PKM IMPROVEMENT COMPETENCY CURRICULUM UJI KOMPETENSI KEAHLIAN (UKK) AND NETWORK AUTOMATION TO IMPROVE SOFT SKILL ASPECTS AT SMKS NUSANTARA

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ABSTRACT

The implementation of Program Pengabdian kepada Masyarakat (PKM), to improve the competence of SMK TKJ Nusantara 1 Ciputat students in terms of skills and soft skills in facing the Uji Kompetensi Keahlian (UKK) through a series of structured network training and practicum activities. The methods used include theoretical training and intensive practicum implementation that focuses on 1) Network Security Design, Installation and Configuration of Dynamic Routing 2) Wired and Wireless Network Design with VLAN and Routing 3) Troubleshooting Network Services on Client Server Networks 4) Troubleshooting Network Security on WAN Networks 5) Network Automation on MikroTik routers using Paramiko and Netmiko Python. The results achieved showed a significant increase in the technical skills and soft skills of the students. The final scores of the student groups ranged from 8.05 to 9.15. These results indicate that each student is increasingly mastering the technical skills needed for the configuration and management of questions and assignments tested on the UKK. The results of this PKM activity also include the preparation of UKK modules and writing books for Network automation on MikroTik RouterOS using Python, which is intended as a reference and ongoing learning material for students and teachers in practical learning and teaching activities.

Keywords: pengabdian kepada masyarakat (PKM), mikrotik, network automation, ukk

INTRODUCTION

SMK Nusantara 1 Ciputat is an educational institution that aims to prepare and produce quality students with reliable competencies and noble morals, competence, excellence and professionalism. In addition, every year for the standards of student ability and graduation, SMK Nusantara 1 also takes the Uji Kompetensi dan Keahlian (UKK) as one of the final exam practicals (Pujianto, 2021; Saptono1 et al., 2020). The PKM activity that will be proposed is a form of realization of vocational education in Indonesia as an effort to increase access to certification for graduates of students in vocational schools through the UKK and improve soft skills through PKM activities (Muharni & Syaputra, 2023; Pratikno et al., 2021). The UKK measurement value is the competency or ability that is in accordance with the field or vocation chosen by the student as a reference and standard of quality of expertise in the field being tested, including the UKK TKJ (Damanik et al., 2022; Damanik & Anggraeni, 2022). UKK questions and assignments, in the world of education, are one of the skills needed by students as a form of competency achievement that is carried out every year (Anggraini & Dayat, 2019; Asfani et al., 2022). Then the technology that refers to network automation techniques on network devices, in the soft skill aspect of TKJ students, makes TKJ teachers at SMK Nusantara, have to prepare students to have the knowledge and skills to be competitive in the industrial job (Damanik et al., 2023). The implementation practicals of UKK questions and assignments at SMK Nusantara, until now there are still constraint for students in the installation, configuration and implementation. The constraint experienced by students is when not all of these packages are applied in learning and practicals. The same thing was also proposed by the TKJ teacher team, to the PKM proposal team for the development of student skills through the application and practical of network automation. Through the problems found, the PKM proposal team took the initiative and collaborated with PKM partners to carry out PKM activities with the aim of improving soft skill aspects and modeling practical media devices with materials and implementations of 1) Program Packet-1 (Network Security Design, Installation and Configuration of Dynamic Routing). 2) Program Packet-2 (Design and implement of Wired and Wireless Networks with VLAN and Routing). 3) Program Packet-3 (Troubleshooting Network Services on Client Server Networks). 4) Program Packet-4 (Troubleshooting Network Security on WAN Networks). As well as installation and configuration for network automation implement using paramiko and netmiko python.

METHOD

Figure 1 is the phase that will be carried out for PKM activities, with a partnership with Universitas Budi Luhur Lecturers from the Information Technology Faculty and Economics Faculty. The implementation of PKM will

position SMK Nusantara as objects and subjects for activeness and cooperation in the implementation of PKM activities.

