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The Goal-Oriented Model Evaluation of Implementing Teaching Factory in Refrigeration and Air Conditioning at SMK Center Of Excellence, DK Jakarta

Aghnina Camilla Husna*, Muksin, Soeprijanto
Technology and Vocational Education, Universitas Negeri Jakarta, East Jakarta, 13220, Indonesia

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* *Corresponding author:*

E-mail: aghninacamilla@gmail.com

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A B S T R A C T

Teaching factory is a real production-based learning method, such as making, selling products, or providing services in an educational environment. This study aims to assess the level of implementation of the Teaching Factory learning program on the expertise competency of Refrigeration and Air Conditioning Engineering (TPTU) at the Center of Excellence Vocational High School of the Special Region of Jakarta based on the objectives of the program itself (Goal Oriented). The approach used in this study is a mixed method with data collection techniques through interviews, observations, documentation, and questionnaires. This study was conducted at the Centre of Excellence Vocational School which organizes a learning Teaching Factory on the competence of refrigeration and air conditioning engineering expertise in the Special Region of Jakarta. The sample of this study consisted of 5 schools with an average evaluation result of 80,58%. Based on this value, it can be concluded that the implementation of the Teaching Factory on the competence of refrigeration and air conditioning engineering expertise at the SMK Pusat Keunggulan DK Jakarta was carried out well.

1. Introduction

The 21st century is marked by the era of globalization and rapid advances in information and digital technology due to the industrial revolution 4.0. Therefore, human resources in the 21st century are required to be able to adapt and follow the dynamics of technological developments that continue to change. Based on data from the Central Statistics Agency (BPS) in February 2025, vocational high school graduates are still the highest contributors to unemployment, namely 8%, although there was a decrease of 0.62% compared to the period in August 2024. DKI Jakarta Governor Regulation No. 32 of 2019 concerning Vocational High School Revitalization emphasizes that the main objective of revitalization is to equip

graduates to be ready to face change and have the ability to work, continue their education, or become entrepreneurs (BMW). As an effort to support the objectives of vocational high school revitalization, the Center of Excellence Vocational High School program was launched as a strategy to improve the quality of vocational education.

The International Labour Organization (ILO, 2020) states that unemployment occurs due to an imbalance between the limited labor market demand for certain skills and the abundance of labor. Excess labor and minimal job opportunities are one of the causes of the mismatch between education and labor market needs (Tessa & Humaedi, 2024). Suparno, as cited in Aini & Purba (2022) stated that failure to align job seekers' competencies with industry needs is the cause of educational mismatch. The purpose of the link and match concept is to adjust students' abilities to the demands of the Business World and Industry (DUDI), so that vocational school graduates can be immediately accepted into the workforce after completing their education. The Center of Excellence Vocational School Program is a form of innovation designed to address various problems in improving the quality of vocational schools (Lince, 2022). Collaborative efforts in the Center of Excellence Vocational School program are realized through the 8+i concept Link and Match**,** One of these concepts is the Teaching Factory.

Teaching Factory is a combination of competency-based learning and production-based learning with the aim that the skills learned by students are applied following actual work procedures, with product results that meet the standards and requirements set by the market or consumers (Rukmana, et al., 2021). The purpose of Teaching Factory learning is to prepare students to enter the workforce by mastering relevant competencies aligned with market demands, enabling them to succeed in hands-on practice and perform well in the workplace (Sofyan, 2015). The implementation of the Teaching Factory must adhere to established principles and standards and be supported by strong collaboration between schools and industry.

Despite a well-designed program, certain obstacles and challenges will inevitably arise. For example, a study by Widodo & Utama (2022) used SWOT analysis to examine the current state and prospects of TEFA implementation in vocational schools. Their findings revealed weaknesses such as the lack of production-based learning and limited industrial work experience among some teachers. Additionally, the study identified threats, including rapid technological advancements that require continual updates and the dependence of many schools on government financial assistance.

Further research by Walsiyam (2022) identified several barriers to the implementation of Teaching Factory in the Refrigeration and Air Conditioning competency program in vocational schools. These barriers include limited funding, minimal IT-based learning, the fact that most industries are located outside the city, and low parental involvement. Therefore, it is crucial to pay serious attention to the implementation of Teaching Factory learning to produce competent graduates who meet the evolving demands of the workforce.

