IMPROVING TEACHER AND STUDENT COMPETENCE WITH COMPUTER NETWORK AND NETWORK SECURITY TRAINING ON SOFT SKILL AND CYBER SECURITY AWARENESS ASPECTS AT SMK PUSTEK SERPONG

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ABSTRACT

Program Kemitraan Masyarakat (PKM) that we propose in the SMK Pustek Serpong, the targets are Teknik Komputer dan Jaringan (TKJ) students. The implementation of this PKM activity aims to overcome and provide problems faced by Pustek Serpong Vocational School. The TKJ expertise program at SMK Pustek does not facilitate students to conduct training activities, due to the lack of tools or equipment for practical activities and their implementation for hardware and software equipment according to industry standards. The curriculum being taught is not adequate with the current technological developments, as well as suggestions from the study program teacher team that there is a need for discussion and material in the form of learning modules for Network Security competencies. Capacity building in the form of training workshops, practice and proposed implementation activities are arranged based on a scheme according to the qualification level of students and the abilities of teachers and students at Pustek Serpong Vocational School. The results of this PKM are expected to gain an increase in scientific capacity and competence by 50% for increasing Cisco conceptual and implementation capabilities, and 40% for Network Security conceptual and implementation skills. The results to be achieved in this service will also create training modules, provide conceptual and practical material and their implementation in a workshop such as configuration, troubleshooting and equipment implementation.

Keywords: Cyber Security, Network Security, Computer Network, Mikrotik, Cisco

1. INTRODUCTION

Computer Network and Network Security material, especially in the field of cyber security, is currently one of the world education and work industries as one of the skills or soft skills that are needed and must be possessed. Education levels in Indonesia at all levels now and in the future will be oriented to global developments and changes, science, technology, art, and culture. Mastery of ICT is important, especially for students, especially those majoring in Teknik Komputer dan Jaringan (TKJ) because every party involved is required to be able to actively participate and continue to improve their abilities and soft skills to be able to compete (Kemdikbud, 2022). The current reality is that the government has made ICT a subject (*IT as a subject learning*) as a compulsory subject, starting from the elementary and high school levels. Indonesia from other nations (Digital Registry, 2022). Mastery of ICT is important, especially for students, especially those major TKJ because every party involved is required to be able to actively participate and continue to improve their abilities and soft skills to be able to compete (Kemdikbud, 2022). The requirements for mastery of competence the major of computer networks at least on Cisco and MikroTik products, as well as information security in an organization including education have undergone two major changes in the last few decades. Prior to the widespread use of data processing equipment, the security of information that was perceived as valuable to organizations was provided primarily through physical and administrative means. Network security measures are required to protect data during their transmission. Because almost all businesses, governments, and academic or educational organizations connect their data processing equipment with a collection of interconnected networks (Damanik, 2021), (Akhyar & Merry, 2020). Such a collection is often referred to as the internet and the terms global internet and internal network security are used. The focus on the problems that partners found from the results of interviews and observation activities are:

1. Learning activities on the material are only basic knowledge regarding competencies and discussion of teaching materials that students must have, and have not yet represented them in the majors of TKJ which will later be used or applied to the industrial world.
2. There are difficulties for students to do exercises and Practice Lab on Uji Kompetensi dan Keahlian (UKK) materials, especially on Cisco and MikroTik.
3. In the previous curriculum there were Network Security teaching materials and materials and since 2013 the curriculum and teaching materials have disappeared. Then discussions with the Study Program Teachers need to have training activities on Network Security and the need for teaching aids in the form of server devices for practical activities and Network Security Implementation.

The cooperation program between the proposer and the partner (SMK Pustek Serpong) will also create discussion modules for Network Security and Computer Networks at the basic and intermediate level, providing conceptual and practical material and its implementation in a workshop such as configuration, troubleshooting and the use of equipment (device). Server, MikroTik router and Packet Tracert simulator, with the design and implementation of a learning and debriefing scheme, in the form of providing vocational education and training for TKJ Vocational High Schools that combines systematically and synchronously between educational programs in schools and job mastery programs with training (Denney & Tewksbury, 2013), (Goldstein & Bucciero, 2009). It is hoped that with the knowledge and application of the training provided to teachers and students, they can motivate and provide knowledge of Information and Communication Technology, especially in the field of cyber security technology and aspects that include network security so that future students can be ready to use the world and the work industry. Kallberg & Thuraisingham, 2012). The proposed material is arranged based on a scheme according to the qualification level of students which includes the ability to carry out specific, operational jobs. Then in preparation for the implementation of learning and training activities, this will also apply to the ability of teachers to increase knowledge, especially in relevant industrial fields, so that students' ability to receive future material will be better (Cisco, 2022).

