Development of Electropneumatic Control System Learning E-Modules Department of Industrial Automation Engineering at Muhammadiyah Vocational School Batam

Gusrita Dewi[1], Ridwan[2], Sukardi[3], Ambiyar[4], and Unung Verawardina[5]

[1,2,3,4,5]Universitas Negeri Padang

***Abstract*—** The low learning outcomes of class XII students of industrial automation techniques in the subject of electropneumatic control systems are due to the fact that there are still many students who have difficulty understanding electropneumatics, lecture-oriented presentation of material causes students to be passive and bored because they tend to memorize concepts without knowing how the concept is formed. This causes students to not be able to learn independently. The purpose of this research is to develop teaching materials for electropneumatic control system learning e-modules in the industrial automation engineering department that have feasible, practical and effective criteria. This study uses research and development (R&D) methods with a 4D (four-D) development model. The results showed that the E-learning module was declared valid with a validity value of 0, 89 based on the validation of four material validators and in terms of media validity it was declared valid with a value of 0.88 from three validators. E-modules are stated to be very practical based on teacher and student responses. This shows that, E-modules are effectively used as one of the teaching materials in learning in improving student learning outcomes.

***Keywords*—** E-Module, Electropneumatic Control System, Research and Development.

INTRODUCTION

Rapid technological developments encourage the replacement of print media with computer technology in learning activities. "Modules, which were originally printed learning media, were transformed into electronic form, giving birth to a new term, namely electronic modules or better known as e-modules" (Agustin, 2018). One of the teaching materials that students can use to study independently is e-module. E-modules are referred to as media for independent learning because they are equipped with instructions for learning without assistance. Module readers can carry out learning activities without the direct presence of the teacher. E-Modul is a self-study package that is systematically designed to help students achieve learning goals.

E-Module arranged in a language that is easily understood by students according to their level of knowledge and age, so that students can learn independently. Sanjaya (2008) states, "Through the module students can learn according to their wishes and speed, students who can complete the module package quickly, on the other hand, students who are slow to learn, will also be slow to complete their lessons. The scientific approach can provide understanding for students to know, understand, practice what is being studied scientifically. Therefore, in the learning process it is taught so that students find out from various sources through observing, asking, trying, processing, presenting, concluding, and creating for all subjects (Sudarwan, 2003).

SMK Muhammadiyah Batam is one of the private vocational schools that is responsible for producing graduates who are able to compete in the world of work. Industrial Automation Engineering is one of the five majors in SMK Muhammdiyah Batam. Based on the results of observations and interviews with productive teachers of Industrial Automation Engineering at SMK Muhammadiyah Batam, it was found that the school had actually provided textbooks, but the material taught was not in accordance with the basic competencies of students and at the same time the cognitive aspects were dominant and less contextual. Furthermore, based on the results of interviews from the students themselves, the package books provided were not suitable for use because they had been damaged and some pages had been lost. One of the efforts made by students was to copy the package books or take notes, but not all students make the effort. In addition, when the learning process occurs, some students are busy going in and out of class, talking to their friends, busy pulling their friends' books and sometimes laughing loudly. This indicates that students' interest in learning is low. This of course causes delays in the student learning process, and can affect the average student learning outcomes in SKE subjects.

The learning results show that 47.28% of students do not pass, of course, far from the actual learning success rate.

There are still many students who have difficulty understanding Electropneumatics. The presentation of the lecture-oriented Electropneumatic Control System material has caused students to be passive and bored because students tend to memorize concepts without knowing how these concepts are formed. Independent learning has not been developed by the teacher. The content of the job sheet has not varied so it cannot be developed by students in learning the Electropneumatic Control System subject. Lack of supporting tools in learning Electropneumatic Control Systems.

To focuslearnersto the materialwhichtaught, oneusedevelopment of learning e-modules that help students to study independently and also reduce paper production, because e-modules do not need to be printed. Development of learning e-modules as a reference and learning guide for students to be more time efficient in learning and also students can study outside the classroom independently. The e-module is developed by implementing the modelProject Based Learning (PjBL). Nizwardi (2016) states "seven steps Project Based Learning (PjBL) consists of: 1) formulating the expected learning outcomes, 2) understanding the concept of teaching materials, 3) skills training, 4) designing project themes, 5) making project proposals, 6) carrying out project tasks 7) presenting project reports that apply seven stepsProject Based Learning (PjBL) get to increase the productivity of student competencies". Such a process is expected to produce productive, creative, innovative and effective student learning outcomes through the strengthening of integrated attitudes, skills and knowledge.

In the practicum process of SMK Muhammadiyah, the teacher directly guides students in carrying out a practicum approach by using a job sheet so that students do not master the theory before doing practice. One way to help students' understanding in understanding theory is by presenting a module with a scientific approach that is equipped with theoretical teaching materials and also practice questions so that students can understand theory before doing practice.

