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Development of a hybrid teaching factory model based on school governance in improving employability skills of vocational students

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ABSTRACT

This research aims to develop a framework for a hybrid teaching factory model that combines face-to-face and online learning with information and communication technology to improve employability skills in the new normal era. The research method uses the ADDIE Research and Development model, which consists of five stages: analysis, design, development, implementation, and evaluation. The research was conducted in several vocational high schools in DKI Jakarta Region, Indonesia. The findings in the research prove that the implementation of hybrid learning has an impact on students and teachers. Hybrid learning teaching factory is proven to be able to overcome frustrations and limitations between teachers and students in the learning process through online facilities, making teaching factory learning more innovative because there are variations of learning to interact and discuss, and making the classroom atmosphere conducive because students become happy and active in learning and skilled in working. The success of a hybrid teaching factory is considered mutually beneficial for both students and teachers who complete one of the teaching factory learning curriculums while industry instructors develop and work on collaborative platforms that provide useful services such as augmented reality and virtual reality-based applications.

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INTRODUCTION

Vocational High Schools (VHS) have an important role in supporting the development of qualified human resources and meeting the needs of the labor market (Coyanda et al., 2023; Soleh et al., 2023). However, there still needs to be a gap between the educational qualifications of VHS students and industry demands. The number of VHS graduates who need help in getting a job or are not in accordance with their field of study indicates a problem that needs to be addressed immediately. Previous research conducted by Vitriani et al. (2023) and Kristanto et al. (2023) showed that industry-centred learning models, such as Teaching Factory (TEFA), can help improve students' practical skills and prepare them to enter the world of work. However, there are still areas for improvement in implementing this model, especially related to integrating theory and practice, as well as effective school governance.

The teaching factory concept is designed to bridge the gap between academia and industry by promoting symbiotic knowledge exchange (Agus, 2023; Endang & Kuat, 2023; Vitriani et al., 2023). The TEFA model, as applied in vocational schools, aims to improve students' competencies and skills to fulfill the competencies required in the industrial world (Pahmi et al., 2023). By incorporating innovative approaches such as flipped classrooms and Knowledge Management Systems (KMS), TEFA can effectively prepare students to meet the increasing challenges of Industrial Revolution 4.0 (Yudiastuti & Hasia, 2023). In addition, TEFA encourages active student

engagement in the learning process by moving away from traditional teacher-centered learning methods.

Hybrid learning is learning done by combining face-to-face and online elements, which is a collaborative approach that is effective in classrooms during the Pandemic and post-COVID-19 Pandemic. Research conducted by Lhafra and Abdoun (2023) and Chi (2022) highlighted the positive impact of hybrid learning on educational effectiveness, showing that hybrid learning can improve student performance compared to traditional methods. Furthermore, according to Olapiriyakul and Scher (2006), hybrid learning is collaborative learning that is very effective to be implemented in the classroom.

A hybrid teaching factory is an extension of this concept, which combines theoretical knowledge with hands-on experience to enhance students' work-related abilities. A hybrid teaching factory integrates traditional TEFA concepts with TEFA concepts with more modern elements to improve the competence of vocational students according to industry demands (Ma, 2023). This hybrid teaching factory approach combines face-to-face and online teaching by utilizing technology and promoting interaction to improve the quality and flexibility of education (Guerrero-Quiñonez et al., 2023). The integration of theory with practice in a hybrid teaching factory can create a dynamic learning environment that aligns education with industry requirements, effectively preparing students for the challenges of the 4.0 era (Krishnan & Nagaratnam, 2023).

Like traditional teaching factories, hybrid teaching factories also emphasize authentic practical experiences for students (Mourtzis et al., 2023). However, this approach also pays attention to the importance of integrating the theories taught in the classroom with practical applications in the field. This aims to ensure that students not only understand the concepts theoretically but are also able to apply them in real situations.

