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Implementation of Technical Standard Operating Procedures in Teaching Factory for Developing Vocational High School Students' Work Readiness in Accordance with Industry Standards

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ABSTRACT

The gap between vocational high school (SMK) graduates' competencies and industry demands remains a structural challenge in Indonesian vocational education. This study aims to describe the effectiveness of implementing Technical Standard Operating Procedures (SOPs) within the Teaching Factory (TEFA) program at SMK Canda Bhirawa Pare in developing students' work readiness in accordance with industry standards. A mixed method approach with a Sequential Explanatory design was employed, involving 40 respondents comprising TEFA students, supervising teachers, and alumni. Data were collected through questionnaires and semi-structured interviews. The findings indicate that the implementation of TEFA technical SOPs is highly effective with both primary variables classified under the highly effective category in fostering work discipline, responsibility, procedural compliance, and the internalization of industrial work culture among students. Convergent quantitative and qualitative data confirm that technical SOPs function not merely as operational guidelines, but as a systematic instructional instrument for developing students' professional character. This study concludes that the integration of industry-standard SOPs into TEFA programs substantially bridges the competency gap between SMK graduates and industry expectations, with practical implications for the sustainable development of Teaching Factory programs in vocational education.

Informasi Artikel

Kata Kunci:

Teaching Factory; standar operasional prosedur; kesiapan kerja; Pendidikan vokasi; SMK

ABSTRAK

Kesenjangan antara kompetensi lulusan SMK dan kebutuhan dunia industri masih menjadi tantangan struktural pendidikan vokasi di Indonesia. Penelitian ini bertujuan mendeskripsikan efektivitas penerapan Standar Operasional Prosedur (SOP) teknis Teaching Factory (TEFA) di SMK Canda Bhirawa Pare dalam membentuk kesiapan kerja siswa sesuai standar industri. Penelitian menggunakan pendekatan *mixed method* dengan desain *Sequential Explanatory*, melibatkan 40 responden yang terdiri atas siswa peserta TEFA, guru pembimbing, dan alumni. Pengumpulan data dilakukan melalui angket dan wawancara semi-terstruktur. Hasil penelitian menunjukkan bahwa penerapan SOP teknis TEFA berlangsung sangat efektif dengan kedua variabel utama tergolong dalam kategori sangat efektif dalam membentuk kedisiplinan kerja, tanggung jawab, kepatuhan terhadap prosedur, dan internalisasi budaya kerja industri pada diri siswa. Temuan kuantitatif dan kualitatif secara konsisten mengonfirmasi bahwa SOP teknis tidak hanya berfungsi sebagai panduan operasional, tetapi juga sebagai instrumen pembelajaran yang membentuk karakter kerja siswa secara sistematis. Penelitian ini menyimpulkan bahwa integrasi SOP berbasis standar industri dalam program TEFA secara nyata menjembatani kesenjangan kompetensi lulusan SMK dengan kebutuhan industri, sekaligus memberikan implikasi praktis bagi penguatan program Teaching Factory yang berkelanjutan di pendidikan vokasi.

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1. Introduction

Vocational education in Indonesia plays a strategic role in preparing a skilled workforce that is ready to compete in both the national and global job markets. Vocational High Schools, known as SMK are education institutions. They are designed to produce graduates who process competencies. These technical competencies match the needs of the business and industrial sectors, which are referred to as (DUDI) [1]. Based on the provisions of Presidential Instruction No. 9 of 2016 on the Revitalization of Vocational High Schools (SMK), the government explicitly emphasizes the importance of aligning the SMK curriculum with industry standards to enhance the competitiveness of graduates. This requirement matches the pace of the fourth industrial revolution. the fourth industrial revolution requires that the workforce be technically skilled, the workforce must also be able to adapt to changes. the workforce should have a work ethic, the workforce must follow industry procedurs [1]. To meet these demands SMK Canda Bhirawa Pare, a school created a Teaxhing Factory program that links the learning process with real industrial work practices. after watching 13 students, in the teaching factory we saw that the standard operating procedures were not followed consistently especially when it came to documenting work and following the established workflows. This situation indicates that the implementation of technical SOPs in the TEFA still requires evaluation to ensure it optimally supports the development of students work readiness in accordance with industry standards.

These conditions have a direct impact on the development of students work readiness, which is the primary objective of the TEFA program at SMK Canda Bhirawa Pare. Work readiness is a multidimensional construct that encompasses attitudinal maturity, mastery of technical competencies, the ability to adapt to the work environment, and an understanding of industrial organizational procedures and culture.[2].[3] defines work readiness as a state in which an individual possesses the necessary skills, attitudes, and knowledge to enter and succeed in the workforce. In the context of vocational high school education, students work readiness serves as a key indicator of the success of the vocational education process, as vocational high school graduates are prepared to enter the workforce immediately upon completing their education [3]

According to [5], work readiness is a combination of knowledge, skills, and personal attributes that enable individuals to successfully enter and adapt to the work environment. Furthermore, [4] through the Work Readiness Scale, explains that work readiness consists of four main dimensions: personal characteristics, organizational acumen, work competence, and social intelligence. These four dimensions indicate that work readiness is not only related to technical abilities but also encompasses the ability to adapt, understand organizational culture, collaborate with others, and demonstrate a professional attitude. The modern industrial work environment demands more than just mastery of technical skills; vocational high school students are expected to possess critical thinking skills, the ability to work in teams, an understanding of quality management systems, and the ability to consistently and precisely follow work procedures in accordance with industry standards[6]. n addition, the industrial world also demands graduates who possess work discipline and the ability to apply standard operating procedures (SOPs) in every work process to maintain production quality and efficiency [3]. Developing work readiness in high school students cannot be done just through traditional theory only teaching, it needs to be supported by industry based learning, this kind of learning gives students real word work experience, that experience helps them prepare better for jobs, without work exposure students may not fully understand what their future careers will require. So combining classroom learning with hands on work experience is essential, it builds skill that classroom alone cannot teach, students gain confidence and practical knowledge, they learn how to work in teams follow procedures and solve problems on the job, this kind of learning is not optional, it is a necessity for work readiness.