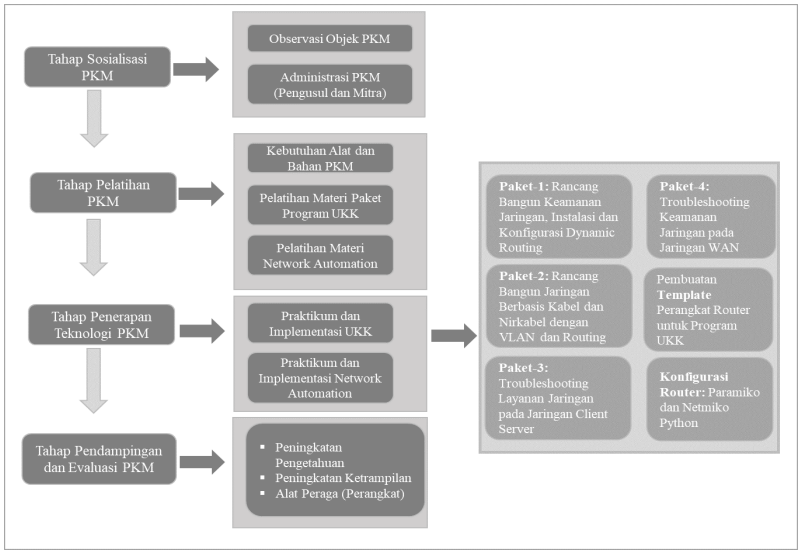

Figure 1. Implementation of the PKM Program Activity Flow

Training Concept Training (UKK and Network Automation Program)

Training for UKK and network automation will be conducted with workshops and question and answer sessions with students. This material activity will also be carried out with pre-test and post-test activities to test student abilities before and after each material concept discussion is carried out.

Implementation Practical Uji Kompetensi Keahlian (UKK) and *Network Automation*

The implementation of the UKK and network automation practical aims to implement soft skill according to the UKK curriculum, router configuration with paramiko and netmiko python, with implementation activities using the concept and application of technology transfer, which will be delivered from lecturers and the PKM program implementation team to partners effectively, efficiently and sustainably. Determination of the assessment weight and value components for the UKK and network automation practical program uses the analytic rubric method based on the evaluation criteria that have been determined for each component. The assessment formula used for all aspects to be assessed uses the following formula:

$$Nilai\ Akhir = \sum (Bobot\ Komponen * Nilai\ Komponen)/Total\ Bobot$$

Description:

- Weight (%): According to the weight given to each practical program, maximum of 100%.
- Component Value: Value based on student practical performance on each UKK and network automation implementing with a score of 1-10.

The assessment indicators given will focus on the students abilities and skills in installing and configuring routers, switches, access points and cabling on program paket-1 UKK. This assessment covers various aspects, from the quality of physical installation of cables and devices to logical configurations, such as IP addressing, static routing, dynamic routing (OSPF), DHCP server, NAT IPv4, Wireless WLAN, site blocking, and bandwidth management.

1) Calculation of final value for practical program paket-1 UKK for group-1:
   - Install and Configure UTP Cable = 5% * 9 = 0.05 * 9 = 0.45
   - Configuring IP Address = 5% * 9 = 0.05 * 9 = 0.45
   - Configuring Static Routing = 5% * 9 = 0.05 * 9 = 0.45
   - Configuring Dynamic Routing (OSPF) = 15% *8 = 0.15*8=1.2
   - Configuring DHCP-Server = 10% * 8 = 0.10 * 8 = 0.8
   - Configuring NAT IPv4 = 15% * 8 = 0.15*8 = 1.2
   - Configuring WLAN Interface = 15% * 9 = 0.15*9= 1.35
   - Configuring Blocking Situs = 15% * 8 = 0.15*8 =1.2
   - Configuring Simple Queue = 10% * 9 = 0.10*9 = 0.9

- Testing Configuration = 5% * 9 = 0.05*9 = 0.45

2) Total value component = 0.45 + 0.45 + 0.45 + 1.2 + 0.8 + 1.2 + 1.35 + 1.2 + 0.9 + 0.45 = 8.45.

