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# Teaching Factory-Based Learning and its Impact on Students' Employability Skills

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**Abstract.** Vocational schools aim to equip students with the knowledge and skills needed to compete in the job market. However, the high unemployment rate among vocational high school graduates has demonstrated the ineffectiveness of learning in vocational schools. The implementation of teaching factory-based learning in vocational schools was theoretically expected to strengthen students' employability skills, which consist of seven indicators: fundamental skills, essential skills, workplace skills, twenty-first century skills, learning and innovation skills, information media and technology skills, and life and career skills. This study used a longitudinal approach to analyze the development of students' employability skills after being involved in teaching factory-based learning for five semesters. The population in this study were students from three public vocational high schools in East Java, Indonesia. Proportional random sampling was used to determine the sample size. Descriptive analysis was used in this study to describe the development of students' employability skills. Meanwhile, multivariate analysis was used to determine the most effective teaching factory-based learning model in strengthening students' employability skills. This study found that students' involvement in teaching factory-based learning for five semesters significantly improved employability skills. The most effective learning models for sequentially strengthening students' employability skills are dual systems, industry-based learning, production-based education and training, and competency-based training. This study recommends that vocational schools intensify practical learning as a key for strengthening graduates' employability skills. Furthermore, schools should strengthen collaboration with businesses and industry to implement TEFA-based learning more effectively.

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## 1. Introduction

Over the past decade, vocational schools in Indonesia have faced a persistent gap between demand and supply. On the demand side, the industrial sector has reported that graduates' qualifications fall short of expectations, not only in terms of hard skills but also soft skills such as work ethic, resilience, and communication. These competencies are becoming increasingly critical for businesses and industries to stay competitive in the face of technological advancements. On the supply side, vocational schools struggle with limited resources and insufficient involvement from industry partners in enhancing learning activities, which has hindered efforts to equip graduates with skills aligned to labor market needs (Isnantyo et al., 2024; Perdana, 2019).

This issue has contributed to persistently high unemployment rates among vocational school graduates over the past decade (Sakernas, 2025). These conditions highlight the urgent need for learning innovations in vocational schools to ensure graduates remain competitive in the job market. Accordingly, vocational learning activities should focus on strengthening practical and technical skills aligned with the demands of industry and business (Munadi et al., 2018; Prianto et al., 2021).

To address the problem of the gap between demand and supply of vocational school graduates, the Ministry of Education and Culture of the Republic of Indonesia has set a main agenda to strengthen students' employability skills (Hadam et al., 2017). To support this initiative, the government issued Presidential Instruction Number 9/2016 on the revitalization of vocational schools. As part of this policy, the Ministry facilitated the implementation of Teaching Factory-Based Learning (TEFA) in vocational schools (Imran et al., 2024; Khurniawan, 2016). Through TEFA, vocational learning integrates school-based instruction with practices commonly applied in the business and industrial sectors, enabling students to engage in both theoretical and practical learning simultaneously.

The primary objective of implementing TEFA in vocational schools is to align graduates' competencies with the skills demanded by the business and industrial sectors. Delivered through an integrative approach, TEFA encompasses psychomotor, affective (attitudinal), and Higher-Order Thinking Skills (HOTS), including critical thinking and problem-solving. Thus, vocational learning activities equip students with both technical expertise and essential soft skills (Hadam et al., 2017).

TEFA-based learning has been implemented in vocational schools for 10 years, following the Indonesian government's policy on revitalizing vocational high schools. Previous research on TEFA-based learning has focused more on students' job readiness (Imran et al., 2024). Meanwhile, previous studies have shown that employability skills are a key factor in in workforce success (Omar et al., 2023). However, TEFA-based learning is a learning model implemented in vocational

schools in Indonesia over the past decade. Therefore, this study aims to fill this gap by analyzing the effectiveness of TEFA in strengthening students' employability skills.

Thus, the main question of this research was whether the implementation of TEFA-based learning has an impact on strengthening students' employability skills? The following research questions are proposed to detail the various issues to be addressed in this study, as follows: (a) How did students' employability skills develop, based on indicators and sub-indicators, after participating in TEFA-based learning for five semesters? (b) How effective was the TEFA-based learning model in enhancing students' employability skills? and (c) Which TEFA learning model proved to be the most effective in strengthening employability skills?

## 2. Literature Review

### 2.1. Teaching Factory-Based Learning (TEFA)

TEFA is a learning model implemented in vocational schools as part of the Indonesian government's vocational school revitalization policy (Khurniawan, 2016). Its design is based on standards, procedures, and work environments that mirror those in industry and business. TEFA aims to prepare students for both employment and entrepreneurship immediately after graduation (Hadam et al., 2017). Consequently, its implementation requires active involvement from the business and industrial sectors to evaluate and ensure the quality of vocational learning activities.

The basic principle of TEFA-based learning is to enrich the learning experience through practical learning. This refers to Kolb's experiential learning theory (Kolb, 1984). This theory argues that effective learning should occur through four stages: concrete experience, reflection, conceptualization, and experimentation (Akella, 2010)(Kolb, 1984). Thus, to strengthen students' learning experiences, learning activities should be reinforced with practical activities.

The implementation of TEFA-based learning in vocational schools in Indonesia is essentially an application of Work-Based Learning (WBL) over six semesters. By applying WBL principles, TEFA is implemented through various learning models, such as Competency-Based Training (CBT), Production-Based Education and Training (PBET), Industry-Based Learning (IBL), and Dual System (DS). CBT, PBET, and IBL are implemented in workshops within the school environment, while DS are implemented in the business and industrial world. These four learning models are implemented by vocational schools because they combine theoretical and practical learning. (Imran et al., 2024).

CBT is a learning model designed to complement theoretical instruction by providing practical experience in laboratories or workshops that simulate industrial environments. CBT emphasizes the simultaneous mastery of knowledge and skills relevant to workplace requirements. PBET is a learning model conducted in schools or communities that emphasizes production-oriented activities. PBET aims to strengthen students' competencies in producing goods

and services required by society. IBL is a learning model that teaches students to carry out production and service activities through synergy between schools and industry. IBL was integrated into the school curriculum, particularly in subjects related to production processes, work practices, and job skills. DS is a learning model implemented through fieldwork practice in business and industrial settings. The primary objective of DS is to provide students with authentic work experience as preparation for entering the job market (Imran et al., 2024; Nurhasanah et al., 2022).

The characteristic of TEFA-based learning is that it is carried out throughout the school year. Meanwhile, WBL is usually held at the end of the school year. For comparison, the implementation of WBL in China employs a "three-in-one" concept. Students learn theory in the classroom for three years, followed by one year of practical experience in the business and industrial world (Wang et al., 2024). Similarly, in Malaysia, WBL is implemented by students through work experience in the industrial world during a specific academic year (Hao, 2024). This distinguishes TEFA-based learning from the general implementation of WBL, although both of them apply practical learning principles and are designed to minimize the gap between education and the workplace.