The reality on the ground reveals a significant gap between the competencies of vocational high school (SMK) graduates and the expectations of the industrial sector. Data from the Central Statistics Agency (BPS) as of February 2023 shows that the open unemployment rate for SMK graduates remains at 9.60 percent, making SMK the largest contributor to unemployment among all educational levels. This situation indicates that the learning process at vocational high schools has not yet been fully able to effectively bridge the gap with industry needs. Several studies show that this gap is influenced by the low level of integration of industrial work culture into the learning process, as well as a lack of real world work experience gained by students during their time at school. The implementation of the Teaching Factory program is considered suboptimal in some vocational high schools, meaning that students are not yet fully accustomed to the actual industrial work system.[2]. In addition, the limited availability of practical training facilities which do not yet fully replicate real world industrial conditions is another factor hindering the job readiness of vocational high school graduates. Practical training in schools is often still simulation based and does not consistently apply industry standards, causing students to struggle to adapt when they enter the workforce. [7]. Other studies have also shown that standard operating procedures (SOPs) are not yet consistently applied in practical learning activities, so students are not yet accustomed to working

according to actual industry standards. In fact, the implementation of SOPs is crucial for fostering a work culture, discipline, and professionalism among students in a Teaching Factory environment [3]. Therefore, a learning approach is needed that can integrate industry experience into the teaching and learning process at school.

In an effort to bridge the gap between the competencies of vocational high school (SMK) graduates and the needs of the industrial sector, various SMKs in Indonesia have begun implementing the Teaching Factory (TEFA) learning model as a strategy to improve the quality of vocational education and students job readiness. The Teaching Factory is an industry based learning model that integrates real world production or service processes into learning activities, allowing students to learn in an environment that closely resembles actual industrial work conditions[1]. This learning model is designed to align the educational process at vocational high schools with the needs of the business and industrial sectors through structured, real-world work experiences oriented toward industry standards. Teaching Factory based learning is considered capable of bridging the competency gap between vocational high school graduates and industry needs because students are directly involved in production and service activities that resemble real world work conditions[8]. Through the Teaching Factory, students not only learn theory in the classroom but are also directly involved in production and service activities according to their respective fields of expertise[2]. Student involvement in these real world work processes helps develop technical skills, teamwork abilities, work discipline, and an understanding of industrial work culture. Thus, the Teaching Factory model is considered capable of creating a more contextual and authentic learning experience than conventional learning, as students become accustomed to working in accordance with the procedures and quality standards applied in the industrial world.

Through TEFA, students are trained to plan their work, carry out production processes in accordance with quality standards, perform quality checks, and adapt to the dynamic pace of industrial work [9] TEFA instruction also helps foster an industrial work culture, as students are accustomed to working in accordance with the procedures and operational standards applicable in an industrial setting[9]. Thus, the Teaching Factory serves not only as a learning method but also as a means of fostering students professionalism so they are better prepared to enter the workforce.

Several vocational high schools in Indonesia have successfully implemented the Teaching Factory (TEFA) program as an effort to enhance students job readiness and align the learning process more closely with the industrial world. SMKN 1 Singosari Malang, for example, has implemented the Teaching Factory model in the field of Information Technology by integrating the software production process into learning activities, thereby providing students with work experience that closely resembles real world industrial settings [10]. This implementation helps students understand industrial work culture, improve their technical skills, and accustom them to working according to industry-standard procedures. On the other hand, the application of the Teaching Factory model in the fields of engineering and manufacturing has also shown positive impacts on students work readiness. Production based learning within the Teaching Factory model is considered effective in improving practical skills, work discipline, teamwork abilities, and students. understanding of industrial work procedures, as students are directly involved in production and service processes that closely resemble the real world workplace[11]. The successful implementation of the Teaching Factory program at several vocational high schools demonstrates that industry based learning can be a solution for improving the quality of vocational high school graduates so they are better prepared to enter the workforce. However, the implementation of TEFA at various vocational high schools does not always proceed optimally. Challenges in implementing the Teaching Factory (TEFA) program at vocational high schools still include suboptimal control over production processes and quality standards, as evidenced by the lack of systematic quality control and inconsistent product quality relative to established standards [12]. This situation highlights implementation gaps that must be addressed immediately so that TEFA can have the maximum impact on students work readiness. Technical SOPs in the context of the Teaching Factory (TEFA) serve as guidelines for industry based learning, directing students through every stage of production and service activities. The application of SOPs based on industry standards accustoms students to working in a structured manner according to procedures prevalent in the industrial world[9]. In its implementation, TEFA emphasizes practice based learning that is oriented not only toward work outcomes but also toward the application of occupational safety standards and product quality as part of an industry based learning process that mimics real-world working conditions [12].

Inconsistencies in the implementation of work procedures, a lack of SOP documentation that is easily accessible to students, and suboptimal supervision of student compliance with SOPs remain issues encountered in the implementation of the Teaching Factory program at SMK Canda Bhirawa Pare. These conditions have the potential to hinder the effectiveness of the Teaching Factory in preparing students for the workforce in accordance with expected industry standards. Although numerous studies on the Teaching Factory have been conducted, most of them focus on the effectiveness of the Teaching Factory as an industry

based learning model, the improvement of student competencies, and the evaluation of program implementation in general. Various studies indicate that the Teaching Factory is capable of enhancing students' technical skills, work experience, and work readiness through production-based learning that simulates real world industrial conditions. However, research specifically examining the application of technical SOPs as operational tools in the implementation of the Teaching Factory model remains relatively limited. In fact, technical SOPs play a crucial role in shaping work habits, discipline, adherence to procedures, and an understanding of industrial work culture all of which are indicators of students work readiness. This study looks at how technical SOPs work in teaching factories to help students get ready for jobs that meet industry standards. it also fills the research gap in studies, about teaching factories in education .

The novelty of this study lies in its focus on the implementation of technical SOPs as a key component of the Teaching Factory program, which is linked to developing students' work readiness in accordance with industry standards. Unlike previous studies, which have largely focused on the Teaching Factory in general, this study examines technical SOPs as a variable, evaluating the effectiveness of their implementation through a mixed methods approach that involves students, teachers, and alumni as data sources.

Based on the problem statement, theoretical review, and identification of research gaps outlined above, this study is highly relevant both academically and practically. Academically, this study is expected to enrich the body of knowledge in vocational education, particularly in the areas of TEFA management and the development of students work readiness. Practically, the findings of this study are expected to serve as a reference for SMK Canda Bhirawa Pare and other vocational schools in developing, implementing, and evaluating TEFA technical SOPs more effectively and in a standardized manner. Thus, this study is titled: "The Application of Technical Teaching Factory SOPs in Developing Vocational High School Students Work Readiness in Accordance with Industry Standards," with the hope that it can make a tangible contribution to improving the quality of vocational education in Indonesia.

2. Method

This study employs a mixed methods approach using a Sequential Explanatory design (Creswell, 2018). The design consisted of two sequential phases: a quantitative phase followed by a qualitative phase. The quantitative phase was conducted first to measure the implementation of Teaching Factory (TEFA) technical SOPs and students work readiness based on the perceptions of students, TEFA instructors, and alumni. The results of the quantitative phase were then used to determine the focus of the qualitative inquiry, including the aspects requiring further explanation and the selection of qualitative informants.