Regarding the implementation and management of teaching factories in the new normal era, SMKs have implemented the 5R system in the arrangement of workspaces, learning spaces, and workshop or laboratory arrangements to create a safe, comfortable, and healthy learning and working atmosphere so that the learning and working process becomes more thorough and focused (Sudhoff et al., 2020). The results of the survey conducted by researchers that the reference for the implementation of learning activities during the new normal period are: (1) Each school makes a learning schedule according to the conditions of each school, referring to the health and safety protocol for the new normal period after the Covid-19 Pandemic; (2) The schedule contains the use of learning facilities and facilities for a maximum capacity of 18 students for one study group. The practical learning schedule is designed in blocks so that the implementation of practice produces meaningful products face-to-face and online; (3) The school prepares a teaching factory implementation curriculum for each skill competency that is adjusted to new normal conditions; and (4) The school prepares an annual program and semester program in accordance with the demands of new normal conditions.

The implementation of good school governance can assist in the systematic planning, implementation, and evaluation of the teaching and learning process in accordance with the National Education Standards (Farrell, 2014). A good school governance assessment can be used to identify issues and areas of education that require development to improve performance and effectiveness and ensure that leaders or responsible parties are up to date with legislation affecting VHSs, in this case, the National Education Standards (Leechman et al., 2019). There are eight standards that VHSs must manage appropriately, namely content standards, process standards, graduate competency standards, educational assessment standards, facilities and infrastructure standards, education and education personnel standards, management standards, and education financing standards (Yuen et al., 2019).

One of the main challenges in vocational education is integrating theory learned in the classroom with practice in the industrial world (Peng et al., 2023). The industry continues to evolve rapidly, and there is often a gap between the skills taught in schools and what the labor market requires. The next issue is that in addition to technical skills, it is also important for vocational students to develop soft skills such as communication skills, teamwork, problem-solving, and adaptation (AlGhamdi, 2023; Rosmiati & Hendriani, 2023; Safitri, 2022; Suroto et al., 2023).

Therefore, the education process, especially in VHS, must ensure that VHS students not only understand the theory but can also apply it in real situations in the workplace.

Based on the identification of these problems, an alternative solution that can be designed is to use information and communication technology in learning through the right tools. The appropriate use of technology is incorporating internet technology in learning through a suitable learning model, namely hybrid learning (Nash et al., 2018). The development of a hybrid teaching factory model will help improve vocational students' readiness to enter the world of work. With practical experience and strong industry engagement, students will have a better chance to get a job that suits their field of study and succeed in their future careers.

However, in practice, the process of implementing face-to-face and online hybrid teaching factory learning still experiences several obstacles, namely not providing a variety of learning for students, and teachers tend to lack understanding of the effective use of learning media in hybrid teaching factories. The less-than-optimal utilization of information and communication technology affects learning activities. Ilkovičová and Ilkovič (2021) revealed that school infrastructure is also influential in shaping an efficient learning environment. It can be said that limited resources, both in terms of funds, personnel, and facilities, are one of the obstacles to the implementation of a hybrid teaching factory (Mourtzis et al., 2023).

Based on these problems, it is necessary to develop a learning model that combines elements of the teaching factory with a good school governance approach. This hybrid teaching factory model is expected to create a learning environment conducive to the development of employability skills of vocational students so that they are ready to compete in an increasingly competitive labor market. This research aims to develop and test the effectiveness of a hybrid teaching factory model based on school governance in improving the employability skills of vocational students. Research on the development of a hybrid teaching factory model based on school governance is expected to make a significant contribution to improving the quality of vocational education and preparing vocational students to succeed in an increasingly competitive labor market.

METHOD

This research uses a Research and Development (R&D) approach, specifically the ADDIE model, which has five stages: analysis, design, development, implementation, and evaluation. ADDIE is widely used for the purpose of designing and creating effective learning or training programmes (Sugiyono, 2022). Effective communication among all stakeholders, including learning designers, topic experts, and participants (students, educators, and educational staff), is essential at every level of the ADDIE paradigm. This research involved stakeholders from the beginning and consistently revised strategies that would help facilitate the resolution of barriers encountered during the implementation phase. Good school governance includes several components, such as effective leadership, appropriate resource allocation, stakeholder engagement, evidence-based decision-making, and commitment to improving educational excellence (Nadiyah & Faaizah, 2015).