As WBL, the implementation of TEFA emphasizes collaboration between vocational schools and industry to enhance students' work experience and competencies in producing goods and services. Through TEFA, students are expected to engage in authentic work environments that closely mirror real-world industry practices (Yoto et al., 2024). This means that TEFA places a strong emphasis on practical learning that is closely aligned with current and future industrial needs.

TEFA emphasized more demand-oriented learning activities, equipping students with entrepreneurial character, and involving the business and industry sectors as key partners (Imran et al., 2024). Through TEFA, collaboration between education and industry enables learning activities in vocational schools to be more oriented towards industry needs. TEFA has served as a link between vocational schools and the business and industry sectors, encouraging technology transfer to schools to improve teacher quality and student soft skills (Amaliah & Irfan, 2022).

Thus, the implementation of TEFA in vocational schools expects vocational schools to carry out more intensive practical learning activities.The implementation of TEFA in vocational schools provides several benefits: (1) students gain knowledge and skills relevant to the needs of business and industry; (2) students acquire competencies and real-world experience that prepare them for employment after graduation; (3) schools can integrate industrial practices into their curricula, enabling students to engage in learning experiences that are more aligned with labor market demands; and (4) vocational schools have the opportunity to strengthen partnerships with business and industry, ensuring that both curricula and student learning experiences remain relevant to workforce needs.

These benefits enable students to develop skills that are needed by businesses and industry. This means that students' involvement in TEFA-based learning allows them to strengthen their employability skills. Ultimately, it is necessary to examine whether students' involvement in TEFA-based learning will strengthen their employability skills. This is the primary issue of this research.

**2.2. Employability skills**

Employability is defined as a set of achievements encompassing skills, knowledge, and personal attributes—both hard and soft skills—that enable graduates to obtain meaningful employment, succeed in their chosen careers, adapt to changes in the workplace resulting from developments in information and communication technology, be able to meet the challenges of the 21st-century workplace, be lifelong learners, and contribute to the workplace, society, and the national economy (Zhao & Kularatne, 2020).

Previous studies have identified various indicators of employability, broadly categorized into hard skills and soft skills (Tang et al., 2025). Hard skills, also referred to as technical skills, relate to discipline-specific knowledge and abilities (Hadiyanto et al., 2021). In contrast, soft skills—more commonly known as generic skills—are essential for effective performance in both professional and social contexts (Elkhayma & Ezzaidi, 2025). These include language proficiency, communication skills, personal qualities, critical literacy, and critical thinking (Elkhayma & Ezzaidi, 2025; Hadiyanto et al., 2021; Kamaruzaman et al., 2025).

Prospective workers should possess adequate employability skills to adapt to the rapidly changing world of work. Similarly, organizations require dedicated and professional employees who not only master technical skills but also adopt emerging technologies, demonstrate self-motivation, and actively engage in their work (Ditlhale & van den Berg, 2024). Individuals with strong employability skills can perform tasks effectively with competence and confidence. Nevertheless, previous studies consistently show that many graduates still lack the employability skills necessary to compete in the job market (Ditlhale & van den Berg, 2024; Febriana et al., 2023; Suppiah et al., 2025; Tang et al., 2025).

Adequate employability skills are reflected in graduates' ability to obtain and retain employment after graduation. Researchers have defined employability as the capacity to secure a job, maintain employment, and transition to more desirable or higher-paying positions (Areisy & Sudira, 2022). Similarly, employability has also been described as the ability to accept a job offer, sustain employment, and pursue career development (Othman et al., 2022; Suppiah et al., 2025).

Other literature views employability as a combination of essential skills, attributes, knowledge, and understanding required in the workplace (Donald et al., 2025; Firman et al., 2024; Omar et al., 2023). These skills encompass a wide range of personal attributes, including knowledge, communication, decision-making, willingness to learn, personal integrity, problem-solving, analytical ability, and career resilience (Othman et al., 2022).

Employability skills are critical to meeting the demands of the 21st-century workplace (Tushar & Sooraksa, 2023). Core competencies include communication, problem-solving, decision-making, and teamwork (Firman et al., 2024; Prianto et al., 2022). Graduates are also expected to show personal attributes such as self-awareness, self-confidence, independence, emotional intelligence, flexibility, adaptability, stress tolerance, creativity, initiative, willingness to learn, commitment to lifelong learning, and professional conduct (Areisy & Sudira, 2022; Ditlhale & van den Berg, 2024; Febriana et al., 2023; Tang et al., 2025).

This discussion of previous research concludes that learning activities in vocational schools should focus more on strengthening students' employability skills. Theoretically, students' involvement in TEFA-based learning will enable them to develop their employability skills.
Based on previous research, researchers summarized seven indicators and sub-indicators that describe students' employability skills:

a) Essential Skills for Job Preparation (ES) consist of five sub-indicators: (ES1) time management and punctuality, referring to students' ability to organize and plan time effectively to complete tasks, achieve goals, and maximize productivity; (ES2) professional orientation, defined as students' understanding of professional requirements, goals, and workplace culture; (ES3) teamwork ethic, reflecting students' adherence to principles, values, and standards that promote collaboration, respect, and productivity within a team; (ES4) verbal communication, referring to students' ability to convey ideas effectively in conversations and presentations; and (ES5) problem-solving, which encompasses identifying problems, gathering information, formulating and selecting solutions, as well as implementing and evaluating outcomes.

b) Fundamental skills (FS) consist of 3 sub-indicators: (FS1) basic skills as students' literacy, numeracy, and science mastery skills; (FS2) thinking skills as students' ability to process information, decision making, problem solving, and generate ideas; (FS3) personal qualities as the characteristics, attributes, or personality traits that guide how a person acts, thinks, and interacts with others, both in personal and professional life.

c) Workplace Skills (WS) consist of five sub-indicators: (WS1) resource skills, referring to students' ability to manage various resources required for work; (WS2) interpersonal skills, reflecting students' capacity to actively engage with colleagues and organizational leaders; (WS3) information acquisition skills, defined as the ability to identify, locate, evaluate, and apply information for specific tasks or objectives; (WS4) systems literacy, referring to students' understanding of complex work systems and their ability to make sound decisions and communicate effectively within them; and (WS5) technology acquisition skills, encompassing students' ability to master and utilize technological tools to complete tasks efficiently and effectively.