Table 1. is an assessment for four groups working on program paket-1 based on the value components and weights that have been given.

No.	Program	Weight (%)	Value Component			
			Group-1	Group-2	Group-3	Group-4
1	Install and Configure UTP Cable	5	9	9	9	9
2	IP Addressing	5	9	9	9	9
3	Static Routing	5	9	9	9	9
4	Dynamic Routing (OSPF)	15	8	8	8	9
5	DHCP-Server	10	8	8	8	8
6	NAT IPv4	15	8	8	8	8
7	WLAN Interface	15	9	7	9	8
8	Blocking Situs	15	8	8	8	8
9	Management Bandwidth (Simple Queue)	10	9	8	9	8
10	Test Configuration	5	9	9	9	9

The following is the basis for determining the assessment weight and value components program paket-1 Uji Kompetensi dan Keahlian (UKK)

Table 2. Assessment weight and value component

Analytic Rubric Evaluation UKK Paket-1				
No.	Program Chapter	Weight (%)	Value Component	Description
1	Install and Configuring UTP Cable	5		Basic and essential competencies for performing network installations
2	IP Addressing	5		Basic Configure IP address
3	Static Routing	5		Basic competency that is important is how networks can be connected
4	Dynamic Routing (OSPF)	15		It is very important to connect 2 different hosts on the same router with OSPF.
5	DHCP Server	10		It is important to automatically distribute IP addresses to devices on the network.
6	NAT IPv4	15		It is very important because NAT (Network Address Translation) allows devices on a local network to connect to the internet.
7	Wireless WLAN	15		It is very important for the host device to be connected wireless
8	Blocking Situs	15		Important for security and managing network access
9	Management Bandwidth	10		It is important to maintain network performance and manage users.
10	Testing Configuration	5		Important as part of the verification process

RESULTS AND DISCUSSION

This PKM activity is carried out through a series of intensive theoretical and conceptual training sessions and direct practice, with the aim of improving student technical abilities as well as soft skill aspects such as teamwork and problem solving. The implementation of this PKM activity began on July 23, 2024. The implementation of PKM activity began with a focus on program paket-1, namely network security design, installation and configuration of dynamic routing. The material given to students includes designing and building networks using MikroTik RB941 devices. Students are introduced to basic concepts such as IP addressing, static routing, dynamic routing, NAT IPv4, Wireless WLAN, DHCP-Server, as well as the implementation of transparent proxy servers and blocking sites on http services and protocols. In addition, students also learn about bandwidth management to optimize client usage on each LAN and wireless network device, as seen in the topology and practical media in figure 1.

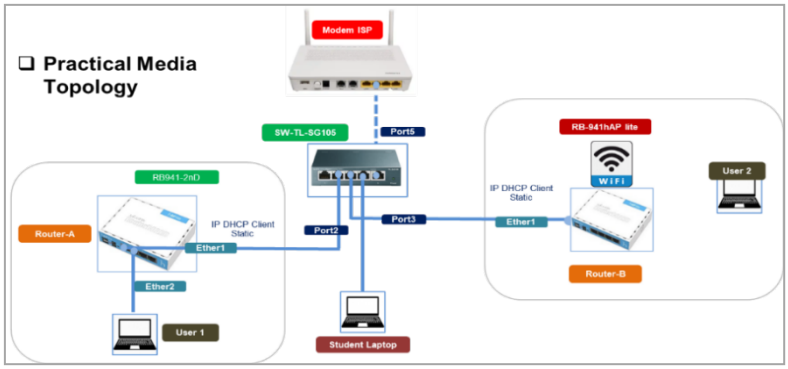

Figure 2. Practical Media Topology Program Paket-1

In Figure 2, student participation in each training session and the opportunity for students, in addition to theory, are also able to apply their knowledge in direct practice using router devices.

Figure 3. Student Activities Configuring Devices for Program Paket-1

Figure 2 guided by the lecturer each group continues to configure the hotspot server on the MikroTik router that will be used for client access using HP and laptop devices (program paket-2 UKK). This hotspot server scenario will create user profiles for the principal, teachers, and students, and set the bandwidth allocated for each client. The students also configure the vlan trunk to carry vlan-id 10 (students) and vlan-id 20 (teachers) from the switch (router 941 which is used as a switch) to the MikroTik router.

