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Learning Design Collaboration Vocational High School and Telecommunication Industry

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Abstract: - Learning Design Collaboration VHS and Telecommunication Industry implementation expected to produce capable graduates with IT competence. Therefore, this study aimed to analyze learning design collaboration VHS and telecommunication industry to setting up fiber opic laboratory using a qualitative approach. The research was conducted at four VHS in East Java Province that collaborate with PT Telkom. Data were obtained through observation, interview, and document study with deputy head of curriculum, head of expertise program network engineering, students, and industry. The result shows four themes from analyze: School policy, setting up laboratory preparation, project-based learning implementation, and evaluation. School policy related follow-up to vocational education general directorate program to collaborate with industry so that students have the provision of knowledge, skills, and attitudes in the field of fiber optic technology. Project-based learning implementation is the key to successful learning because it is seen from the impact felt by students through certificates obtained as support for entering telecommunications industry.

Keywords: Collaboration, Fiber optic Laboratory, Learning Design, VHS.

1. INTRODUCTION

Currently, the rapid development of information and communication technology has changed the pattern of human thinking in working, learning, and interacting with each other, giving rise to the characteristics of modern society that wants everything to be instant, flexible, and efficient. These characteristics cause internet access to be used as a basic necessity which has an impact on the pattern of human life. According to data from the International Telecommunication Union (ITU) the accumulation of Internet use in 2023 is 5.4 billion or equivalent to 67% of the world's population [1]. According to the Association of Internet Service Operators of Indonesia (APJII), internet usage in Indonesia in 2023 reached 222 thousand or 79.5% of the 279 thousand population [2]. Increasing numbers of Internet users in Indonesia and around the world are emphasizing that bandwidth greatly supports network performance because it has a major influence on data transfer speed, connectivity stability, and increased responsiveness of online services. The high bandwidth needs can be met through fiber optic networks, because technology fiber optic's able to provide a larger bandwidth than conventional cables [3]. Fiber optics's therefore a new breakthrough in making it easier for users to improve information technology services through data transfer speeds and stable internet connections [4]. Human needs for increasing internet access can be optimized through the development of fiber optic networks to reach more areas [5]. This can be expressed in supply and demand cooperation between the telecommunications industry as a provider of infrastructure and practical experience, while vocational education institutions as a creator of quality resources.

Vocational High Schools (VHS) as vocational education institutions can contribute in developing fiber optic networks in collaboration with the telecommunications industry in providing internet access needs [6]. This can be realized in the fiber optic laboratory program organized by PT Telkom as the largest telecommunications industry in Indonesia. The program aims to equip VHS students with knowledge, skills, and attitudes in the fiber optic field, so that they can become capable graduates in the IT field. Adequate laboratory facilities and curriculum relevance to industry needs, VHS students can develop competencies in fiber optic network installation,

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maintenance, and development [7]. Kholifah et al [8] stated that the curriculum in VHS is designed with the needs of industry and the world of work in mind. This aims to ensure that VHS graduates have skills that match the demands of the job market. This collaboration not only benefits the industry with the availability of skilled labor, but also opens up career opportunities for VHS graduates in the growing telecommunications industry.

The establishment of the laboratory organized by PT Telkom in collaboration with VHS was carried out as a strategic step in bridging the gap between vocational education institutions and industry. This collaboration is carried out through a series of structured stages, starting with the signing of a Memorandum of Understanding (MoU) between the school and the industry [9]. Furthermore, curriculum alignment is carried out to ensure that learning materials are in accordance with the latest industry needs. The application of project-based learning in the collaborative learning design between SMK and fiber optic telecommunication industry provides benefits in the form of increasing the relevance of learning to the needs of the world of work, developing specific technical skills in the fiber optic field, training important soft skills such as communication and teamwork, increasing student learning motivation through real project work, facilitating the transfer of the latest knowledge from industry to school. At the end of the program, students undergo a comprehensive evaluation, namely a competency test or certification test and get a certificate that has been recognized by the Professional Certification Agency because the industry also collaborates with the National Professional Certification Agency, so that the certificate can be used as proof of student competence in the field of fiber optic networks and as a significant added value when entering the workforce.

