

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;
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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 (SMK), as vocational education institutions, are designed to produce graduates with technical competencies that meet the needs of the business and industrial sectors (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 is in line with the dynamics of the Fourth Industrial Revolution, which demands that the workforce not only be technically proficient but also adaptable to technological changes, possess a strong work ethic, and be able to work in accordance with standard industry procedures [1]. In an effort to address these demands, SMK Canda Bhirawa Pare as one of the vocational schools—has developed a Teaching Factory (TEFA) program to align the learning process more closely with industrial work practices. However, based on initial observations of 13 students participating in the Teaching Factory, it was found that the implementation of standard operating procedures (SOPs) has not been consistent, particularly regarding work documentation and adherence to 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]. In 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]. Thus, developing vocational high school students' work readiness cannot be achieved solely through conventional, purely theoretical learning approaches but must be supported by industry-based learning that provides students with real-world work experience.

However, 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. Therefore, this study focuses on analyzing the effectiveness of implementing technical SOPs in Teaching Factories to foster students' work readiness in accordance with industry standards, thereby addressing the existing research gap in studies on Teaching Factories in vocational 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). yaitu suatu pendekatan penelitian campuran yang which is a mixed-methods research approach that places the collection and analysis of quantitative data in the first phase, followed by the collection and analysis of qualitative data in the second phase to expand upon and deepen the quantitative findings obtained. This design was chosen because the phenomenon of implementing the Teaching Factory technical SOP at SMK Canda Bhirawa Pare cannot be fully understood through numbers alone; an exploration of meaning, process, and context is required, which can only be uncovered through qualitative data. Thus, the quantitative phase serves to measure students' work readiness in a structured manner, while the

qualitative phase provides an in-depth explanation of the factors underlying those 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 comprises three groups, namely: (1) all students actively participating in the Teaching Factory program, (2) all Teaching Factory instructors, and (3) alumni who have participated in the Teaching Factory program at SMK Canda Bhirawa Pare. The selection of these three population groups was based on the consideration that a comprehensive understanding of the effectiveness of implementing the Teaching Factory's technical SOPs requires perspectives from active learners, facilitators, and those who have directly experienced its impact in the workplace.

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. The use of total sampling in this study was deemed appropriate given that the population size in each group was relatively small, allowing all members of the population to be reached as data sources.

Tabel 1. Research Sample Profile

No	Kelompok Responden	Jumlah (n)	Persentase
1	Siswa peserta Teaching Factory	13	32,5%
2	Guru pembimbing Teaching Factory	13	32,5%
3	Alumni Teaching Factory	14	35%
	Total Responden	40	100%

Source: Research data (2026)

2.3. Research Instrument

This study used two complementary data collection instruments. First, a questionnaire using a Likert scale was used to measure respondents' perceptions of the implementation of the Teaching Factory's 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 phenomena[14]. In this study, the scale used consisted of four response points, ranging from "Strongly Disagree" (score 1) to "Strongly Agree" (score 4). Before being used in the study, the questionnaire was first reviewed by teachers at the Teaching Factory program at SMK Canda Bhirawa Pare to ensure that the indicators aligned with the research objectives and the conditions under which the Teaching Factory program is implemented at the school. Based on the results of this review, the instrument was deemed suitable for use with several revisions based on the validators' feedback. Subsequently, the questionnaire was calibrated through validity and reliability tests to ensure the suitability of the measurements. The validity test was conducted on 20 items using the Corrected Item-Total Correlation technique, with a criterion of a value > 0.30 indicating validity. The test results showed that all items were deemed valid, with correlation values ranging from 0.451 to 0.728; thus, all items were deemed suitable for retention. The reliability test, using Cronbach's Alpha, yielded a value of 0.932, indicating that the instrument is highly reliable and suitable for use.

Second, semi-structured interviews were conducted with selected informants to gather more in-depth qualitative data. Semi-structured interviews were chosen because they allow the interviewer to explore the respondents' answers more openly, while still staying focused on the main research issues[15]. The interview guidelines were developed based on the implementation dimensions of the Teaching Factory SOP and work readiness indicators in accordance with industry standards.

