THE DEVELOPMENT OF TRAINING MODEL OF WEB ENHANCE LEARNING in COMPUTER PROGRAMMING (WELComP) RESULTING IN BASIC PROGRAMMER COMPETENCE

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Abstract

Education has a role in creating quality human resources which is the main capital in development and are an investment to prepare humans to have the capacity for creativity, productivity, and competitiveness in encountering the environment of the digital revolution 4.0 era. However, formal education only is not enough to improve the quality of graduates. Training needs to be implemented as well in order to provide a better competency ability. The selection of appropriate training approaches, models, and strategies is one of the efforts to achieve successful training in order to achieve competency standards in accordance with training objectives. Active, creative, and innovative learning process innovation is the key to successful training. The Web-Enhanced Learning in Computer Programming (WELComP) training model is a model produced in Research and Development (R&D). This study was designed using the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) development model. The development was carried out in collaboration with the scientific approach, the discovery learning model, and the demonstration learning method. This research aimed to produce and improve the competence of a Basic Programmer. The feasibility of the WELComP training model to be applied to training activities was proven by the validity test results conducted using Aiken's V formula. The V value obtained was 0.771, which is in the range $0 < V < 1.00$ and greater than 0.677, thus it is indicated as a fairly high coefficient and considered valid. The validity test indicates that the WELComP training model can be used in training as an effort to produce basic programmer competencies.

Keywords: research model, WELComP, basic programming.

Introduction

The emergence of revolution 4.0 (cyber physical system) causes changes in various sectors. This revolution focuses on the use of technology in automation in collaboration with cyber technology. This revolution combines information and communication technology in various industrial fields. Major changes occur in human labor which is replaced by machines and technology that were considered more effective and efficient. The human resources (HR) needed are human resources who have the competence to adapt to the demands of the industrial revolution 4.0 era.

It is important to know the industrial revolution that has been existing before discussing these stages further. The first industrial revolution that occurred around the 18th and 19th centuries came with the emergence of mechanization, steam power, and hydropower which replaced human and animal power. This mechanization was then followed by the second industrial revolution, which was related to mass production and assembly lines that employed electricity.

The third industrial revolution was marked by the use of automation technology in industrial activities. An overview of the four stages of the industrial revolution can be seen in Figure 1 below:
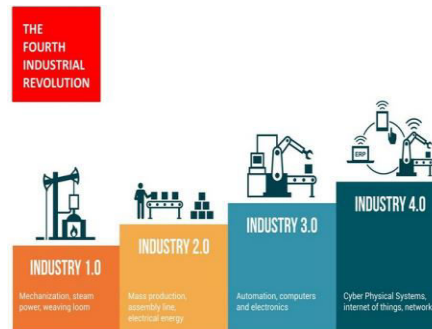

Figure 1. Illustration of industrial revolution 1.0 to 4.0

There are at least five technologies which were applied in the industrial revolution 4.0 trend which become the main pillars to develop a digital-ready industry, those are: Internet of Things (IoT), Big Data, Artificial Intelligence, Cloud Computing, and Additive Manufacturing.

The competencies or skills needed in such industrial revolution 4.0 era are skills in three literacies including data literacy, technological literacy, and human literacy (Rozak, 2018). These three literacies are very important in all types of activities or jobs in the industrial revolution 4.0 era, therefore the education field must follow this change. The world of education must be able to produce human resources who have skills in these three literacy skills.

New business opportunities and unprecedented jobs related to the use of information and communication technology in the industrial revolution 4.0 era affect the job market. Job seekers will face the skills or competencies of being able to adapt to the demands of the 4.0 industrial revolution era.

The need for human resources (HR) in the field of information and communication technology is very crucial. A research project that was conducted by the Center for Research and Development of Public Information and Information and Communication Applications (Puslitbang Aptika-IKP) of the Human Resources Research and Development Agency of the Ministry of Communication and Informatics in 2019 estimated that there were 129,465 human resources needed in the field of information and communication technology in 2020. Based on the research data, Full Stack Programmer profession is the most profession needed in 2020 with an estimated number of 35,172 HR, followed by Data Analyst Big Data Scientist profession at the second place with an estimated number of 21,705 HR.