Collaboration between vocational schools and the telecommunications industry has a significant impact on various related parties, such as students, this collaboration opens up opportunities to gain more relevant and practical learning experiences, improve technical skills in the field of fiber optics, and expand professional network. Students also gain a competitive advantage in the job market with the industry certifications they have obtained [9]. For schools, this collaboration enables the improvement of education quality through access to the latest technology and curriculum alignment with industry needs. It also enhances the school's reputation as an institution that produces quality, work-ready graduates [10]. Meanwhile, the telecommunications industry benefits from access to a talent pool that is trained according to industry standards and needs, reduces the cost of training new employees, and has the opportunity to contribute to shaping the skills of the future workforce. This collaboration also creates a more integrated education and industry ecosystem, encourages innovation, and ultimately contributes to increasing the competitiveness of the national telecommunications industry and reducing unemployment among VHS graduates [11]. The research conducted by Marsofiyati1, et al. [12] that collaboration can have an impact on increasing synergy between the two parties and can benefit each other.

This research aims to analyze the collaborative learning design between VHS and the telecommunications industry in establishing a fiber optic laboratory. The learning design applied through project-based learning is expected to produce VHS graduates who are not only qualified in the IT field, but also have proof of competence recognized by the industry, so as to increase the absorption of graduates in the world of work and contribute to the expansion of internet access which is a public need [14] [15] [16]. Thus, this research is expected to be a strategic step in overcoming the highest unemployment rate in Indonesia, which is dominated by SMK graduates.

2. RESEARCH METHOD

A qualitative approach was taken to analyze the development of a learning design for the collaboration of VHS and the Telecommunications Industry to setting up fiber optic laboratory. Data collection using snowball sampling was obtained from direct observation at 4 VHS, in-depth interviews with related parties, namely PT Telkom, deputy head of curriculum, head of expertise network engineering program, and students. In addition, document studies related to cooperation programs such as MoU, curriculum, and other supporting documents. The selection of VHS locations is based on representatives from 4 working areas in East Java Province that cooperate with PT Telkom Indonesia.

Data analysis used the Collaizi approach with two steps, namely: First, it is done individually to find findings from each VHS through data collection from observations, interviews, and document studies by recording in detail the results of observations related to the learning process of the fiber optic laboratory procurement program collaboration between VHS and the Telecommunications Industry. Furthermore, data reduction is filtering and organizing documents through checking data to ensure the completeness and accuracy of data from all informants, providing codes to facilitate the making of interview transcripts. Examples of coding can be seen in Table 1. Second, cross-case data analysis is carried out to compare the findings obtained from individual data analysis.

Table 1. Code Meaning for Transcripts

No.	Aspect	Kode
A.	School of Research	
	VHSDB	S1
	VHSPG	S2
	VHSTL	S3
	VHSPS	S4
B.	Research Focus	
	. Kebijakan Sekolah	F1
	. Persiapan Pengadaan Lab	F2
	. Implementasi Pembelajaran	F3
	. Dampak	F4
C.	Data Collection Technique	
	1. Interview	I
	2. Observation	O
	3. Documentation	D
D.	Data Sources	
	1. Industry	Ind
	2. Deputy head of curriculum	Depcur
	3. Head of Expertise Network Engineering Program	Henep
	4. Student	Std
E.	Data Retrieval Time	
	Date (02)-Month (06)- Years (2023)	02-06-2023

3. RESULT AND DISCUSSION

This research aims to analyze the development of collaborative learning design between VHS and Telecommunication Industry to setting up fiber optic laboratory. Collaboration between educational institutions and industry is an important aspect to improve the quality of graduates in meeting the needs of skilled labor [13] [14]. In Indonesia, the highest unemployment rate is dominated by VHS graduates, reaching 10.87% in August 2023 [2]. Therefore, the development of learning designs that are relevant to industry needs must be implemented since vocational secondary education. The existence of collaborative learning design is useful to help the telecommunication industry expand internet access and ensure VHS can produce graduates who are capable in the IT field, so as to prevent the increase in the unemployment rate of VHS graduates [15] [16]. The analysis for the development of this collaborative learning design shows several main themes: school policy, setting up laboratory preparation, learning implementation, and evaluation.