Figure 4. Each group guided by the lecturer performs the configuration of program Paket-2

This program paket-2, each group configures access vlan, trunk vlan, and switching mode on the MikroTik router. This configuration ensures that each port on the switch is properly configured to receive the appropriate vlan and tests network connectivity to ensure that all configured devices can communicate via the specified path, both wired and wireless clients as seen in the figure 3.

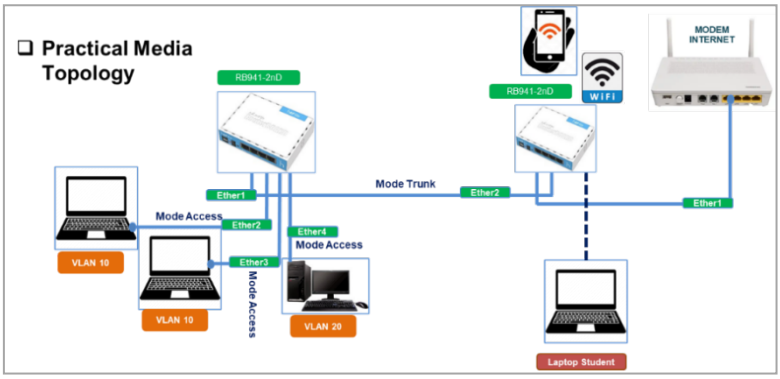

Figure 5. Practical Media Topology Program Paket-2

Program paket-3 UKK focuses on the development and configuration of server-based networks and web services. This practical will begin with network design using router MikroTik devices, ubuntu server, and TP-Link access points. The scenario of this practical, each group of students will serve as a network administrator and be assigned to create a network topology that can support various services contained in the program paket-3. As seen in Figure 4, each group is accompanied proposing lecturer to carry out the initial stage by installing and configuring the vmware hypervisor.

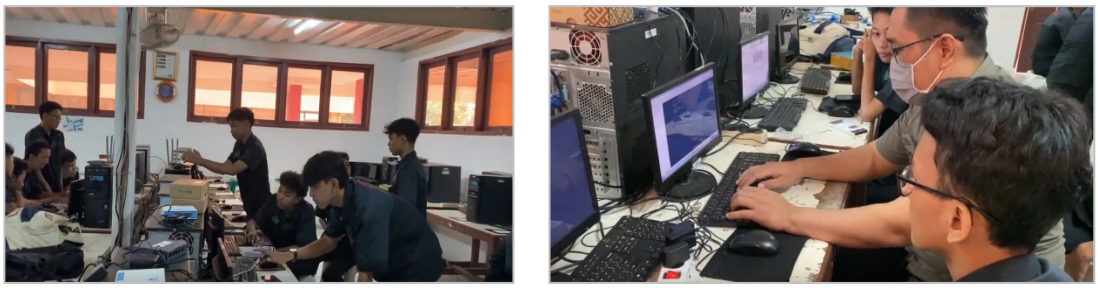

Figure 6. Each group guided by the lecturer performs the configuration of program Paket-3

Practice program packet-3 is with the installation and configuration of vmware hypervisor. Each group of students is asked to install and configure this hypervisor on a PC device, which will be used to run the ubuntu server 20.04 operating system. After installing the hypervisor, students continue with the installation and configuration of the apache web server on the ubuntu server. Furthermore, each group installs and configures linux-based wordpress on the ubuntu server that has been installed and configured. In addition, each group of students also configures the web server and mysql database so that it can be accessed by clients using wired or wireless connections. In addition, on MikroTik devices, students are required to configure bandwidth for each client, with the rule that clients using cables have a speed of 256 kbps and clients using wireless with a speed of 128 kbps, model topology program packet-3 as seen in the figure 5.

