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Teaching Factory As A Model For Maintenance And Repair Learning In Vocational Motorcycle Engineering: A Systematic Review

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Abstract

This study systematically reviews the implementation of the Teaching Factory (TeFa) model in vocational motorcycle engineering education, with a specific focus on maintenance and repair learning. The background of the research lies in the persistent gap between theoretical instruction and practical application in vocational schools, which often leaves graduates underprepared for the demands of the labor market. The objective of this review is to synthesize empirical evidence on how TeFa supports the development of technical and soft skills, while also identifying enabling and inhibiting factors that influence its effectiveness. A Systematic Literature Review (SLR) approach was employed using the PRISMA protocol, analyzing 16 selected articles published between 2018 and 2025 from international and national journals. Data were extracted and analyzed thematically to identify recurring patterns and critical insights. The findings reveal that TeFa enhances students' diagnostic, servicing, and repair skills, while fostering teamwork, communication, and problem-solving abilities. Supporting factors include adequate facilities, curriculum alignment, and industry partnerships, whereas challenges involve limited equipment, insufficient practice time, and teacher readiness. The study concludes that TeFa not only advances theories of work-based learning and competency-based training but also provides significant implications for policymakers, educators, and industry stakeholders

Keywords: *Motorcycle Engineering, Teaching Factory, Vocational Education*

Introduction

TeFa model bridges the gap between theoretical knowledge and practical application, which is crucial in vocational education. Recent studies highlight that through direct participation in production processes, students in vocational high schools not only acquire essential skills but also cultivate a deep understanding of industry standards and expectations (Azizah et al., 2019). Hands-on experience afforded by TeFa cultivates competencies that remain with students long after they complete their education (Chasovy et al., 2024). Model implementation enhances collaborative and communication skills essential for the workforce (Wahjusaputri et al., 2020). Alignment of educational experience with industry requirements is reflected in reduced unemployment rates among vocational graduates, a condition linked to enhanced practical experience in vocational education (Wahjusaputri et al., 2020). Integration of industry within the TeFa framework is a critical factor for its success. Involvement of industry stakeholders in evaluating vocational education achievements ensures curriculum relevance to current industrial needs (Wahjusaputri et al., 2021). TeFa merges competency-based learning with production-oriented strategies, fostering entrepreneurial skills necessary for students to thrive in the industrial landscape of the Fourth Industrial Revolution (Dhani & Kristiani, 2021). Effective

cooperation between vocational schools and industry partners significantly enhances learning quality and prepares students for real-world challenges (Nurrohmawati, 2023).

Promising outcomes offered by the TeFa model are accompanied by several challenges. These challenges often arise from a lack of resources, varying levels of industry engagement, and the need for skilled instructors capable of delivering the TeFa curriculum effectively. Management deficiencies have been cited as a significant barrier to effective execution in vocational settings, underscoring the need for training and support for educators (Kautsar et al., 2022). Successful realisation also hinges on understanding the specific environments of vocational schools and the corresponding capabilities of industry partners (Puspitasari, 2024). This complexity is compounded by the necessity for ongoing dialogue and adaptation to ensure that vocational education remains relevant and responsive to evolving industry needs (Puspitasari, 2024). Assessment of TeFa programs requires systematic evaluation strategies to measure impacts. Mixed-method evaluation approaches incorporating expert feedback refine curriculum offerings and learning experiences within the framework (Nurrohmawati et al., 2023). Evaluation mechanisms that align with industry expectations ensure that competencies taught are relevant in the labor market (Sunaryo et al., 2021).

Evaluation efforts are critical not only for assessing student competencies but also for improving overall educational processes within vocational institutions. Continuous feedback from both educators and industry representatives refines the objectives and methodologies of the TeFa approach, ensuring alignment with contemporary industrial practices (Bikas et al., 2021). Collaborative networks between educational institutions and industry leaders promote knowledge exchange that enhances both teaching and learning in vocational settings (Dhani & Kristiani, 2021; Bikas et al., 2021). Implementation of TeFa is complicated by cultural and systemic factors inherent in different educational contexts. In Indonesia, traditional teaching methodologies may conflict with the hands-on, collaborative nature of the TeFa model. Reconceptualization of vocational education policies may be necessary to facilitate integration of competency-based education frameworks that align with international standards (Misbah et al., 2019). Strategic commitment from educational stakeholders is required to innovate pedagogical practices that not only embrace TeFa but also enhance the overall vocational education landscape (Misbah et al., 2019).