d) Twenty-first century skills (CS) comprise seven sub-indicators: (CS1) civic literacy, referring to students' ability to actively participate in community life while understanding their rights and responsibilities as citizens or

organizational members; (CS2) world language skills, defined as the ability to communicate, understand, and interact in more than one language, particularly a foreign language not used in daily life; (CS3) global awareness, reflecting students' understanding of the interconnections between local, national, and international issues, as well as their appreciation of diverse cultures, perspectives, and global values; (CS4) financial literacy, referring to students' ability to make effective and responsible financial decisions; (CS5) economic literacy, encompassing students' knowledge and application of economic principles to make rational decisions; (CS6) business and entrepreneurial literacy, defined as students' understanding of business and entrepreneurship, including knowledge of planning, managing, and developing a business; and (CS7) environmental literacy, referring to students' capacity to understand, interpret, and take action to preserve, restore, and improve environmental conditions.

e) Learning and Innovation Skills (LIS) comprise five sub-indicators: (LIS1) creativity and innovation, referring to students' ability to generate original ideas and apply them as practical solutions beneficial to real-life contexts; (LIS2) critical thinking, defined as the capacity to think rationally, objectively, and analytically in order to evaluate information, assess arguments, and make well-grounded judgments; (LIS3) learning to learn, encompassing students' ability to manage their own learning and their willingness to engage in lifelong learning; (LIS4) communication, referring to students' ability to convey, receive, interpret, and respond effectively to verbal messages, nonverbal cues, and body language to achieve communication goals; and (LIS5) collaboration, describing students' capacity to strengthen teamwork, interact effectively, share ideas, respect differences, resolve conflicts, and coordinate efforts within a group to accomplish shared objectives.

f) Information, Media, and Technology Skills (IMTS) comprise three sub-indicators: (IMTS1) information literacy, which refers to students' ability to identify essential information, as well as to locate, evaluate, use, and communicate it effectively and ethically; (IMTS2) media literacy, which encompasses students' ability to access, analyze, evaluate, and create media messages, understand how media operates and influences audiences, and apply media responsibly and effectively; and (IMTS3) information and communication technology literacy, which denotes students' ability to use digital technologies, information resources, and communication tools to solve problems, communicate effectively, make informed decisions, and participate responsibly as ethical global citizens in the digital world.

g) Life and Career Skills (LCS) consist of five sub-indicators: (LCS1) flexibility and adaptability, referring to students' willingness and ability to adapt to new situations; (LCS2) initiative and self-direction, denoting students' capacity to take proactive action based on self-awareness to accomplish tasks and achieve goals; (LCS3) social and cross-cultural skills, reflecting students' ability to interact and communicate effectively with individuals from diverse cultural backgrounds; (LCS4) productivity and accountability, which emphasize

students' capacity to work efficiently, produce measurable outcomes, take responsibility for decisions and performance; and (LCS5) leadership and responsibility, describing students' ability to assume accountability for their actions, make decisions that consider organizational goals and stakeholders, and contribute to organizational sustainability.

## 3. Methodology

This study employed a longitudinal research design to examine the development of students' employability skills after participating in teaching factory (TEFA)-based learning for five semesters (2.5 years). The population consisted of students from three public vocational schools in East Java, Indonesia: SMK 3 Jombang, SMK 1 Jetis Mojokerto, and SMK 2 Malang. These schools have implemented TEFA-based learning intensively, with a total population of 965 students.

The sample size was determined using the formula $n = N / (1 + (N \times e^2))$—where n represents the required sample size, N the total population, and e the margin of error (5%) (Sugiyono, 2019). Based on this calculation, the sample size was 282 students. All sampled students had been actively involved in TEFA for five consecutive semesters, covering the academic years 2022/2023, 2023/2024, and 2024/2025. The sample distribution was determined through proportional random sampling (Setiawan, 2024), as presented in Table 1.

**Table 1: Distribution of research samples**

| School | Population | Proportion to population | Sample size |
|---|---|---|---|
| SMK 3 Jombang | 320 | 0.331 | 93 |
| SMK 1 Jetis Mojokerto | 322 | 0.334 | 94 |
| SMK 2 Malang | 323 | 0.335 | 95 |
| Total | 965 students | 1.000 | 282 students |

This study investigates the impact of students' involvement in TEFA-based learning through four learning models(a) Competency-Based Training (CBT), (b) Production-Based Education and Training (PBET), (c) Industry-Based Learning (IBL), and (d) the Dual System (DS)on the development of employability skills. The CBT, PBET, and IBL models were implemented continuously throughout the academic year, while the DS model was applied during the 5$^{th}$ semester. Accordingly, this study examines the development of students' employability skills from the first to the fourth semester under the CBT, PBET, and IBL models, and evaluates their further development following participation in the DS model at the end of the 5$^{th}$ semester.

A questionnaire on employability skills was developed by the researcher based on valid indicators and sub-indicators. The researchers developed a 5-point scale questionnaire (lowest score = 1, highest score = 5) (Mohd Rokeman, 2024) related to employability skills, which was confirmed to be valid and reliable, as presented in Appendix.

We used SPSS software to evaluate the validity and reliability of the research questionnaire. We evaluated the validity of the research questionnaire using

Cronbach's Alpha and Pearson bivariate correlation, with a significance level of 5%. We tested the reliability of the questionnaire using Cronbach's Alpha, with an alpha criterion greater than or equal to 0.70 (Azwar, 2022).

The effectiveness of TEFA-based learning models in enhancing students' employability skills was assessed based on their achievement levels, which were classified into five categories: very high, high, moderate, low, and very low. The criteria for these categories were determined using the formula presented in Table 2 (Sugiyono, 2019).

**Table 2: Categories of students' employability skills**

| Scoring criteria | Interval class | Description |
|---|---|---|
| $X \leq M - 1{,}5SD$ | $X \leq 1.995$ | Very low |
| $M - 1{,}5SD < X \leq M - 0{,}5SD$ | $1.995 < X \leq 2.665$ | Low |
| $M - 0{,}5SD < X \leq M + 0{,}5SD$ | $2.665 < X \leq 3.335$ | Moderate |
| $M + 0{,}5SD < X \leq M + 1{,}5SD$ | $3.335 < X \leq 4.005$ | High |
| $M + 1{,}5SD < X$ | $4.005 < X$ | Very high |

**Note:** $X_{min} = 1$, $X_{max} = 5$; range = $(X_{max} - X_{min})$; Mean = $(X_{max} + X_{min})/2$; SD = range/6 (normally distributed data consists of 6 standard deviations)

Descriptive analysis was used in this study to describe the development of students' employability skills as an impact of their involvement in TEFA, which is explained by 7 indicators and their sub-indicators, namely: (a) ES, containing sub-indicators ES1-5, (b) FS, containing sub-indicators FS1-3, (c) WS, containing sub-indicators WS1-5, (d) CS, containing sub-indicators CS1-7, (e) LIS, containing sub-indicators LIS1-5, (f) IMTS, containing sub-indicators IMTS1-3, and (g) LCS, containing sub-indicators LCS1-5.