2. METHOD

This PKM implementation activity uses the partnership method, this service partners from Information and Technology Faculty and Economics Faculty Budi Luhur University Lecturers. This PKM activity places PKM partners (SMK Pustek Serpong) as objects as well as subjects with the aim and intent of activeness and cooperation in conveying problems and conditions expected from existing problems. The PKM implementation activities consist of 3 phase and sub-phase starting from the PKM Activity Planning Preparation Phase, Training and Implementation Phase and then the Mentoring and Evaluation stage and process which will involve all elements of the PKM partner environment. In order to realize the objectives of the PKM implementation activities, several stages will be taken and carried out in implementing them, among others illustrated in the flow chart in Figure 1.

Preparation phase for PKM activities

The method from the results of the implementation of this PKM activity will explain the phase taken in implementing the solutions offered to overcome problems at the Pustek Serpong Vocational School. PKM activities will be preceded by preparation for the implementation of activities, and socialization activities with teachers and public relations at SMK Pustek Serpong. The socialization activities carried out aim to provide information and syllabus about the agenda of activities and the objectives of implementing PKM activities as well as seeking agreement with the Teacher of TKJ Study Program and Public Relations regarding the implementation schedule and PKM materials to be presented to students. After the socialization activities were carried out which were attended by the Head of the TKJ Study Program, Public Relations and coaching teachers, 25 (twenty-five) participants were obtained for PKM activity participants, starting from 21 May 2022 – 31 October 2022.

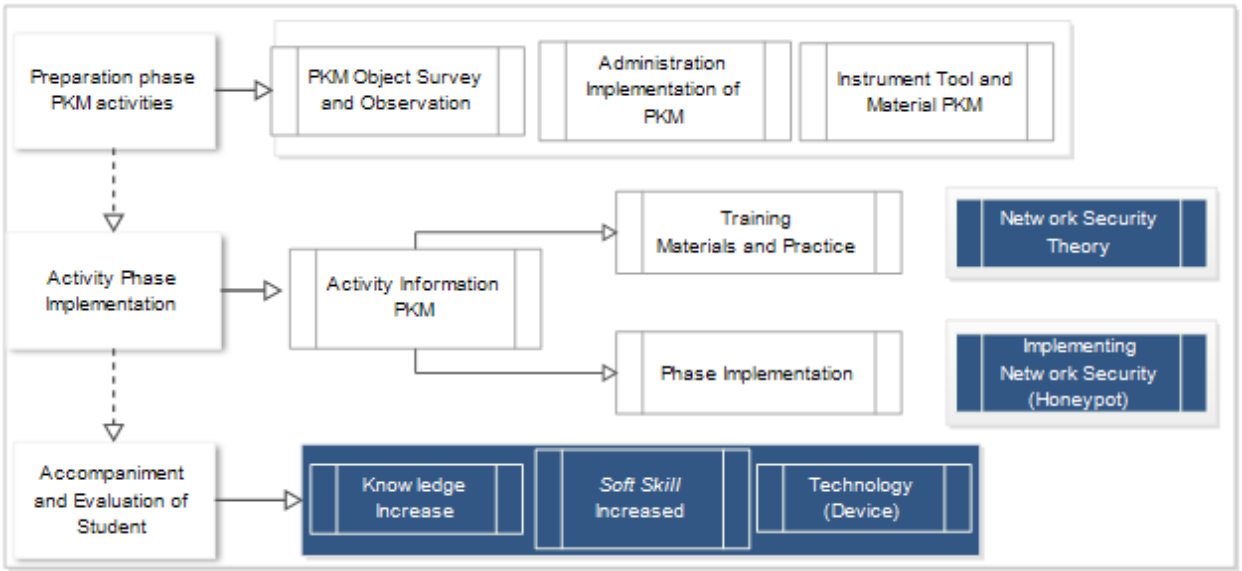

Figure 1. Phase and flow of activities for the Community Activity Program (PKM) activity planning

Syllabus and materials for the implementation of PKM activities

This information and training activity is designed so that students can understand the system comprehensively and be able to use it, and can apply and add insight later in the industrial world (Cisco, 2022). The method of this training activity is also carried out based on the theoretical learning process approach and practical learning as well as its implementation. The comparison between theory learning and practical learning is around 1:2 and will be done offline and online. Practical activities with Cisco packet tracer, Ubuntu Server 20.04 and Hypervisor Proxmox VM.