To date, the implementation of the Teaching Factory program in the Refrigeration and Air Conditioning competency area at SMK Center of Excellence in the Jakarta Special Region has not been evaluated. Without evaluation, it is difficult to determine the success of a program. This aligns with Astiti (2017) who stated that evaluation is a way to identify whether a program has achieved its intended goals, whether it is feasible, and whether its implementation is efficient. The Goal-Oriented Evaluation Model is one of the various evaluation models developed by Tyler. Goal-Oriented Evaluation (GOE) focuses on the objectives established before the program's implementation (Inayati et al., 2024).

The evaluation process in this study follows Tyler's seven steps in the Goal-Oriented Evaluation model: (1) Formulating goals; (2) Classifying goals; (3) Defining goals into more specific and measurable indicators; (4) Determining when the goals should be achieved; (5) Selecting and developing appropriate measurement methods; (6) Collecting data; and (7) Interpreting data to the goals. The GOE model is highly relevant in the context of Teaching Factory implementation, where every activity and learning process is expected to achieve the predetermined objectives. Thus, the evaluation process becomes more focused and effective in supporting the achievement of optimal results.

2. Methodology

Sub-chapter (if any)

The evaluation model used is Tyler's Goal Oriented, where the evaluation is designed to be goal-oriented both from the start of the activity and when the activity is still ongoing (Wardani et al., 2022). The approach in this study uses a combination of qualitative and quantitative research (*mixed methods*). This study uses a case study method for qualitative data and a survey method for quantitative data. This study uses a model of *Concurrent* (mixed combination), the process of collecting and analyzing qualitative and quantitative data simultaneously (Creswell, 2023). Qualitative and quantitative data in this study were obtained from data collection techniques, namely observation, documentation, questionnaires, and semi-structured interviews, which will then be analyzed using triangulation techniques and sources.

The research sample was obtained using the technique of Stratified *Sampling*, namely a sampling method that is carried out in stages. The basis for forming strata is based on the Center of Excellence Vocational School, which implements the *Teaching Factory* on the expertise competency of Refrigeration and Air Conditioning Engineering. There are five schools that are samples in this study, namely SMKN 26 Jakarta, SMKN 5 Jakarta, SMKN 34 Jakarta, SMKN 55 Jakarta, and SMKN 54 Jakarta. Respondents for interviews in this study were teachers, vice principals, and collaborating industries, while respondents for the questionnaire were students.

3. Results and Discussion

Results

The data collected in this study were then analyzed using data triangulation techniques and descriptive statistics. The results of the implementation of the Teaching Factory based on data triangulation from observations, interviews, and documentation can be seen in Table 1. below.

Table 1. Results of Teaching Factory Implementation for the Whole School

No.	School	Average Result	Category
1.	SMKN 26	73,52%	Good
2.	SMKN 5	85,29%	Good
3.	SMKN 34	70,58%	Moderate
4.	SMKN 55	82,35%	Good
5.	SMKN 54	91,17%	Good
Average		80,58%	Good

In the table above, it can be seen that the implementation of Teaching Factory at SMKN 54 received the highest score with 91.17% and was included in the High category. This result was obtained based on the entrepreneurial aspect, where SMKN 54 focused not only on developing the competencies of its students but also on increasing the entrepreneurial spirit in students. Furthermore, SMKN 34 found the lowest position with a score of 70.58% and was included in the moderate category. This is because the administrative process of the implementation of the Teaching Factory was not optimal. Overall, the results of the implementation of Teaching Factory on the expertise of Refrigeration and Air Conditioning Engineering at SMK PK DK Jakarta received an average score of 80.58% and was included in the Good category. The results of the implementation of the Teaching Factory from each school in Table 1. above were then re-validated by students using a questionnaire. The following is a descriptive table of the results of the student questionnaire from each sample school.

