IMPROVING THE COMPETENCE OF SMK MODIS TENJO STUDENTS THROUGH BASIC MIKROTIK ROUTER CONFIGURATION TRAINING AND DATA COMMUNICATION THEORY

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ABSTRACT

This study aimed to enhance the competencies of SMK Modis Tenjo students through training in basic MikroTik router configuration and fundamental data communication theory. Conducted from February to May 2023, the program comprised five main stages: partner condition observation, quantitative data collection, literature review, material development, training implementation at Universitas Budi Luhur, and post-training evaluation using a pretest–posttest design coupled with questionnaires. Evaluation results revealed that average theoretical understanding rose from a pretest score of 45 to a posttest score of 78; 72 % of participants reported that the training improved their skills, 56 % found the practice examples clear and easy to follow, and 58 % considered the training modules detailed and comprehensible. During hands-on configuration of the MikroTik RB941-2nD-TC device, participants generally followed the instructor's demonstration effectively, although some required intensive guidance. In conclusion, the training successfully strengthened both practical and theoretical competencies. Follow-up recommendations include offering advanced sessions on topics such as dynamic routing or network security, extending the duration of practical exercises, and implementing periodic mentoring to ensure sustained application of skills at SMK Modis Tenjo.

Keywords: Basic Mikrotik Router Configuration, Data Communication Theory, Competency Improvement, Vocational High School Training

1. INTRODUCTION

SMK Modis is a vocational high school established in 2013 that currently offers a single expertise program: Computer and Network Engineering (TKJ). Like other vocational secondary schools (Undang-Undang Republik Indonesia Nomor 20 Tahun 2023 Tentang Sistem Pendidikan Nasional, 2003), SMK Modis focuses on developing students' skills to perform specific job-related tasks. Its primary objective is to prepare students for the workforce and to foster professional attitudes. In accordance with Government Regulation No. 29 of 1990, SMK Modis delivers educational programs that align with labor market needs (Kemendikbudristek, 2022).

Based on the basic data from the Ministry of Education and Culture (Kemdikbud, 2023), SMK Modis has obtained accreditation status. The school implements the 2013 Curriculum in a full-time learning system that runs five days per week.

To enhance the competitiveness of vocational high school graduates, students must acquire robust and relevant competencies (Bramantiya et al., 2024; Direktorat Analisis dan Pengembangan Statistik, 2022). Such competencies can be developed through vocational education at SMKs or at higher-education institutions specializing in Information and Communication Technology (Directorate of Statistical Analysis and Development, 2022). However, in practice, the competencies of many SMK graduates remain insufficient. In fact, vocational schools in Indonesia record the highest open unemployment rate compared to other education levels (Aprilliofany, 2020).

Several factors contribute to the high open unemployment rate among SMK graduates. One significant factor is the limited number and quality of vocational subject teachers (Mukhlason et al., 2020). Another factor is the lack of sufficient practical training opportunities both inside and outside the school. Therefore, effective learning strategies are needed to support students' competency development (Nurhasanah et al., 2019).

SMK Modis also faces the challenge of lacking physical networking devices for hands-on practice. A critical device for computer network practicums is the router. Currently, teaching relies on network simulators such as GNS3—a software tool used to simulate various networking products like Cisco, MikroTik, Juniper, and others (Neumann, 2015).

As a solution, this community-service activity aims to facilitate SMK Modis students in conducting hands-on practice using MikroTik routers. Universitas Budi Luhur provides the necessary resources, including the MikroTik Academy curriculum and MikroTik router devices. As a member of the MikroTik Academy, Universitas Budi Luhur is authorized to deliver MikroTik device training to both its own students and external partners.

Through its collaboration with Mikrotik, Universitas Budi Luhur has received a grant of 22 RB941-2nD-TC routers. These devices will be utilized to conduct practical training on MikroTik router configuration for both campus participants and external collaborators.

2. METHOD

The implementation method of this Community Service Program consists of five main stages: information gathering, activity planning, material preparation, training execution, and report writing. Each stage is described as follows:

1) Observation

   After the partner provided information about their needs, the project team immediately conducted a situational analysis by observing the partner's current conditions, including the school's location, profile, laboratory facilities, and accreditation status as recorded in the Ministry of Education and Culture database.

2) Data Collection

   In addition to analyzing the partner's situation, the team collected quantitative data on the number of active students, vocational teachers, and educational staff at SMK Modis for further analysis.

3) Literature Review

   A literature review was carried out by sourcing information from valid references such as journals, theses, academic papers, and official documents. This review aimed to deepen understanding of the partner's needs and to identify suitable solutions.

