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THE READINESS OF IMPLEMENTATION TEACHING FACTORY

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Abstract

This study aims to assess the readiness of production workshop facilities and infrastructure for implementing a teaching factory. Observations were conducted to determine if the minimum requirements were met. The results indicated that the readiness of the facilities and infrastructure achieved a percentage of 82.42%. This high level of readiness suggests that the current state of the facilities and infrastructure is largely sufficient to support the teaching factory model. However, there are areas that require further improvement to fully optimize the implementation process. The study highlights the importance of continuous evaluation and upgrading of resources to ensure the successful integration of teaching factories in educational settings.

Keywords: Education, Engineering Facilities readiness, Infrastructure assessment, Teaching factory.

1. Introduction

A university is a higher education institution that provides academic education and can provide vocational education in various fields of science and/ or technology [1-4]. If it meets the requirements, the university can organize professional education (Government Regulation of the Republic of Indonesia Number 4/2014 Article 1). University is an educational institution that educates prospective experts to have superior and quality Human Resources (HR). Based on data from the Indonesian Central Statistics Agency (BPS) in August 2017, the national open unemployment rate reached 7 million individuals, with 1.6 million of them being vocational graduates. To address this, Indonesia needs to enhance the skills of its human resources, aiming to develop a more professional and competent workforce. This is particularly important in the context of the fourth industrial revolution. Consequently, the education sector must actively contribute to improving both the quality and quantity of competencies, ensuring that the workforce is capable of competing on a global scale [5]. To achieve this objective, the development of the education system is continuously being developed, such as the implementation of the teaching factory implementation program at the university.

The teaching factory program promotes collaboration between educational institutions and industry partners by providing students with access to advanced technology and real-world experiences, combining Competency-Based Training (CBT) and Production-Based Training (PBT) to create a business and production-oriented learning environment [6]. This approach emphasizes practical, innovative learning technologies aligned with industry requirements, fostering synergy between education and industry through teamwork and shared resources [7, 8]. For instance, Universitas Pendidikan Indonesia is preparing its Mechanical Engineering Education program for Teaching Factory-based learning, despite challenges like inadequate facilities and limited marketing access (Government Regulation of the Republic of Indonesia Number 15 of 2014). This model, which involves performing tasks according to industry standards and using real customer materials, aims to prepare graduates with the skills required by the industry while also promoting the safety and responsibility of students [9, 10]. The problems that occurred in the readiness of implementing the teaching factory-based learning process inspired us to determine the level of facilities and infrastructure readiness.

2.Literature Survey

The teaching factory is an educational paradigm that merges learning and working environments to provide students with realistic and relevant learning experiences [11]. This model integrates real-world work environments into the teaching process [12], aiming to equip students with up-to-date industry knowledge and make them competitive in the job market [7]. The primary goal is to prepare work-ready graduates by integrating vocational curricula with practical job experiences, ensuring their skills align with industry requirements [5].

In vocational high schools, the teaching factory is implemented through production or service activities integrated into the learning process. Schools must have facilities like factories or workshops to support these activities, allowing students to create products or services that meet marketable quality standards [13]. The teaching factory paradigm also encourages collaboration between schools and industry, facilitating the transfer of technology and information and promoting two-way communication.

Successful implementation of the teaching factory depends on factors such as quality equipment, skilled human resources, and effective marketing strategies. Challenges like legal regulations and insufficient leadership support can hinder its effectiveness [12, 13]. Partnerships between schools and industry are crucial, as they ensure that the skills taught are relevant and *up-to-date* [14]. Additionally, incorporating emerging digital technologies and transitioning to Education 4.0 is essential for advancing the Teaching Factory model [15].

Adequate facilities and infrastructure are essential to support the implementation of the teaching factory. A crucial component is the establishment of production units or business units within schools, allowing students to directly apply their skills by creating goods or services for sale [7]. Additionally, integrating manufacturing education with industrial practices through the teaching factory model has been applied in construction equipment, underscoring the importance of facilities that support real-world industrial practice. These facilities must be equipped with industry-standard equipment and technology to ensure the relevance and quality of the learning experience [16].

Based on interviews with stakeholders from vocational high schools in Central Java, several factors contribute to the successful implementation of the Teaching Factory model. These factors include (i) School management, which encompasses financial administration, organizational structure, job descriptions, standard of operations for performance and workflow, leadership, and the school environment; (ii) workshop and laboratory facilities and infrastructure; (iii) the teaching factory learning model; (iv) marketing strategies for the teaching factory; (v) products and services offered; (vi) teaching factory resources; and (vii) partnerships between schools and industry [17]. The learning factory (LF) model, a subset of the Teaching Factory, utilizes university equipment and manufacturing facilities that replicate an industrial environment on campus. This model involves participation from both academic and industry professionals in specific courses, aiming to promote new manufacturing concepts, trends, and knowledge within an academic setting [18].