The quantitative findings served as the basis for developing the qualitative phase in three ways. First, the indicators with relatively higher and lower scores were identified to determine which findings required further explanation. Second, the quantitative results from the three respondent groups were compared to identify similarities and variations in their perceptions. Third, these findings were used to formulate interview questions that explored the reasons, experiences, and contextual factors underlying the quantitative results. Thus, the qualitative phase was not conducted independently, but was specifically designed to explain and deepen the quantitative findings.

The qualitative phase involved semi structured interviews with selected informants from the same three respondent groups. The interview data were analyzed thematically and then integrated with the quantitative findings during the interpretation stage. Through this sequence, the quantitative phase provided a general description of the research variables, while the qualitative phase explained the reasons and contextual conditions underlying the quantitative results

2.1. Research Location and Timeframe

The study was conducted at SMK Canda Bhirawa Pare, Kediri Regency, East Java, Indonesia. This school was selected because it has implemented the Teaching Factory program as part of an industry based curriculum that is directly relevant to the focus of this study. Data collection took place during the 2026 school year.

2.2. Population and Sample

The population in this study consisted of three groups involved in the Teaching Factory (TEFA) program at SMK Canda Bhirawa Pare, namely students who were actively participating in the TEFA program, TEFA instructors who were directly involved in supervising or coordinating TEFA activities, and TEFA alumni who had participated in the TEFA program during their study and had subsequently entered the workforce.I chose these three groups because these three grous had experience with the implementation of TEFA technical SOPs, which made them relevant to the objectives of the study.

The inclusion criteria, for the student group were students who were not actively participating in the TEFA program at the time of data collection, students who were not actively participating in the TEFA program were not included. For the instructor group, the inclusion criteria were teachers who were directly involved as TEFA instructors, supervisors, or coordinators. Teachers who were not involved in the implementation or supervision of TEFA activities were

not included. For the alumni group, the inclusion criteria were former students who had participated in the TEFA program during their study at SMK Canda Bhirawa Pare and had subsequently entered the workforce. Individuals who had not participated in the TEFA program were not included in the alumni population.

The sampling technique used was total sampling, in which all members of the population were included as research respondents. According to [14] total sampling or saturation sampling is used when the population size is relatively small or when the researcher seeks more representative results by minimizing generalization error. In this study, the accessible population consisted of 13 active TEFA students, 13 TEFA instructors, and 14 TEFA alumni who met the specified inclusion criteria, resulting in a total of 40 individuals. Because all members of the accessible population could be reached during the data collection period, all 40 individuals were included as quantitative respondents. Thus, the sample represented the entire accessible TEFA population within the context of SMK Canda Bhirawa Pare, rather than a sample intended to represent TEFA populations across other schools.

Tables 1. Research Sample Profile

No	Kelompok Responden	Jumlah (n)
1	Siswa peserta Teaching Factory	13
2	Guru pembimbing Teaching Factory	13
3	Alumni Teaching Factory	14
	Total Responden	40

Source: Research data (2026)

2.3. Research Instrument

This study used two complementary data collection instruments: a questionnaire and a semi-structured interview guide. The questionnaire was used in the quantitative phase to measure respondents perceptions of the implementation of the Teaching Factory (TEFA) technical SOPs and students work readiness in accordance with industry standards. The Likert scale is a measurement instrument developed to assess the attitudes, opinions, and perceptions of an individual or group of people toward a social phenomenon [14]. In this study, the scale consisted of four response points, ranging from strongly disagree (score 1) to strongly agree (score 4).

The questionnaire consisted of 20 items, comprising 10 items measuring the implementation of TEFA technical SOPs and 10 items measuring student work readiness. The indicators of the TEFA technical SOP implementation variable were derived directly from the questionnaire statements and included: understanding of TEFA SOPs, ease of understanding and implementing SOPs, consistency of SOP implementation, clarity of work procedures, compliance with documentation procedures, reduction of work errors, conformity of TEFA workflows with industrial practices, evaluation and quality control, work order and effectiveness, and professional work culture.

The student work readiness variable consisted of ten indicators corresponding directly to the questionnaire items:technical skills required in the workplace, communication skills in the workplace, teamwork, problem solving skills, (5) work discipline, (6) responsibility for work, (7) understanding of industry quality standards, (8) self confidence in entering the workforce, (9) preparation for work according to industry needs, and (10) overall readiness for work.

Before being used in the study, the questionnaire was first reviewed by teachers involved in the Teaching Factory program at SMK Canda Bhirawa Pare to ensure that the indicators were aligned with the research objectives and the actual conditions of the Teaching Factory program. Based on the review, revisions were made according to the validators feedback. Subsequently, the questionnaire was calibrated through validity and reliability tests. The validity test was conducted on 20 items using the Corrected Item total correlation technique, with a coefficient greater than 0.30 indicating validity. The results showed that all 20 items were valid, with correlation values ranging from 0.451 to 0.728. The reliability test using Cronbach's Alpha yielded a coefficient of 0.932, indicating that the instrument had high internal consistency.

The questionnaire scores were analyzed descriptively using mean scores and percentage scores. The percentage score was calculated by comparing the obtained score with the maximum possible score and multiplying it by 100%. The interpretation criteria were very effective (85-100%), effective (70-84%), fairly effective (55-69%), less effective (40-54%), and ineffective (<40%). These criteria were used to determine the effectiveness category of each indicator and the overall variable.

The second instrument was a semi structured

interview guide used in the qualitative phase. The interview questions were developed after the quantitative results had been analyzed, particularly to explore findings that required further explanation or contextual interpretation. Thus, the qualitative instrument was directly connected to the quantitative findings, consistent with the Sequential Explanatory Mixed Method design.

2.4. Data Collection Method

Quantitative data was gathered by giving out a questionnaire to every person involved, these people included students, faculty advisors and alumni, the questionnaire had statements that could be measured, these statements were about how teaching factories technical SOPs were being used, they also included how ready the students were for jobs. Qualitative data came from two methods were, in depth interviews. The interviews were semi strructured. The people interviews were chosen on purpose, they were selected from students supervising teachers and alumni, the choice was based on the variety of their experiences and thei different points of view. Quantitative data collection was carried out first during the initial phase, and the results of that analysis were then used as the basis for developing the interview guide for the qualitative phase.

2.5. Data Analysis Techniques

In accordance with the Sequential Explanatory design, data analysis in this study was conducted in two sequential and interrelated phases.

