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MANAGEMENT TEACHING FACTORY IN IMPROVING THE COMPETENCY OF MECHANICAL ENGINEERING STUDENTS INDUSTRY AT NUSANTARA MANDIRI VOCATIONAL SCHOOL BONTANG

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ABSTRACT

The gap between student competency and industry encourages the implementationTeaching Factory (TeFa). This descriptive qualitative research aims to describe the management (planning, organizing, implementation, supervision) as well as the supporting and inhibiting factors of TeFa in the Industrial Mechanical Engineering Department of SMK Nusantara Mandiri Bontang. Data were collected through observation, interviews, and documentation, then analyzed using the Miles and Huberman model. The results of the study indicate: (1) collaborative planning according to practical needs; (2) organization through the formation of a special structure; (3) implementation involves curriculum alignment, 10 JP/month industrial learning, a block system, and two-stage PKL; (4) supervision is carried out in stages; (5) supporting factors include teacher competence and industry-standard facilities, while obstacles include limited funds and time for completing large projects.

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1. INTRODUCTION

Vocational education plays a strategic role in developing competent and competitive human resources. However, data from the Central Statistics Agency (BPS) in 2023 shows that the Open Unemployment Rate (TPT) for vocational high school graduates remains the highest compared to other educational levels, at 9.42%. This indicates a gap (mismatch) between the competencies taught in schools and the needs of the industrial world. Many graduates need to be retrained when entering the workforce because of practical and technical skills. Soft skillsThey do not yet fully meet industry standards (Patria, 2024). Research by Putra & Sari (2022) also shows that most vocational school graduates still struggle to apply theory to real-world practice.

The Indonesian government, through Presidential Regulation No. 68 of 2022 concerning the Revitalization of Vocational Education, has encouraged curriculum alignment with the business and industrial world (DUDI). One implementable solution to bridge this gap is the learning model. Teaching Factory (TeFa). TeFa is a production/service-based learning model that brings an industrial atmosphere into the school environment, so that students not only learn theory but also produce products that meet market standards. TeFa has proven to be feasible and effective in improving entrepreneurship programs and industry-based student competencies in vocational schools (Dwikurniangsih, 2025).

Previous research on TeFa has been conducted with various focuses. For example, Setiawan (2021) examined the effect of TeFa on improving the skills of vocational high school students and found significant results in the technical skills aspect. Meanwhile, Putri (2022) highlighted supporting and inhibiting factors in TeFa implementation, such as the availability of practice facilities and industry support. Suwito (2025) analyzed the impact of implementing learning models. Teaching Factoryon the entrepreneurial interest of students at SMK Negeri 1 Duduksampeyan and the results had a very significant effect on students' entrepreneurial interest, with an average score of 82.85% and 78% of students were motivated to start a business (Suwito et al., 2025).

SMK Nusantara Mandiri Bontang, particularly its Industrial Mechanical Engineering (TMI) Department, has implemented TeFa and demonstrated success indicators, such as orders from major industries (PT. Tigatra, PT. BES, Pupuk Kaltim) and high graduate absorption. However, TeFa's success depends not only on facilities but also on sound management governance, including planning, organization, implementation, and supervision. This study aims to analyze the management ofTeaching Factoryin an effort to improve student competency at SMK Nusantara Mandiri Bontang, which is expected to become a reference model for effective vocational education management.

2. RESEARCH METHODS

This study used a descriptive qualitative approach to obtain an in-depth overview of the TeFa management phenomenon in the field. The research was conducted at SMK Nusantara Mandiri Bontang, East Kalimantan Province.

Data and Data Sources

Primary data sources were obtained through in-depth interviews with key informants selected using techniques. Purposive sampling, where the researcher himself determined the informants who were considered to understand and be directly involved in the implementation of the Teaching Factory, including: the Principal, Vice Principal for Curriculum, TeFa Coordinator, Head of the TMI Department, and Productive Teachers. Secondary data were collected from curriculum documents, MoUs with industry, activity reports, and organizational structures.

