulse to have the achievement and the desire to try to carry out the task effectively. It is this mismatch in competencies that distinguishes a superior actor from a performer with limited achievement. Limited competencies and special competencies for a particular job are patterns or guidelines in the selection of employees, task shift planning, work assessment and development. Competence is mastery of a set of knowledge, skills, values and attitudes that lead to performance and are reflected in the habits of thinking and acting in accordance with their profession. Furthermore, competence is defined as the ability to carry out or do a job or task based on the skills and work knowledge required by the job. This competence is everything that is owned by someone in the form of knowledge, skills and other internal factors of individuals to be able to make something work. In other words, competence is the ability to carry out tasks based on the knowledge and skills possessed by each individual [14].

D. Electronic Computer Based Training

Computer Based Training (CBT) is a CD / LAN / WEB Interactive based communication media created as a training tool and an introduction to the internal material of an institution or institution. Implementation of this learning, that training participants can learn through a training learning program on a computer, CBT is very useful in training participants to use applications on the computer, because CBT can be integrated with various other applications. A participant can learn many things through this CBT, for example, corporate training, computer training, and others. This learning and training method is even more popular because now anyone can learn without the need to be limited by time and space. They can adjust learning time according to their time availability. Generally CBT is equipped with interactive tutorials, exercises, simulations via video accessed online [15].

E. Computer Assisted Instruction

Computer-based learning is interpreted simply related to learning and teaching related to computers that allow interactive communication between students and teachers to create a conducive learning atmosphere. In this definition, with computer-based learning students will interact and deal directly with computers individually so that what is experienced by a student will be different from what is experienced by other students [16] - [19]. Six formats or forms of learning interactions that can be applied in designing an interactive learning media. Format or form of interaction, namely: a) drill and practice; b) tutorial; c) games; d) simulation; e) discovery; and f) problem solving

III. METHODOLOGY

The training needs analysis method carried out in this study uses a research and development approach called Research and Development [20]. The training needs analysis method aims to analyze the needs of online computer-assisted training with Focus Group Discussion (FGD) activities. The online method of developing computer-assisted training is carried out in 3 stages, namely: Phase I needs analysis [9] and model design [21], Phase II develops with validity and practicality, and Phase III will carry out model testing [22]. This study will only be focused on phase I, namely the needs analysis and design of the model, involving 50 students who take pedagogic learning subjects in engineering education at the University of Padang, Indonesia. The instrument to collect training needs analysis information was used a questionnaire and data analysis was performed with descriptive statistics. There are several items that are asked to students about the needs, 1) Lesson Plan, 2) Understanding and Developing Student's Self Potential, 3) Work Ethics, Responsibility and Pride, 4) Learning Implementation and Planning, 5) Get to know the characteristics of students, 6) Educating Learning Activities, 7) Communication with students, 8) Evaluation.

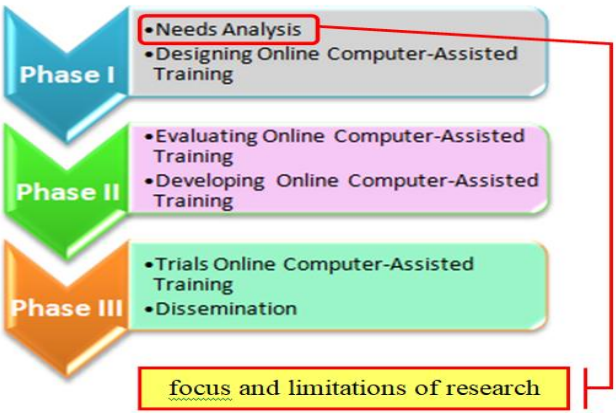

Fig 1. Framework for Research Stages of Developing Online Computer-Assisted Training

IV. RESULT AND DISCUSSION

Focus Group Discussion (FGD) is a scientific discussion activity that is used to gather information from various experts, making this method fast, economical and efficient from various participants [23], in the implementation of the FGD it helps to share information that researchers need [24]. In addition, the interactions that occur between FGD participants can produce important information [25], can make the possibility for more spontaneous responses from FGD participants and can provide settings where FGD participants can discuss problems and at the same time provide possible solutions.

Based on the implementation of the Focus Group Discussion (FGD), there were some input and suggestions from experts on the computer-based training of pedagogical competencies that were built and the products produced need to be improved by carrying out the initial stages of Training Needs Analysis. Thus, prospective graduates of engineering education on pedagogical competencies, needs to be analyzed needs. To ensure the ability to design learning tools researchers will provide a needs analysis questionnaire to students written in the form of respondent achievement levels. Data from the need analysis questionnaire was analyzed in such a way that conclusions would be drawn from the needs of students towards the development of computer-based training on pedagogical competence. Achievement of students' needs analysis response to computer-based training in pedagogical competence The data are a questionnaire distributed to students to ask their needs for the development of computer-based training in pedagogical competence.