In the quantitative phase, questionnaire data were analyzed using descriptive statistics, including calculations of means, percentages, and categorization of effectiveness. Effectiveness categories were defined based on the following percentage ranges: very effective (85-100%), effective (70-84%), moderately effective (55-69%), less effective (40-54%), and ineffective (<40%). This descriptive percentage analysis approach was chosen because it allows for a structured and easily interpretable depiction of the actual conditions of Teaching Factory SOP implementation.

in the qualitative phase, interview data were analyzed using a thematic analysis approach within the interactive analysis model proposed by Miles and Huberman [16]. The analysis consisted of three interconnected activities: data reduction, data display, and conclusion drawing/verification. First, the interview data from six informants (G1, G2, S1, S2, A1, and A2) were transcribed and reviewed repeatedly. Relevant statements concerning TEFA technical SOP implementation and students work readiness were identified and assigned initial codes. Similar codes were then grouped into categories based on recurring meanings across the interview responses.

Second, the coded data were organized into thematic displays to facilitate comparison among the three respondent groups: teachers, students, and alumni. The categories were examined for recurring patterns and relationships, and were subsequently developed into five main themes: (1) implementation of SOPs, (2) work discipline, (3) work responsibility, (4) industrial work culture, and (5) students' work readiness. For example, statements from G1 and G2 concerning the consistent application and supervision of SOPs, together with S1's statement that SOPs helped students understand work procedures, were grouped under the theme of implementation of SOPs. Statements from G1 and S1 concerning students adherence to work rules and procedures were grouped under work discipline, while statements from S2 and G2 concerning responsibility, systematic work processes, and reduction of errors were grouped under work responsibility. Statements from G2, S2, A1, and A2 concerning systematic work habits, industrial standards, discipline, and adaptation to workplace conditions contributed to the theme of industrial work culture. Finally, statements from G1, S1, S2, A1, and A2 concerning preparation for entering and adapting to the workforce were grouped under students work readiness.

Third, conclusions were drawn and verified by comparing the themes across informants and respondent groups and by relating the qualitative findings to the quantitative results. Source triangulation was conducted by comparing information obtained from teachers, students, and alumni, while methodological triangulation was conducted by comparing questionnaire and interview findings. These procedures were used to identify convergence and differences across data sources and methods and to strengthen the credibility of the interpretation [17].

The qualitative analysis therefore followed the sequence transcription, initial coding, categorization, theme development, cross informant comparison, verification and interpretation. The resulting themes were then integrated with the quantitative findings during the interpretation stage of the sequential explanatory design, particularly to explain and contextualize the quantitative results.

2.6. Data Triangulation

To strengthen the credibility of the findings, this study employed source triangulation by comparing information obtained from three groups of informants: TEFA supervising teachers, students, and alumni [17]. The comparison was conducted by examining the consistency of information across informants regarding the implementation of TEFA technical SOPs and students work readiness. The researchers compared recurring meanings, supporting statements, and differences across the three groups in relation to the five qualitative themes: SOP implementation, work discipline, work responsibility, industrial work culture, and students' work readiness. For example, teachers described the consistent implementation and supervision of SOPs, students described how SOPs helped them

understand work procedures and develop discipline, while alumni described the contribution of TEFA experience to their adaptation to workplace conditions. When similar patterns were identified across different respondent groups, the information was considered convergent and used to strengthen the interpretation of the corresponding finding. Differences among groups were retained and considered as contextual information rather than being treated as contradictions.

Methodological triangulation was conducted by comparing the quantitative questionnaire results with the qualitative interview findings. The comparison was performed after the quantitative analysis by identifying findings that required further explanation and examining how the interview data supported, explained, or expanded those findings. For example, the quantitative results showed that the implementation of TEFA technical SOPs was classified as very effective, with an overall percentage of 87,88%, while student work readiness reached 88,06%. The qualitative findings provided an explanatory account of these results. The theme of SOP implementation showed that teachers and students described SOPs as consistently applied and supervised during TEFA activities. The themes of work discipline and work responsibility further explained how repeated adherence to procedures contributed to orderly and responsible work habits. Meanwhile, the themes of industrial work culture and students work readiness showed how these habits were connected to students understanding of workplace standards, confidence, and adaptation to industrial environments.

The integration of quantitative and qualitative data therefore occurred through an explanatory sequence. The quantitative phase first identified the level and pattern of TEFA technical SOP implementation and student work readiness, while the qualitative phase was subsequently used to explain the processes and experiences underlying those numerical findings. Thus, the qualitative results did not merely repeat the quantitative results; they provided contextual explanations of how and why the observed high ratings were reflected in students' work habits and workplace preparation. Conversely, the qualitative findings also provided contextual information that could not be obtained from the questionnaire alone, particularly regarding discipline, responsibility, industrial work culture, and adaptation to workplace expectations. The integrated interpretation therefore combined the magnitude of the findings from the quantitative phase with the experiential and contextual explanations from the qualitative phase, consistent with the Sequential Explanatory design [13].

3. Results and Discussion

3.1 Respondent Profile

This study involved 40 respondents divided into three groups 13 students actively participating in the Teaching Factory (TEFA) program, 13 TEFA supervising teachers/coordinators, and 14 TEFA alumni who had entered the workforce. The respondents were selected using total sampling, so all members of the accessible population in each group were included in the study. The distribution of respondents is presented in Table 2.

Based on Table 2, the respondents consisted of 13 TEFA students (32,5%), 13 TEFA supervising teachers/coordinators (32,5%), and 14 TEFA alumni (35,0%). The student group represents participants who were directly involved in current TEFA activities, while the teacher group represents those responsible for supervising and coordinating the program. The alumni group represents graduates who had previously participated in TEFA and subsequently entered the workforce. These three groups therefore provide complementary perspectives on the implementation of TEFA technical SOPs and students work readiness.

For the alumni group, the analysis was based on their status as TEFA participants who had entered the workforce. Graduation cohort and specific program pathway were not included as respondent-profile variables in the questionnaire; therefore, the interpretation of the findings was not differentiated based on alumni cohort or program pathway.