Enhancement of students' technical skills is one of the most prominent outcomes of employing TeFa in motorcycle engineering education. By engaging in practical, hands-on learning within a simulated factory environment, students can apply theoretical knowledge directly to real-world scenarios (Kautsar et al., 2022). Structure of TeFa promotes experiential learning, allowing students to develop vital technical proficiencies required in motorcycle maintenance and repair, thereby narrowing the competency gap between academic knowledge and industrial expectations (Puspitasari, 2024). Practical learning experiences mirroring corporate cultures significantly contribute to students mastering both hard skills specific to their trade and broader competencies (Puspitasari, 2024). Soft skills development is another crucial aspect fostered by TeFa. Pedagogical strategies employed within this framework encourage collaboration, communication, and problem-solving, skills essential for success in modern workplaces (Almeida & Morais, 2021). Participation in group projects and industry collaborations as part of TeFa experience builds stronger teamwork capabilities and improves emotional intelligence, which are critical for employability in today's job market (Marwa et al., 2020).

Employability outcomes of students who undergo training within a Teaching Factory framework demonstrate increased job readiness upon graduation. Students with practical experience in factory settings have a notable advantage in the job market, as they are equipped with specialized knowledge and soft skills highly valued by employers (Diwangkoro & Soenarto,

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2020). Implementation of TeFa significantly narrows the competency gaps between industry needs and student skills, enabling graduates to transition into employment more readily than those from traditional vocational education tracks (Wahjusaputri & Bunyamin, 2022). Implementation challenges remain, particularly regarding availability of appropriate resources and facilities that mimic real industrial environments. Inadequate facilities and lack of equipment limit the educational experience provided through TeFa (Kuat & Purnawan, 2022). Lack of structured collaboration between educational institutions and industry partners often results in misalignments between skills taught and those demanded by the job market (Pais-Montes et al., 2019). Sustainable collaborations are necessary for effective implementation, as absence of such partnerships inhibits students' learning opportunities and employability (Sultan et al., 2019).

Faculty preparedness and training represent key factors in successful adoption of TeFa. Many educators lack familiarity with industry standards or practices, hindering their ability to teach effectively within this framework. Continuous professional development for teachers is essential to ensure that pedagogical strategies remain aligned with evolving industry needs (Schefer-Wenzl & Miladinović, 2019). Institutional investment in instructor training must emphasize both technical skills and pedagogical techniques suitable for the Teaching Factory environment (Schefer-Wenzl & Miladinović, 2019)

Method

This study employed a Systematic Literature Review (SLR) approach guided by the PRISMA protocol to examine the implementation of the Teaching Factory (TeFa) model in maintenance and repair learning within vocational motorcycle engineering programs. The process began with a comprehensive search of multiple academic databases, including Scopus, Web of Science, Google Scholar, DOAJ, and Sinta, using keywords such as "Teaching Factory," "Vocational Education," "Motorcycle Engineering," and "Maintenance and Repair Learning." The initial search yielded 457 articles. After removing duplicates, 300 unique articles remained for further consideration. The next stage involved applying inclusion and exclusion criteria. Articles that did not qualify as peer-reviewed publications or were irrelevant to the research focus were excluded, leaving 40 articles to be analyzed based on their titles and abstracts. At this stage, 260 articles were eliminated for not meeting the predetermined criteria, either in terms of content relevance or type of publication. Among the 40 articles reviewed in detail, 24 were deemed irrelevant because they discussed TeFa in general without addressing its specific application to maintenance and repair learning or vocational automotive contexts.

The final stage of the screening process resulted in 16 articles that were considered suitable for in-depth review. These articles were then analyzed systematically by extracting essential information such as author, year of publication, research location, methodology, research focus, and key findings. Thematic analysis was conducted to identify patterns, similarities, and differences across studies, as well as their implications for vocational education practices. The selection process is illustrated in Figure 1, which outlines the stages from the initial database search to the identification of the final set of eligible articles.