4) Material Preparation

   Based on the needs analysis and literature review, the team developed instructional materials covering the fundamental theory of data communication and a practical guide for basic MikroTik router configuration.

5) Study Visit and Training

   The partner and selected student representatives were scheduled to visit Universitas Budi Luhur to conduct a comparative study of the MikroTik Academy's facilities and curriculum, and to participate in hands-on training on MikroTik router configuration.

6) Evaluation

   Upon completion of the training, the team conducted an evaluation by distributing questionnaires to all participants, designed to measure improvements in theoretical understanding, practical configuration skills, and overall participant satisfaction.

The implementation stages of the community service program are illustrated in Figure 1.

Figure 1. Implementation Method

3. RESULTS AND DISCUSSION

This community service activity was carried out over a period of three months, beginning with preparation in mid-February 2023 and concluding with the final report in mid-May 2023. The introductory MikroTik training for SMK MODIS TENJO students was held in the Computer Laboratory of the Diploma Three Excellence Program at the Faculty of Information Technology, Universitas Budi Luhur. The training session took place on Thursday, May 25, 2023, from 09:00 to 12:00 Western Indonesia Time, with 25 student participants. One week before the scheduled activity, confirmations were obtained from SMK Modis Tenjo students: thirty confirmed their attendance, but five later withdrew, resulting in twenty-five attendees on the training day.

The training began with a pretest to assess participants' baseline skills (Adri, 2020), proceeded with theoretical and practical material on data communication theory and basic MikroTik router configuration, and concluded with a

posttest to evaluate learning outcomes. During the session, students used computers in the D3 Computer Laboratory of FTI Universitas Budi Luhur and practiced on ten MikroTik hardware units provided by the university. The training ran smoothly, with students attentively following the instruction and applying the configuration steps directly on the devices.

The training began with a brief theoretical overview of the data communication processes in computer networks(Fajri, 2021) (Fajri, 2021). As shown in Figure 2, participants listened attentively to the presentation, and there was good interaction through several questions from trainees.

Figure 2. Participants listening to the presentation

The next session was a hands-on practicum using the MikroTik RB941-2nD-TC device. In Figure 3, trainees are observing the instructor's demonstration of the MikroTik RB941-2nD-TC configuration. The instructor provided step-by-step examples to facilitate participants' understanding.

Figure 3. Trainees observing the MikroTik RB941-2nD-TC configuration demonstration

After the demonstration, participants paired up to practice configuring the device themselves. Because the material was new to many, some trainees required intensive guidance. Figure 4 shows the instructor assisting participants who encountered difficulties during the practicum.

Figure 4. Instructor providing direct guidance during the practicum

Upon completing the material and the post-test—which was used to assess learning outcomes (Magdalena et al., 2021)—all participants and the project team took a group photo for documentation, as shown in Figure 5.

Figure 5. Group photo session at the end of the training

After the training session concluded, a questionnaire was administered to participants to evaluate the activity (Isti Pujihastuti, 2010). The questionnaire items covered the perceived usefulness of the training, the clarity of the instructor's explanations, the ease of practice examples, and the clarity of the materials provided. The results collected from training participants are presented below:

1) "The training activity is useful for enhancing participants' skills" Based on the questionnaire, 72% of respondents indicated they strongly agreed with this statement (Figure 6).

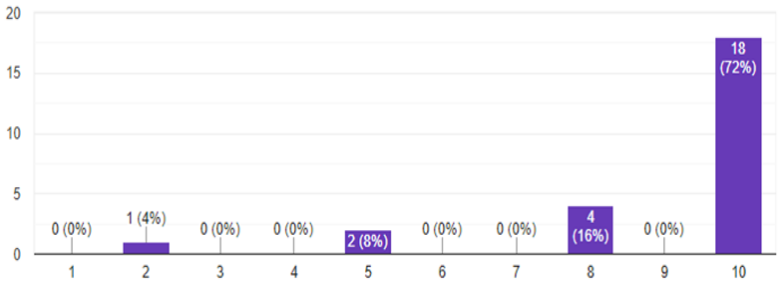

Figure 6. Questionnaire results for "The training activity is useful for enhancing participants' skills"

2) “The instructor explained the material clearly and understandably” In response to this statement, 52% of participants strongly agreed (Figure 7).

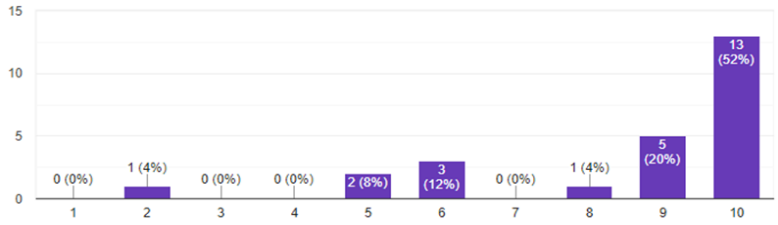

Figure 7. Questionnaire results for “The instructor explained the material clearly and understandably”

3) “The instructor provided practice examples that were clear and easy to understand” For this item, 56% of participants strongly agreed (Figure 8).