Tables 2. Distribution of Research Respondent Profiles

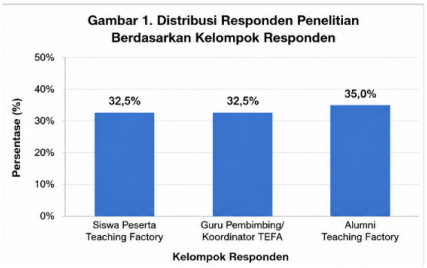
No.	Kelompok Responden	Jumlah (n)	Persentase (%)	Keterangan
1	Siswa Peserta Teaching Factory	13	32,5 %	Aktif mengikuti TEFA
2	Guru Pembimbing/Koordinator TEFA	13	32,5 %	Guru pembimbing & koordinator
3	Alumni Teaching Factory	14	35,0 %	Telah memasuki dunia kerja

Total	40	100 %	—

Source: Data primer (2026)

Based on Table 2, the alumni group was the largest, with 14 respondents (35,0%), followed by students and teachers, each with 13 respondents (32,5%). The relatively balanced composition among the three groups reflects an effort to obtain a comprehensive picture of the implementation of the Teaching Factory technical SOPs from various perspectives:

Figures 1. Distribution of Research Respondents by Respondent Group



the perspectives of facilitators (teachers), active participants in the learning process (students), and those who have had firsthand experience in the workforce (alumni). This diversity of data sources aligns with the principle of data triangulation used in the study, so the resulting findings are expected to be more credible and representative.

3.2. Results of the Analysis of Variables Affecting the Implementation of Technical SOPs in Teaching Factories

The variables related to the implementation of the Teaching Factory technical SOPs were measured using a 10 item instrument covering aspects of understanding, consistency, compliance with industry standards, and the impact of the SOPs on work processes. Descriptive statistical analysis, including calculations of the mean and percentage of effectiveness, was conducted on all respondents (n = 40). The criteria for categorizing effectiveness refer to the ranges established in the research method: very effective (85-100%), effective (70-84%), fairly effective (55-69%), less effective (40-54%), and ineffective (<40%). The results of the analysis for each indicator are presented in Table 3 below.

Tables 3. Descriptive Analysis of Variables Related to the Implementation of TEFA Technical SOPs

No.	Indikator	*Mean*	Persentase (%)	Kategori
1	Saya memahami SOP yang diterapkan dalam kegiatan TEFA	3.48	86,88 %	Sangat Efektif
2	SOP TEFA mudah dipahami dan dilaksanakan	3.52	88,12 %	Sangat Efektif
3	SOP diterapkan secara konsisten dalam setiap kegiatan TEFA	3.52	88,12 %	Sangat Efektif
4	Setiap kegiatan TEFA memiliki prosedur kerja yang jelas	3.52	88,12 %	Sangat Efektif
5	Dokumentasi kegiatan dilakukan sesuai SOP yang berlaku	3.45	86,25 %	Sangat Efektif
6	Penerapan SOP membantu mengurangi kesalahan dalam pekerjaan	3.58	89,38 %	Sangat Efektif
7	Kegiatan TEFA telah sesuai dengan alur kerja yang diterapkan	3.50	87,50 %	Sangat Efektif

	di industri			
8	Kegiatan evaluasi dan *quality control* dilakukan sesuai prosedur	3.55	88,75 %	Sangat Efektif
9	Penerapan SOP membuat proses kerja lebih teratur dan efektif	3.48	86,88 %	Sangat Efektif
10	SOP TEFA mendukung terciptanya budaya kerja yang profesional	3.55	88,75 %	Sangat Efektif
Rata-rata Variabel		3,51	87,88 %	Sangat Efektif

Source: Processed primary data (2026)

Based on Table 3, all indicators of the variables related to the implementation of technical SOPs in the Teaching Factory fall into the very effective category. The highest scoring indicator was the implementation of SOPs helps reduce errors in work (mean = 3.58), followed by the indicators for evaluation and quality control, as well as professional work culture, each of which achieved a mean of 3,55. The high scores on these three indicators suggest that the role of SOPs as a quality control tool and a shaper of work culture has been well internalized by the respondents. This makes sense, given that these three aspects are the elements students most frequently encounter in their direct interactions with the day to day TEFA production process.

The indicator with the lowest score was documentation of activities is carried out in accordance with applicable SOPs (mean = 3.45). Although it remains in the very effective category, this relatively lower score is consistent with the findings of the study's initial observations, which showed that the documentation aspect is the dimension most prone to inconsistency. Documentation tends to be perceived as an additional administrative burden compared to the technical aspects of performing the work; therefore, compliance with it requires more intensive habituation. The overall average for the TEFA technical SOP implementation variable reached 87,88%, which falls into the very effective category. The bar chart showing the percentage of effectiveness for each indicator of the TEFA technical SOP implementation variable is presented as follows:

Figures 2. Presentase of Implementation of TEFA Technical SOPs

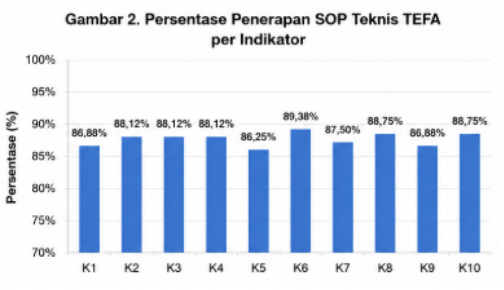


Figure 2 shows that all indicators of TEFA technical SOP implementation achieved percentages ranging from 86,25% to 89,38%, with an overall percentage of 87,88%. The difference between the highest and lowest indicator was 3.13 percentage points, indicating that the respondents' assessments across the SOP implementation indicators were within a relatively narrow range. Therefore, the results show a relatively consistent assessment across the measured dimensions of TEFA technical SOP implementation.

3.3. Results of the Analysis of Student Work

Readiness Variables Student work readiness was measured using a 10 item instrument covering the following aspects: technical skills, communication skills, teamwork, problem solving skills, discipline, responsibility, understanding of industry quality standards, self confidence, and overall work readiness. The results of the descriptive statistical analysis are presented in Table 4 below.

Tables 4. Descriptive Analysis of Student Work Readiness Variables

No.	Indikator	*Mean*	Persentase (%)	Kategori
1	TEFA meningkatkan keterampilan teknis yang dibutuhkan dunia kerja	3.50	87,50 %	Sangat Efektif
2	TEFA	3.40	85,00	Sangat

	meningkatkan kemampuan komunikasi dalam lingkungan kerja		%	Efektif
3	TEFA meningkatkan kemampuan bekerja sama dalam tim	3.58	89,38 %	Sangat Efektif
4	TEFA meningkatkan kemampuan memecahkan masalah saat bekerja	3.48	86,88 %	Sangat Efektif
5	TEFA meningkatkan kedisiplinan dalam bekerja	3.50	87,50 %	Sangat Efektif
6	TEFA meningkatkan rasa tanggung jawab terhadap pekerjaan	3.55	88,75 %	Sangat Efektif
7	TEFA membantu memahami standar kualitas yang digunakan di industri	3.42	85,62 %	Sangat Efektif
8	TEFA meningkatkan kepercayaan diri dalam menghadapi dunia kerja	3.60	90,00 %	Sangat Efektif
9	TEFA membantu mempersiapkan diri untuk bekerja sesuai kebutuhan industri	3.52	88,12 %	Sangat Efektif
10	Secara keseluruhan, penerapan SOP TEFA efektif dalam mempersiapkan SDM yang siap kerja	3.67	91.88 %	Sangat Efektif
	Rata-rata Variabel	3,52	88,06 %	Sangat Efektif

Based on Table 4, all indicators of students' work readiness fall into the very effective category based on the predetermined effectiveness criteria. The questionnaire used a four point Likert scale ranging from 1 (Strongly Disagree) to 4 (Strongly Agree). The effectiveness percentage was calculated by comparing the obtained score with the maximum possible score and multiplying it by 100%. Based on the predetermined criteria, percentage scores of 85-100% are classified as very effective, 70-84% as effective, 55-69% as fairly effective, 40-54% as less effective, and below 40% as ineffective.