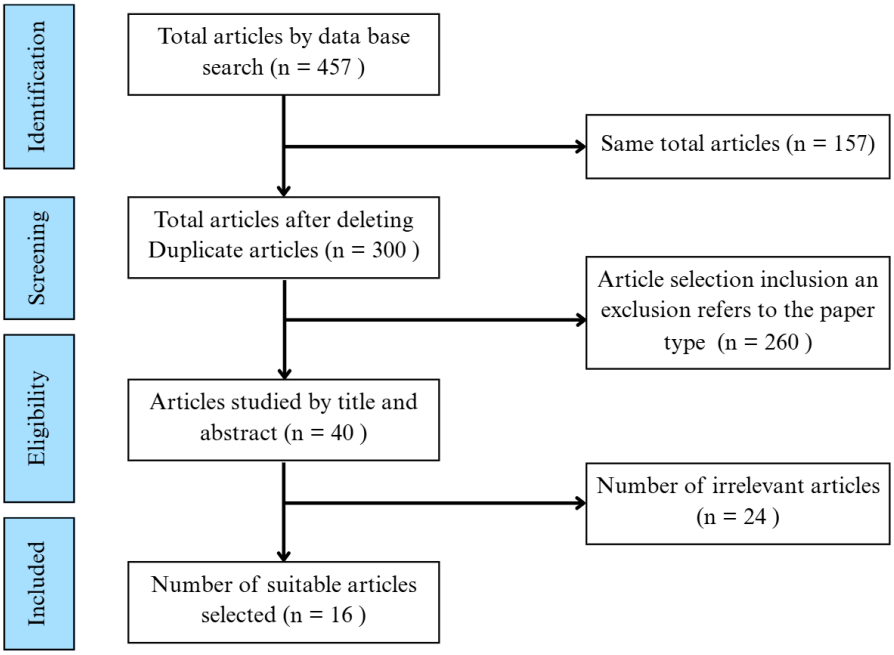


Figure 1. PRISMA flow diagram

Results

Overview of Selected Studies

A total of 16 articles met the inclusion criteria and were included in this review. The distribution of studies varied across publication years, with a noticeable increase in research interest on Teaching Factory (TeFa) in vocational education over the past decade. Geographically, most studies were conducted in Indonesia, where TeFa has been widely promoted as part of vocational school reforms, though several comparative studies from other countries provided valuable contextual insights. In terms of educational contexts, the selected studies predominantly focused on vocational secondary schools specializing in motorcycle engineering, with some extending to broader automotive and technical programs.

Implementation of Teaching Factory in M&R Learning

Table 1 presents four articles specifically highlighting the models of TeFa implementation in maintenance and repair learning. These studies demonstrate that TeFa has been carried out through diverse approaches, ranging from model development in vocational schools to curriculum innovation and program analysis.

Table 1. Reviewed Articles on the Theme of Implementation of Teaching Factory in M&R Learning

No	Author(s)	Year	Heading
1	Azizah, D., Muslim, S., Achmad, R., Lukmantoro, D., Farida, U., Ciptono, A., & Joko, J.	2019	Development of teaching factory model at vocational high school (VHS) in Indonesia
2	Chasovy, A., Jalinus, N., Waskito, W., & Wulansari, R.	2024	Analysis of the implementation of the teaching factory program in vocational high school

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3	Kautsar, A., Wiyono, G., Mulia, M., Iqbal, M., & Al-Fairusy, M.	2022	Teaching factory model development in vocational high schools
4	Hanum, F., Nurrohmawati, L., Roslan, M., & Prihantoro, C.	2022	Teaching factory implementation analysis in the world of vocational education in Indonesia

The implementation of TeFa has proven effective in bridging the gap between theoretical learning and practical application while also encouraging vocational schools to build stronger collaborations with industry. The variety of models reflected in the literature shows the flexibility of TeFa in adapting to different educational contexts. The selected studies consistently emphasized diverse models of TeFa implementation in *maintenance and repair* (M&R) learning. These models included school-based workshop simulations designed to replicate industrial environments, collaborative projects with industry partners, and real production or service-based activities within school facilities. Each model aimed to immerse students in authentic work processes while aligning learning objectives with industry standards. The findings suggest that these approaches not only bridge the gap between theoretical knowledge and practice but also cultivate entrepreneurial mindsets by exposing students to production-oriented environments.

Impact on Students' Competence

Table 2 summarizes studies that explore the impact of TeFa on enhancing students' competencies, both technical and non-technical. These findings confirm that direct engagement in real-world practice strengthens students' diagnostic, maintenance, and service skills, while also fostering essential soft skills such as teamwork and communication.

