Improving the Competency of Vocational Teachers Through Android-Based Electricity Engineering Learning Media Training

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Abstract. The Electric Power System is one of the competencies that must be mastered by vocational teachers in Electrical Power Installation Engineering fields. However, many vocational teachers have difficulty in distance learning, both in theory and practice, during the Covid-19 pandemic. This article discusses efforts to increase the competence of vocational teachers in the electricity sector through the implementation of training on Android-based Electric Power System Learning Media Development. The training program is designed online through the Zoom Meeting application. The training method uses an andragogy learning approach that combines lectures, demonstrations, exercises, evaluations, and mentoring. The training material consists of the concept of an electric power system which includes components of the electric power system, modelling of the electric power system, analysis of the electric power system, engineering learning media, learning media with android applications, and how to compose electric power engineering learning media based on Android applications. This training can improve the competence of vocational teachers in the field of electric power systems. The indicator of teacher competency improvement is indicated by the increase in test scores from 72.04 to 77.67.

Keywords: Competence · Vocational teachers · Electrical · Android · Learning media

1 Introduction

Vocational education aims to produce graduates ready to work and have competencies following their field of expertise. Vocational education graduates should be able to work directly in the business or industrial world. Therefore, the curriculum, learning, evaluation, learning atmosphere, environment, and teaching teachers must link and match with industry needs [1, 2]. Learning materials must adapt to the needs of the industry so that the competence of graduates can be maintained and follow the needs of the industry. Vocational school teachers must continuously update their professional competencies to be in line with developments in the industry. In the 21st century, the development of industrial automation is often referred to as the industrial revolution 4.0. Where the

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implementation of work in industry is mainly carried out with computer-assisted automation devices and the internet of things (IoT) which means that all fields of work in the industry are carried out through automation systems that are integrated with the internet network [2, 3].

Electrical Power Engineering is one of the fields of science that studies and discusses natural phenomena about electron flow which are widely applied in life [1, 10]. Household appliances and industrial production machines require an electric power supply. Some industrial equipment includes electric motors, heaters, coolers, funnels, compressors, pumps, conveyors, and others that need electric power systems. Teachers are one of the essential factors in the success of education and learning. Vocational teachers must have personality, social, professional, and pedagogic competencies [3,[4]. Professional competence is a teacher's competence that emphasizes mastery of the scientific field. Professional competence is dynamic because it follows the development of science and technology [5, 6]. Teachers must be adaptive in mastering scientific fields, especially electric power engineering, developing very rapidly. In the era of the industrial revolution 4.0, many changes in the electric power system have led to automation and internet of things applications.

In addition to professional competence, vocational teachers must master pedagogic competence in planning learning, developing learning materials, developing learning media, implementing learning, and evaluating learning outcomes [6, 7]. One of the most critical educational abilities in the era of Industrial Revolution 4.0 is learning media. Learning supported by appropriate learning media can increase student motivation and learning outcomes [6, 7, 10, 11]. Many types of learning media can be used to help learning and independent learning, including (1) learning media in the form of audio, (2) visual learning media, (3) Audio-visual learning media, (4) multimedia learning media, (5) Photography pictures, (6) Maps and Globes [7].

Learning methods and media are essential aspects that affect the quality of learning [7]. The selection of one of the teaching methods will affect the appropriate type of learning media. Aspects that influence the selection of learning media consist of purpose, type of task. The responses expected participants, learning contexts, and learning characteristics. The primary function of learning media is to help teach aid that affects the climate, condition, and the learning environment created by the teacher [8, 9].

The Covid-19 pandemic has caused a change in learning patterns from conventional in the classroom to distance learning. The government's policy of closing offices and schools requires that education be carried out remotely using online methods. This condition causes many teachers to experience difficulties in implementing distance learning, especially online. For this reason, efforts are needed to improve the professional and pedagogic competence of teachers in preparation for online learning. There are many ways that teachers can improve competence, including (1) Further studies according to the field of expertise, (2) Participating in the Teacher Certification Program, (3) Providing training and education for teachers. (4) Reading Teacher Movement, (5) Through Teacher Working Group organization [5].