The DKI Jakarta region was chosen due to its status as the center of economic, business, and industrial activities in Indonesia. The DKI Jakarta region is the center of Indonesia's economy, trade, and industry. Therefore, the effectiveness of vocational secondary education in this region is crucial to meet national labor market demand. DKI Jakarta Province has various economic sectors, including banking, trade, tourism, and manufacturing, which require diverse skills from vocational high school graduates.

This research was conducted at SMKN 57 Jakarta, SMKN 26 Jakarta, SMKN 27 Jakarta, and SMKN 30 Jakarta due to their status as centers of excellence and effective implementation of school governance in DKI Jakarta. These schools have comprehensive infrastructure and have established partnerships with business and industry. In addition, these schools also engage foreign teachers as guest instructors in the learning process and facilitate the exchange of teachers and students for internships in the industrial sector. The data collection techniques in this study were interviews and questionnaires.

RESULTS AND DISCUSSION

Results

The analysis stage is the first result of the ADDIE model application conducted during this research. In this analysis stage, the process is to identify learning needs, understand the characteristics of the intended audience or students, and evaluate the surrounding circumstances where learning will take place. At this stage, there are various important tasks to be performed by the researcher, including identification of learning requirements and objectives, identification of the target audience and their characteristics, analysis of available resources, and potential barriers that may be encountered. The analysis stage is conducted using two methodologies, namely interviews and questionnaires. The respondents selected as subjects to conduct the pilot test were 30 students of SMK Class X-XII taken at each SMK in DKI Jakarta, namely SMK Negeri 57 Jakarta, SMK Negeri 26, SMK Negeri 27 and SMK Negeri 30 Jakarta.

The second stage is the design stage. The design stage involves creating a comprehensive plan for the learning materials, which includes developing effective learning techniques, organizing materials, and selecting appropriate evaluation methods. The design step includes formulating appropriate learning objectives, creating a well-organized and informative learning structure and content, and selecting appropriate teaching techniques, strategies, and resources.

The third stage is the development stage. The development stage involves the process of creating learning materials, developing teaching materials, and preparing content according to the design plan. The stages in the development process are creating learning or training materials and developing teaching materials such as modules, presentations, or multimedia materials. In the development stage, researchers use e-learning development software, graphic design, or video editing.

The fourth stage is the implementation stage. In the implementation stage, the designed learning content is put into practice in the learning environment according to the plan that has been set before. The implementation step involves implementing the learning or training program and offering technical and logistical assistance throughout the process. The hybrid teaching factory learning trial is one of the important stages in the implementation of research and development (R&D) because this activity will determine whether the method developed by the researcher can be used or not. Through this trial, it will also be known whether the model developed can achieve the objectives or not.

The last stage is the evaluation stage. In this evaluation stage, learning effectiveness is achieved by collecting data and feedback and making improvements or adjustments if needed. The evaluation stage is conducted to assess the success of the learning or training process. In addition, this stage is also conducted to obtain feedback from participants and stakeholders.

Virtual education refers to the practice of teaching and learning using online platforms and digital services. The effectiveness of online education depends on the presence of a high-speed and reliable internet connection, educational software, proficiency in digital skills, cost, and access to technology. This research presents a framework for a hybrid teaching-learning approach that was successfully implemented and validated during the lockdown phase of the COVID-19 pandemic and into the transition to the new normal. The implementation of the hybrid learning teaching factory for students at SMK in DKI Jakarta Province, Indonesia, can be seen in Figure 1.

The implementation of hybrid teaching factory learning, as shown in Figure 1, has been customized to accommodate institution-specific conditions. Model 1 is a hybrid teaching factory learning approach that fully utilizes online resources throughout the learning activities. This model requires students and teachers to always stand by on the internet. All teaching and learning activities are conducted through the internet, for example, through videoconferencing. However, the implementation instructions are carried out face-to-face. This model can be applied to higher education institutions where teachers and students or lecturers and students are not in the classroom.

Model 2 is a hybrid learning approach that utilizes internet resources, either exclusively or intermittently. Model 2 allows students and teachers to use the internet only at certain times, which can be customized to suit their individual learning needs. For example, the internet can be used for certain parts of the learning session, while in other parts, face-to-face interaction is the main focus.