Table 2. Results of Teaching Factory Implementation Based on Questionnaires from Each School

No.	School	Average Result	Category
1.	SMKN 26	80,52	Fairly good
2.	SMKN 5	87,76	Fairly good
3.	SMKN 34	79,05	Fairly good
4.	SMKN 55	83,43	Fairly good
5.	SMKN 54	88,44	Fairly good
Average		83,84	Fairly good

From Table 1. above, we can see that SMKN 54 is the school with the highest TEFA implementation score, which is 88.44, which means it is in the fairly good category. SMKN 34 got the lowest score, which is 79.05 although this number is still in the fairly good category. SMKN 26 got a score of 80.52, which means it is fairly good. SMKN 5 got a score of 87.76, which means it is fairly good. SMKN 55 got a score of 83.43, which means it is fairly good. In addition, the average results from each

school related to the implementation of the Teaching Factory in the refrigeration and air conditioning engineering expertise competency at SMK PK DK Jakarta got a score of 83.84, which is in the fairly good category. The following is a description of the results from each school.

1. SMKN 26 Jakarta

Based on the results of the questionnaire that has been distributed to students at SMKN 26 Jakarta, data were obtained regarding the level of success of program implementation based on several indicators, as shown in the following table.

Table 3. Results of Teaching Factory Implementation Based on SMKN 26 Jakarta

No.	School	Average Result
1.	Industrial Culture	86
2.	Service Results	83
3.	Real Experience Learning	83
4.	Creative Skills	79
5.	Communication Skills	85
6.	Critical Thinking Skills	80
7.	Collaboration Skills	82
8.	Relationship with Industry	74
9.	Entrepreneurship	73
	Average	81

From the table above, we can see that the implementation of industrial culture got a score of 86, which means it is in the good category. This supports the interview statement from the teacher and vice principal, that the school always directs teachers to apply industrial work principles and evaluates them at the end of each activity. The results of the service got a score of 83, which means it is fairly good, indicating that the quality of the service provided is good. Real experience learning got a score of 83, which means it is fairly good. In creative skills, it got a score of 79, which means it is fairly good. Communication skills got a score of 85, which means it is fairly good. Critical thinking skills got a score of 80, which means it is fairly good.

Collaboration skills got a score of 82, which means it is fairly good. Looking at the results of the 4C skill scores at SMKN 26, it shows that the school is quite successful in improving 21st-century skills for its students. Furthermore, industrial relations got a score of 74, which means it is not good. This supports the school's statement that the school is still trying to create a production unit, and the submission of authorized is still in process. Furthermore, entrepreneurship got a score of 73, which means it is not good, indicating that the school has not been able to improve the entrepreneurial spirit in students. The overall average result is 81, which shows that the implementation of the teaching factory in the refrigeration and air conditioning engineering expertise competency at SMKN 26 is fairly good.

2. SMKN 5 Jakarta

The results of the questionnaire distributed to students at SMKN 5 Jakarta regarding the level of success of program implementation based on several specific indicators can be seen in Table 4. below.

Table 4. Results of Teaching Factory Implementation Based on SMKN 5 Jakarta

No.	School	Average Result
1.	Industrial Culture	88
2.	Service Results	86
3.	Real Experience Learning	90
4.	Creative Skills	86
5.	Communication Skills	89
6.	Critical Thinking Skills	87
7.	Collaboration Skills	90
8.	Relationship with Industry	89
9.	Entrepreneurship	86
	Average	88

We can see Table 4. above shows that the implementation of industrial culture gets a score of 88, which means it is in the fairly good category based on the value interval from SMKN 5 Jakarta. This shows that the school really instills the principles of industrial work in Teaching Factory learning. The results of the service get a score of 86, which means it is fairly good, indicating that the quality of service provided is fairly good. Real experience learning gets a score of 90, which means it is fairly good, which supports the interview results that the school really pays attention to equipment layout, K3, tool usage procedures, and trains student independence optimally.

In creative skills, it gets a score of 86, which means it is fairly good. Communication skills get a score of 89, which means it is fairly good. Critical thinking skills get a score of 87, which means it is fairly good. Collaboration skills get a score of 90, which means it is fairly good. Looking at the results of the 4C skill scores at SMKN 5 also shows that the school is fairly successful in improving 21st-century skills for its students. Furthermore, industrial relations scored 89, which means it is fairly good, even the school already has further cooperation for Teaching Factory in refrigeration, namely Panasonic Authorized Service Center (PASS) and there is support from industry in improving knowledge and technology in schools such as holding teacher training, presenting guest teachers, and providing grants in the form of AC units and trainer services.