The percentage scores of the ten work-readiness indicators ranged from 85,00% to 91,88%. Thus, all indicators exceeded the minimum cut off of 85% for the very effective category. The highest scoring indicator was overall, the implementation of TEFA SOPs is effective in preparing students to be job ready (mean = 3.67, 91,88%), followed by TEFA boosts students confidence in entering the workforce (mean = 3.60; 90,00%). The difference between the highest and lowest indicator scores was 6,88 percentage points, indicating that the measured work readiness indicators were generally rated highly.

The item level response frequency distribution was not analyzed in this study therefore, the findings are interpreted based on the mean and percentage scores reported for each indicator rather than on the distribution of responses across the four likert categories. These results indicate that respondents generally gave high ratings to the measured dimensions of students work readiness, particularly overall work preparation and self confidence.

The indicator with the lowest score was "TEFA improves communication skills in the workplace" (mean = 3.40; 85,00%). Although it was still classified as very effective, this score was relatively lower than those of the other indicators and warrants further analytical consideration. Communication skills are soft skills whose development requires social interaction, direct feedback, and diverse work situations. In the context of TEFA, production activities tend to be structured around technical and procedural aspects, so opportunities to practice interpersonal communication, such as oral reporting, negotiation, or cross role communication, may be less prominent. This finding provides an important consideration for TEFA managers to design learning scenarios that explicitly integrate communication exercises into the production workflow. The overall average for the work readiness variable reached 88,06%, which falls into the very effective category. The bar chart showing the percentage of effectiveness for each indicator of student work readiness is presented as follows:

Figures 3. Percentage of Student Work Readiness by Indicator

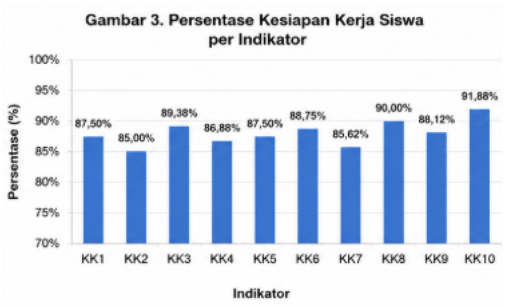


Figure 3 shows that the percentages for all indicators of student work readiness fall within a high and even range, with K10 (overall effectiveness) and K8 (self confidence) ranking at the top. This even distribution pattern indicates that respondents assessments of TEFA's impact.

3.4 Summary of Research Findings

To provide a comprehensive overview of the overall research findings, a summary of the two research variables is presented in Table 5 below.

Table 5. Summary of the Analysis Results for the Two Research Variables

No.	Variabel	Jumlah Indikator	*Mean*	Persentase (%)	Kategori
1	Penerapan SOP Teknis TEFA	10	3,51	87,88 %	Sangat Efektif
2	Kesiapan Kerja Siswa	10	3,52	88,06 %	Sangat Efektif
Rata-rata Keseluruhan			3,52	87,97 %	Sangat Efektif

Source: Processed primary data (2026)

Table 5 shows that both research variables fall into the very effective category based on the predetermined effectiveness criteria. The TEFA technical SOP implementation variable obtained an effectiveness percentage of 87,88%, while the students' work readiness variable obtained 88,06%, resulting in a difference of 0.18 percentage points. Both percentages are within the same very effective category, indicating that the overall ratings for the two measured variables were similarly high. However, the similarity in category and percentage should be interpreted descriptively, as this study did not conduct a statistical analysis to examine the relationship or causal association between TEFA technical SOP implementation and students' work readiness. The overall average across the two variables was 87,97%, which also falls within the very effective category. The bar chart comparing the effectiveness percentages of the two variables is presented as follows

Figures 4. Comparison of the Percentages of Research Variables

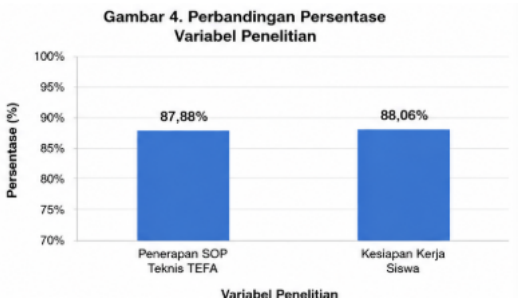


Figure 4 confirms that both variables fall into the same category namely, very effective with nearly identical percentages. The alignment of categories between the SOP implementation variable and the work readiness variable indicates that a high level of implementation of TEFA technical SOPs is accompanied by a high assessment of students work readiness.

3.5. Source Triangulation

To verify and strengthen the validity of the findings, source triangulation was conducted by comparing data from three different sources: overall questionnaire results, teacher interview results, student interview results, and alumni interview results. To support quantitative triangulation, average questionnaire scores were also calculated based on respondent groups from the primary data. The results of the comparison are presented in Table 6 below.

Tables 6. Comparison of Perceptions Among Three Groups of Respondents (Source Triangulation)

Kelompok	n	*Mean* SOP	% SOP	*Mean* Kesiapan	% Kesiapan	Kategori
Guru	13	3.57	89,23 %	3.62	90,38 %	Sangat Efektif
Siswa	13	3.38	84,42 %	3.49	87,31 %	Sangat Efektif
Alumni	14	3.59	89,82 %	3.46	86,61 %	Sangat Efektif

Source: Processed primary data (2026)

Table 6 shows that all three respondent groups consistently rated both research variables as very effective. This convergence reinforces the credibility of the finding that the implementation of TEFA technical SOPs at SMK Canda Bhirawa Pare is highly effective from various perspectives.