In addition, Model 2 also allows the integration of the internet in specialized academic activities, such as conducting exams or submitting assignments. For example, in exam situations, Model 2 can utilize online platforms to provide exam questions or to monitor and evaluate student performance in real-time. Similarly, in the case of assignment collection, students can use the internet to submit assignments in the form of research papers or reports to teachers.

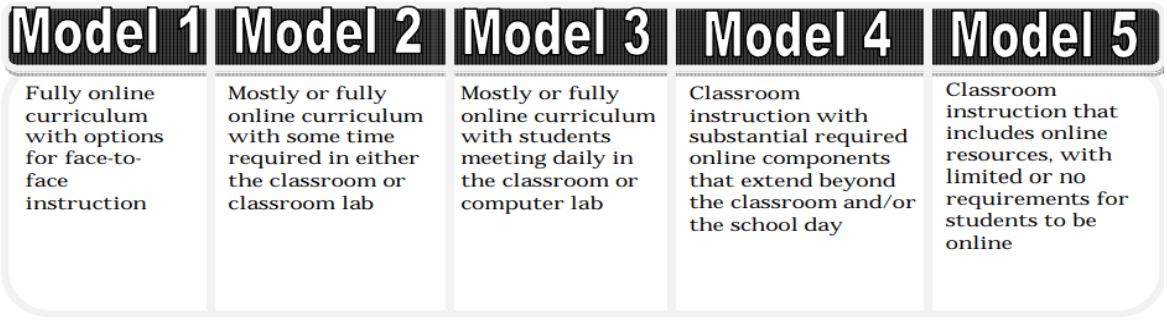

Figure 1. Illustration of Teaching Factory Hybrid Learning Model

Model 3 is an application of a hybrid teaching factory that relies heavily on internet resources for learning activities. Face-to-face learning occurs during class discussions or hands-on practical exercises. In this model, interaction between students and teachers or between fellow students relies heavily on the use of internet resources. Although face-to-face learning is still an important part of the learning process, especially in the context of class discussions or practical exercises that require direct interaction, the use of the internet becomes an integral component that supports the entire learning process. In Model 3, the internet is used to facilitate communication, collaboration, and access to various educational resources. Students and teachers can interact directly through online platforms, be it through discussion forums, chat rooms, or video conferencing. In addition, the internet also allows easy access to learning materials, references, and additional learning materials needed to support learning.

Model 4 is a simpler implementation of hybrid learning. This approach utilizes Internet resources for educational purposes while still incorporating a significant amount of face-to-face interaction between teachers and students. In this Model 4, the internet serves as a tool to facilitate learning. For example, during class discussions, the teacher asks students to search for relevant information online and then share their findings.

Model 5 exemplifies hybrid learning in its simplest form. This strategy does not require constant internet connectivity for students during the learning process. It facilitates students to access online information provided by the teacher, even when they are not physically present in the classroom or school. Internet presence needs to be present in this classroom learning model. In addition, in-class interactions between students and teachers still use traditional face-to-face methods, complemented by educational resources that can be accessed through online platforms, including videos, music, films, animations, photos, and various other things.

Based on the results of the research conducted, the application of hybrid teaching factory learning has a significant influence on students and teachers. The effect of hybrid learning on teaching factory learning is as follows: (1) Hybrid learning effectively addresses the challenges and constraints faced by teachers and students during the learning process by utilizing online resources; (2) Hybrid learning fosters innovation in learning by providing diverse opportunities for interaction and discussion; and (3) Hybrid learning creates a conducive classroom environment, encouraging student engagement and satisfaction. The results of the implementation of the hybrid learning teaching factory model based on good school governance in DKI Jakarta Province can be seen in Table 1.