Table 2. Reviewed Articles on the Theme of Impact on Students' Competence

No	Author(s)	Year	Heading
1	Sulistyo, B., Siswanto, I., & Widodo, N.	2019	The effects of a teaching factory learning model on students' competency in automotive engineering
2	Arsana, I., Susila, I., Hidayatullah, R., & Ariyanto, S.	2019	Implementation of troubleshooting teaching method to develop student's competency in conducting motorcycle tune-up
3	Indrastana, N., Dewangga, V., & Rinda, R.	2023	Exploring students' perception on the use of teaching factory method in English learning
4	Agustiani, R.	2025	Teaching factory framework for knowledge retention and teamwork in vocational education

These studies highlight that TeFa is not only effective in improving the technical skills required in the labor market but also plays a crucial role in shaping students' social and interpersonal skills to meet the demands of modern industry. Across the studies, TeFa implementation was found to significantly enhance students' technical competencies. Students demonstrated improved abilities in diagnosis, repair, and maintenance of motorcycles, reflecting mastery of essential trade skills. Beyond technical proficiency, the TeFa model was also reported to strengthen students' soft skills, particularly in teamwork, discipline, communication, and

problem-solving. These outcomes highlight TeFa's dual role in developing both hard and soft skills, ensuring that graduates are better prepared to meet the multifaceted demands of the modern workforce.

Supporting and Inhibiting Factors

Table 3 outlines the articles discussing supporting and inhibiting factors in TeFa implementation. Key enablers include adequate facilities, curriculum alignment, and industry partnerships, while major challenges involve limited equipment, restricted practice time, and insufficient teacher readiness.

Table 3. Reviewed Articles on the Theme of Supporting and Inhibiting Factors

No	Author(s)	Year	Heading
1	Wahyudin, D., Hanafi, I., & Ahmad, M.	2025	Enhancing vocational education through the teaching factory model: industry-education collaboration
2	Friska, F. & Jannana, N.	2023	Implementing the teaching factory approach: curriculum management in MAN 2 Bantul
3	Saputro, I., Nurhidayati, A., Suharno, S., Winiawati, C., Yunika, R., & Kusumadevi, M.	2023	Evaluation of the factory implementation using the CIPP method in Indonesian vocational education
4	Sari, S. & Silviana, L.	2020	Evaluation of teaching factory program in SMK YP IPPI Cakung

The analysis of supporting and inhibiting factors provides a more comprehensive understanding of the real conditions in the field and highlights the strategies needed to optimize the effectiveness of TeFa implementation. The review identified several supporting factors that facilitated successful TeFa implementation, including adequate workshop facilities, alignment of curricula with industry practices, and strong partnerships with industrial stakeholders. However, challenges also emerged, such as limited access to advanced equipment, restricted time allocation for practical sessions, and varying levels of teacher readiness to deliver TeFa-based instruction. These inhibiting factors underscore the need for resource investment and continuous teacher professional development to maximize the effectiveness of the model.

Pedagogical and Policy Implications

Table 4 includes articles examining the pedagogical and policy implications of TeFa. The studies emphasize the alignment of TeFa with national vocational education policies, the link-and-match initiative, and broader frameworks such as work-based learning and competency-based training.

Table 4. Reviewed Articles on the Theme of Pedagogical and Policy Implications

No	Author(s)	Year	Heading
1	Majid, H.	2023	National vocational education policy and ease of learning in motorcycle engineering
2	Fitrian, Y. & Sugiyono, S.	2020	Synchronization of dual system education programs with work needs

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3	Hulaimi, M., Munadi, S., Kurniawan, R., & Haq, A.	2024	Link and match policy to increase labor absorption in Aceh
4	Khomsah, N.	2025	Strengthening link and match 8+i program in vocational education

These findings confirm that the Teaching Factory serves as an important instrument in supporting vocational education policies, strengthening school-industry partnerships, and preparing graduates with the competencies required for the Fourth Industrial Revolution. The findings indicate that TeFa aligns closely with national vocational education policies, particularly the *link-and-match* initiative designed to strengthen collaboration between schools and industries. Moreover, the model resonates with broader educational frameworks such as *work-based learning* and *competency-based training*, which prioritize experiential learning and skill mastery. These alignments suggest that TeFa has significant potential to serve as a standardized model for vocational motorcycle engineering education, provided that systemic challenges related to resources and teacher capacity are adequately addressed.