We use the provisions in Table 2 as a guideline to describe the development of students' employability skills after they were involved in TEFA-based learning. Multivariate analysis was employed in this study to examine the learning model that had the strongest impact on the development of students' employability skills. Furthermore, we used multivariate analysis to identify the most effective learning model for developing students' employability skills (Wijaya & Budiman, 2016).

## 4. Results and Findings

This study examined the development of students' employability skills after their participation in four learning models—CBT, PBET, IBL, and DS—over the course of five semesters. The following section presents a description of students' employability skills based on seven indicators and their respective sub-indicators.

### 4.1. The development of students' employability skills based on 7 indicators and each sub indicators

*4.1.1. The development of essential skills (ES) and their indicators*

This study described the development of students' essential skills from semester 1 to semester 5 (see Figure 1).

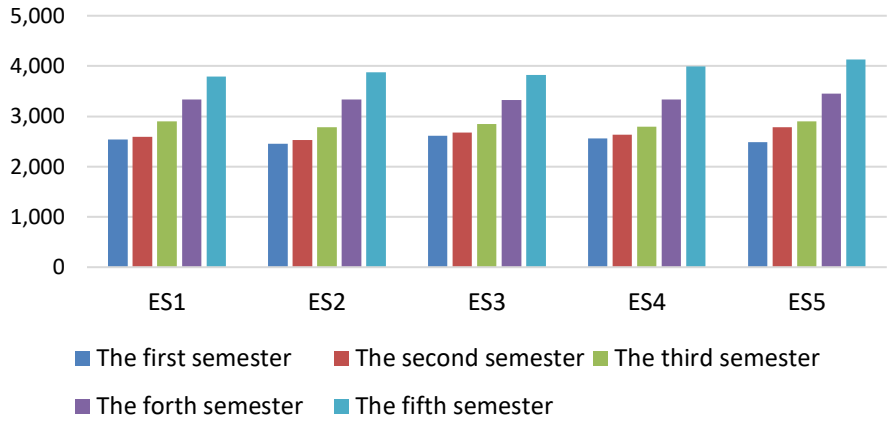


**Figure 1: The development of students' esential skills**

This study found that all five indicators of essential skills showed consistent improvement from the first to the fifth semester. Students' essential skills progressed from the "low" category in the first semester to "high" and "very high" categories by the fifth semester. These findings demonstrate that participation in TEFA-based learning has a positive influence on the development of students' essential skills. In particular, TEFA-based learning proved to be effective in strengthening problem-solving skills (ES5).

*4.1.2. The development of fundamental skills (FS) and its indicators*

This study described the development of students' fundamental skills from semester 1 to semester 5 (see Figure 2).

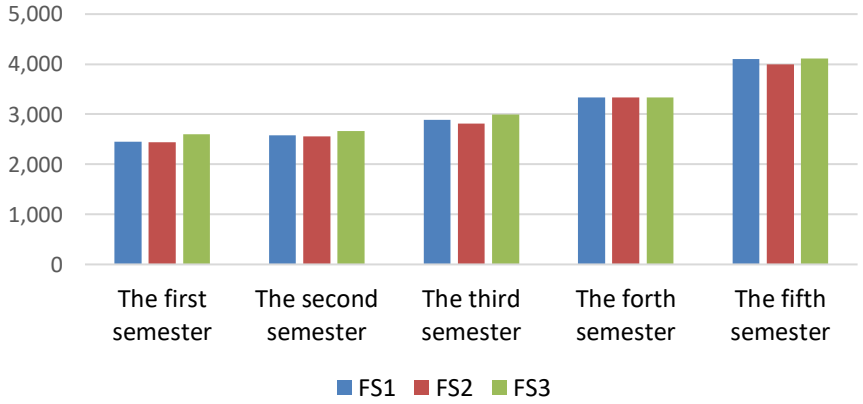


**Figure 2: The development of students' fundamental skills**

This study found that all three indicators of fundamental skills improved steadily from the first to the fifth semester. Students' fundamental skills progressed from the "low" category in the first semester to the "high" and "very high" categories by the fifth semester. These results indicate that participation in TEFA-based learning significantly enhanced students' fundamental skills. In particular, TEFA-based learning was most effective in strengthening basic skills (FS1) and personal qualities (FS3).

*4.1.3. The development of workplace skills (WS) and its indicators*
This study described the development of students' workplace skills from semester 1 to semester 5 (see Figure 3).

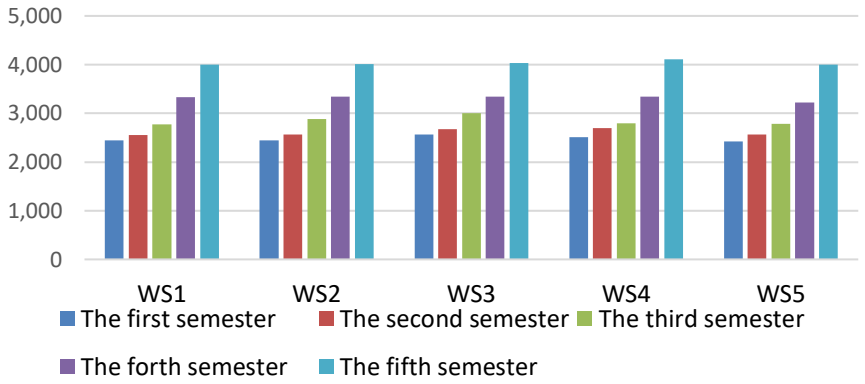


**Figure 3: The development of students' workplace skills**

This study found that all five indicators of workplace skills improved from the first to the fifth semester. Students' workplace skills progressed from the "low" category in the first semester to the "high" and "very high" categories by the fifth semester. These findings indicate that participation in TEFA-based learning significantly enhanced students' workplace skills. In particular, TEFA-based learning was most effective in strengthening interpersonal skills (WS2), information acquisition skills (WS3), and systems literacy (WS4).

*4.1.4. The development of the 21st century skills (CS) and its indicators*
This study described the development of the 21st century skills of students from the 1st to the 5th semester (see Figure 4).