Educational media facilities are crucial [19-23], especially when facing with the teaching factory learning model. This approach is supported by advanced ICT and high-quality industrial didactic equipment, functioning as a two-way communication channel that integrates real factory environments into the classroom and academic laboratories into the factory setting. This study was selected and became one of the attractive subjects (see Fig. 1). Detailed information for obtaining this data is explained elsewhere.

3.Method

The research design used is descriptive research. This study used a quantitative approach and observation using a checklist of facilities and infrastructure readiness for the Teaching Factory implementation. The research used quantitative data and descriptive research which has the aim of extracting information about the variables to be studied. The research was conducted at the production workshop. Research data collection was carried out in October 2020. The production workshop was chosen because the workshop was a facility and infrastructure for the study program that wanted to implement the Teaching Factory. Data collection is obtained through observation [24]. Observation is a technique of collecting data by observing something or a phenomenon that has been determined. The data analysis technique used in this research is descriptive statistics [25]. This technique is used because this research is a quantitative study that aims to describe the readiness of implementing the Teaching Factory in the Department of Mechanical Engineering Education, Faculty of Technology and Vocational Education, Universitas Pendidikan Indonesia in terms of the infrastructure aspect by calculating the score of the results of observation. The scoring reference for the readiness of facilities and infrastructure uses a Likert scale of numbers 1, 2, 3, and 4. Thus, after all the data related to infrastructure are obtained, the data is analysed and concluded.

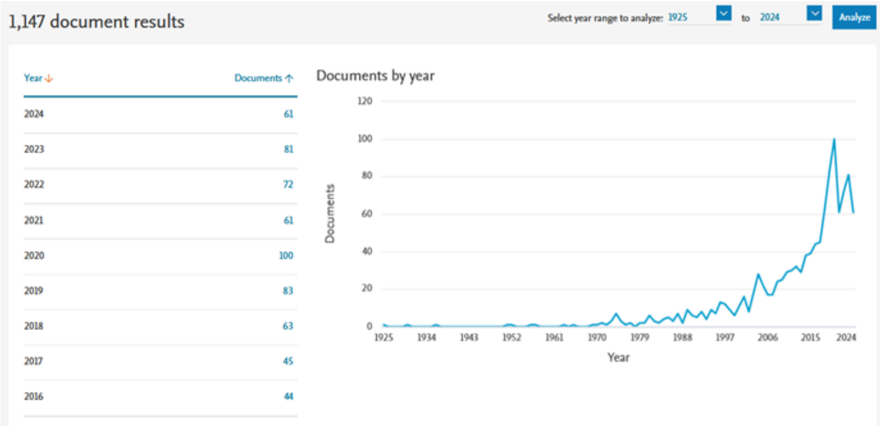

Fig. 1. Research trends in Scopus using keyword "teaching factory".

4.Results and Discussion

The assessment of the workshop infrastructure (Table 1) indicates a generally high level of readiness, with specific areas highlighted for improvement. The bench work area and measurement and metal testing room were rated highly, with scores of 4 for capacity and layout, reflecting their ample space and organization for practical instruction. Similarly, the lathe machine, milling machine, and grinding machine work areas also scored 4 for their capacity and space, showing they are well-suited to accommodate students, and the tasks performed. However, the storage and instructor room received a lower score of 1, suggesting issues with space or organization that may hinder its effectiveness for teaching and storage.

Regarding tools, all work areas were found to be adequately stocked to meet student needs, with the highest score of 4 across the bench work area, measurement and metal testing room, lathe machine work area, milling machine work area, and grinding machine work area, ensuring sufficient resources for hands-on activities. The workshop is well-equipped and ready to support student activities, with all necessary machinery and tools in good condition. Essential equipment like hand tools, micrometres, vernier callipers, steel rulers, lathes, milling machines, and grinding machines are adequately provided, receiving a uniform score of 4, indicating high preparedness for machining and measurement tasks. Similarly, the educational media and other equipment, such as whiteboards, projectors, socket boxes, and trash cans, were rated between 3 and 4, reflecting their good to very good quality and maintenance. This setup ensures a smooth and effective learning environment, with only minor improvements needed in storage and instructor facilities.