Hence, the increase of the competence of the human resources becomes the prioritize of the Indonesian government to be conducted in order to be ready in facing the industrial revolution 4.0 era so that Indonesia human resources are able to compete with Asian countries and even compete globally so that the Indonesian industry can become a complete industry 4.0.

OBJECTIVES

The objectives of this research are:

1) Developing a web enhanced learning in computer programming (WELComP) training model which is applied to basic programming training to produce basic programmer competencies in the Informatics and Computer Technology Education Study Program, Faculty of Engineering, Unimed.

2) Identifying the validity (feasibility) of the WELComP training model developed in basic programming training to produce basic programmer competencies in the Informatics and Computer Technology Education Study Program, Faculty of Engineering, Unimed.

LITERATURE REVIEW

Training is a learning process concerning a discourse of knowledge and skills aimed at the application of learning outcomes in accordance with certain demands. Training is a process where students achieve certain abilities to help achieve the organizational goals (Mathis, 2002).

Training has a close relationship with practice, therefore these two are integrated to each other. Practice is an activity or work to train to acquire skills, while training activities aim to improve a person's knowledge and skills so that those who are trained gain knowledge and skills in understanding and carrying out a job effectively and efficiently.

Based on the above understanding, training contains the following elements::
a) practice contains a general goal to be achieved,
b) held intentionally, organized and systematic.
c) practice takes place outside the school system,
d) practice provides a certain knowledge and skill,
e) practice is carried out in a relatively short time,
f) practice focuses on the implementation rather than theory.

The development of information and communication technology has affected education, especially in the learning process. Moreover, it also affects the job competition in the globalization era and the challenges in the industrial revolution 4.0 era which requires higher-order thinking/HOT. Higher-order thinking is a mental activity or the last three-stage cognitive activity in Bloom's taxonomy which includes analyzing, evaluating, and creating (Rusman, 2012).

Skills in the field of information and communication technology can be used as a basic capital that has great opportunities in the job in the 4.0 era. Based on the current rapid development in all aspects of human life, it leads to the use of digital applications which births one of the biggest opportunities in the job world to become a programmer because applications that can facilitate the completion of a job with more accurate results are designed and made by a programmer. Therefore, the quality and relevance of graduate competencies need to be improved. Hence, link and match are necessary between the graduates' skills and the demand of job world. This can be realized by learning that focuses on skill competencies through training programs.

Training is part of education which has the characteristics of being specific, practical, fast, and meaningful. Practical and fast means that the material provided during the training can be implemented into a practice. Training generally aims to improve the expertise in various job skills in a relatively short time. The Regulation of Government (PP) No. 31 of 2006 concerning the National Job Training System explains that training is all activities to provide, improve, and develop work competence, productivity, discipline, attitude, and ethic at the level of expertise and special skills in accordance with level and qualification of the position or job (Burhanudin, Yusuf, 2015).

Training curriculum is conceptually designed to carry out or perform (action) work in the form of demonstrations as a vehicle for learning. The results of the training are in the form of

actual outcomes and desired outcomes both as learning design decisions in making the choice of the training model used.

The general purpose of basic programming training carried out in the PTIK department is to produce competent basic programmers. In order to achieve this goal, a training needs to be provided to the participants called competency-based basic programming training using online methods. In addition, this training aimed to instill and strengthen the motivation, activity, and creativity of students as trainees to become reliable basic programmers. Through this training, participants are also equipped with supporting character values (Prabantoro, 2015), including:

1. Careful, full of interest, and pay attention in carrying out the tasks provided
2. Thorough and careful care in carrying out the assigned tasks;
3. Right, correct, or straight, and carry out the tasks given correctly and in accordance with the directions;
4. Curiosity, the effort made to know more deeply about something seen, heard, and learned;
5. Never give up, efforts are made earnestly in carrying out the tasks given to get the best results in learning.