Table 1 provides a brief description of the planned training activities and implementation to be carried out.

Meeting Topics	
Computer Networks	**Network Security**
Configuring a Network Operating System	Network Security Fundamental and Modern Threats
Network Protocols and Communications	Securing Network Device
IP Addressing (IPv4 and IPv6)	Authentication, Authorization, and Accounting (AAA)
Subnetting IP Networks	Implementing Firewall Technologies
VLANs	Implementing Intrusion Prevention (IPS)
Inter-VLAN Routing	Cryptographic Systems
Static Routing	Symmetric Versus Asymmetric Encryption
Routing Dynamically	Implementing Virtual Private Networks
Single-Area OSPF-OSPFv2	Ethical Hacking Series: Honeypots
EIGRP	Managing a Secure Network
Access Control Lists	
LAN Redundancy	
Link Aggregation	
Implementing Virtual Private Networks (VPNs)	

Phase of implementation material

The syllabus for the activities and implementation of this PKM will be carried out in phase and continuously with the material in outline explaining the basic concepts of computer network and network security knowledge and its sub-categories of discussion. The method of this training activity is also carried out based on a theoretical learning process approach and practical learning and its implementation.

Table 2. Training activities and discussion of materials and programs of Computer Network and Network Security training materials.

	Training Information
Academy	Student and Teacher SMK Pustek Serpong
Partner PKM	SMK PUSTEK Serpong
Access Calss	*Offline and Online Class*
Description Training	Describes the conceptual basis of knowledge and its relevance (knowledge) of computer networks, especially those based on Cisco by honing skills (soft skills) on the aspects of preparation and implementation of training activities, as well as honing skills (soft skills) on aspects of the results of training activities, as well as the Fundamental Network security
Activity	Training Training is carried out offline with Packet Tracer and Quiz (Pretest and Posttest), syllabus or. Participants learn independently and through mentoring.

3. RESULT AND DISCUSSION

The PKM activity was opened by the Head of Student Affairs, Head of Public Relations and Head of Teacher TKJ Program SMK Pustek Serpong (Figure 2). Activities The PKM, which took place at the Computer Laboratory of Pustek Serpong Vocational School, was also attended by the chairperson and members of the implementing team, the assistant team (Budi Luhur University Students).

Figure 2. Implementation (opening) of PKM at SMK Pustek Serpong

The method from the results of the implementation of this PKM activity will explain the phase taken in implementing the solutions offered to overcome problems at the SMK Pustek Serpong. PKM activities will be preceded by preparation for the implementation of activities, and socialize activities with teachers and public relations at SMK Pustek Serpong. Figure 3 is the presenter and assisted by the team. The presenters delivered the material using the workshop method, question and answer and practice using infocus media, packet tracer applications, and GNS3, Router Mikrotik RB951Ui-2HND, Modem HSDPA 4G and Hypervisor Proxmox in their delivery.

Figure 3. PKM Implementation Activities at Pustek Serpong Vocational School

Figure 4 is the presenter and is assisted by the team. The presenters, delivered the material using the workshop method, question and answer and practice. An overview of science and technology provided to PKM activities at SMK Pustek with the delivery of material and simulation activities as well as implementation using concepts in the form of technology transfer from lecturers implementing the PKM program to partners in an effective, efficient and sustainable manner.

Figure 4. PKM Implementation Activities at Pustek Serpong Vocational School

The results of the phase of each material and practice provided are conducting a pre-test agenda with the aim of measuring the ability of students. The results of the pre-test carried out by students will be used as a comparison of the team success rate in providing training activities from the aspects carried out to students. This activity will be used as material and evaluation by the implementing team with Pre-Test and Post-Test. Figure 5 shows the average results of Pre-Test and Post-Test 25 participants for Computer Networks.