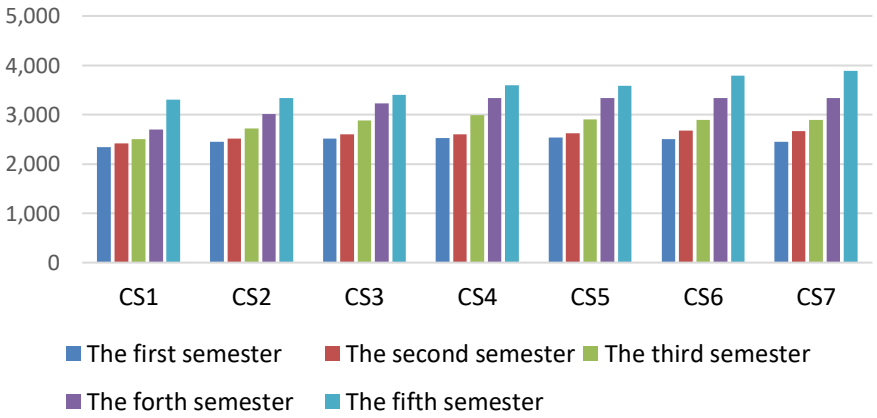


**Figure 4: The development of students' 21st century skills**

This study found that all seven indicators of 21st-century skills showed improvement from the first to the fifth semester. Students' 21st-century skills advanced from the "low" category in the first semester to the "high" category in the fifth semester. These results indicate that participation in TEFA-based learning

significantly enhanced students' 21st-century skills. In particular, TEFA-based learning was most effective in strengthening financial literacy (CS4), economic literacy (CS5), business and entrepreneurial literacy (CS6), and environmental literacy (CS7).

*4.1.5. The development of learning and innovation skills (LIS) and its indicators*

This study described the development of students' learning and innovation skills from the 1st semester to the 5th semester (see Figure 5).

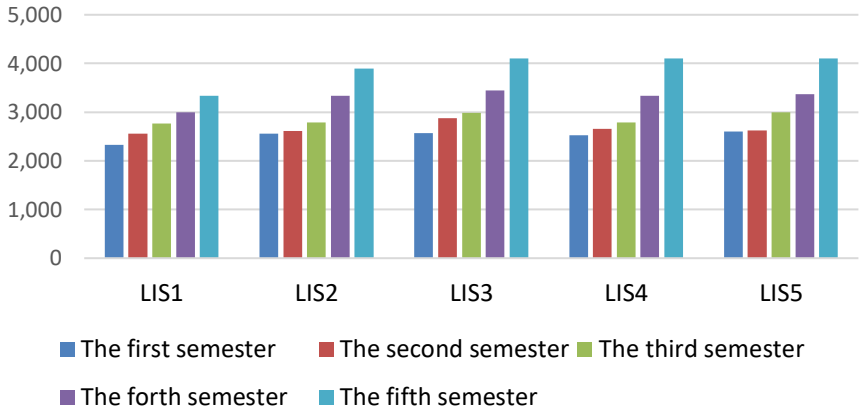


**Figure 5: The development of students' learning and innovation century skills**

This study found that all five indicators of learning and innovation skills improved from the first to the fifth semester. Students' learning and innovation skills progressed from the "low" category in the first semester to the "high" and "very high" categories by the fifth semester. These findings indicate that participation in TEFA-based learning significantly enhanced students' learning and innovation skills. In particular, TEFA-based learning was most effective in strengthening learning how to learn (LIS3), communication skills (LIS4), and collaboration skills (LIS5).

*4.1.6. The development of Information, media and technology skills (IMTS) and its indicators*

This study described the development of students' information, media and technology skills from semester 1 to semester 5 (see Figure 6).

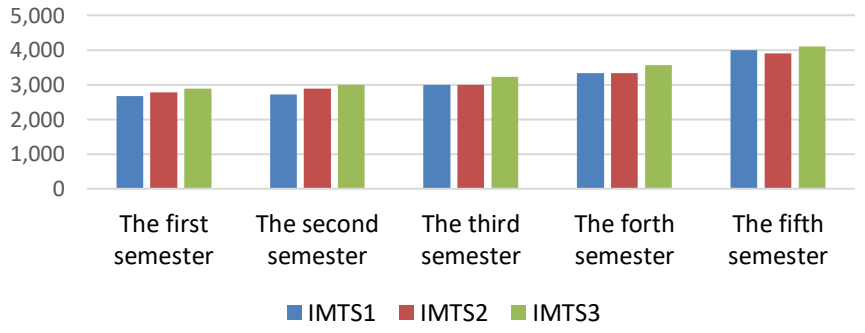


**Figure 6: The development of students' information, media and technology skills**

This study revealed that three indicators of information, media, and technology skills increased from the first to the fifth semester. Students' information, media, and technology skills increased, from the "low" category in the first semester to "high" in the fifth semester. This indicates that students' involvement in TEFA-based learning had an impact on improving students' information, media, and technology skills. In other words, TEFA-based learning was an effective learning model for strengthening students' information, media, and technology skills, particularly information and communication technology literacy (IMTS3).

*4.1.7. The development of life and career skills (LCS) and its indicators*

This study described the development of students' life and career skills from semester 1 to semester 5 (see Figure 7).

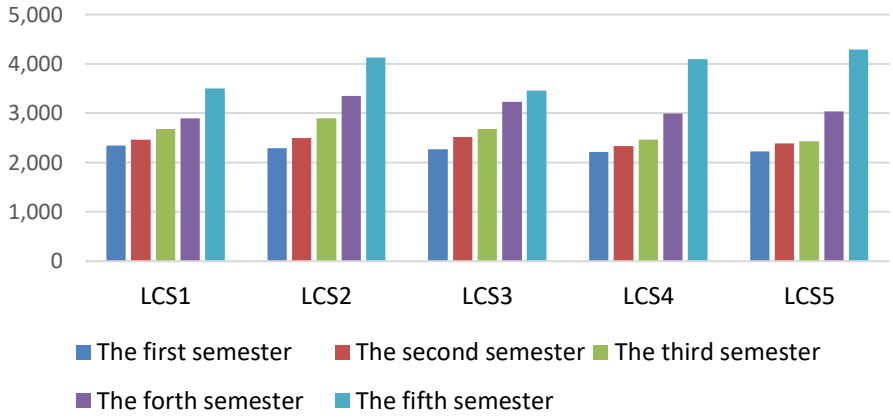


**Figure 7: The development of students' life and career skills**

This study found that all five indicators of life and career skills improved from the first to the fifth semester. Students' life and career skills progressed from the "low" category in the first semester to the "high" and "very high" categories by the fifth semester. These findings indicate that participation in TEFA-based learning significantly enhanced students' life and career skills. In particular, TEFA-based learning was most effective in strengthening initiative and self-direction (LCS2), productivity and accountability (LCS4), and leadership and responsibility (LCS5).

**4.2. The development of students' employability skills based on the learning model implemented**

The development of students' employability skills based on each indicator after the students were involved in the TEFA-based learning model for 5 semesters was described in table 3.