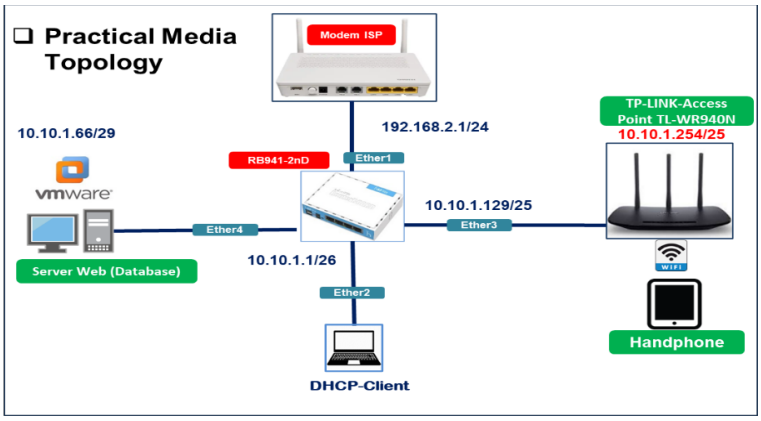

Figure 7. Practical Media Topology Program Paket-3

Program paket-4 students will act as a system administrator, who is responsible for designing and building a network using router devices with a focus on network management and security. This practical also aims to equip students with skills in managing and securing networks on a large scale. As seen in Figure 6, students are given access point devices for practical activities.

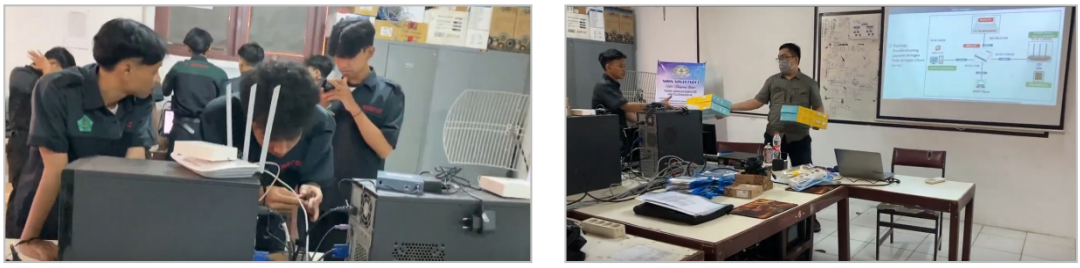

Figure 8. Each group guided by the lecturer performs the configuration of program Paket-4

Each group of students is also required to create 20 hotspot accounts randomly in the radius manager MikroTik, with internet access time limits from 07:00 to 16:00. This phase tests student ability to manage client internet access via hotspot. The final phase of this program packet-4 practical, each group of students completes their task by implementing a firewall by blocking access to the site https://www.linux.org and restricting access to files with the extensions .mp3 and .mkv. This practical activity not only tests student's technical skills in managing firewalls and increases their knowledge of bandwidth management and access control, topology model program packet-3 as seen figure 7.

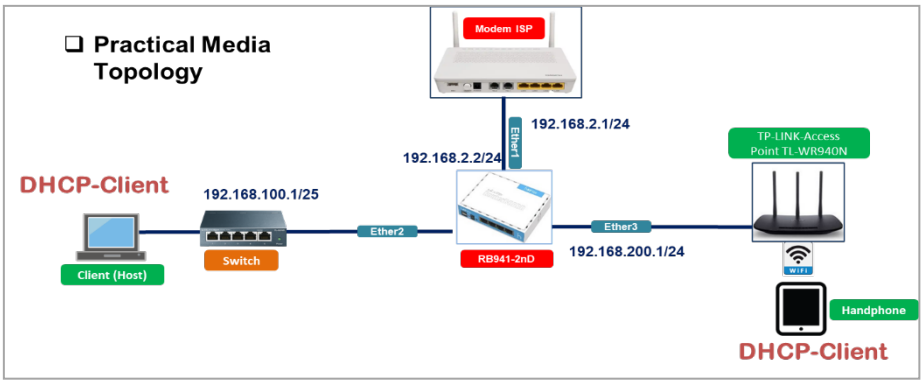

Figure 9. Practical Media Topology Program Paket-4

The active participation of each student and implementation of training and practical shows that the application of this technology is not only adjusted to the existing curriculum, but is also able to attract interest and increase participation of both teachers and students at SMK Nusantara 1. Figure 8 is a graph that is displayed, there is a comparison between the pre-test and post-test scores of each student for each UKK program from program packet-1 to program packet-4 and the network automation program.