Table 1. Implementation of Hybrid Learning Teaching Factory Model Based on Good School Governance in DKI Jakarta Province

Dimension	Indicator	Corrected Item-Total Correlation
Curriculum	Completeness of curriculum documents	0.522
	Completeness of curriculum device documents	0.583
	Completeness of curriculum supporting documents	0.525
Learning Process	Lesson Planning	0.618
	Learning Implementation	0.527
	Assessment of learning outcomes	0.669
	Supervision of the learning process	0.438
Graduate Competency	Academic achievement, related to the graduation rate of students in the last year, and the absorption of graduates by the business and industry world	0.577
	Non-academic achievements, related to students' success in winning various fields of student competitions in extracurricular activities	0.864
Assessment	Assessment conducted by educators	0.864
	Assessment conducted by the educational unit	0.864
	Assessment conducted by the Government	0.764
Teachers and educational staff	The academic quality of educators and education workers is relevant to their sector of employment.	0.504
	The relevance of the field of expertise of educators and education personnel to the field of work	0.403
	Attendance rate of educators and education personnel	0.565
	The level of effectiveness of completing the tasks of educators and education staff	0.565
	The level of discipline of educators and education staff in carrying out their duties	0.602
Physical amenities and structures	Completeness and adequacy of physical facilities (such as classrooms, laboratories, teacher rooms and library rooms)	0.745
	Completeness and adequacy of tools/practice	0.777
	Completeness and adequacy of the library	0.745
Administration	Availability of School Development Plans (RPS)	0.535
	Implementation and successful implementation of the program	0.525
	Principal supervision is related to the completeness of the principal's supervision instrument, and the frequency of principal's supervision	0.535
Funding	Allocation of use of funds	0.412
	Transparency	0.882
	Accountability	0.764

Discussion

Several forms of multimedia facilitate the hybrid learning concept of the teaching factory. The multimedia is in the form of Macromedia Flash, simulation/virtual, video, audio, and others. Multimedia has a great impact on the teaching and learning process (Wahyudi et al., 2023). Based on the results of research conducted by researchers, the platform for implementing the hybrid learning model of the teaching factory that is often used is e-learning using Moodle. The use of Moodle as an e-learning media has several benefits, namely: (1) facilitating communication and interaction between students and teaching staff and industry, (2) increasing collaboration between students to form a learning community, (3) encouraging students to independently search for learning resources, (4) providing feedback through time and space, and (5) helping students build their knowledge through active and interactive learning (Nasrum et al., 2023; Suparjan et al., 2023).

In this research, the hybrid teaching factory trial consisted of individual sessions for each team, where student teams engaged with industry instructors and teachers using a video conferencing platform (Google Classroom). They were instructed to complete teaching factory product challenges

that were remotely controlled online. Siagian et al. (2020) and Alim et al. (2021) found that most vocational students often choose to study in the comfort of their own homes, allowing them easy access to all resources without having to move from their seats physically. Finally, as mentioned earlier, each team can guide the technician/industry supervisor through a combination of ICT.

Digital manufacturing technologies play an important role in the ongoing efforts to reduce the time and costs involved in product manufacturing, as well as provide more opportunities for product customization (Brzezicki, 2020). Therefore, the use of the suggested hybrid teaching factory model outlined in this study presents tremendous prospects for users (such as students, instructors, industry professionals, researchers, and others) to accelerate their employability improvement, as this model is actively promoted in the wake of the COVID-19 pandemic.

Based on the implementation of the hybrid teaching factory model at SMKs in DKI Jakarta, the researcher obtained several notes that can be used as suggestions to improve the effectiveness of using this model. The research found that one of the main obstacles in the implementation of the hybrid teaching factory model is the inadequate allocation of funds, this is in accordance with research conducted by Endang and Kuat (2023), which highlighted several obstacles faced in implementing the teaching factory model. This can hinder the development of facilities and the purchase of equipment needed to support practical learning in the school environment. Solutions to this problem involve better budget planning, selection of appropriate funding sources, or increased support from relevant parties, such as local government or private parties.

Further findings show that the availability of School Development Plans (SDPs) in some SMKs in DKI Jakarta Province may be challenging. A good RPS can be the foundation for planning and managing learning programs, including the implementation of hybrid teaching factory models (Rojhi, 2022). Therefore, it is necessary to increase awareness and commitment from the school to develop a comprehensive RPS that is relevant to the objectives of vocational education. The implementation of the hybrid teaching factory model also requires strong coordination and support from all relevant parties, including principals, teachers, school staff, industry, and local government. Lack of coordination and effective communication can hinder the successful implementation of the program. Therefore, it is necessary to improve coordination among stakeholders and continuous monitoring to ensure the program runs smoothly and achieves the set objectives.