2.4. Data Collection Method

Quantitative data were collected by distributing a questionnaire to all respondents (students, faculty advisors, and alumni) containing measurable statements regarding the implementation of the Teaching Factory's technical SOPs and students' level of job readiness. Qualitative data was obtained through two methods: (1) in-depth, semi-structured interviews with informants selected purposively from among students, supervising teachers, and alumni based on the diversity of their experiences and perspectives. 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 an interactive analysis model[16], which consists of three simultaneously occurring activity streams: (1) data reduction, namely the process of selecting, focusing, simplifying, and transforming raw data derived from field notes; (2) data presentation, which involves organizing the reduced data into a structured format such as narrative text, matrices, or charts to enable the drawing of conclusions; and (3) conclusion-drawing/verification, which involves systematically interpreting the presented data to produce credible and scientifically accountable findings.

2.6. Data Triangulation

To ensure the validity and credibility of the data, this study employed source triangulation, which involves comparing and verifying the reliability of information obtained from three distinct groups of sources: students, guidance counselors, and alumni[17]. In addition to source triangulation, methodological triangulation was also conducted by comparing data obtained through questionnaires and interviews. This triangulation process ensures that the research findings are not based solely on a single perspective or a single type of instrument but rather reflect a convergence of various sources and data collection methods.

The integration of quantitative and qualitative data took place during the interpretation phase, where quantitative findings in the form of numbers and percentages were reinforced, clarified, and deepened by qualitative findings that described the mechanisms and contexts behind those figures. This mixed-methods approach with a Sequential Explanatory design, as noted by [13] as proven effective in providing a more comprehensive and holistic picture of complex educational phenomena, including the implementation of the Teaching Factory program in the context of vocational education.

3. Results and Discussion

3.1 Respondent Profile

This study involved 40 respondents divided into three groups: students participating in the Teaching Factory program, Teaching Factory advisors/coordinators, and Teaching Factory alumni from SMK Canda Bhirawa Pare. Respondents were selected using total sampling due to the limited size of the population in each group. The complete distribution of respondents is presented in Table 2 below.

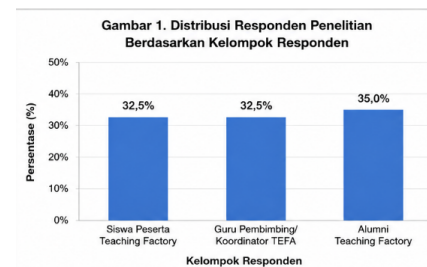
Table 2. Distribution of Research Respondent Profiles

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's technical SOPs from various perspectives:

Figure 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.

Table 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	3.5	88.12	Sangat Efektif

	lebih teratur dan 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

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.

Figure 2. Presentase of Implementation of TEFA Technical SOPs

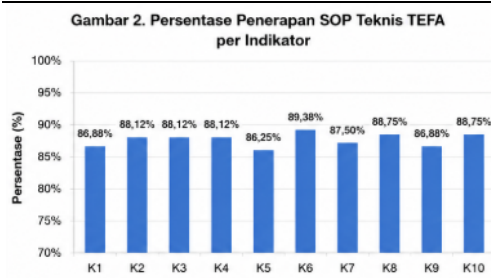


Figure 2 shows that all indicators have percentages above 85% with an even distribution pattern, indicating consistency in respondents' assessments of all dimensions of SOP implementation in Teaching Factory activities.

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.

Table 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 meningkatkan kemampuan komunikasi dalam lingkungan kerja	3.40	85.00 %	Sangat Efektif
3	TEFA meningkatkan kemampuan bekerja sama dalam	3.58	89.38 %	Sangat Efektif

tim				
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	3.67	91.88 %	Sangat Efektif

dalam
mempersiap
kan SDM
yang siap
kerja

Rata-rata Variabel	3,52	88,06 %	Sangat Efektif
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Based on Table 4, all indicators of students' work readiness fall into the "Very Effective" category. The highest-scoring indicators are "Overall, the implementation of TEFA SOPs is effective in preparing students to be job-ready" (mean = 3.67) and "TEFA boosts students' confidence in entering the workforce" (mean = 3.60). The high scores on these two indicators reflect that real-world work experience in TEFA has a significant psychological impact students not only acquire technical skills but also build the self-confidence that they are capable of working according to industry standards.