Discussion

Implementation of Teaching Factory in M&R Learning

Use of real production systems within the Teaching Factory framework strengthens the integration between theory and practice. Integration of production processes into the learning environment provides students with direct exposure to operational realities in the motorcycle industry, enhancing their understanding of technical maintenance and repair while simultaneously introducing them to broader industrial guidelines, including compliance with safety standards and efficiency metrics (Wahjusaputri & Bunyamin, 2022). Several challenges persist despite the benefits associated with the Teaching Factory model. Adequately equipped facilities are essential for advanced instructional methods, as the absence of appropriate tools and equipment limits students' engagement in both workshop simulations and real production projects (Kautsar et al., 2022). Dependence on industry partnerships further renders the success of Teaching Factory programs contingent on the willingness and capacity of local businesses to collaborate, emphasizing the need for strategic management to build and sustain long-term partnerships (Kautsar et al., 2022). Faculty readiness is critical for the successful execution of the Teaching Factory framework. Educators are required not only to possess technical expertise but also to apply pedagogical strategies that support active and industry-relevant learning. Professional development opportunities are therefore necessary to ensure instructors remain aligned with the latest industrial practices and instructional methodologies, preventing a disconnect between school-based training and workforce demands (Martama & Jatmika, 2023).

Impact on Students' Competence

Enhancement of diagnostic abilities constitutes a significant finding within technical competencies of students engaged in the Teaching Factory model. Students participating in Teaching Factory learning demonstrated notable improvements in diagnostic competence and problem-solving in automotive engineering tasks, with average competency scores increasing from 77.87 to 83.82, illustrating clear advantages over traditional training methods (Sulistyo et al., 2019). Troubleshooting-focused teaching methods adapted from the Teaching Factory approach have also demonstrated substantial benefits. Students exhibited marked improvement in competencies related to motorcycle tune-ups, with classical study completeness improving from 53.8% to 88.5% across three cycles of implementation, suggesting both stronger

knowledge retention and enhanced technical mastery (Arsana et al., 2019). Development of soft skills has similarly been emphasized as a critical contribution of Teaching Factory models. Frameworks such as TeFa not only support technical knowledge retention but also cultivate teamwork and communication abilities vital for industrial success (Agustiani, 2025). Collaborative projects within Teaching Factory environments reinforce interpersonal competencies by requiring extensive peer engagement. This is further corroborated by systematic analyses highlighting that collaborative environments within teaching factories promote mutual respect, cooperation, and collective problem-solving (Kafi & Harjanto, 2024).

Discipline and work ethic also emerge as key attributes strengthened through Teaching Factory participation. Structured environments demand adherence to professional standards, deadlines, and collaborative practices, reinforcing habits essential for vocational success (Indrastana et al., 2023). Simulation of real-world factory contexts ensures that theoretical learning is consistently bridged with practical application, facilitating more effective assimilation of concepts and leading to higher competency in both technical and non-technical domains (Gozali et al., 2018). Innovations within Teaching Factory pedagogy have been positively correlated with improvements in learning outcomes. Holistic benefits extend beyond individual student competencies to include systemic enhancements in vocational training quality, strengthening the role of vocational institutions in responding to industrial demands (Pratama et al., 2025). Challenges remain, particularly concerning resource availability. Lack of access to modern equipment and tools restricts the ability of schools to simulate authentic industrial environments, thereby limiting opportunities for experiential learning (Hanum et al., 2022). Faculty preparedness further plays a decisive role in the model's effectiveness. Teaching quality in vocational education is heavily dependent on instructors equipped with both subject knowledge and pedagogical expertise, underscoring the importance of continuous professional development and targeted training programs (Maulana & Pradikto, 2025).

Supporting and Inhibiting Factors

The implementation of the Teaching Factory (TeFa) model in vocational motorcycle engineering education has gained significant attention in recent studies. The success of TeFa depends heavily on various supporting and inhibiting factors, particularly concerning facilities, curriculum alignment, and industry support. This synthesis discusses how these factors function as enablers or obstacles in the effective deployment of the Teaching Factory within motorcycle engineering courses.