Table 1. Informant Determination List

No	Informant	Number of people)	Gender
1	Headmaster	1	Man
2	Deputy Principal for Curriculum	1	Man
3	TeFa Coordinator	1	Man
4	Head of TMI Department	1	Woman
5	TMI Productive Teacher	1	Man
		5 People	

Data Collection and Analysis Techniques

Data collection was conducted through three main techniques: participant observation of TeFa activities, in-depth interviews, and documentation studies. During the observation activities, researchers directly observed TeFa activities in the TMI department, including observing existing infrastructure. Semi-structured interviews were conducted using interview guidelines, but could be developed according to the reality in the field. Each informant required 1-1.5 hours to gather information related to TeFa management. Meanwhile, documentation studies were conducted by comparing existing documents related to TeFa, including curriculum alignment documents, organizational structures, Field Work Practice (PKL) reports, teaching modules, and cooperation documents (MoUs) with industrial partners. Data analysis used the Miles and Huberman interactive model consisting of three stages: data reduction, data presentation, and drawing conclusions (Miles & Huberman, 2014). First, data reduction/data condensation (data condensation) where raw data obtained from interviews, observations, and documentation are sorted and condensed according to the research focus. With data reduction, researchers can filter information that truly supports management analysis. Teaching Factory, both data presentations (data display), conducted in the form of narrative descriptions, tables, matrices, or charts to observe patterns, relationships between categories, and trends in the research results. Structured data presentation facilitates the interpretation process and minimizes researcher bias (Creswell & Creswell, 2021). The final stage is drawing conclusions (conclusion drawing/verification) where this conclusion is not drawn instantly, but rather through a repeated confirmation process with additional data to maintain the validity of the findings. Data validity checks were conducted using source triangulation from the five informants and technical triangulation by comparing data from observations, interviews, and documentation studies to ensure the consistency and accuracy of the research findings. In addition, data validation was also conductedmember checkby asking for confirmation from research participants regarding the temporary findings (Sugiyono, 2022).

3. RESULT AND ANALYSIS

Planning (Planning)

The TeFa planning at SMK Nusantara Mandiri Bontang was carried out collaboratively, involving school management, including the principal, teachers, students, and industry partners. This process included analyzing market needs, aligning the curriculum with industry, and determining product/service types. Findings indicate that the planning was conducted in a focused manner to ensure that production activities did not disrupt learning outcomes but instead strengthened them. The schedule was arranged to align with industry needs without sacrificing normative and adaptive subjects. This planning pattern reflects the characteristics ofTeaching Factorywhich emphasizes standardized collaboration (Ary Sunaryo, 2022).

Aligning the curriculum is the first step in implementing TeFa to meet the needs of the industrial world. The curriculum is structured in line with industry standards, encompassing competencies, learning materials, methods, and the products or services produced by students, ensuring students gain a learning experience that closely approximates actual work conditions (Wayan Dasna, 2024).

Organizing (Organizing)

Organization is carried out by establishing the TeFa structure. The TeFa organizational structure is professionally structured, resembling an industrial structure. There is a clear division of duties, starting with President Director (Principal) to the technical implementers of students. The clarity of this organizational structure allows for effective division of tasks in planning, implementing, supervising, and evaluating activities. Teaching Factory (Djoko Dwi Kusumojanto, 2020).

Human Aspect (Man)

Productive teachers act as supervisors/instructors, while students are placed in work positions according to their competency level (operator, quality control).

Market Aspects (Market)

Product marketing is carried out extensively, covering orders from government agencies (the Environmental Agency), private companies, and even internal school needs. The increasing number of partner industries will further train students with real-world projects, thereby enhancing their skills. The implementation of TeFa has been shown to increase students' hard and soft skill competencies by up to 78.26% and strengthen relationships with industry (Een Rohaeni, 2021).

The following is the TeFa structure at SMK Nusantara Mandiri Bontang.

Figure 1. Tefa Structure Image

Implementation (Actuating)

Based on the research results, the implementationTeaching FactoryAt SMK Nusantara Mandiri Bontang, it is implemented in an integrated manner with reference to the 7M elements as the basis for managing production-based learning. In this aspect, man, implementation Teaching FactoryThis involves the active role of productive teachers as mentors and facilitators, while students act as the implementers of the assigned tasks. Teachers not only provide technical instructions but also provide guidance throughout the work process to ensure students understand work procedures and industry standards. Consistent, organized, and industry-standard implementation significantly impacts success. Teaching factory (Aulya Chasovy, 2024).

TeFa's implementation utilizes a weekly block system and specific assignments. The block system provides flexibility in learning time, allows students to focus on completing job assignments according to targets, and optimally aligns the ratio of tool use and teacher support (Akbarul Kautsar, 2022). Integrating learning through real-world practice improves students' understanding of workflows and skills (Agum Anugrah Ugama Hendra, 2020).