In addition, the findings in this study also show that the role of the school principal in supervising and supporting the implementation of the hybrid teaching factory model is very important. However, the study found that there are shortcomings in the completeness of the principal's supervision instruments and the frequency of principal supervision in some vocational schools in DKI Jakarta Province, so it is necessary to improve the quality and consistency of principal supervision to ensure the effectiveness of the implementation of the hybrid teaching factory model. The level of effectiveness of task completion of educators and education personnel is also a critical factor in the implementation of the hybrid teaching factory model. Educators and education personnel need to have sufficient competence and dedication to perform their tasks well. A holistic approach is needed to improve the quality and productivity of the work of educators and education personnel.

Considering these findings, implementing the hybrid teaching factory model based on school governance requires strong support from various aspects, including financial management, strategic planning, principal supervision, and human resource development. Therefore, it is necessary to make joint efforts between stakeholders to overcome the obstacles encountered and increase the effectiveness of the implementation of this model in order to improve the employability skills of vocational students in DKI Jakarta Province.

CONCLUSION

Hybrid learning refers to the integration of traditional face-to-face teaching with computer and internet-based technologies. Hybrid learning covers all disciplines, facilitating teaching and learning activities for both students and teachers. The hybrid learning paradigm encourages increased student engagement and a student-centered approach to learning through the inclusion of additional student activities. The teacher's role in hybrid learning includes acting as a facilitator and guide for

students. Before adopting hybrid learning, it is important to first modify school conditions according to the specific form of hybrid learning.

The findings of this study support the framework and model of hybrid teaching applied in teaching factories during the post-COVID-19 pandemic adjustment period to the new normal. The success of the hybrid teaching factory pilot was viewed favorably by students and teachers enrolled in one of the teaching factory learning programs, while industry instructors enhanced their skills and contributed to collaborative platforms that provide essential services such as augmented reality and virtual reality applications. The pandemic has clearly created opportunities to adapt to new habits, as evidenced by the increased collaboration of online education systems, increased partnerships between the public and private sectors, and the development of interpersonal competencies such as adaptability, versatility, and accountability in teachers, students, schools, and industries. This research is expected to make a significant contribution to the development of vocational education in Indonesia, particularly in improving the quality of learning and the preparation of vocational students to enter the world of work. However, this research is still limited by focusing on the implementation of a hybrid teaching factory model based on school governance in Vocational High Schools (VHS) in certain areas, with a focus on SMK students in DKI Jakarta Province. In the future, researchers hope that the results of this study can strengthen cooperation between industry and educational institutions by strengthening the integration between the world of education and the demands of the world of work.

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Hybrid Teaching Factory Based on Good School Governance in Improving Employability Skills of Vocational Students in the New Normal Period

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Abstract

Purpose: The purpose of this research is a hybrid teaching factory combining face-to-face and online learning with the use of information, information and communication technology to improve employability skills in the new normal. **Method:** The research method uses the ADDIE Research and Development model, which consists of five stages: analysis, design, development, implementation, and evaluation. The research location is Vocational Secondary Education in the DKI Jakarta Region, Indonesia. **Findings:** The research findings are 1) Research findings that the implementation of hybrid learning has impacts to students and teachers. The impact of hybrid learning in teaching factory learning can be summarized as follows: (1) Hybrid learning teaching factory effectively addresses the challenges and limitations faced by teachers and students during the learning process by utilizing online resources, (2) Hybrid learning teaching factory fosters innovation in teaching factory learning by introducing diverse methods of interaction and discussion, and (3) Hybrid learning teaching factory creates a conducive classroom environment where students are engaged, motivated, and equipped with employability skills. **Implications for Research and Practice**: The success of the Hybrid Teaching Factory is seen as advantageous for both students and teachers who are engaged in one of the teaching factory learning programs, while industrial instructors enhance their skills and contribute to collaborative platforms that offer valuable services, such as Augmented Reality and Virtual Reality Applications.