The indicator with the lowest score was "TEFA improves communication skills in the workplace" (mean = 3.40). Although it is still classified as "Very Effective," this score is relatively lower than that of other indicators and warrants further analytical scrutiny. Communication skills are soft skills whose development requires intensive social interaction, direct feedback, and diverse work situations. In the context of TEFA, production activities tend to be more structured in terms of technical and procedural aspects, so opportunities to practice interpersonal communication such as negotiation, oral reporting, or cross-role communication—have not been fully accommodated. This serves as an important note for TEFA managers to design learning scenarios that explicitly integrate communication exercises into the production workflow. The overall average for work readiness variables 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:

Figure 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, with a very small percentage difference between them. The parity of these categories is not merely a statistical coincidence it reflects a functional relationship between the implementation of structured SOPs and the development of students' work readiness. When SOPs are consistently implemented, students gain standardized work experience, which in turn builds the competencies, discipline, and self-confidence required in the workplace. The overall average for the study was 87.97%, which consistently falls within the "Very Effective" category. The bar chart comparing the effectiveness percentages among the variables is presented as follows:

Figure 4. Comparison of the Percentages of Research Variables

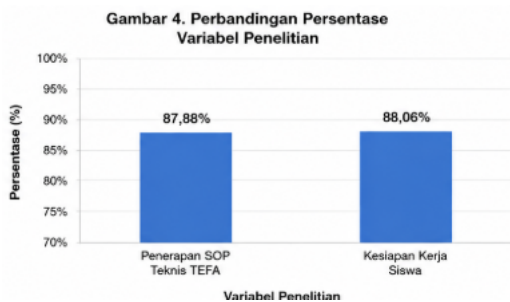


Figure 4 confirms that both variables fall into the same category namely, “Very Effective” with nearly identical percentages. The alignment of categories between the SOP implementation variable and the work readiness variable indicates that a high level of implementation of TEFA technical SOPs is accompanied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

Table 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 variables (85.00%), although it remained in the "Very Effective" category. This finding suggests that the development of communication competencies can still be further improved. The modern industrial world demands a workforce that is not only technically skilled but also capable of communicating effectively in the workplace. The relatively low score on this indicator can be understood from a structural perspective: TEFA's activities, which are centered on production processes and procedural compliance, tend to leave little room for the development of complex interpersonal communication, such as negotiation, cross-role verbal reporting, or communication in unpredictable work situations. This represents an implementation gap that warrants attention. As a mitigation strategy, TEFA managers may consider integrating role-based learning scenarios such as simulations of work briefings, presentations of production results, or structured team discussions that explicitly train communication in industrial work contexts without sacrificing the focus on the application of technical SOPs.

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 descriptive 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's 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 results of this study support the need to standardize Teaching Factory SOPs in accordance with the latest industry standards, in line with the mandate of Presidential Instruction No. 9 of 2016 on the Revitalization of Vocational High Schools, which emphasizes the importance of aligning the vocational high school curriculum with industry standards.

Overall, this study provides a descriptive overview showing that the consistent and structured application of the Teaching Factory's technical SOPs is highly effective in the context of SMK Canda Bhirawa Pare. However, this high level of effectiveness does not mean that the implementation has been flawless documentation, consistency of perception across groups, and communication development are three areas that require attention in the future development of the TEFA program. These findings provide an empirical foundation for the continuous development, evaluation, and refinement of the Teaching Factory program, particularly regarding communication and the adaptation of SOPs to evolving industry needs.

4. Conclusion

The implementation of the Teaching Factory

(TEFA) technical Standard Operating Procedures (SOPs) at SMK Canda Bhirawa Pare has proven effective in preparing students for the workforce in accordance with industry standards. Research findings indicate that the integration of industry-based SOPs into vocational education serves not only as a technical operational guideline but also as a tool for fostering work ethic, including discipline, responsibility, adherence to procedures, and the internalization of industrial work culture. The convergence of quantitative and qualitative data reinforces the finding that the structured and consistent implementation of TEFA is capable of bridging the gap between the competencies of vocational high school graduates and the needs of the workforce. These findings confirm that technical SOPs not only serve as tools for controlling work processes within the Teaching Factory but also as effective learning strategies for developing students' work readiness in accordance with industry standards.

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 strengthen 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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