3.1 School Policy

The first step in the development of collaborative learning design between VHS and telecommunication industry is the implementation of school policy that follows up the Directorate of VHS's directive on link and match program. This policy aims to bridge the gap between vocational education and industry needs, preparing VHS graduates to be ready to enter the world of work with competencies that match the industry standards listed in Table 2. The implementation of this policy is realized through the issuance of a Decree (SK) that establishes the organizational structure of the program, including the appointment of the person in charge of laboratory procurement. Next was the signing of a Memorandum of Understanding (MoU) with partner industries, which became the formal basis for ongoing collaboration between VHS and the telecommunications industry sector.

Table 2. Fiber optic Telecommunication Industry Standards in School Policy

Knowledge	Skill	Attitude
Basic understanding of the working principle offiber optic Knowledge of fiber optic cable types and their uses Understanding of fiber optic network topology Knowledge of fiber optic communication standards and protocols Understanding of fiber optic measurement and testing equipment	Ability to perform fiber optic cable installation Skill in fiber optic splicing Ability to measure and test the quality of fiber optic networks Skills in troubleshooting and repairing fiber optic networks Ability to use special tools such as OTDR (Optical Time Domain Reflectometer) Skills in configuring active devices of fiber optic networks	Accuracy and precision in work, given the sensitivity of fiber optic equipment Awareness of work safety, especially in the use of lasers Ability to work in a team Readiness to learn continuously to keep up with technological developments Discipline in following operational procedures and standards Professional attitude in serving customers or end users

One of the school policies in realizing the link and match program in accordance with the direction of the Directorate of Vocational Schools by equipping with knowledge aspects that are emphasized to include a basic understanding of fiber optic networks. This can be seen from the statement provided:

"student's prepared with comprehensive knowledge of fiber optic networks, starting from the basic principles of fiber optic work, cable types and their uses, network topology, communication standards and protocols, to an understanding of measurement and testing equipment. The goal is that students have a strong knowledge before going into the field, so it is hoped that students will be better prepared to face challenges in the world of work and can adapt quickly to the development of fiber optic technology." (S1/F1/Depcur-I/02-03-2024).

Another aspect contained in the school policy is the skills aspect, which emphasizes practical and technical abilities that can be directly applied in the work of fiber optic networks, as shown in the following statement:

"*The skills aspect is given to practical students to ensure they are prepared for the demands of the industry, and our focus includes cable installation, splicing, network quality measurement and testing, troubleshooting and repair, use of specialized tools such as OTDR, and active device configuration. With these skills, students are expected to directly contribute to fiber optic projects in the telecommunications industry."* (S2/F1/Ind-I/22-04-2024).

The attitudinal aspects emphasized in the school's policy for vocational cooperation with the telecommunications industry include several key behaviors that are essential in a professional work environment, as shown in the following statement:

"*VHS collaboration with the telecommunications industry not only focuses on knowledge and skills, but also strongly emphasizes attitude building. Such as applying work safety, working effectively in teams and discipline in following operational procedures and standards. By equipping students with these attitudes, students will become a workforce that is not only skilled, but also professional and ready to face challenges in the telecommunications industry*." (S4/F1/Henep-I/05-02-2024).

The results show that school policies that implement collaboration or cooperation with industry, as a follow up to the Directorate of Vocational Schools' directives on link and match, can be an effective bridge to prepare graduates to be ready to work and immediately get a job by equipping students with three important interrelated aspects, namely strong theoretical knowledge, relevant practical skills, and professional attitudes in accordance with the demands of modern industry. School policies should include the development of three key aspects: knowledge through an up-to-date and relevant curriculum, skills through practice and internships, and attitudes through character assessment and self-development programs that are implemented in an integrated manner in the learning process, monitored by a dedicated team, and supported by cooperation with industry, to produce graduates who are work-ready and competent in their field. In addition, Collaborative learning can be an effective way to develop social skills, critical thinking and teamwork [17] [18] [19][20].