Furthermore, entrepreneurship scored 86, which means it is fairly good. This supports the results of interviews with the school, that the school provides opportunities for students to borrow service equipment on holidays, and for students to start opening businesses independently with the competencies they have. The overall average result is 88, which shows that the implementation of the teaching factory in the refrigeration and air conditioning engineering expertise competency at SMKN 5 is fairly good.

3. SMKN 34 Jakarta

Data on the level of success of program implementation based on several indicators, obtained through a questionnaire to students at SMKN 34 Jakarta, are presented in Table 5. below.

Table 5. Results of Teaching Factory Implementation Based on SMKN 34 Jakarta

No.	School	Average Result
1.	Industrial Culture	84
2.	Service Results	72
3.	Real Experience Learning	81
4.	Creative Skills	78
5.	Communication Skills	89
6.	Critical Thinking Skills	74
7.	Collaboration Skills	84
8.	Relationship with Industry	77
9.	Entrepreneurship	75
	Average	79

Based on Table 5. it can be seen that the implementation of industrial culture at SMKN 34 Jakarta obtained a score of 84, which is categorized as fairly good according to the assessment interval used. This indicates that the school has consistently integrated industrial work principles in the implementation of Teaching Factory learning. Services obtained a score of 72, which can be categorized as less good. This supports the results of interviews with the school that services at SMKN 34 are still within the scope of the school, so that students have not been trained when providing services outside of school. Real experience-based learning received a score of 81, with a fairly good category. In terms of 21st-century skills, the creative skills score is 78, which means fairly good. Communication skills with a score of 89, which means good. Critical thinking skills with a score of 74, which means fairly good. Collaboration skills with a score of 84, which means fairly good. This reflects the success of the school in developing 4C skills in students. Relationships with industry received a score of 77, which means fairly good. For entrepreneurship, the score obtained was 75, which means fairly good. Overall, the average score was 79, which shows that the implementation of the Teaching Factory for Refrigeration and Air Conditioning Engineering competency at SMKN 34 Jakarta went fairly good.

4. SMKN 55 Jakarta

The results of data from SMKN 55 Jakarta regarding the level of success of program implementation based on a number of indicators obtained through questionnaires to students are presented in Table 6. below.

Table 6. Results of Teaching Factory Implementation Based on SMKN 55 Jakarta

No.	School	Average Result
1.	Industrial Culture	86
2.	Service Results	82
3.	Real Experience Learning	86
4.	Creative Skills	82
5.	Communication Skills	85
6.	Critical Thinking Skills	82
7.	Collaboration Skills	85
8.	Relationship with Industry	82
9.	Entrepreneurship	81
	Average	83

Based on Table 6. it can be seen that the implementation of industrial culture at SMKN 55 Jakarta obtained a score of 86, which is categorized as fairly good according to the assessment interval used. This shows that the school has succeeded in integrating industrial work principles in the implementation of Teaching Factory learning. In terms of service, the school obtained a score of 82, which is also categorized as fairly good. This reflects that the quality of the services provided has met the standards. Real experience learning achieved a score of 86 and was categorized as fairly good, as it strengthens the interview results, which stated that the school really adopted industrial work standards, starting from curriculum alignment, work time, and product processing must be done by SOP.

In 21st century skills, namely 4C, SMKN 55 obtained a score of 82 for creative skills, 85 for communication skills, 82 for critical thinking, and 85 for collaboration skills, all of which are included in the fairly good category. These results show that the school is quite successful in developing 21st-century skills in its students. In terms of relations with industry, the school scored 82, which is also fairly good. In addition to SMKN 55 having established further cooperation in the form of Panasonic Authorized Service Center (PASS), the school and industry are also actively collaborating with the industry to improve superior human resources by providing training for both teachers and students, and providing assistance in the form of AC units and trainer services. Meanwhile, in the aspect of entrepreneurship, the score obtained was 81, also categorized as fairly good. Overall, the average score obtained was 83, which shows that the implementation of the Teaching Factory in the expertise competency of Refrigeration and Air Conditioning Engineering at SMKN 55 Jakarta is running fairly good.