Supporting Factors

Proper facilities and equipment are fundamental to the successful implementation of the Teaching Factory model. Well-equipped workshops enhance student learning and engagement by providing classrooms that simulate real-world working environments, enabling students to apply theoretical concepts in practical contexts and thereby strengthening their technical competencies (Wahyudin et al., 2025). Adequate infrastructure also develops students' practical skills while simultaneously increasing their motivation and interest in vocational studies (Kautsar & Purnawan, 2022). Functional facilities that support hands-on training are further considered crucial for students to effectively master maintenance, servicing, and repair tasks within motorcycle engineering (Friska & Jannana, 2023).

Alignment of curricula with industry standards plays a pivotal role in enhancing the relevance of vocational education. A curriculum structured around current industry requirements not only facilitates the acquisition of technical skills but also ensures that students are adequately prepared for employment upon graduation (Putri & Pranata, 2024). Integration of practical competencies within the Teaching Factory framework guarantees that theoretical knowledge is directly connected to workplace applications, supporting students' readiness for professional

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roles. Curriculum alignment with local industry needs also enhances students' understanding of real-world practices while improving their employability prospects in the labor market (Sari & Silviana, 2020).

Collaboration with industry partners is equally vital for ensuring the success of Teaching Factory implementation. Strong partnerships with local businesses provide students with opportunities to engage in authentic learning while simultaneously gaining insights into professional practices and workplace expectations (Fitriawati et al., 2025). Industry collaboration enables vocational schools to keep their training programs responsive to dynamic market conditions and evolving technological advancements. Involving industry professionals in the educational process further enriches learning experiences by offering mentorship and hands-on exposure, thereby connecting classroom instruction with workplace realities (Wahjusaputri et al., 2024).

Inhibiting Factors

Limited availability of up-to-date equipment and facilities remains one of the most consistent challenges in the implementation of the Teaching Factory model. Outdated machinery and insufficient access to modern tools hinder students from acquiring essential technical skills, creating a gap between industry expectations and the training received in schools (Saputro et al., 2023). The inadequacy of resources reduces the relevance of vocational education, leaving graduates less prepared for workforce demands. Provision of contemporary tools and technologies is therefore essential to ensure meaningful and industry-aligned learning experiences (Friska & Jannana, 2023). Restricted practice time presents another barrier in maximizing the benefits of the Teaching Factory approach. Practical learning opportunities are often limited due to competition with theoretical instruction, which results in inadequate exposure to hands-on training (Saputro et al., 2023). Insufficient time for practice can significantly constrain the development of practical working skills among students, weakening their ability to adapt to real workplace conditions. A balanced schedule that integrates both theory and practice is required to ensure students benefit equally from conceptual understanding and practical engagement (Kautsar & Purnawan, 2022).

Teacher readiness represents a decisive factor in the effective implementation of the Teaching Factory model. Lack of adequately trained faculty diminishes the quality of instructional delivery and undermines the potential benefits of the model (Sari & Silviana, 2020). Instructors must be equipped not only with updated industry knowledge but also with pedagogical techniques that foster active learning and experiential engagement. Continuous professional development and structured training programs are critical to enhance teacher preparedness and sustain high-quality vocational education outcomes (Suciati et al., 2025).

Pedagogical and Policy Implications

A core aspect of the Teaching Factory model is its coherence with national vocational education policies that emphasize the importance of equipping students with both technical and soft skills. National Vocational Education Policy highlights the necessity of frameworks that provide students with competencies essential for employment in the motorcycle industry, including maintenance, repair, and technical service skills (Majid, 2023). The Teaching Factory model supports these policies by offering hands-on experience and transferable skills applicable in industrial environments. Influence of interest groups on shaping vocational education policies has been noted as an important factor in aligning curricula with labor market demands. Research suggests that the Teaching Factory model not only supports educational policies but also contributes to a more coherent approach by bridging academic training with industry requirements, ensuring employability through responsiveness to labor market changes (Yasdin & Muksins, 2024).

The link-and-match initiative, designed to synchronize educational outcomes with industry needs, is essential to the effective application of the Teaching Factory model. Systematic partnerships between schools and industries are identified as critical for producing graduates who meet job market expectations, and the dual system education embedded in TeFa facilitates such cooperation through adaptive curricula that reflect current labor demands (Fitrian & Sugiyono, 2020). Effectiveness of link-and-match policies has been evaluated by examining how vocational high schools collaborate with industry to improve labor absorption rates. Teaching Factory advances these initiatives by integrating practical training into educational institutions, enabling students to gain real-world skills that are consistent with industrial standards (Hulaimi et al., 2024). Strengthening link-and-match through direct collaboration with industry stakeholders enriches student learning experiences and ensures curricula remain relevant, ultimately benefiting both graduates and employers (Khomsah, 2025).