Variations in scores across groups provide important analytical insights. Teachers scored highest on the work readiness variable, which is understandable since they observe students progress directly and continuously throughout the learning process. Alumni scored highest on the SOP variable, reflecting their ability to compare their TEFA experiences with real-world job demands; alumni evaluations are, in fact, the most objective form of external validation because they are provided after the alumni have directly experienced the relevance of these SOPs in the industry. Students showed slightly lower scores on the SOP variable compared to the other two groups, which is reasonable given that students are active practitioners who directly face the challenges and obstacles of daily SOP implementation including documentation aspects, which were also recorded as the lowest indicator in the per-indicator analysis.

The convergence of findings from these three groups with different perspectives aligns with the principle of source triangulation as proposed by Moleong (2017). These survey findings are further supported by interview data presented in the following subsection.

3.6 Interview Results

Semi structured interviews were conducted with six informants selected through purposive sampling, consisting of two teachers (T1 and T2), two current students (S1 and S2), and two alumni (A1 and A2). The interview data were used to support and clarify the quantitative findings. The interview findings were grouped into five main themes aligned with the research indicators, as follows**.**

a. Implementation of SOPs

All informants confirmed that SOPs are implemented at every stage of Teaching Factory activities. G1 stated that before practical activities begin, students are given instructions regarding the work procedures they must follow in accordance with established standards. G2 stated that SOPs are consistently applied in every practical activity and that teachers always supervise to ensure students perform their tasks according to procedure. From the students perspective, S1 stated that SOPs help them understand the steps they must take during practical training, making their work more focused. These statements from the three informants reinforce the quantitative findings, which indicate that the consistent implementation of SOPs is one of the indicators with the highest scores in the TEFA technical SOP implementation variable.

b. Work Discipline

Interview data indicate that the implementation of SOPs is assessed as having a positive impact on students work discipline. G1 stated that SOPs help improve discipline because students must follow predetermined work rules, making them more orderly, punctual, and responsible for the tasks assigned. S1 stated that through TEFA activities, they have become more disciplined, more meticulous, and have a better understanding of how to work according to the correct procedures. These statements reinforce the quantitative findings, which indicate that work discipline is one of the indicators with a high rating in the variable of students' work readiness.

c. Work Responsibility

The aspect of work responsibility was supported by the interview data. S2 stated that in TEFA activities, students must follow every established procedure so that they

become more responsible for the results of their work. G2 stated that SOPs help students understand the workflow systematically, making them more meticulous and able to reduce errors during the practical process. These statements align with the quantitative findings, which identify work responsibility as one of the indicators of work readiness, with consistently high ratings from all three respondent groups.

d. Industrial Work Culture

The informants also expressed positive views on the development of an industrial work culture through TEFA. G2 stated that the SOPs used were developed based on industrial work practices, allowing students to gain learning experiences that closely resemble real-world work conditions. S2 noted that the SOPs make work more structured, enabling students to complete tasks more effectively and reduce errors. Alumnus A1 noted that the SOPs implemented during the Teaching Factory program were quite relevant to the procedures used in the workplace, which helped with the adaptation process when starting their first job. A2 noted that TEFA instilled the habit of working systematically and in accordance with established standards. The convergence of statements from these four informants from different groups confirms that the development of an industrial work culture is a consistently felt impact of TEFA, both by active participants and by those who have entered the workforce.

e. Students' Work Readiness

Students work readiness received positive evaluations from all groups of experts. G1 stated that through SOPs, students become accustomed to working according to industry standards, giving them a clearer picture of the work culture they will encounter in the workforce. S1 stated that the TEFA experience was very helpful because students were accustomed to working according to the rules and standards applicable in the workplace. S2 stated that their confidence had increased because they were already accustomed to working according to procedures similar to those applied in the industry. A1 stated that the experience of participating in the Teaching Factory greatly aids work readiness because many work habits have been cultivated since their time in school. A2 stated that TEFA makes it easier to adapt to the workplace because students already understand the work culture, discipline, and responsibilities required in an industrial setting, and recommended that the implementation of SOPs be maintained and continuously adapted to evolving industry needs. Taken together, these statements from the informants qualitatively confirm that the implementation of TEFA's technical SOPs makes a tangible contribution to the development of students' comprehensive work readiness encompassing technical aspects, professional attitudes, discipline, and the ability to adapt to an industrial work environment.

3.7 Discussion

The overall research results indicate that the implementation of the Teaching Factory technical SOPs at SMK Canda Bhirawa Pare is classified as very effective, both in terms of SOP implementation (87,88%) and student work readiness (88,06%). These findings warrant in-depth discussion in light of the theoretical framework and relevant prior research.

First, the high effectiveness rate of the variable implementation of TEFA technical SOPs (87,88%) is consistent with the view that [9] which states that SOPs based on industry standards accustom students to work in a structured manner in accordance with the work procedures applicable in the industrial world. The results of this study indicate that the implementation of SOPs in the TEFA program at SMK Canda Bhirawa Pare serves not only as a technical guide but also as an instrument for fostering a work culture that closely resembles real-world industrial conditions. This aligns with the concept of the Teaching Factory as a learning model that integrates real production processes into learning activities [1] so that students gain authentic and contextual learning experiences. Nevertheless, these findings should be interpreted critically, bearing in mind that the study's initial observations actually identified inconsistencies in the implementation of SOPs, particularly regarding documentation and adherence to workflows. The discrepancy between the initial observation findings and these survey results can be explained by two possibilities first, positive developments in SOP implementation as the TEFA program progressed; second, a gap between respondents' perceptions of the SOPs and the actual conditions of their implementation in the field. Therefore, these highly effective results should not be interpreted as a perfect state, but rather as an achievement that still needs to be maintained and strengthened through continuous SOP monitoring and evaluation mechanisms.

Second, the high value of the student work readiness variable (88,06%) is consistent with the definition of work readiness proposed by [3], namely, a state in which an individual possesses the necessary skills, attitudes, and knowledge to enter and succeed in the workforce. The survey results indicate that by becoming accustomed to working in accordance with standard operating procedures (SOPs), students at SMK Canda Bhirawa Pare gain experience that prepares them to meet the comprehensive demands of the industrial workforce, encompassing technical skills, discipline, responsibility, communication, and teamwork. These findings are consistent with the argument [2] that work

readiness is a multidimensional construct that requires real world work experience.

Third, when compared with previous studies, the findings of this study are consistent with the results of [11] which found that production based learning in the Teaching Factory model can improve students practical skills, work discipline, ability to collaborate, and understanding of industrial work procedures. Furthermore, these findings are consistent with a study conducted by [10] regarding the implementation of TEFA at SMKN 1 Singosari in Malang, which shows that the application of TEFA helps students understand the industrial work culture and get accustomed to working in accordance with established procedures. The consistency of these findings across different contexts indicates that TEFA's high effectiveness is not a result unique to a single school, but rather a consistent pattern in the implementation of TEFA at various vocational high schools.