5. SMKN 54 Jakarta

The results of the questionnaire distributed to students at SMKN 54 Jakarta regarding the level of success of program implementation based on several specific indicators can be seen in Table 7. below.

Table 7. Results of Teaching Factory Implementation Based on SMKN 54 Jakarta

No.	School	Average Result
1.	Industrial Culture	91
2.	Service Results	84
3.	Real Experience Learning	92
4.	Creative Skills	88
5.	Communication Skills	89
6.	Critical Thinking Skills	88
7.	Collaboration Skills	90
8.	Relationship with Industry	91
9.	Entrepreneurship	84
	Average	89

Based on Table 7. it can be seen that the implementation of industrial culture at SMKN 54 Jakarta obtained a score of 91, which is categorized as fairly good according to the assessment interval used. The school is fairly successful in integrating industrial work principles in the implementation of Teaching Factory learning. In terms of service, the school obtained a score of 84, which is also

categorized as fairly good. Based on the interview results, in carrying out services, the school carries out strict quality control for both its students and instructor teachers. Real experience learning achieved a score of 92 and is categorized as fairly good, as it strengthens the interview results, which state that teachers always provide case studies for each practical learning so that students can have an idea of the problems and solutions when they directly service consumer AC units. In 21st century skills, namely 4C, SMKN 54 obtained a score of 88 for creative skills, 89 for communication skills, 88 for critical thinking, and 90 for collaboration skills, all of which are also included in the fairly good category.

These results indicate that the school is fairly successful in developing 21st-century skills in its students. In terms of relations with industry, the school scored 91, which is also fairly good. In addition to SMKN 55 having established further cooperation in the form of Panasonic Authorized Service Center (PASS), the school and industry are also actively collaborating with the industry to improve superior human resources by providing training for both teachers and students, and providing assistance in the form of AC units and trainer services. Meanwhile, in the aspect of entrepreneurship, the score obtained was 84, also categorized as fairly good. This supports the results of the interview, the teacher gave an assignment to make a poster about the services that they will disseminate through social media or the surrounding environment, so that students are required to dare to open a business with the skills they have. Overall, the average score obtained was 89, which shows that the implementation of the Teaching Factory in the expertise competency of Refrigeration and Air Conditioning Engineering at SMKN 54 Jakarta went fairly good.

Discussion

The results of the study on the implementation of Teaching Factory (TEFA) in the expertise of Refrigeration and Air Conditioning Engineering in five SMK PK DK Jakarta showed that all schools were quite successful in implementing the Teaching Factory learning program well. This can be seen from the average value of the implementation of Teaching Factory in each sample school of 80.58% and is included in the high category. This is then supported by the results of the questionnaire from students of 83.84, which is included in the fairly good category according to the assessment interval used. SMKN 54 Jakarta became the school with the highest score of 91.17%, followed by SMKN 5 with 85.29%, SMKN 55 with 82.35%, SMKN 26 with 73.52%, and SMKN 34 with the lowest score of 70.58%. Then the results are in line with the questionnaire data from students in each school. Although all schools are still in the same category range, the variation in scores reflects differences in the level of readiness, industry support, and TEFA implementation strategies in each school.

One of the main strengths in the implementation of TEFA in most schools is learning based on the application of industrial culture and real experience. Industrial culture, namely 5R, which includes the principles of Concise, Neat, Clean, Maintain, and Diligent, is an approach that aims to improve efficiency and productivity in the industrial workplace (Sari, 2023). Meanwhile, according to Irfan

et al. (2024) real experience can improve students' practical skills by encouraging the development of abilities such as problem solving, cooperation, communication, and technical skills needed in the world of work. Schools such as SMKN 54 and SMKN 5 have succeeded in creating a learning environment that resembles industry, starting from the layout of the practice room, enforcing occupational safety procedures (K3), to compiling case studies based on real problems. Students are actively involved in the service process, which gives them experience and an in-depth understanding of the competence of refrigeration expertise. This practice not only improves students' technical skills but also forms a professional mindset and work discipline needed in the industrial world.