The scientific approach is a way or mechanism to gain knowledge with procedures based on the scientific method. The scientific approach consists of 5 main activities, namely: (1) observing (observing), (2) asking questions (questioning), (3) gathering information (experimental), (4) processing information (associating), (5) communicating.

With the scientific approach, will support learning using the festo fluidim simulation. Festo fluidsim simulation is a training that demonstrates something in an artificial form that is similar to the real situation. The term simulation is usually done before you do something or the real situation. So learning on the subject of electropneumatic control systems will be more effective when using a festo fluidim simulation.

The essence of learning and learning are two things that are related to one another. Learning is a pattern change that occurs in objects or actors, while learning is a process that is passed to achieve the expected learning goals. Therefore, a person is said to be learning if he has experienced the learning process.

METHOD

Research and Development (R&D) is a research method used by researchers. According to Nana Syaudih Sukmadinata (2009:164), Research and Development (R&D) is a process or steps to develop a new product or improve an existing product, which can be accounted for. The development model used is the 4D development model, Thiagarajan and Semmet in Trianto (2012) state that the 4D model consists of 4 development stages, namely Define, Design, Develop, and Disseminate.

In the first stage, namely define, analysis is carried out as a determinant of the basic problems in the development of the E-module that will be carried out. The following analysis includes needs analysis obtained through observing the phenomena encountered during the implementation of learning, media analysis, namely observing the use of media in learning. Student analysis is observing the characteristics of students. Concept analysis is an observation of the development concept that will be made. Curriculum analysis to adjust synopsis and syllabus to subjects.

The second stage is design, this designstarting with compiling the components of the e-module framework based on competency standards, basic competencies, indicators, learning materials and formative tests that exist in each learning material. Thiagarajan divides the design stage into four activities. Activities carried out at this stage include: Constructing Criterion-Referenced test, Media Selection, Format Selection and Iinitial design.

The third stage is developing and in this stage, it is the stage of producing a learning media which is stated in 3 steps, namely: validity, practicality and effectiveness. The ultimate goal of making this media is to produce an electropneumatic control system learning e-module that has been improved by the validator through trial data.

The last stage is disseminateto get input, criticism and suggestions for the development of e-modules to be

better. The dissemination stage can be done by distributing the developed learning e-modules, dissemination can be done in other classes with the aim of knowing the effectiveness in the learning process by using the learning e-modules. Dissemination can also be done by distributing journals and using e-learning modules in the classroom or in other departments that also have Electropneumatic Control System subjects.

RESULTS AND DISCUSSION

The e-module has gone through the testing phase for validity, practicality, and effectiveness. The validity test was carried out by asking the validator for opinion through a questionnaire, from the validity test which was carried out after several revisions, the results of the electropneumatic control system e-module were valid to be used as one of the learning media. Practicality trials were carried out by asking for opinions from subject teachers and students through a questionnaire. From the practicality test that has been carried out, the results show that this e-module is practically used as a learning medium.

The validation of the e-module was obtained from the validator's responses about the validity of the developed learning module. The e-module validator gives a value of 0.81. For aspects of didactic requirements, for aspects of construction with a value of 0.87, while for technical requirements with a value of 0.79, it can be concluded that the overall score on the simulator gets an average of 0.82 with a valid category. Validation material expert test data is obtained through validation instruments. filled out by 4 Validators. This validation is carried out by 4 validators who are competent in their fields, the purpose of material expert validation is to determine the accuracy and suitability of the material from the product developed whether it is in accordance with learning needs. Showing the validation results from media experts on e-modules with data analysis of the validity of e-modules used as learning media in the electropneumatic control system, it can be seen that the average content feasibility aspect is 0.79, the linguistic feasibility aspect is 0.83 and the presentation aspect is 0. .83 and 0.78 aspects of self-study. The results of the assessment of each aspect of the indicators given by the validator can be taken on the average of the overall validity of the tool, it can be concluded that the e-module developed is in the Valid category.

The assessment of the practicality of the e-module was obtained from a questionnaire filled out by the teacher's response about the practicality of the e-module used as a learning medium in the subject of electropneumatic control systems. It can be seen that the average score is 86.72% with a very practical category. Thus, based on the teacher's response, the product developed is of very practical value.

The effectiveness of the use of e-modules as a learning medium in the electropneumatic control system is obtained from the achievement of student learning outcomes after using this e-module. Student learning outcomes were compared before using this e-module as a learning (pretest).

Learning outcomes data were obtained from objective tests which were first tested for validity, reliability, difficulty level and differentiating power. The research data are as follows: Effectiveness is an important factor in learning, effective learning is a match between students who are doing learning with the learning objectives or goals to be achieved. The effectiveness test is carried out by giving tests to students, the instrument is in the form of a multiple choice test with 40 questions, before the test is given, a test test is carried out and analyzed, after analyzing the test test results, 20 valid items and 20 invalid items are obtained. .