Relevance of the Teaching Factory to work-based learning and competency-based training frameworks is substantial. Evidence indicates that TeFa enhances student competencies by integrating theoretical knowledge with practical application in authentic settings, thereby aligning with competency-based training principles that emphasize specific, outcome-driven skill development (Sulistyo et al., 2019). Experiential learning fostered by this approach leads to significant gains in technical abilities, such as diagnosing and repairing motorcycles, while also reinforcing teamwork, communication, and problem-solving skills necessary for workplace success (Sulistyo et al., 2019). Evaluation of work-based learning frameworks emphasizes the necessity of curricula that support sustained engagement in industry environments. Such exposure ensures that students acquire a comprehensive skill set encompassing both hard and soft skills. Teaching Factory represents a model capable of integrating these principles into vocational education, thereby preparing students more effectively for the demands of their future professions (Sutarya, 2023).

Highlighting the Significance of the Study

The findings of this review provide significant contributions to the advancement of vocational education research, particularly in the context of Teaching Factory (TeFa) for motorcycle maintenance and repair learning. This study advances knowledge by synthesizing evidence from multiple empirical works, thereby offering a comprehensive understanding of how TeFa bridges theoretical knowledge with practical application. The review highlights new insights into how TeFa not only strengthens technical competencies but also enhances soft skills essential for employability, which has not been systematically documented in previous literature. From a policy perspective, the study clarifies the role of TeFa as an effective instrument in supporting the link-and-match initiative and competency-based training frameworks, ensuring that vocational education outcomes are aligned with industrial needs. These findings contribute to solving the original research problem by demonstrating that TeFa can reduce the gap between vocational training and workforce expectations, thereby supporting both educational and labor market goals.

Suggestions for Future Research

Future research should expand the scope of inquiry by examining the implementation of TeFa in different cultural and institutional contexts, particularly in countries with advanced vocational training systems. Studies employing longitudinal designs are recommended to measure the long-term impact of TeFa on student employability and career progression. Future investigations should also explore the integration of digital technologies, such as virtual simulations and Industry 4.0 tools, into the TeFa framework to enhance learning outcomes. Moreover, further work could refine theoretical models by incorporating variables such as teacher readiness, industry commitment, and student motivation, thus developing a more holistic understanding of

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the conditions required for successful TeFa implementation. Research should also focus on cost-benefit analyses to provide policymakers with evidence of the economic viability of scaling up TeFa programs in vocational schools

Conclusion

The systematic review highlights the Teaching Factory (TeFa) model as a transformative framework in vocational motorcycle engineering education, particularly in maintenance and repair learning. The findings demonstrate that TeFa effectively bridges the persistent gap between theoretical instruction and practical application by immersing students in authentic work environments. Through workshop simulations, industry collaborations, and real production systems, TeFa fosters technical competencies such as diagnosis, servicing, and repair, while simultaneously strengthening soft skills including teamwork, communication, discipline, and problem-solving. This dual impact positions TeFa as a highly relevant model for contemporary vocational education, ensuring that graduates are not only technically proficient but also equipped with the interpersonal and professional attributes demanded by the modern labor market. The study also reinforces the role of TeFa in supporting competency-based training frameworks and work-based learning principles, while aligning with national vocational education policies and the link-and-match initiative designed to synchronize education with industry needs.

The review further identifies both enabling and inhibiting factors that shape the success of TeFa implementation. Adequate facilities, curriculum alignment, and sustained industry support emerged as key drivers of effective outcomes, while limited access to modern equipment, restricted practice time, and varying levels of teacher readiness were identified as major obstacles. Despite these challenges, the synthesis underscores that TeFa contributes to refining theoretical frameworks of vocational pedagogy, offering valuable implications for educators, policymakers, and industry stakeholders. It emphasizes the importance of investing in infrastructure, promoting continuous professional development for teachers, and fostering long-term partnerships with industry to enhance the sustainability of TeFa programs. Overall, the study concludes that TeFa represents a strategic educational innovation and policy instrument with the potential to reshape vocational education, better preparing students for employability in the era of the Fourth Industrial Revolution

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