The data analysis used was quantitative in the form separated by category (See Table 2) and then concluded according to previous studies (Piet,2000). The conclusions obtained from the observation of facilities and infrastructure are 82.42%, categorized as very ready. This study adds new information for supporting the teaching and learning process, as reported elsewhere [26-31].

Table 1. Recap of observation results of the mechanical engineering education department production workshop.

Category	Aspects	Observation Results	Score
Workshop Infrastructure	Bench Work, Measurement Room, etc.	Various	1-4
Tools	Number of students per tool	1-6	4
Workshop Equipment	Hand tools, Machines, etc.	1-3 per equipment	4
Educational Media	Whiteboard Quality, Projector Quality	Good to Very Good	3-4
Other Equipment	Socket Box Quality, Trash can quality	Good	3
Total	-	-	211
Maximum Possible Score	-	-	256

Table 2. Percentage criteria.

Percentage (%)	Category
81-100%	Very Ready
61-80%	Ready
41-60%	Sufficient
21-40%	Less Ready
0-20%	Not Ready

5. Conclusion

Based on the results of research data analysis and discussion, the infrastructure aspects in the production workshop are categorized as very ready to carry out teaching factory-based learning with a percentage of 82.42%, informing they should continue to improve the production workshop infrastructure, especially in the storage room and instructor room. Judging from the observation, the assessment result is insufficient, only 1 out of 4 points. In addition, the quality of educational media facilities in production workshops must be improved again. Thus, teaching factory-based learning can run optimally.

References

1. Luckyardi, S.; Hurriyati, R.; Disman, D.; and Dirgantari, P.D. (2022). A systematic review of the IoT in smart university: Model and contribution. *Indonesian Journal of Science and Technology*, 7(3), 529-550.
2. Al-Momani, M.O.; and Rababa, E.M. (2022). Mixed education and quality standard in the university teaching: A theoretical study. *Indonesian Journal of Educational Research and Technology*, 2(3), 155-174.
3. Krishnaiah, J.; Begum, S.A.; Madhuri, Y.; and Kamraju, M. (2023). The importance of infrastructural facilities in the university. *Indonesian Journal of Educational Research and Technology*, 4(1), 29-36.
4. Bolaji, H.M. (2022). Information and communication technology as a veritable tool for administrators in university: From teaching perspectives to challenges in education. *Indonesian Journal of Teaching in Science*, 2(2), 183-192.
5. Wulandari, I.; and Sudiyatno. (2019). Development of industrial-work culture through teaching factory program in vocational schools. *Journal of Physics*: *Conference Series*, 1273(1), 012033.
6. Isnandar; Ichwanto, M.A.; and Ansyorie, M.M.A. (2023). Sister-cousin TF model based on the influence of work preparedness and learning outcome. *Social Sciences & Humanities Open*, 8(1), 100722.
7. Putra, R.C.; Kusumah, I.H.; Komaro, M.; Rahayu, Y.; and Asfiyanur, E.P. (2018). Design learning of teaching factory in mechanical engineering. *IOP Conference Series*: *Materials Science and Engineering*, 306(1), 1-5.
8. Ruslan; Simanjuntak, R.R.; and Hidayat, M.A. (2024). Energy efficiency through solar panelled mobile workshop for vocational education teaching factory. *IOP Conference Series*: *Earth and Environmental Science*, 1324(1), 012099.
9. Gozali; Milaningrum, E.; Kusuma, B.J.; and Damayanti, L. (2021). Revitalization road map of vocational higher education in industry 4.0 (a study in Politeknik Negeri Balikpapan). *Journal of Physics*: *Conference Series*, 1807(1), 012021.
10. Mourtzis, D.; Boli, N.; Dimitrakopoulos, G.; Zygomalas, S.; and Koutoupes, A. (2018). Enabling small medium enterprises (SMEs) to improve their potential through the teaching factory paradigm. *Procedia Manufacturing*, 23, 183-188.
11. Botifoll, M.; Pinto-Huguet, I.; and Arbiol, J. (2022). Machine learning in electron microscopy for advanced nanocharacterization: Current developments, available tools and future outlook. *Nanoscale Horizons*, 7(12), 1427-1477.
12. Sumual, H.; and Soputan, G.J. (2018). Entrepreneurship education through industrial internship for technical and vocational students. *IOP Conference Series*: *Materials Science and Engineering*, 306(1), 1-5.
13. Diwangkoro, E.; and Soenarto, S. (2020). Development of teaching factory learning models in vocational schools. *Journal of Physics*: *Conference Series*, 1456(1), 1-5.