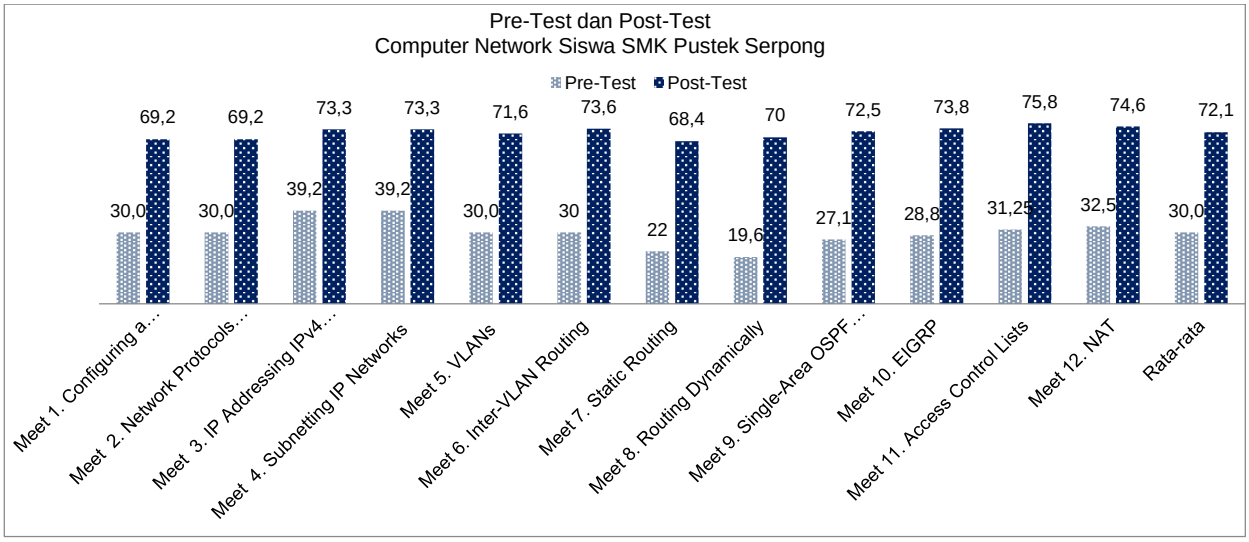

Figure 5. Average Results of Pre-Test and Post-Test Student (Participant) Computer Networks

Figure 6. shows the average results of the Pre-Test and Post-Test conducted by 25 participants for the Computer Networks material. From these results, it was obtained that there was an increase in understanding from the training participants from each meeting held.

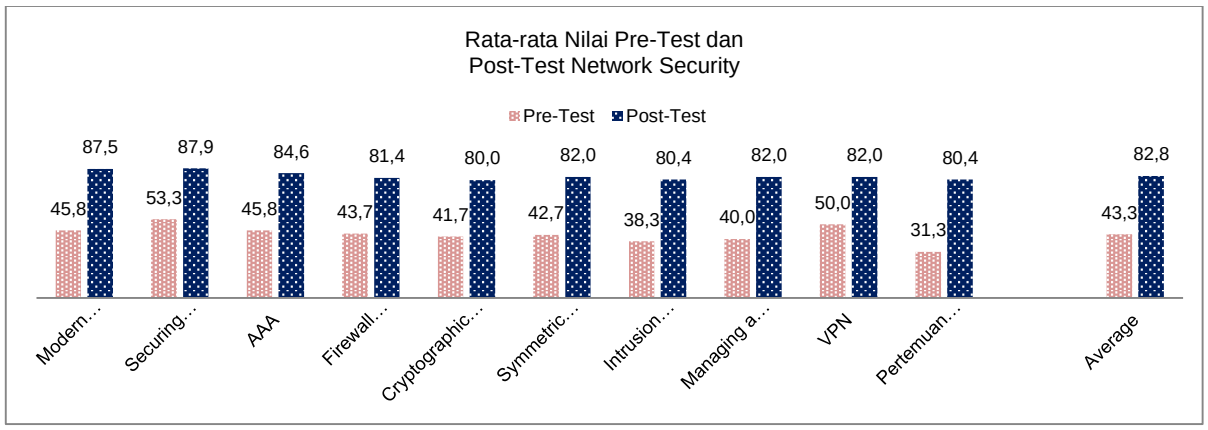

Figure 6. Average Results of Pre-Test and Post-Test Student (Participant) Network Security

Results PKM lab activities and technology aspects

The technology aspect for the implementation phase of the Community Partnership Program (PKM), is a technology on a network connectivity with a scheme for using the Mikrotik RB951Ui-2HND Router and 4G Broadband

HSDPA Modem which is combined and modeled, to be used as a transmission medium and as a gateway that can have level of availability, reliability and security that can be used as a medium for connectivity for Service Providers (SP). The Mikrotik RB951Ui-2HND router as Layer 3 and Layer 2 media can be applied as a facilitation as Infrastructure in an organization. Virtualization scheme, and 4G HSDPA Modem as Connection to Cellular Operator to get internet connectivity Dynamically, with the topological scheme of applying Wide Area Network (WAN), it can become an understanding for teachers and students, especially in knowing and understanding WAN network connectivity virtually by utilizing VPN Tunneling with remote locations or in geographically separated area scales.