Scientific approach of 5M stages (Observing, Questioning, Trying, Reasoning, and Communicating) is chosen with the consideration that this is an appropriate approach to be used as an approach on the training model. The scientific approach aims to make the students understand in recognizing and comprehending various materials that information can come from anywhere, anytime, and not depending on unidirectional information from educators. Scientific directs students to be more active in finding answers to problems found during a learning process (training).

In this approach, the learning is student-centered and educators are not the only information source for the learning materials because students can look for knowledge from other sources. At the observing stage, the scientific approach allows students to practice seriousness and thoroughness in finding information on the material taught. At the questioning stage, competencies are developed in the form of developing creativity, curiosity, and the ability to formulate questions to form more critical thinking. The information collection stage trains students to develop conscientiousness, honesty, courtesy, respect for the opinions of others, communication skills, and the ability to gather information from various relevant sources. The next stage is associating. In addition to developing honest, thorough, and disciplined attitudes, students also hone the ability to think inductively and deductively so that they can draw a good conclusion in accordance with the material and learning objectives. The last stage of the scientific approach is students practice in order to convey the results of observations and conclusions that have been made based on the analysis results either orally, in written, or other media (such as the internet).

The Discovery Learning model is a learning process where students are not provided with lessons in their final form, but they are expected to organize themselves. This is in accordance with Bruner's opinion that "Discovery Learning can be defined as the learning that takes place when the student is not presented with subject matter in the final form, but rather is required to organize it himself" (Sani, 2014). This opinion is based on the opinion stated by Piaget that students must play an active role in learning in class.

Bruner in the Ministry of Education and Culture (2013b: 4) stated that the learning process can be implemented well and creatively if the teacher give the students opportunities to find a concept, theory, rule, or understanding through examples of problems. Discovery learning is

employed to change the passive learning conditions into more active and creative. It also employed to change the teacher-oriented learning to student-oriented learning and change the expository mode where students receive the whole information from the teacher into discovery mode where students find information themselves. Siahaan, S (in the Ministry of Education and Culture, 2013b: 4) revealed that in the application of discovery learning model, the role of educators is as mentors who provide opportunities for students to learn actively. In this case, the educator must have the ability to guide and direct student learning activities according to the objectives. It can be concluded that the Discovery Learning model is a learning model that directs students to the data and information that has been provided. The data were further processed by the students themselves with the guidance of their educators. Furthermore, students will find out the general principles of the data and information provided to be used in its application by themselves.

It is the same as the other learning models, discovery learning models have their own setting or syntax, one of them is the steps in the application of discovery learning models, those are stimulation (the provision of stimulation), problem statement (problem identification), data collection, data processing, verification (proofing), and generalization (drawing conclusions).

The demonstration learning method provides an opportunity for students to see and hear the relevant details taught in the training process. Participants are directly involved in the training activities according to the training objectives. Demonstrations are carried out to provide details of the training process. The details include the necessary background knowledge, procedures, or precautions. Therefore, demonstration learning provides an opportunity for students to become proficient and is recommended because it does not leave other opportunities. In addition, the stages used in demonstration learning are in accordance with the training process used in WELComP Training. The learning stages in the demonstration learning method used in the study were taken from Gussen's opinion (Akhmad Sudrajat, 2008) which is:

1) The instructor delivers the competencies to be achieved.
2) The instructor presents an overview of the material to be delivered.
3) Preparing necessary materials or tools.
4) Appointing one of the students to give a demonstration according to the prepared scenario.
5) All students pay attention to the demonstration and analyze it.
6) Each student presents his analysis results and demonstrates their experience.
7) Instructor draws a conclusion

The demonstration method is recommended for teaching skills because it covers all the necessary steps in a process and gives opportunity to the learners to see and hear the relevant details taught.