**Table 3: The development of students' employability skills based on each indicator**

| Indicators | | ES | FS | WS | CS | LIS | EMTS | LCS | Mean |
|---|---|---|---|---|---|---|---|---|---|
| Model | Semester | | | | | | | | |
| CBT | 1st | 2.462 Low | 2.452 Low | 2.124 Low | 2.330 Low | 2.400 Low | 2.671 Moderate | 2.201 Low | 2.334 Low |
| | 2nd | 2.462 Low | 2.452 Low | 2.124 Low | 2.330 Low | 2.400 Low | 2.671 Moderate | 2.201 Low | 2.390 Low |
| | 3rd | 2.665 Moderate | 2.779 Mode-rate | 2.520 Low | 2.511 Low | 2.384 Low | 2.741 Moderate | 2.380 Low | 2.511 Low |
| | 4th | 3.332 Moderate | 3.305 Mode-rate | 3.019 Mode-rate | 2.554 Low | 2.883 Modera-te | 2.381 Moderate | 2.502 Low | 2.997 Moderate |
| | Mean | 2.730 Moderate | 2.747 Mode-rate | 2.446 Low | 2.431 Low | 2.516 Low | 2.616 Low | 2.321 Low | 2.544 Low |
| PBET | 1st | 2.522 Low | 2.494 Low | 2.424 Low | 2.511 Low | 2.540 Low | 2.782 Moderate | 2.305 Low | 2.511 Low |
| | 2nd | 2.598 Low | 2.587 Low | 2.498 Low | 2.567 Low | 2.799 Modera-te | 2.978 Moderate | 2.388 Low | 2.631 Low |
| | 3rd | 2.845 Moderate | 2.889 Mode-rate | 2.921 Mode-rate | 2.865 Mode-rate | 2.895 Modera-te | 3.110 Moderate | 2.503 Low | 2.861 Moderate |
| | 4th | 3.337 High | 3.333 Mode-rate | 3.355 High | 3.078 Mode-rate | 3.099 Modera-te | 3.412 High | 3.201 Moderate | 3.259 Moderate |
| | Mean | 2.833 Moderate | 2.826 Mode-rate | 2800 Mode-rate | 2.755 Mode-rate | 2.833 Modera-te | 3.071 Moderate | 2.599 Low | 2.816 Moderate |
| IBL | 1st | 2.613 Low | 2.545 Low | 2.887 Mode-rate | 2.581 Low | 2.609 Low | 2.877 Moderate | 2.301 Low | 2.630 Low |
| | 2nd | 2.745 Moderate | 2.667 Mode-rate | 2.887 Mode-rate | 2.971 Mode-rate | 2.973 Modera-te | 3.025 Moderate | 2.656 Moderate | 2.846 Moderate |
| | 3rd | 3.021 Moderate | 3.019 Mode-rate | 3.110 Mode-rate | 3.100 Mode-rate | 3.320 Modera-te | 3.369 High | 2.656 Low | 3.114 Moderate |
| | 4th | 3.393 High | 3.367 High | 3.572 High | 3.911 High | 3.911 High | 3.441 High | 3.606 High | 3.600 High |
| | Mean | 2.943 Moderate | 2.900 Mode-rate | 3.114 Mode-rate | 3.141 Mode-rate | 3.203 Modera-te | 3.178 Moderate | 2.805 Moderate | 3.048 Moderate |
| DS | 5th | 3.920 High | 4.069 Very high | 4.029 Very high | 3.557 High | 3.905 High | 3.999 High | 3.893 High | 3.910 High |

This study had revealed the role of the four TEFA-based learning models, namely: CBT, PBET, IBL, and DS; in strengthening students' employability skills.

*4.2.1. The role of CBT in strengthening students' employability skills*
The average score of students' employability skills after participating in CBT for four semesters was 2.554, which falls within the "low" category. Four employability skill indicators—ES, FS, WS, and LIS—improved from the "low" to the "moderate" category following students' participation in CBT. However, the remaining three indicators, CS, IMTS, and LCS, showed no improvement. This study revealed that CBT was not effective in developing students' employability skills. (see Table 3).

*4.2.2. The role of PBET in strengthening students' employability skills*
The average employability skill score of students after participating in the PBET learning model for four semesters was 2.816, which falls within the "moderate" category. Three employability skill indicators—ES, WS, and IMTS—improved from the "low" to the "high" category following students' participation in PBET. Meanwhile, four other indicators—FS, CS, LIS, and LCS—showed improvement from the "low" to the "moderate" category. This study revealed that PBET was quite effective in developing students' employability skills. (see Table 3).

*4.2.3. The role of IBL in strengthening students' employability skills*
The average employability skill score of students after participating in the IBL model for four semesters was 3,048 (categorized as "moderate"). Five employability skill indicators increased, from "low" to "high" after students participated in IBL, namely ES, FS, CS, LIS, and LCS. Meanwhile, two other employability skill indicators, namely WS and EMTS, increased from "moderate" to "high". This study revealed that IBL was effective in developing students' employability skills (see Table 3).

*4.2.4. The effectiveness of DS in strengthening students' employability skills*
The average employability skill score of students after participating in the DS learning model during the fifth semester was 3.910, which falls into the 'high' category. Two employability skill indicators, namely Fundamental Skills (FS) and Workplace Skills (WS), were categorized as 'very high.' Meanwhile, the remaining five indicators—Essential Skills (ES), Career Skills (CS), Learning and Innovation Skills (LIS), Information, Media, and Technology Skills (IMTS), and Life and Career Skills (LCS)—were categorized as 'high'. This study revealed that DS was effective in developing students' employability skills (see Table 3).

**4.3. The most effective learning model to strengthen employability skills**
This study revealed that the implementation of TEFA-based learning models over five semesters was effective in strengthening students' employability skills. The integration of TEFA-based learning and students' active participation in learning activities across five semesters collectively contributed 51.3% to the development of their employability skills (see Table 5).

**Table 5: Tests of Between-Subjects Effects**

| Source | Type III Sum of Squares | df | Mean Square | F | Sig |
|---|---|---|---|---|---|
| Corrected model | 113.666[a] | 12 | 9.472 | 122.839 | .000 |
| Learning_model | 9.896 | 2 | 4.948 | 64.168 | .000 |
| Semester | 48.408 | 3 | 16.136 | 209.258 | .000 |
| Learning_model*semester | 3.437 | 6 | .573 | 7.429 | .000 |

a. R Squared = .513 (Adjusted R Squared = .509)

These results highlight the importance of intensively implementing TEFA-based learning models in vocational schools to enhance students' employability skills. Sustained involvement in TEFA-based learning activities over five semesters significantly contributed to the improvement of students' employability skills. The study revealed that students' employability skills varied significantly from the first to the fifth semester. This demonstrated that the more intensive students' involvement in TEFA-based learning, the stronger their employability skills (see Table 6).