Students gain hands-on learning experience from industry practitioners for 10 teaching hours (JP) per month. Field Work Practice (PKL) is conducted twice: five months in grade 11 and four months in grade 12. This approach has proven effective in improving student learning. Hard skills (machining techniques, welding) as well assoft skills (discipline, work ethic, K3). Effective time management allows practical activities to run optimally while maintaining a balance between theoretical and practical learning. This shows that the implementationTeaching Factoryhas been designed to support the achievement of student competencies in a sustainable manner while improving students' technical skills and creativity (Hazizah, 2023).

The products produced by students vary according to customer orders, including: Traffic lightand metal construction, trellises, scaffolding, fences, and so on. Students' services are even being utilized in the IKN project.

Supervision (Controlling)

TeFa supervision at SMK Nusantara Mandiri Bontang is carried out in stages and continuously, covering all aspects, from planning, implementation, and post-implementation. Comprehensive evaluations provide a complete picture of quality. Teaching Factory of school (Lisna Nurrohmawati, 2023).

a. Planning
   Oversight of the planning aspect is carried out through checking the Teaching Factory curriculum's alignment with industry needs, validating the block system learning schedule, and verifying the planned material and practical equipment requirements. The principal and management team also oversee the completeness of planning documents such as activity proposals, organizational structures, and task allocations to ensure implementation is focused.
b. Implementation
   Supervision during the implementation phase focuses on the ongoing learning and production processes. Productive teachers and Teaching Factory coordinators directly supervise machine use, the implementation of SOPs and K3, the efficiency of material use, and the achievement of job order completion targets. In addition, routine monitoring of student attendance, student engagement in the work process, and the quality of interim results is conducted to ensure the Teaching Factory is running according to plan. Direct supervision is also provided by productive teachers and industry instructors during project execution.
c. Post implementation
   Post-implementation monitoring is conducted through a comprehensive evaluation of the results of the Teaching Factory activities. This monitoring includes assessing the quality of the products or services produced, evaluating student competency achievement, and analyzing the alignment between planning and implementation. The results of post-implementation monitoring are used for reflection and continuous improvement in the planning of the Teaching Factory for the following period. Quality ControlStrict QC (Quality Control) is applied to final products before they are delivered to consumers. Routine evaluations are conducted to identify technical and managerial deficiencies. This is in line with the characteristics ofTeaching Factorywhich demands quality processes and production results as part of learning (Triatmoko & Slamet, 2021).

Supporting and Inhibiting Factors

Supporting factors for the Teaching Factory at SMK Nusantara Mandiri Bontang include teacher competency according to their field of expertise, student competency, industry-standard infrastructure (workshops), readily available practical materials, and strong commitment from industry partners in the form of PKL (Practice Practice) facilities, financial assistance, competency tests, and in-school learning. The inhibiting factors for the Teaching Factory are limited funding for large-scale projects, where the school is unable to finance external orders that exceed the school's budget, and limited practical time to complete complex and large production jobs. For more details regarding the supporting and inhibiting factors for the Teaching Factory, see the following table:

Table 2. Supporting and Inhibiting Factors

Supporting Factors	Inhibiting Factors
Teacher and student competencies	Limited funds for large projects
Complete industrial standard infrastructure	Limited student practice time
Practice materials are easy to obtain	
Strong partnership with industry	

The solution to overcome the existing inhibiting factors is to establish cooperation with industry in terms of funding/assistance in supplying project materials and providing special allowances outside of school hours in completing large projects

4. CONCLUSION

Implementation of managementTeaching Factoryat SMK Nusantara Mandiri Bontang in the Industrial Mechanical Engineering Department has been running effectively through the implementation of the POAC management function (Planning, Organizing, Actuating, Controlling) integrated. In terms of planning, the school has aligned its curriculum with industry. Organizational aspects include establishing a TeFa structure with the principal as president director. TeFa is implemented collaboratively between the school and industry partners, with 10 industrial learning sessions per month, block-based learning, and two student internships. Supervision is carried out in stages, starting from planning, implementation, and post-implementation on an ongoing basis. This has a positive impact on improving student competency, as evidenced by students' ability to produce market-standard products and high industry trust. The inhibiting factor of limited funding for large-scale projects is addressed by collaborating with industry for funding and by supplying project materials as agreed. Time constraints for project work are addressed by providing special assignments outside of student practice hours. Recommendations for further development include strengthening the quality control system. Teaching Factoryespecially in maintaining product quality and industry trust, providing mentoring to students, especially in building work attitudes and optimizing practical time management to accommodate large-scale projects.

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