However, the research results also revealed several challenges that schools still face, especially in terms of entrepreneurship and relations with industry. Low scores in both aspects were evident in SMKN 26 and SMKN 34, indicating that cooperation with the Business World and Industry (DUDI) has not been running optimally. The minimal involvement of industry in the implementation of Teaching Factory has the potential to create a mismatch between the competencies formed in the school environment and the demands needed by the industrial world (Kasman, 2017). Undeveloped production units and minimal involvement of industry in providing orders for the learning process cause students to lose the opportunity to learn about work dynamics, deal directly with consumers, and build an entrepreneurial spirit. According to Kasman (2017) the success of TEFA is also seen from the provision of entrepreneurial knowledge. This aspect is very crucial in bridging vocational high school graduates to be able to become entrepreneurs or work independently after graduating.

Another obstacle is the limited supporting facilities and infrastructure, especially in schools with low scores. Some schools still have difficulty in providing practical tools that are in accordance with current industry needs. For example, currently in schools, there are only split AC units, while in the industry, the AC units used are various, such as cassette AC, inverter AC, window AC, etc. This limitation has an impact on the less-than-optimal learning experience, as well as delays in adapting new technologies that are being developed in the refrigeration and air conditioning engineering sector. In addition, the existence of productive teachers who have not participated in regular industrial training also contributes to the obstacle in bridging the gap between learning in schools and the demands of the world of work.

To overcome these problems, it is necessary to strengthen the partnership between schools and industry. According to the (Amin, 2020)the success of cooperation with industry is the result of cooperation, *project work*, increasing technological knowledge, and industrial investment. The development of production units in schools should be a priority, by encouraging students and teachers to provide services that can be offered directly to the community in a sustainable manner. This not only trains entrepreneurial skills, but also increases school income independently. Local governments can also provide incentives or facilities for TEFA service results. In addition, strengthening teacher competency is key to improving the quality of TEFA implementation. Teachers need to be encouraged to take training that is relevant to the latest technology and industry trends. According

to Dewi et al. (2024) teacher internship training programs in industry will have an impact on the quality of teaching, teachers will provide relevant materials, methods that follow the industry, and teachers will be more confident in teaching. In the long term, the preparation of a TEFA implementation roadmap that is adjusted to local potential and needs is very necessary. This roadmap must include infrastructure development, human resource development, the formation of industrial networks, and program evaluation and monitoring strategies.

Overall, the results of this study indicate that the implementation of Teaching Factory on Refrigeration and Air Conditioning Engineering competencies at SMK PK DKI Jakarta has shown a positive direction, even though it still faces several challenges. To improve the effectiveness of TEFA implementation, it is necessary to strengthen cooperation with the industrial world, improve access and quality of services offered by schools, and empower students in entrepreneurship. In addition, continuous evaluation and strengthening of teacher capacity in managing TEFA are very important to maintain the quality of the program. Thus, TEFA can be a driving force for improving the quality of SMK graduates who are competent, productive, and ready to compete in the global workforce.

4. Conclusion

This study aims to evaluate the implementation of the Teaching Factory (TEFA) program on the Refrigeration and Air Conditioning Engineering Expertise Competence at SMK PK DK Jakarta, which is based on the objectives of the Teaching Factory program (Goal Oriented). The evaluation includes industrial culture, service results, real-world learning experiences, 21st-century skills 4C, relationships with industry, and entrepreneurship. The research findings indicate that the implementation of the Teaching Factory program is running fairly good, especially in the application of industrial culture in schools and learning with real experiences. However, collaboration with industry, instilling an entrepreneurial spirit, and student involvement in making improvements outside of school need to be improved.

Overall, the implementation of the Teaching Factory (TEFA) has made a positive contribution in reducing the gap between the world of vocational education and the real needs of the industrial world. Through a learning approach based on production and direct practice following industry standards, students are equipped with more relevant, applicable, and ready-to-use competencies. This shows that TEFA is an important bridge in creating graduates who are highly competitive in the job market. With the active involvement of industry in the education process, such as in terms of curriculum development, teacher training, and provision of practice facilities, it is hoped that TEFA will be able to create a learning ecosystem that is close to the real work atmosphere. It is hoped that future research can explore the continued impact of TEFA implementation, especially in examining the long-term impact on graduates' work readiness and the effectiveness of TEFA in improving the quality and relevance of student competencies in various sectors of expertise.

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