Figure 7. Phase and Explanation of VPN Implementation with PPTP and EoIP Tunneling Protocol

The results of the implementing of the honeypot designed to gain the ability of the type of attack to be monitored and evaluated within 1 month from the public internet with monitoring and attack analysis in the form of a centralized logging system, timestamp (signature) which is used to collect information about the source IP address, country, Brute Force attack, a type of malware. Figure 8 is a T-Pot Honeypot after the installation and configuration process on hypervisor Proxmox.

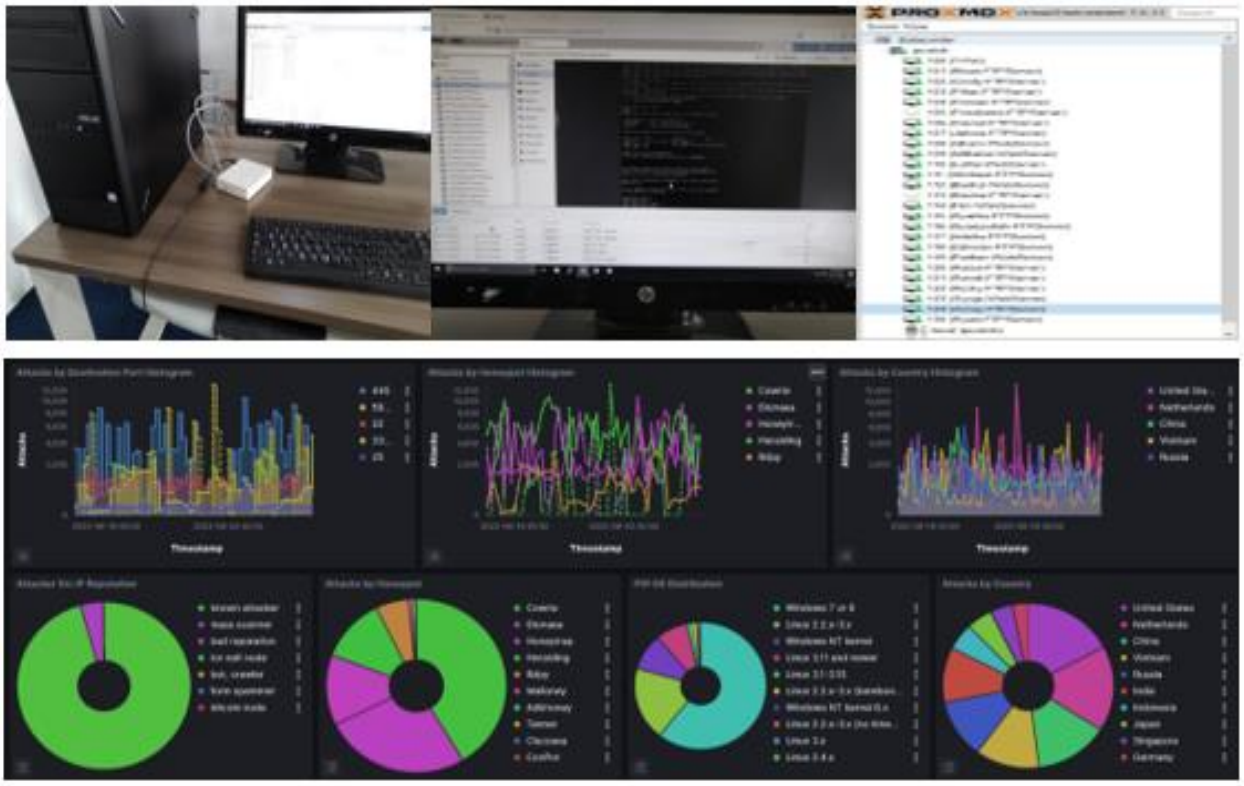

Figure 8. Types of attacks from graph virtualization T-Pot Honeypot

Figure 9 shows the enthusiasm of the participants in following the practice of designing this topology and how the presenters explain in detail.