3.2 Setting up laboratory preparation

The second theme is in realizing learning through the procurement of fiber optic laboratories in collaboration with the telecommunications industry, the preparation of facilities and infrastructure is a crucial aspect that requires special attention. Laboratories have a crucial role in vocational education, the existence of these facilities allows students to transform concepts and theories learned in class into practical skills through hands-on experience allowing students to more effectively apply and strengthen their theoretical understanding through direct observation and experimentation [21] [22]. The school is responsible for providing laboratory

rooms that meet PT Telkom's industry standards, while practical equipment is provided by the industry. The room criteria set by PT Telkom cover various important aspects, including dimensions, layout, lighting, ventilation and security, which aim to create an optimal learning environment that resembles real working conditions in the telecommunications industry. Some important aspects that need to be considered to ensure the effectiveness and safety of practical learning are the provision of adequate space for furniture and equipment, assurance of safety in practicum activities, consideration of ergonomics and work efficiency, smooth movement of personnel and materials, space readiness for emergency situations, ease of access for maintenance and cleaning, and provision of adequate safety facilities. All these aspects aim to create a learning environment that is optimal, safe, and in line with industry standards [23] [24].

Meanwhile, the industry provides and maintains all practical equipment for the fiber optic industry class, including fusion splicers, OTDR, power meters, light sources, and other installation tools. This provision aims to enable students to learn using equipment that is identical to that used in the industry. The industry is also responsible for periodic maintenance and replacement of damaged equipment to ensure the smooth running of the learning process. Something similar was revealed in the research of Ranjan et al. [25] setting up a reliable and efficient fiber optic network requires a series of critical components and equipment, including fiber optic cables as data transmission media, media converters for signal transformation, various types of fiber optic connections, measurement devices such as power meters and OTDRs, splicing machines for splicing, cable protection and identification equipment, and special installation equipment, all of which must be used appropriately to ensure optimal network performance [26][27].

3.3 Project-based learning implementation

The third theme of learning design collaboration VHS and telecommunication industry to setting up fiber optic laboratory is learning implementation. Based on the results of the observations that have been made, the learning implemented is project-based-learning using six steps, namely: determining the fundamental question, project design, developing a schedule, monitoring, testing the results, and evaluating the experience. Table 3 below explains the explanation of each step based on the statement of each data source or informant.

Table 3. Project-based-learning steps

Steps	Description	Quotes
Determine fundamental question	Tracking fiber optic network faults or troubleshooting	*"Teacher and industry instructor present a problem of a network that is experiencing interference that causes a decrease in performance, then prompt the students with the question "How do you identify, track, and resolve interference on a fiber optic network?"* (S2/F3/Henep-I/22-04-2024).
Design project planning	Using OTDR to perform fiber optic network repair	*"Students discuss with teachers and industry instructors to think about and outline the procedures required, from tool preparation to interpretation of measurement results. Students are asked to consider various aspects such as equipment calibration, setting measurement parameters, OTDR trace analysis, and determining the location and type of damage to fiber optic networks."* (S3/F3/Ind-I/11-05-2024).
Schedule	Project work is done before the end of the meeting	*"Students are asked to consider timing using a Gantt chart to determine (days, weeks, or months) and list project tasks or activities, as the project must be completed before the end of the meeting."* (S1/F3/Depcur-I/02-03-2024).
Monitor project progress	Ensure the project is completed and students are ready to carry out the certification test	*"The teacher reminded the students of the project deadline and asked them about their progress, then asked them to identify challenges and obstacles in completing the project. Next, identify the material that still needs to be strengthened before facing the certification test."* (S4/F3/Depcur-I/04-02-2024).
Evaluation of results	Certification tests in collaboration with professional certification bodies and BNSP	*"The evaluation is carried out by conducting certification tests with the aim of verifying and validating that students have reached the required level of competence in the fiber optic field in accordance with industry standards. Furthermore, the school and industry ensure that the certification test process is carried out systematically, transparently, and in accordance with the standards set by BNSP, so that the certificates obtained by students have credibility and are recognized nationally."* (S2/F3/Depcur-I/05-04-2024).
Evaluation of experience	Reflection and discuss	*"Students' experience in using the fusion splicer was that the equipment was very sensitive. But after a few tries and learning from mistakes, students began to understand the technique. The biggest challenge was troubleshooting a complex fiber network. They had to learn to think systematically and use OTDR appropriately. This experience is very valuable and makes students more confident in facing the certification test and students can understand the industry expectations of competent fiber optic technicians*." (S1/F3/Std-I/05-03-2024)