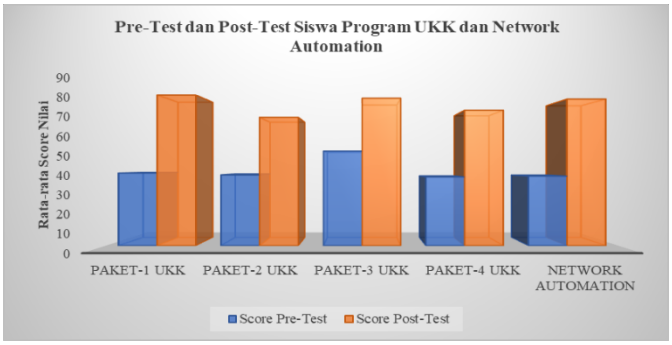

Figure 10. Results of the comparison between student's pre-test and post-test scores.

The results of the pre-test and post-test scores show a consistent increase in the average score in each program UKK and network automation with an increase of 43%. These results theoretically indicate that the training program has succeeded in improving student skills and understanding in various aspects of networking and automation. Figure 9 shows from the graph, each group of students after completing the implement UKK task produced a fairly high average score ranging from 8.6. Each group of students got a score in the range average of 8.4 - 8.6 points, from the results of this point it can be concluded, each group of students is able to install and configure the network according to the specifications and criteria that have been set in the UKK questions and tasks.

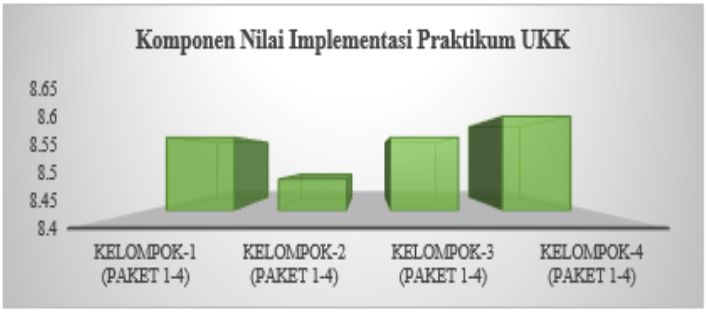

Figure 11. Components of the program UKK implementation score

In addition to improving the aspects of student skills, the results of this PKM activity also include the preparation of UKK modules and books for Network automation on MikroTik RouterOS using Python, which are expected to be

references and ongoing learning materials for students and teachers for learning and teaching activities for implement practical.

Figure 12. Uji Kompetensi dan Keahlian Modules and Network Automation Books

CONCLUSION

The PKM activities carried out for the concept and implementation UKK and network automation practical have succeeded in significantly increasing the knowledge and skills of each student. From the results of the implementation of PKM activities, there is a significant increase in the soft skills of student TKJ from program packet-1 to packet-4 UKK. The results of learning and practical show that each group of students obtained high component scores in each program packet UKK. In the packet-1, the final score of each group of students ranged from 8.05 to 8.45. In packet-4, the student group scores also increased and were more consistent between 9 and 9.15. These results indicate that through a structured implement practical approach, students are able to achieve higher competencies in each UKK question and assignment that is applied. This success is also reflected in the student's ability to implement concepts that require an understanding of router, switch and access point devices from network topology models.

ACKNOWLEDGMENT

The authors and the team would like to Direktorat Riset dan Pengabdian kepada Masyarakat Direktorat Jenderal Penguatan Riset dan Pengembangan Kementerian Riset, Teknologi, dan Pendidikan Tinggi Republik Indonesia, for providing grants research funding in 2024 Year.

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