14. Stavropoulos, P.; Bikas, H.; and Mourtzis, D. (2018). Collaborative machine tool design: The teaching factory paradigm. *Procedia Manufacturing*, 23, 123-128.
15. Uno, K.; Imaie, K.; Maekawa, K.; Smith, G.; Suyama, A.; and Hatori, J. (2013). Development of mining machinery and future outlook for electrification. *Hitachi Review*, 62(2), 99-106.
16. Wahjusaputri, S.; Bunyamin, B.; and Nastiti, T.I. (2021). Critical success factors in implementing teaching factory-based competency for vocational high school students. *Cakrawala Pendidikan*, 40(3), 584-592.
17. Wahjusaputri, S.; and Bunyamin, B. (2022). Development of teaching factory competency-based for vocational secondary education in Central Java, Indonesia. *International Journal of Evaluation and Research in Education*, 11(1), 353-360.
18. Mourtzis, D.; Panopoulos, N.; Angelopoulos, J.; Zygomalas, S.; Dimitrakopoulos, G.; and Stavropoulos, P. (2021). A hybrid teaching factory model for supporting the educational process in COVID-19 era. *Procedia CIRP*, 104, 1626-1631.
19. Warlina, L.; and Damayanty, L.E.D. (2021). The expansion and spatial pattern of shopping and tourism services facilities in North Bandung Region, Indonesia. *Indonesian Journal of Science and Technology*, 6(2), 385-400.
20. Nuhu, K.M.; Abdulfatai, D.A.; and Onojah, A.O. (2021). Undergraduate awareness and perception on the use of digital collaborative tools in facilitating learning in selected universities within the ilorin metropolis. *Indonesian Journal of Educational Research and Technology*, 1(3), 95-104.
21. Buraimoh, O.F.; Boor, C.H.M.; and Aladesusi, G.A. (2023). Examining facilitating condition and social influence as determinants of secondary school teachers' behavioural intention to use mobile technologies for instruction. *Indonesian Journal of Educational Research and Technology*, 3(1), 25-34.
22. Krishnaiah, J.; Begum, S.A.; Madhuri, Y.; and Kamraju, M. (2023). The importance of infrastructural facilities in the university. *Indonesian Journal of Educational Research and Technology*, 4(1), 29-36.
23. Daramola, F.O. (2022). Command secondary school teachers' attitude towards information and communication technology facilities for instruction. *Indonesian Journal of Multidisciplinary Research*, 2(2), 389-400.
24. Triyanto; Jerusalem, M.A.; and Fitrihana, N. (2019). Bussines model canvas of teaching factory fashion design competency vocational high school in Yogyakarta. *Journal of Physics*: *Conference Series*, 1273(1), 1-7.
25. Subekti, S.; and Ana, A. (2018). Measurement of employability skills on teaching factory learning. IOP conference series: *Materials Science and Engineering*, 306(1), 012118.
26. Daramola, F.O. (2022). Command secondary school teachers' attitude towards information and communication technology facilities for instruction. *Indonesian Journal of Multidisciplinary Research*, 2(2), 389-400.
27. Mohamad, N.; and Masek, A. (2021). Modes of facilitator skills for group learning among design and technology teachers in secondary schools. *Indonesian Journal of Teaching in Science*, 1(1), 17-20.

28. Alam, M.J.; Haque, A.K.M.M.; Kamruzzaman, M.; and Hossain, I. (2023). State of instructional educational facilities of primary education at upazila level. *Indonesian Journal of Teaching in Science*, 3(2), 171-182.
29. Rosina, H.; Virgantina, V.; Ayyash, Y.; Dwiyanti, V.; and Boonsong.S. (2021). Vocational education curriculum: Between vocational education and industrial needs. *ASEAN Journal of Science and Engineering Education*, 1(2), 105-110.
30. Minghat, A.D.; binti Mustakim, S.S.; and Shahroni, N. (2023). Current issue in the technical vocational education and training (TVET) instructor. *ASEAN Journal of Science and Engineering Education*, 3(2), 119-128.
31. Susilawati, A.; Al-Obaidi, A.S.M.; Abduh, A.; Irwansyah, F.S.; and Nandiyanto, A.B.D. (2025). How to do research methodology: From literature review, bibliometric, step-by-step research stages, to practical examples in science and engineering education. *Indonesian Journal of Science and Technology*, 10(1), 1.