The results showed that the application of project-based-learning in vocational school collaboration with the telecommunications industry in laboratory procurement improved students' technical understanding and developed essential skills such as problem solving, teamwork, and communication. This learning also bridges the gap between vocational education and industry demands, producing graduates who are technically skilled and ready to face the complexities of the world of work [28] [29]. Similarly, in a study by Ahmad et al [30], the application of project-based learning not only improves mastery of technical material, but also develops 21st century skills such as critical thinking, creativity, and adaptability[31].

3.4 Evaluation

Based on the discussion in the implementation of collaborative learning using the 6 steps of project-based learning in Table 3, a comprehensive evaluation is needed to improve the quality of the program by knowing the impact felt by related parties such as students, vocational schools, industries, and education agencies. This is conveyed in the statement provided:

"*Collaborative learning between vocational schools and the telecommunications industry to setting up fiber optic laboratory is very useful in developing fiber optic networking skills given the high demand for internet access. In addition, we had the opportunity to take certification tests organized by the Professional Certification Institute and recognized by the National Professional Certification Agency. This gives us an advantage, because even if we are not accepted in the partner industry later, we still have a certificate of competence in the field of fiber optic networks that is nationally recognized."* (S4/F4/Std-I/05-02-2024).

In addition to having an impact on students, schools as vocational education institutions also feel a positive impact with the cooperation or collaborative learning between vocational schools and industry as shown in the following statement:

"*SMK's collaboration with the telecommunications industry significantly improved the quality of graduates and the relevance of the curriculum. As a result, the school's reputation among the community has improved considerably, which has a direct impact on increasing the interest of prospective students. This partnership also provides benefits to remain a SMK to produce and provide quality education that meets the needs of the industry.*" (S3/F4/Depcur-I/11-05-2024).

This is also felt by external parties, namely partner industries and the education office, such as the statements provided:

"Through this partnership, the industry gains direct access to a ready-made skilled workforce armed with relevant certificates of expertise in the telecommunications field. This adds value, streamlines the recruitment and training process, and improves the industry's operational efficiency. Investment in this program has proven to yield positive returns in the form of high-quality human resources." (S1/F4/Ind-I/11-03-2024).

The results show that the evaluation of the implementation of collaborative learning between SMK and the telecommunications industry has a significant positive impact. This collaboration enables curriculum adjustments that are more responsive to industry needs, thereby increasing the absorption rate of SMK graduates in the world of work. In South Sulawesi, Indonesia, research by Rolly, et al. [26] highlighted the importance of industry-involved learning design in shaping vocational education to meet the demands of the world of work and improve students' readiness for real-world employment opportunities. Results research by Fajra, et al. [32] also explained that there is a positive impact with the implementation of learning because it can provide substantial benefits for students in preparing to enter the world of work and develop the skills needed in the industry [30].

4. CONCLUSION

In conclusion, learning design collaboration between VHS and industry to setting up fiber optic laboratory aims to produce graduates who are qualified in the IT field with good knowledge, skills and attitudes so that they are more easily absorbed by the industry. The main focus is to adapt the curriculum to the needs of the industry, considering that curriculum changes in Indonesia often occur unilaterally by the government by implementing six steps of project-based learning. Fiber optic learning includes connection, installation, maintenance, and repair which are very relevant to current technological developments. This collaboration is equipped with a national standard certification test, thus providing added value for graduates, even if VHS graduates are not accepted in partner industries, they still have a certificate in accordance with their field of expertise, namely fiber optic networks. This learning design has a positive impact on all parties, such as: Students get relevant skills and recognized certifications. Schools can improve the quality of their graduates and the relevance of their curriculum. Industry gains access to a ready-to-use skilled workforce. Meanwhile, the education office can achieve the goal of reducing the unemployment rate of VHS graduates and improving the overall quality

of vocational education. Thus, this collaboration is expected to help develop wider internet access through fiber optic networks, while addressing the unemployment problem of VHS graduates.

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