Fourth, the results of source triangulation show that all three groups of respondents teachers, students, and alumni consistently rated the program as very effective. The higher ratings given by teachers for the work readiness variable (90,38%) are understandable given their role as direct observers of student development. Alumni gave higher ratings on the SOP variable (89,82%), while students ratings on the SOP variable were lower than those of teachers and alumni. This gap indicates that those actively implementing the SOPs face implementation challenges that are not always apparent from the perspective of observers or alumni. Students directly face the complexities of applying SOPs in real-world work conditions including time pressures, limited documentation, and team dynamics which may influence their perceptions of the ease and consistency of SOPs. Teachers higher ratings on the work readiness variable (90,38%) are understandable given their role as direct observers of student progress.

The higher ratings given by alumni for the SOP variable (89,82%) reflect evaluations based on real-world work experience, which can serve as a basis for external validation. Interview data from all six informants consistently corroborate the survey results, confirming that the implementation of TEFA's SOPs is proceeding smoothly and that all stakeholders are experiencing its benefits.

Fifth, the communication skills indicator showed the lowest score among the work readiness indicators, with an effectiveness percentage of 85,00%, although it remained within the very effective category. This finding indicates that communication skills received relatively lower ratings than the other measured work-readiness indicators. The communication skills indicator was included a priori as one of the predetermined dimensions of student work readiness in the questionnaire. Therefore, its relatively lower score is interpreted descriptively as an area that received comparatively lower ratings from respondents, rather than as evidence of a specific implementation gap in the TEFA program. The qualitative findings in this study confirmed the broader contribution of TEFA to students work readiness, including discipline, responsibility, industrial work culture, and preparation for entering the workforce; however, the interview data did not specifically examine the mechanisms underlying the lower communication skills score. Therefore, further research could specifically explore how TEFA activities provide opportunities for students to practice workplace communication skills, including reporting, coordination, and interaction within work teams

3.8 Synthesis of Research Findings

Based on all the quantitative and qualitative analysis results presented, this study yielded several key findings that can be summarized as follows. First, the results of the des Based criptive statistical analysis show that the variables of TEFA technical SOP implementation and student work readiness are both in the very effective category, with percentages of 87,88% and 88,06%, respectively. The high level of TEFA technical SOP implementation was accompanied by high ratings of student work readiness, although this study did not measure the causal relationship between the two. These achievements should be interpreted as a starting point for ongoing evaluation, given the indications of a gap between respondents perceptions and the actual conditions identified in the initial observations of the study.

Second, source triangulation revealed consistency in the assessments of the three groups of respondents, who held different perspectives. All three groups teachers, students, and alumni consistently rated the implementation of TEFA technical SOPs as very effective. This consistency is reinforced by interview data showing that informants from all three groups gave positive responses regarding the implementation of the SOPs and their impact on preparation for entering the workforce. Nevertheless, the difference in ratings between the student group and the teacher and alumni groups indicates that implementation challenges at the frontline level still require further attention.

Third, the findings of this study have practical implications for SMK Canda Bhirawa Pare and vocational schools in general. The results indicate that standardization and consistency in the implementation of SOPs within the Teaching Factory program are strategic steps that provide tangible benefits for industry based learning processes. Two aspects that need to be strengthened are the consistency of SOP documentation

and the development of students communication competencies; both of these dimensions scored relatively lower than other indicators, although they still fell within the highly effective category. For the industrial sector, these findings indicate that vocational high school graduates who have participated in the TEFA program with standardized SOPs are adequately prepared for the workforce.

Fourth, from the perspective of vocational education policy, the findings highlight the importance of maintaining and updating TEFA technical SOPs in alignment with industry needs. In this study, the TEFA technical SOP implementation variable obtained an overall effectiveness score of 87,88%, with the lowest indicator being documentation compliance (86,25%). This finding suggests that continuous attention to SOP documentation and alignment with workplace practices remains relevant, even though the overall implementation was classified as very effective. Such efforts are consistent with the policy direction of Presidential Instruction No. 9 of 2016 on the Revitalization of Vocational High Schools, which emphasizes improving and aligning vocational education curricula and competencies with the needs of graduate users and strengthening cooperation between vocational schools and the business and industrial sectors. the policy implication of this study is not the establishment of a new standardized SOP mandated by the policy, but the continued review and updating of existing TEFA SOPs to ensure their relevance to current workplace requirements

Overall, This study gives a picture that using the teaching factory technical SOPs in a steady and organized war works very well at SMK Canda Bhirawa Pare. Still having effectiveness does not show that everything was perfect, there are still problems, with how documentation kept, with how different group see things and with how we talk to one another. These three areas need work fot the future of the TEFA program, the results give evidence that we can keep improving, checking and tweaking the teaching factory program especially when it comes to how we communicate and how we change the SOPs to fit what the industry needs.

4. Conclusion

The Technical Standard Operating Prosedures of the Taching Factpry have been successfully implemented at SMK Canda Bhirawa Pare and have proven their effectiveness in bringing students up to industri standards in preparation work.Research shows that including industry standard operating posedures in vocational training does more than just give students technical guidance, it also helps build important work habits like being disciplined, taking responsibility, following correct processes, and understanding th culture of working in industry. The blending of quantitative and qualitative data supports the idea that when TEFA is applied in a structured and consistent way it helps close the gap, between what vocational high school graduate know and what the workforce actually needs. These results show that standard operating procedures do more than just guide how tasks are done in the teaching factory, they also serve as learning tools, they help students get ready for jobs, this readiness lines up with what industries expect, when standard operating procedures are used in class students learn how tasks are done in work settings, it makes their training feel like real life and actually useful. students follow steps like workers do on the job, this builds confidence and skill. technical SOPs are not just rules, they are part of the learning plan, they show students the way to do their work and help them do it in a smart and effective way. Thats why they are very important in helping students get ready, for their careers

In practical terms, the results of this study indicate that the application of technical SOPs needs to be made an integral part of the Teaching Factory program at vocational high schools. Schools need to ensure the availability and implementation of standardized SOPs instructors need to streng then their guidance based on industry procedures and TEFA administrators need to periodically evaluate and update SOPs in line with evolving industry needs. Furthermore, strengthening aspects of communication, collaboration, and a professional work culture must continue to be integrated into the implementation of the Teaching Factory program. Future research is recommended to test the application of an SOP based Teaching Factory model in vocational high schools with different fields of expertise and industry characteristics to broaden the validity of the findings and their contribution to the development of vocational education.

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