Electrical engineering training is one of the effective ways to improve teachers' professional and pedagogical competence during the Covid-19 pandemic. This article will discuss efforts to enhance the competence of vocational teachers in the field of

electric power engineering through training and assistance in developing learning media for electric power systems based on Android applications.

2 Method

2.1 Target Audience

The target audience in this training is vocational school teachers in electrical power installation engineering fields in the Special Region of Yogyakarta who are in charge of training courses related to electrical power engineering. The training participants amounted to 21 vocational teachers consisting of various vocational school from the DIY province, both public and private. After this training, it is hoped that the teachers can cause a domino effect by spreading the knowledge gained, including (1) the ability to master Electrical Engineering materials and develop learning media based on android applications, (2) Teachers can socialize the knowledge that has been obtained to other teachers. Therefore, teachers who have competence in electrical engineering can improve the quality of learning and improve the quality of students and graduates in facing the world of work, especially in the electricity sector.

2.2 Activity Method

The method of increasing the competency of electrical engineering vocational teachers through Android-based learning media training consists of several steps, which can be described as follows (Fig. 1):

a. Lectures, Discussions and Questions and Answers
   The lecture method provides the trainees with the initial provision of electrical power engineering materials and learning media. Lectures use an adult learning approach (andragogy) that emphasizes things that are considered essential and urgent for participants to understand. The material is delivered using real examples of real-world applications so that participants can capture the material well. After the lecture, discussions and questions and answers were held to explore the material that had been presented.
b. Demonstration
   The demonstration aims to show and provide an accurate picture of the application of electrical power engineering in the industry. The PPM team and instructors gave demonstrations of both natural systems in the laboratory and demonstrations through videos and simulations of electrical power engineering circuits with computer software. The trainees can see and observe directly through the demonstration of the electric power system.
c. Simulation
   Simulations are used to provide preliminary preparation before participants can practice independently. In addition, simulations can assist trainees in conducting electrical engineering experiments even though vocational schools do not yet have adequate equipment.

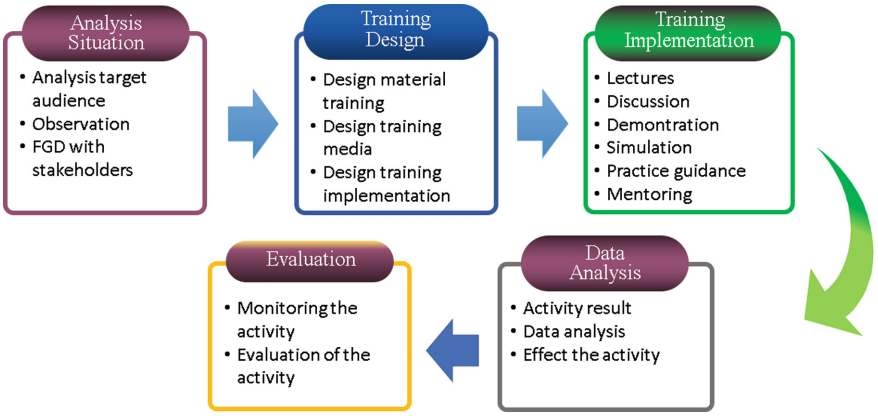

Fig. 1. Activity Method Flowchart

d. Practice with guidance

Practices are carried out in laboratories carried out by technicians and shared live using online with the supervision of lecturers. The practice videos in the laboratory are then shared with the training participants for independent learning. In addition to hands-on practice in the laboratory, participants can also practice simulations with computers.

e. Mentoring

Assistance to training participants is carried out to improve teacher competence in electrical power engineering and Android-based learning media. Training participants can consult with resource persons through WhatsApp communication media and e-learning and online meetings.

3 Results and Discussion

3.1 Implementation of Activities

This training can increase the competence of participants. In more detail, the results and discussion of the training activities can be described as follows.

In the early stages, vocational teachers took a Pre-test to determine initial abilities. The pre-test question is in the form of multiple-choice with 40 questions with five alternative answers. The questions contain material on the electric power system and learning media. The Pre-test results showed that there were still many teachers who scored below the graduation standard of 75. 14 of the 21 participants scored below 75. The complete results of the Pre-test are presented in Table 1 (Fig. 2).