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1. Introduction

The definitive conclusion of the 2019 Coronavirus Disease (Covid-19) pandemic remains uncertain and cannot be accurately forecasted. In addition to these advancements, the Director General of Vocational Education has released a Circular Letter (SE) numbered 02/2020, which addresses the "Implementation of Vocational Education Learning during the Covid-19 Pandemic." In response to the Circular, which states that schools may conduct in-person teaching and learning activities based on specific criteria, the Directorate of Vocational High Schools, under the Directorate General of Vocational Education, has created a guide for the management of Vocational High Schools (SMK) during the New Habit Adaptation Period. This guide serves as a minimum reference for schools. For schools to adopt new practices in

Vocational Schools in order to align with the implementation of Vocational Schools throughout the transitional phase of habit adaption (Wahjusaputri & Nastiti, 2022).

Today's educational landscape is marked by a profound shift in the methods used to carry out learning. The emergence of the notion of "new normal" in vocational secondary education (SMK) is closely tied to technical advancements and shifting global dynamics. Significant obstacles for educators are adjusting to technology advancements, establishing inclusive learning environments, and equipping pupils to navigate the intricacies of the real world.

Hybrid learning is a cutting-edge approach to address these difficulties. This technique integrates in-person instruction with the utilization of technology, resulting in a dynamic and adaptable learning environment. The teaching factory hybrid is an expansion of this concept, combining theoretical knowledge with hands-on experience to enhance students' job-related abilities. The problems in adopting a hybrid teaching factory in Vocational Secondary Education in DKI Jakarta are as follows:

1. Technology Change: Education must promptly adjust to technology advancements, guaranteeing that students possess abilities that are pertinent to the demands of the work market.
2. Promote inclusivity: Cultivate an inclusive atmosphere that prioritizes diversity and ensures fair and equal opportunities for all kids to get excellent education, regardless of their origins or skills.
3. Practical Skill Development: Education should provide students with the necessary tools and abilities to effectively navigate real-world scenarios.

The significance of inventive methodologies, such as the teaching factory hybrid, lies in its ability to address the following: 1) Skills Relevance: Establishing a connection between education and industry demands, therefore equipping graduates with the necessary competencies to seamlessly enter the workforce. 2) Student Engagement: Promotes active involvement of students via interactive learning and hands-on experiences, enhancing their ability to retain knowledge and apply concepts effectively; 3) Lifelong Learning: Establishing a basis for continuous learning and adjustment throughout one's life.

Regarding the implementation and management of teaching factories in the new normal, implementing the "5R System in the arrangement of the workspace, in the study room, and the arrangement of the workshop or laboratory will create a safe, comfortable and healthy learning and working atmosphere so that the learning and work processes are more rigorous and focused" (Sudhoff et al., 2020). The results of the survey conducted by researchers that the reference for implementing learning activities during the adaptation period of new habits are: 1) Each school makes a learning schedule according to the conditions of their respective schools, referring to the health and safety protocols of the Covid-19 Pandemic New Habits Period; 2) The schedule contains the use of learning facilities and facilities for a maximum capacity of 18 students for one study group. The practical learning schedule is designed in blocks so that the implementation of the practice produces meaningful products face-to-face and Online; 3) The school prepares a teaching factory implementation curriculum for each skill competency that is adapted to the conditions of the New Normal Period; 4) Schools prepare annual programs and semester programs by the demands of the conditions of the New Customs Period. The school coordinates the teachers in compiling the syllabus for the subjects they teach, such as: a) The teacher maps the Basic Competencies/Learning topics that can and cannot be implemented face-to-face, b) The teacher prepares learning tools that are adapted to the New Habit Period, including RPP, teaching materials in the form of job sheets and modules by the demands of Basic Competencies/Topics that will be taught face-to-face or by Learning from Home (BDR) derived from annual and semester programs, c) Teachers carry out learning and tutorials both in face-to-face learning as well as in BDR learning, d) The teacher provides

feedback and an assessment of the learning process and results. In implementing BDR, the teacher ensures that students take part in the learning as planned by the teacher (Wahjusaputri & Bunyamin, 2021).