Achievement response analysis needs of 8 (eight) indicators distributed to students as graduates of prospective graduates of engineering education on the development of computer-based training in pedagogical competence in graduates of engineering education shows that on average 66.1% (Answer Yes) students really need training using Pedagogical competency-based computer training in engineering education graduates while on average 33.9% (Answer No), then it can be described in the following graphical form.

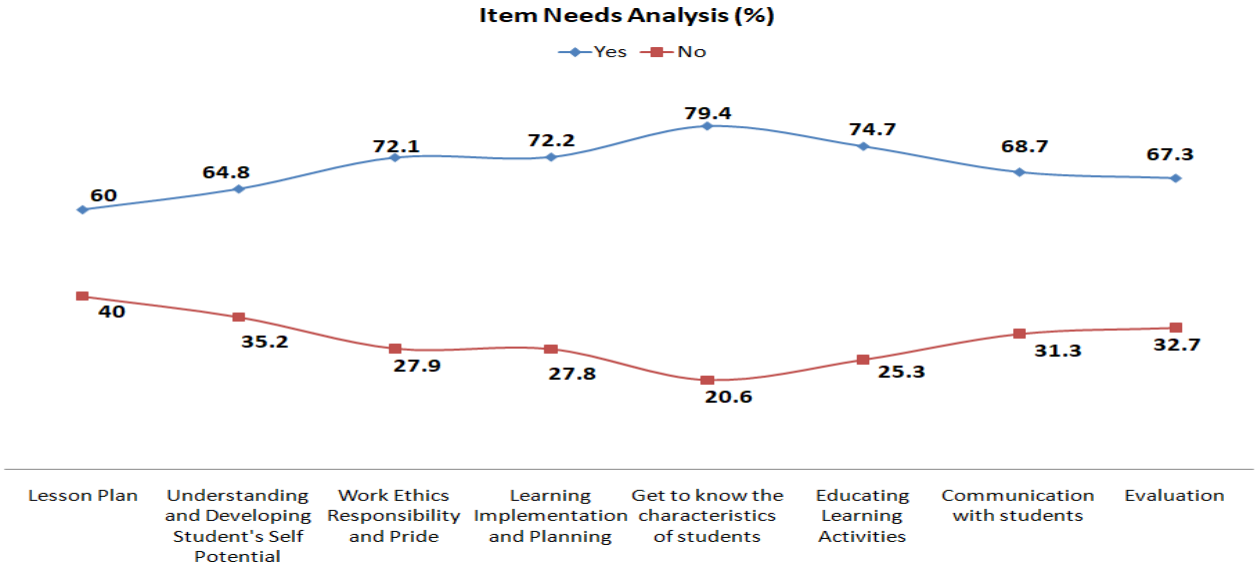

Fig 2. Item Needs Analysis of Developing Online Computer-Assisted Training

Based on the needs analysis of developing online computer-assisted training that has been done, the researcher obtained further information as material in designing the draft online computer-assisted training. The results of the needs analysis and description of the research found that the level of ability of graduates of engineering education was categorized at a good level, which is seen from the aspect of pedagogical competence. Competence of education graduates of engineering education is categorized at a sufficient level, which is seen from the aspect of designing learning tools and aspects of class mastery in the learning process running. In addition, information obtained from interviews and observations in several schools shows that the educational competence of graduates of engineering education is still at a sufficient level. Other facts are also obtained from the results of the needs analysis by experts, stating that graduates of engineering education still have low educational competence, besides that the competency of graduates is still low, and does not answer the needs of the workforce.

The competence of education graduates from the pedagogical aspect at this sufficient level is enhanced through training and learning activities especially in the form of Online Computer-Assisted Training.

This online training facility will greatly help graduates of engineering education to train their skills, knowledge and competencies. Online Computer-Assisted Training enables graduates of engineering education learning wherever and whenever, besides that training options are also available that facilitate the development of engineering education skills graduates. The design process is carried out in the localhost version with the results of the draft computer-assisted training online draft as follows:

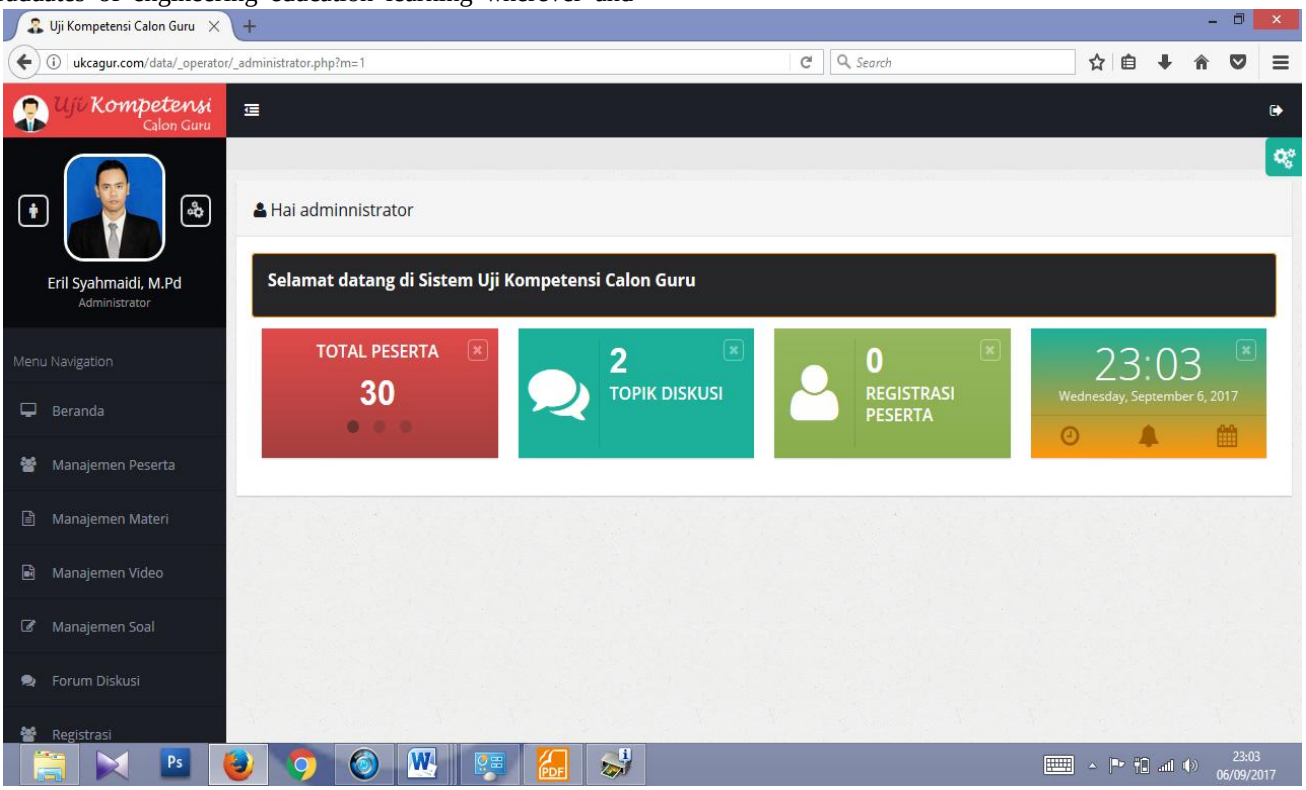

Fig 3. Draft of Developing Online Computer-Assisted Training, visit http://ukcagur.com/

V. CONCLUSION AND FUTURE SCOPE

The implementation of Focus Group Discussion (FGD) obtained some input and suggestions from experts on computer-based training on pedagogical competencies that were built and the products that have been produced need to be improved by carrying out the initial stages of Training Needs Analysis. The results of the analysis of the need for computer-based pedagogical competence training, it can be concluded that in the category of computer-based training that is very much needed pedagogical competency. The implementation of computer-based training is expected to be able to improve the competency of a prospective graduate of engineering education especially the pedagogical competence of graduates of engineering education. Pedagogical competencies prospective graduates of engineering education are able to develop learning tools and know the development of students and have responsibilities towards students.

Increasing the competency of graduates of engineering engineering education can be achieved by computer-based training. Quality training will be able to produce graduates who are superior, resilient, high-tech and have adequate competence so they are able to compete and excel in the world of work. Implementation of training for prospective graduates of engineering education requires careful planning based on an analysis of the needs of engineering education graduates, adequate training teaching materials, strategies and methods of training that are appropriate and effective, so that participants or prospective graduates of engineering education are able to organize learning activities well and be able to respond the needs of students and learning in general.

The application of pedagogical competency-based computer training to graduates of Engineering engineering education will be able to produce prospective graduates of engineering education who are superior, resilient, high-tech and have sufficient competence so that they are able to compete and excel in the world of work.

Limitations of this study are influenced by geographical and weather conditions, Online Computer-Assisted Training that can be utilized online will be disrupted if the weather is bad and the signal quality is disturbed. So that suggestions for improvement for the future must be improved from the infrastructure of the online training system that is able to overcome weather constraints and geographical conditions in many islands such as Indonesia.

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