The next stage is to provide training to teachers. Resource persons at the training consisted of lecturers and practitioners in electrical power engineering, including Ir. Muhamad Ali, M.Eng, Dr Ir. Djoko Laras, Dr Ir. Hartoyo, MP, Dr Sunaryo Sunarto, and Dr Zamtinah. Presentation of theoretical material with lecture and question and answer methods. Then, it was continued with demonstrations and direct practice on each participant's computer-guided by resource persons and technicians. The training was

Table 1. Descriptive data analysis of Pretest

no	Descriptive data analysis			
	Maximum	Minimum	Mean	Deviation Std
21	81	61	72.04	4.60

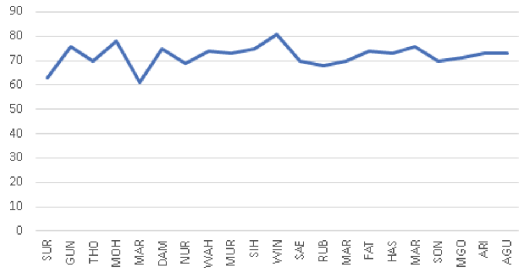

Fig. 2. Pretest Score

Table 2. Descriptive data analysis of Post-test

no	Descriptive data analysis			
	Maximum	Minimum	Mean	Deviation Std
21	82	70	77.67	2.20

carried out for three days with 3 × 8 h of face-to-face meetings. Furthermore, participants carry out independent learning accompanied by resource persons and technicians for two weeks after the training.

The final stage in this training activity is to give a final test (posttest) to all participants in the form of objective questions with material on the electric power system and Android-based learning media. Post Test aims to measure the final ability of participants after participating in the training activities that have been carried out. The results of the posttest showed that all participants scored above 75. This score indicated a significant increase in the trainees' ability after attending the training in theoretical and practical learning. The distribution of posttest data is presented in Table 2 (Fig. 3).

The training participants increased their knowledge and skills in electric power engineering and learning media. They get many training materials, including information, introduction, learning, exercises, demonstrations, and practice of making learning media online. The training participants expressed their gratitude for the information, introduction, exercise, demonstration, and making online learning media. From the results of the discussion and question and answer, it can be seen that the training participants have a high enough motivation to master this material. Therefore, all participants can master the expected competencies: creating learning media for electric power engineering based on Android applications.

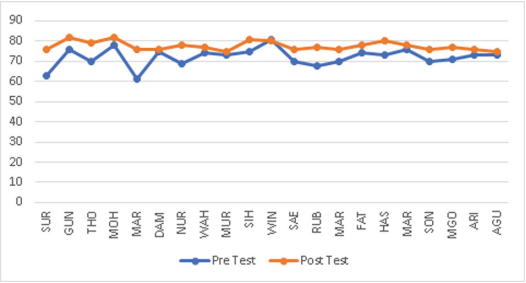

Fig. 3. Pre-test and Post-test Score

The success of training activities cannot be separated from the following things: (1) all activities can be carried out according to the planned schedule; (2) All 21 participants can take part in the entire activity from the beginning to the end of the activity in an orderly and enthusiastic manner; (3) the theoretical training material can be followed and mastered by the participants because it is delivered coherently and straightforwardly (4) the practical material can be done well by the participants because the job is arranged in a practical and easy-to-follow manner and all the equipment in the job sheet can work according to its function. (5). Analyzing the electric power system using computer-based applications makes the trainees better understand the material because the results can be directly seen and analyzed.

4 Conclusion

Based on the design and implementation of PPM activities regarding training and assistance in developing learning media for Android-based electric power engineering for vocational school teachers throughout the province of DIY, it can be concluded as follows: 1. Participants' knowledge and understanding of electric power engineering increased through this activity. This result can be indicated from the opinion of the training participants that this activity provides significant benefits for them, especially in simulating electrical power engineering circuits with computer software. 2. Participants' skills in making electric power engineering learning media with PowerPoint and converting them into Android applications as indicated by the results of independent assignments and mentoring. All participants were able to complete the electric power engineering learning media assigned to them well.

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