DEVELOPMENTAL METHOD

The development applied in this dissertation was a research and development (R & D) model. R&D research is research conducted to develop a new product or improving an existing product. This research and development (R & D) method was used to produce certain products and test their effectiveness (Sugiono, 2015). R&D aims to develop as well as test the benefits and effectiveness of a developed product (model), technology products, materials, organizations, methods, tools, and so on,

The research and development (R&D) method used adopted the ADDIE method using five stages (processes), those are, Analysis, Design, Development, Implementation, and Evaluation. These five stages is presented in the following figure:
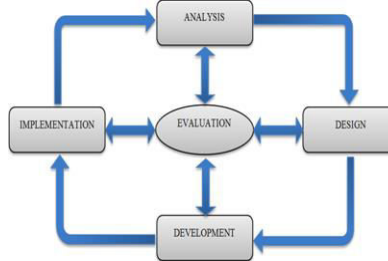

Figure 2. ADDIE Model (Pribadi, 2009)

The research approach used was to produce Basic Programmer competencies in web-based basic programming training in order to support the successful understanding and skills of training participants in basic programming.

The training development carried out in this study is produced from scientific approach, discovery learning model, and demonstration learning method. The collaboration of these three methods produced a model with a new syntax that will be applied to basic programming training. The development of this training model has been through several stages starting from the conceptual model phase, theoretical model phase, hypothetical model phase, and final model phase. Furthermore, validity test was also conducted to test the feasibility of the model by experts in their fields. The validity of the syntax construct was done by identifying the Average Variance Extracted (AVE) value. AVE value which is more than 0.5 indicates that the syntax construct is valid. In addition, the data were also analyzed using the Aiken's V formula with the provision that if the V value > 0.677, then the training model was declared valid.

The training was conducted online so that students as participants were more accustomed to using internet facilities as a medium in learning. The 21st-century TVET learning paradigm is the transformation of long-life learning, education for all, life-based learning, and workplace learning through various work experiences (Putu Sudira, 2014).

DISCUSSION RESULTS

The purpose of the development of the training model in this training was to improve the participants' skills and work attitudes so that they are able to find and determine concepts in basic programming. This model will be applied in a planned training with well-systematic steps so that it can produce a competent basic programmer.

The model that becomes the basis of this training was developed from the stages in the discovery learning model proposed by Bruner. The purpose of using this model was to accommodate the principle of stimulus provision in accordance with the learning theory that underlies this training model, which is the behavioristic learning theory. Furthermore, the learning method in the implementation of this basic programming training refers to the steps of the demonstration learning method proposed by Gussen in Sudrajat (2008).

The training model developed in this study was then named Web-Enhanced Learning in Computer Programming or WELComP. The word web was given in this model since web learning was used as a medium in the training process. The training in this research was implemented online through web learning that had been built. Web-enhanced learning implies

that learning can be enhanced through the web. Furthermore, the phrase of computer programming given in this model naming indicates that the competence to be improved in this training is competence in the field of computer programming. Overall, the name of the Web-Enhanced Learning in Computer Programming model means that learning can be improved through the web in computer programming competence, and is shortened to the WELComP model.

The steps (syntax) in the WELComP training model are collaboration between scientific approach, discovery learning models, and demonstration methods.

The construct validation of WELComP model syntax was carried out by eight validators who are expertise in their fields. Validaty test was carried out using a questionnaire as the research instrument. Prior to the validity test, it was ensured that the loading factor for the indicator must be more than 0.7 (valid). Furthermore, construct validation was carried out by identifying the AVE value (Average Variant Extracted). The AVE result obtained was 0.771, indicating that the WELComP model construct was valid. In addition, the validity of the model book product using the Aikens'V formula obtained a score of 0.768; provided that the value of V > 0.677, thus this training model book was valid.

Based on the validation tests carried out above, the WELComP model is suitableto be applied in basic programming training at the PTIK Study Program of UNIMED.

CONCLUSION

Based on the formulation, objectives, and discussion results of research and development of the Web-Enhanced Learning in Computer Programming (WELComP) training model conducted on students of Information Technology and Computer Education, Universitas Negeri Medan, it can be concluded that this development is feasible to be applied in supporting the advanced programming. The research results can also be employed to improve the competence of basic programmers so that they are competitive in the industrial world and are able to meet the demand of competent programmers according to government needs.

This feasibility was obtained from the validity test conducted by the experts in their respective fields. The experts involved are learning design expert, web media design expert, learning model expert, learning material expert, and evaluation expert.

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