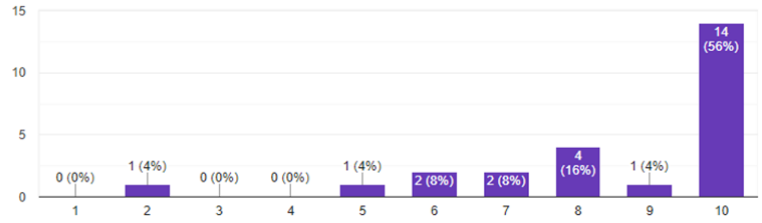

Figure 8. Questionnaire results for “The instructor provided practice examples that were clear and easy to understand”

4) “The instructor and assistant instructor supported participants so that they understood the material well” Here, 56% of respondents strongly agreed with this statement (Figure 9).

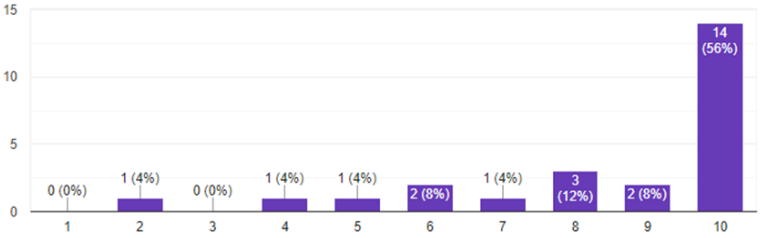

Figure 9. Questionnaire results for “The instructor and assistant instructor supported participants so that they understood the material well”

5) “The training module contains detailed explanations that are easy to understand” In this case, 58% of participants strongly agreed (Figure 10).

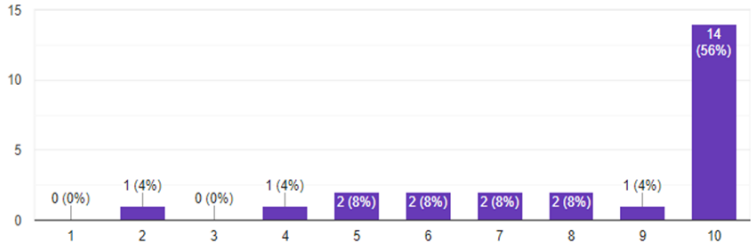

Figure 10. Questionnaire results for “The training module contains detailed explanations that are easy to understand”

6) MikroTik Training Results Graph The graph illustrates the data distribution, showing the number of students who answered each pretest and posttest question correctly (Figure 11).

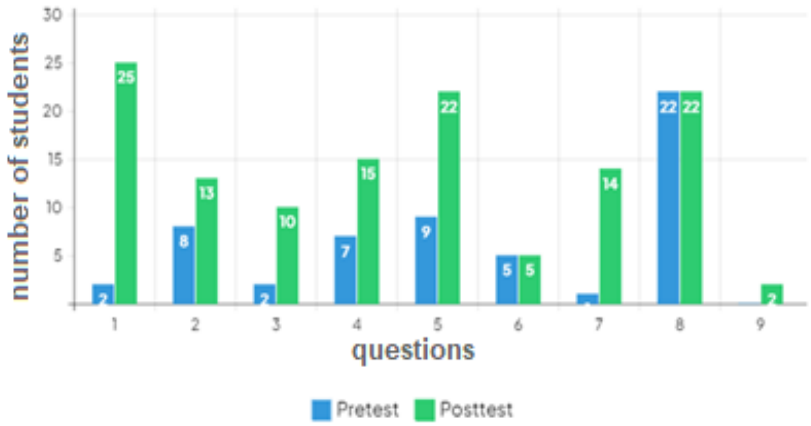

Figure 11. Graph of pretest and posttest results

4. CONCLUSION

Based on the evaluation of the Basic MikroTik Router Configuration training and Data Communication Theory at SMK Modis Tenjo, it can be concluded that the program effectively enhanced participants' competencies. Seventy-two percent of respondents reported that the training was useful for improving their skills, more than half indicated that the materials and practice examples were easy to understand, and the majority successfully completed the hands-on exercises. As a follow-up, it is recommended to organize further training sessions covering more advanced topics—such as dynamic routing or network security—extend the duration of practical exercises, and implement a periodic mentoring program to ensure sustainable application of skills at SMK Modis Tenjo.

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