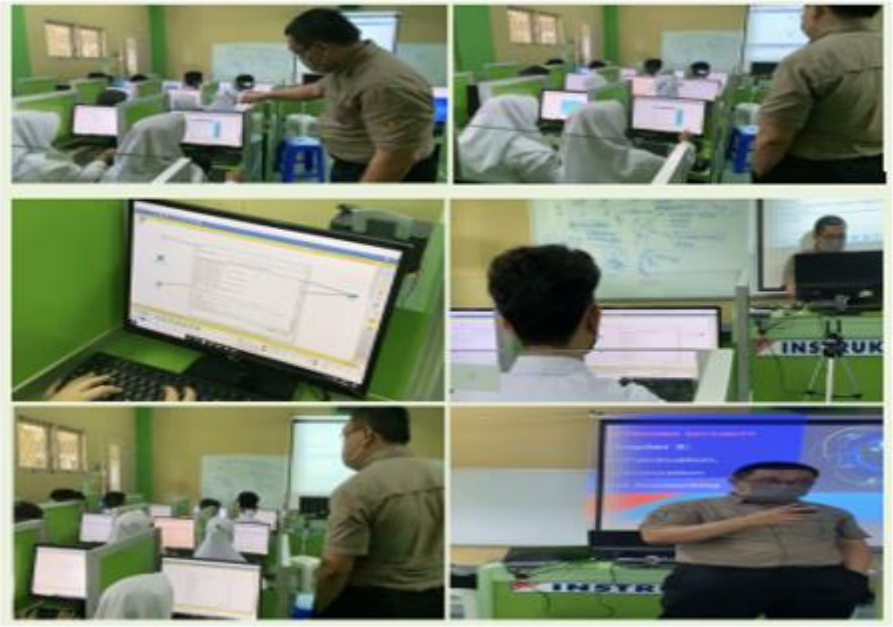

Figure 9. Trainer explains the practice of designing topology and concept of matter

In the follow-up activity for this PKM activity, the proposers will measure the level of success of the PKM activities that have been carried out at the Pustek Serpong Vocational School, for this reason, an evaluation is carried out through 3 (three) stages of evaluation at the stage of the process of implementing PKM activities, evaluating the final results of PKM activities from the implementation and follow-up evaluation.

Table 3. Indicators of the Success of Computer Networks and Network Security Training Program

Data Type	***Data Source***	***Indicator***	***Criteria***	***Instrument***
Computer Network and Network Security	Speakers/Lecturers 1. Presentation 2. Modules and Materials Training 3. Internet 4. Lab Practice	Knowledge, insight and soft skills of the trainees	Improvement, understanding and ability of material which are given	1. Presentation 2. Frequently Asked Questions 3. Demonstration 4. Practical training at every meeting 5. Reviews.
Aspect Knowledge and Technology	Speakers/Lecturers 1. Presentation 2. Modules and Materials Training 3. Internet 4. Lab Practice	Knowledge, skills and soft skills of the trainees	Knowledge and Insights regarding Cyber Attack and its prevention implementation, Network Implementation and VPN Connectivity and UKK Implementing	1. Presentation 2. Frequently Asked Questions 3. Demonstration 4. Practical training at every meeting 5. Reviews.
Evaluation and follow-up process from the implementation Phase	Speaker/Lecturer 1. Guidance 2. Consultation 3. Supervision	PKM activity program and training is applied according to plan	Results from training activities can be implemented in the world of work	1. Device Requirement for service and practical activities as well as teaching and learning media fulfilled. 2. Module and Tools Training 3. Computer Network ISBN Books

4. CONCLUSION

The training and lab practice activities provided, with the delivery of material and simulation activities and implementation using the concept of technology transfer, the intent and purpose of transferring capabilities to be able to utilize and master science and technology delivered from the topic Computer Network and Network Security from lecturers implementing the PKM program to partners effectively, efficiently and sustainably. The concept of technology transfer to PKM partners is carried out through the concept of training workshops, simulations and implementation, which are carried out in directional instruction both offline with two main aspects, namely knowledge and soft skills. In the knowledge aspect, it is explained and discussed how participants and training students are able to translate knowledge about Computer Networks and network security and their implementation in the industrial world, understanding and skills to follow and answer material about UKK. Teachers and training students are also able to translate Cybersecurity into practice and its implementation so as to produce values and skills. Evaluation of the soft skill aspect, in the form of demonstrations and reviews to measure partners' ability to understand knowledge and insights about the implementation of Computer Network and network security which is implemented through practice, demonstrations and reviews to measure partners' ability to understand skills in terms of knowledge (knowledge) and meeting the needs for practicum services and learning media to ensure follow-up on the implementation process of the results of program implementation in partner environments.

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