**Table 6: Multiple comparisons**

| Semester (I) | Semester (J) | Mean difference (I-J) | Standard error | Sig | Conclusion |
|---|---|---|---|---|---|
| The 1st semester | The 2nd semester | -.3473* | .02339 | .000 | The 5th semester > the 4th semester. The 4th semester > the 3rd semester. The 3rd semester > the 2nd semester. The 2nd semester > the 1st semester. |
| | The 3rd semester | -.4208* | .02339 | .000 | |
| | The 4th semester | -.5653* | .02339 | .000 | |
| | The 5th semester | -.8110* | .02336 | .000 | |
| The 2nd semester | The 3rd semester | -.0735* | .02339 | .002 | |
| | The 4th semester | -.2180* | .02339 | .000 | |
| | The 5th semester | -.4637* | .02336 | .000 | |
| The 3rd semester | The 4th semester | -.1445* | .02339 | .000 | |
| | The 5th semester | -.3902* | .02336 | .000 | |
| The 4th semester | The 5th semester | -.2456* | .02336 | .000 | |

**Note:** The negative sign (-) in the mean difference column indicates that the employability skill score in column (J)

Employability skills are essential across all types of jobs, as they enable prospective workers to participate effectively and succeed in the workplace. Core employability skills—including communication, teamwork, problem-solving, creative and critical thinking, self-management, and learning to learn—can be effectively fostered through TEFA-based learning.

This study revealed an effective learning model for strengthening students' employability skills, as presented in Table 7.

**Table 7: Multiple comparisons**

| Learning model (I) | Learning model (J) | Mean difference (I_J) | Standard error | Sig | Conclusion |
|---|---|---|---|---|---|
| CBT | PBET | -.1270* | .02122 | .000 | DS > IBL > PBET |

| | | | | | |
|---|---|---|---|---|---|
| | IBL | -.2191* | .01937 | .000 | > CBT. |
| | DS | -.5957* | .02166 | .000 | |
| PBET | IBL | -.0921* | .02079 | .000 | |
| | DS | -.4688* | .02294 | .000 | |
| IBL | DS | -.3767* | .02124 | .000 | |

The negative sign (-) in the mean difference column indicates that the employability skill score developed by students through learning activities in column (J) is greater than in column (I)

The effective learning models in strengthening employability skills in sequence are as follows: DS, IBL, PBET, and CBT. This study shows that learning models that were implemented more in practical activities and were directly related to the business-industrial world have proven effective in developing students' employability skills.

## 5. Discussion

This study describes the implementation of TEFA-based learning models and their impact on the growth of students' employability skills. The four TEFA-based learning models analyzed in this study are: CBT, PBET, IBL, and DS.

CBT was a TEFA-based learning model implemented in a classical format combining theoretical instruction with practical learning in the laboratory. CBT emphasized the development and demonstration of specific knowledge, skills, and attitudes, enabling students to perform particular tasks or jobs. This study revealed that CBT was not sufficiently effective in developing students' employability skills. The findings of this study support previous research with similar results (Geressu, 2017). However, this finding contradicts previous studies that shown that CBT has been proven to strengthen students' technical skills (Masran et al., 2025). This was understandable because the scope of employability skills was broader than technical skills, as outlined in this study.

PBET is a TEFA-based learning model that integrates theoretical instruction with hands-on practice in the production process. Students involved in contextual learning experiences within work environments designed to replicate real industrial workflows, encompassing planning, implementation, and evaluation of production outcomes. The primary objective was to equip students with practical skills, a comprehensive understanding of the professional world, and an entrepreneurial mindset through the production of goods and services relevant to community needs.

The findings of this study revealed that PBET was quite effective in strengthening students' employability skills. Various learning activities embedded in PBET contributed to the enhancement of both technical and soft skills, particularly oral and written communication (Hakimah, 2023). Consistent with these results, previous studies have shown that PBET, essentially a form of project-based learning, has a significant impact on improving students' employability and entrepreneurial skills (Crawford et al., 2024; Isnantyo et al., 2024; Mustamin et al., 2024).

IBL is a TEFA-based learning model that enables students to engage in industrial activities relevant to their field of study. In Indonesia, several vocational high

schools already operate business entities that well known as Regional Public Service Agencies to facilitate this approach (Sukirno et al., 2019). IBL activities were carried out by students at the school's business entities. Within the IBL framework, students carried out practical learning activities at their school's business entities. The primary objectives of these business entities are to strengthen work and entrepreneurial competencies, enhance efficiency and productivity, meet community needs, and educate students about service quality, thereby preparing them to enter the workforce or become entrepreneurs after graduation (Hariyanto, 2021).

Previous studies have confirmed that IBL is highly effective in strengthening vocational students' work and problem-solving skills (Alongkrontuksin et al., 2024), while also enhancing their work experience (Fania et al., 2024; Sutiman et al., 2022), thereby strengthen the work readiness of prospective graduates (Anwar et al., 2023; Sudarsono et al., 2023). Therefore, this study showed that IBL was an effective learning model for strengthening students' employability skills.

DS was a learning activity that combines theoretical learning in school with practical work training in the business and industrial world. Therefore, students participate in DS in semester 5, after mastering theoretical knowledge and practicing in laboratories or at schools' business entities. The primary goal of DS was to produce prospective vocational school graduates with professional skills, prepared to work according to job market needs, and capable of entrepreneurship. DS enables students to recognize various challenges in the world of work at an early stage (Srabani et al., 2022) and helps minimize skills gaps (Suna et al., 2020). Early job readiness allows students to develop the employability skills required to enter the labor market.

This study found that DS was an effective learning model in developing students' employability skills. The findings of this study are consistent with previous research, which highlights the crucial role of DS in strengthening both technical and soft skills (Abdeen et al., 2025; Kocsis & Pusztai, 2021; Rahmawati & Rodiyah, 2023). The results of this study reinforce previous research emphasizing the importance of implementing TEFA in vocational schools to enhance students' employability skills (Abdeen et al., 2025; Alongkrontuksin et al., 2024; Donald et al., 2025). Thus, learning activities carried out in the form of work practice have proven effective in developing employability skills.
This study revealed that the intensity of students' involvement in TEFA-based learning over five semesters had a positive impact on the development of their employability skills. This was evidenced by significant improvements in 13 employability skill sub-indicators, namely: problem-solving, basic skills, personal qualities, interpersonal skills, information acquisition, systems literacy, learning how to learn, communication, collaboration, information and communication technology literacy, initiative and self-direction, productivity and accountability, as well as leadership and responsibility.

These findings complement previous studies that have examined various strategies to enhance the work readiness and employability skills of vocational

school graduates in Indonesia (Abdeen et al., 2025; Alongkrontuksin et al., 2024; Amaliah & Irfan, 2022; Areisy & Sudira, 2022; Donald et al., 2025; Firman et al., 2024; Imran et al., 2024; Mustamin et al., 2024; Saquing et al., 2025). This study has proven that the more intensively students are involved in practical learning, the more their employability skills develop.

This study identified the most effective learning models for developing students' employability skills. DS and IBL are two TEFA-based learning models that are effective in strengthening students' employability skills. This demonstrates that practical learning activities were highly effective in strengthening students' employability skills. The findings of this study complement previous studies that have discussed the importance of practical learning in strengthening the skills and employability of vocational high school students (Crawford et al., 2024; Fania et al., 2024; Kamaruzaman et al., 2025; Wang et al., 2024; Yoto et al., 2024).