The effectiveness of the use of e-modules is carried out by conducting learning outcomes tests carried out at the beginning and end of learning, the results of these two tests are compared to see the level of effectiveness of the use of the e-modules. Based on the implementation of the pretest or initial test, an average value of 59.63 was obtained and the implementation of the posttest or final test was obtained with an average value of 80.25. The test results show that there is a difference between the average learning outcomes before being given treatment and the average learning outcomes after being given treatment. Comparison between pretest and posttest, what makes the difference between pretest and posttest is student learning outcomes after using the module and before using the e-module, it can be seen from the final result assessment.

The effectiveness test is carried out by looking at the comparison between student learning outcomes using the E-learning Module and not using the E-learning Module. E-learning is one of the effective learning media to be used as learning media.

This research produces a learning media in the form of a PLC trainer integrated with a pneumatic system that can be used as a learning medium for subjects on electronic control systems. The development of this trainer is based on initial observations of the learning process to find out what problems, obstacles, and phenomena are encountered in the field in connection with learning.

Furthermore, the researchers conducted needs analysis, media analysis, student analysis, concept analysis and curriculum analysis. Development of e-modules in the subject of electropneumatic control systems majoring in Industrial Automation Engineering. The subjects that must be mastered are all input elements, process elements, and output elements as well as the function of each component in each of these elements in the electropeumatic control circuit for industrial automation purposes. This e-module has gone through the stages of testing the validity, practicality and effectiveness. In the validity test, it is done by asking the opinion of experts through validation. Aspects that are validated in this tool contain didactic requirements, construction aspects, and technical requirements, from the trials conducted, the results show that all of these aspects are valid.

This practicality trial was conducted by asking the teachers and students for their opinion through a practicality questionnaire sheet. From the practical test, it is known that the resulting product is in a very practical category to be used as a learning medium. The effectiveness test was carried out by looking at the average comparison seen from the pretest (before using the e-module) and posttest (after using the e-module) during learning at school.

CONCLUSIONS

Based on the results of the e-module development research that has been carried out, the following conclusions are obtained, namely the results of the development of this research are products in the form of e-modules in the subject of Electropneumatic control systems. The e-module development process refers to the 4-D development model, namely Define, Design, Develop, and Dessiminate. Based on the results of the validity test, it can be concluded that the media design is valid. While the results of material validation also show that the material on the media is valid. Based on the results of the practicality test, it can be concluded that this e-module is practical in terms of product quality, presentation of material, and benefits based on the assessment of the teacher. SIn addition to the teacher's assessment, the practicality of this e-module is also assessed based on student responses and the results are known in the student response questionnaire that this e-module is practical fromaspects of time, aspects of the ease and attractiveness of the media.Based on the assessment of student learning outcomes from the pretest and posttest, the student's score after using the e-module was higher than the student's score before using the e-module, so that the e-module is effective in improving student learning outcomes and is used in learning.

REFERENCES

[1] Agustin, K., Winatha, K., R, dan Suharsono, N. 2018. Pengembangan E-Modul Interaktif Berbasis Proyek Mata Pelajaran Simulasi Digital. Jurnal Pendidikan Teknologi dan Kejuruan. 15(2), h. 188-200.

[2] Budi, D. S., & Ismayati, E. (2019). Pengembangan Modul Pratikum Berbantuan softwere Festo Fluidsim Pada Mata Pelajaran Instalansi Motor Listrik di SMK Negri 3 Jombang. Jurnal Pendidikan Teknik Elektro, 8(3).

[3] Danim, Sudarwan dan Darwis. 2003. Metode Penelitian Kebidanan: Prosedur Kebijakan Dan Etik. Jakarta: Penerbit Buku Kedokteran EGC

[4] Nizwardi Jalinus dan Ambiyar. 2016. Media & Sumber Pembelajaran. Jakarta: Kencana.

[5] Sanjaya, 2008, Faktor-Faktor yang Mempengaruhi Hasil Belajar, Prenada: Jakarta

[6] Sudjana, Nana dan Rivai, Ahmad. 2011. Media Pengajaran. Bandung: Sinar Baru Algensindo.

[7] Sugiyono. 2016. Metode Penelitian Kuantitatif, Kualitatif dan R&D. Bandung: Alfabeta

[8] Sukmadinata. 2005. Metode Penelitian Pendidikan. Bandung: Remaja Rosda Karya.

[9] Trianto. 2012. Model Pembelajaran Terpadu. Jakarta: Bumi Aksara.

[10] Trianto, Ibnu Badar. 2014. Mendesain Model Pembelajaran Inovatif, Progresif dan Kontekstual. Jakarta: Prenadamedia Group.