This study emphasized the importance of practical learning, whether conducted in workshops, laboratories, or real-world work experiences, as an inseparable part of the theoretical learning delivered in a classroom setting. Vocational school students were prepared to become prospective workers upon graduation. They should not be limited to theoretical knowledge. Furthermore, they should be equipped with practical skills so that they will possess both hard and generic skills simultaneously (Kamaruzaman et al., 2025; Prianto et al., 2021). Therefore, practical learning in vocational schools should be further strengthened.

Student involvement in practical learning enables them to gain a deeper understanding of their specific field. Through this process, students can independently develop their competencies, either by reskilling or upskilling, while fostering a commitment to lifelong learning. Such a willingness to continuously learn equips students with the adaptability required to respond effectively to changes in the workplace.

Employability skills are not limited to mastering the latest technical knowledge and competencies but also encompass the development of soft skills such as communication, negotiation, leadership, resilience, and a commitment to lifelong learning. Previous studies have emphasized that these soft skills are strengthened when students possess a deep understanding of specific knowledge and technical expertise (Hadiyanto et al., 2021; Kamaruzaman et al., 2025). Moreover, such understanding can be enhanced through the implementation of practical learning approaches (Prianto et al., 2022), such as the TEFA-based learning explored in this study.

Finally, this study emphasizes the importance of both theoretical learning activities in the classroom and practical learning in workshops or the industrial world, as learning activities that should be strengthened simultaneously. Learning is not only about acquiring knowledge, but also about applying it meaningfully in everyday life. Vocational school students should not only understand concepts; they should also be able to apply concepts to solve everyday life problems.

## 6. Conclusion

This study revealed that the implementation of TEFA-based learning has been proven to strengthen the development of students' employability skills. Students' employability skills increased along with their involvement in TEFA-based learning from the first to the fifth semester. The learning models that proved effective in strengthening students' employability skills, in order of effectiveness, were DS, IBL, PBET, and CBT.

Among these, DS emerged as the most effective, as it was implemented through students' direct work experience in business and industry settings for six months, thereby exposing them to authentic workplace environments. In contrast, IBL, PBET, and CBT were implemented within schools by simulating work systems comparable to those in business and industry. These findings highlight that practical learning conducted directly in workplace and industry contexts is particularly effective in enhancing students' employability skills.

This study implies that the implementation of the TEFA-based learning model has enriched the range of WBL as an alternative learning model in vocational schools. Furthermore, the implementation of the TEFA-based learning model has proven effective in enhancing students' learning experiences. Nevertheless, this study has several limitations, primarily because the subjects were vocational school students in East Java. Therefore, the conclusions of this study cannot be generalized to all vocational schools in Indonesia. Besides, this study did not analyze the impact of industrial involvement on TEFA-based learning, thus fostering students' employability skills.

Based on the various limitations, this study recommends: (a) Schools should create an atmosphere and learning environment that is as similar as possible to industrial conditions, including workflows, operational standards, and work rules to realize increasingly effective TEFA-based learning; (b) Schools should build partnerships with the business and industrial sector to implement TEFA-based learning more effectively; (c) Further research is needed to analyze the impact of industry involvement on the effectiveness of TEFA-based learning.

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# Appendix

**Employability Skills Questionnaire and its validity-realiability coefficient**

| Indicators | Sub-indicators | Statement | Validity coeficient | Reliability coeficient |
|---|---|---|---|---|
| ES | $ES_1$ | I am able to manage time, so that my tasks were completed on time. | 0.817 | 0.819 |
| | $ES_2$ | I understand the values, norms, and roles associated with my work. | 0.811 | |
| | $ES_3$ | I realize the importance of team work ethic | 0.821 | |
| | $ES_4$ | I am able to convey messages both verbally and in writing | 0.833 | |
| | $ES_5$ | I am able to determine effective solutions to overcome a problem | 0.827 | |
| FS | $FS_1$ | I am able to read, write, count and operate a computer well | 0.828 | 0.829 |
| | $FS_2$ | I understand certain information as a basis for problem solving and decision making. | 0.837 | |
| | $FS_3$ | Honesty, confident, hardworking and resilient are the basic principles in my life | 0.829 | |
| WS | $WS_1$ | I am able to optimize resources to achieve certain goals | 0.799 | 0.806 |
| | $WS_2$ | I am able to build good relationships with others | 0.811 | |
| | $WS_3$ | I am able to use information effectively | 0.809 | |
| | $WS_4$ | I am able to interact with other parties in a complex organizational system | 0.811 | |
| | $WS_5$ | I am able to apply new technologies in a variety of contexts, both for personal and professional purposes | 0.819 | |
| CS | $CS_1$ | I am able to communicate in English as an international language, both both spoken and written | 0.814 | 0.817 |
| | $CS_2$ | I understand the rights and obligations as a citizen of the organization | 0.809 | |
| | $CS_3$ | I understand the relationship between global issues and their impact on my organization and life | 0.815 | |
| | $CS_4$ | I am able to manage finances for productive purposes | 0.811 | |

| | | | | |
|---|---|---|---|---|
| | $CS_5$ | I am able to apply economic principles as a basis for resource management | 0.816 | |
| | $CS_6$ | I am able to apply business and entrepreneurship concepts in various contexts | 0.819 | |
| | $CS_7$ | I understand the importance of environmental sustainability in the 21st century | 0.817 | |
| LIS | $LIS_1$ | I am able to convey new ideas and implement them in the workplace | 0.822 | 0.825 |
| | $LIS_2$ | I am able to synthesize information objectively for decision making | 0.823 | |
| | $LIS_3$ | I realize the importance of lifelong learning | 0.831 | |
| | $LIS_4$ | I am able to convey ideas and thoughts effectively to others | 0.828 | |
| | $LIS_5$ | I am able to work effectively with others to achieve common goals | 0.826 | |
| IMTS | $IMTS_1$ | I am able to select information effectively to solve problems | 0.833 | 0.837 |
| | $IMTS_2$ | I am able to access and disseminate information through various social media | 0.835 | |
| | $IMTS_3$ | I am able to use information and communication technology (ICT) effectively and responsibly | 0.841 | |
| LCS | $LCS_1$ | I am able to adapt to new environments or major changes as an impact of ICT developments | 0.816 | 0.811 |
| | $LCS_2$ | I am able to direct and control actions to realize my goals | 0.809 | |
| | $LCS_3$ | I am able to interact effectively with others based on different cultures | 0.818 | |
| | $LCS_4$ | I am able to act productively and responsibly towards my duties | 0.821 | |
| | $LCS_5$ | I am able to influence and direct others to achieve common goals | 0.814 | |