An alternative solution is needed based on the existing problems, namely using information and communication technology in learning through the right tools. Using the right technology is to include internet technology in learning through a suitable learning model, namely hybrid learning (Nash et al., 2021). Hybrid learning combines face-to-face learning with computer and internet technology. Hybrid learning facilitates students to get materials for learning activities via the internet. Teachers can also monitor student activities via the internet (Jasiołek et al., 2021). The process of implementing hybrid teaching factory learning in Face-to-face (Offline) and Online (Online) experiences several obstacles: learning in the classroom lacks variety in learning for students, and teachers tend to lack understanding of the existing multimedia. The less than optimal use of information and communication technology influences learning activities, namely, the use of inappropriate technology causes learning to be boring and less interactive. Students complain about teachers' technical and digital skills severely lacking while integrating digital tools in teaching. Ultimately, the school infrastructure is inadequate for facilitating an efficient online learning environment (Ilkovičová & Ilkovič, 2021).

After identifying the digital challenges mentioned above, this paper presents a framework for the Hybrid Teaching Model (HMT) in the new normal in vocational schools in DKI Jakarta Province, Indonesia. The structure of the HMT model is presented in Fig 1.

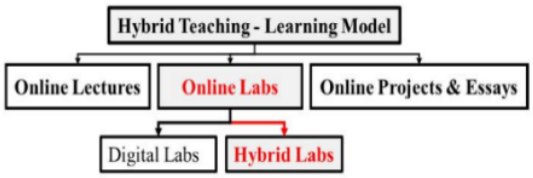

Figure 1. Hybrid Teaching – Learning Model Structure

The suggested approach is based on a hybrid laboratory, which involves the digitization of laboratory operations and process data. This enables a continuous workflow and enhances the quality of the lab (Jasiołek et al., 2021). Meanwhile, students who participate from home and educators/industrial technicians in the laboratory are taking health precautions to prevent the spread of COVID-19 (Krismadinata et al., 2020).

The teaching factory hybrid program specifically targets the enhancement of specific labor skills, including:

1. Technical Skills: Acquisition of practical competencies essential for the professional realm, including proficiency in using cutting-edge technologies.
2. Collaborative Aptitude: Promotes the development of teamwork and interaction among students to cultivate the collaboration abilities essential in a professional setting.
3. Problem Solving: Instructs pupils in the skill of proficiently recognizing, examining, and resolving issues.

2. Literature Review

Hybrid Learning

Hybrid learning integrates online and in-person instruction in a consistent and efficient manner. (Makhin, 2021). Hybrid learning often involves using non-classroom learning methods, such as online courses, study groups, or library resources (Hwang, 2018). Hybrid learning is used as a learning environment through the internet that is promoted in groups

(Alnajdi, 2014). Based on this, hybrid learning is a very effective collaborative learning to be applied in the classroom (Olapiriyakul & Scher, 2006). Hybrid learning models developed are Facebook accounts, Moodle, weblogs, and others (Raes et al., 2020). The hybrid learning model has an impact on learning activities. The efficacy of the hybrid learning model via Facebook has been substantiated in terms of enhancing student motivation, improving student learning outcomes, and fostering more use of weblogs for learning, hence heightening student motivation (Alim et al., 2021). Weblogs can offer prompt feedback to students. The importance of weblogs in enhancing student learning outcomes and promoting active student engagement in the learning process is underscored (Samsul & Anisah, 2019).

Teaching Factory

Teaching Factory (TeFa) idea is founded on the comprehension of the knowledge triangle (Martawijaya, 2015). The Teaching Factory (TeFa) idea facilitates a reciprocal flow of information between business and the classroom by using Information and Communication Technology (ICT) (Louw & Deacon, 2020). An Indonesian research explores the possibility of utilizing Industry 4.0 technologies and cyber-physical systems to transform manufacture training inside the teaching factory framework. This approach effectively tackles the increasing need for proficient workforce by equipping individuals with advanced skills (Wahjusaputri et al., 2019). Therefore, a framework that facilitates collaborative Augmented Reality (AR) product design inside the TF paradigm and acts as a digital connection between students, professors, and industry (Welsh et al., 2020). Students create and construct a Cloud platform to provide file sharing and storage assistance. Cloud platforms can serve as an intermediary for communication among parties (Louw & Deacon, 2020). Specifically, "factory-to-classroom" and "lab-to-factory" are the two modes of operation that are included in the two-way knowledge transfer channel that is offered by Teaching Factory (Welsh et al., 2020). The Teaching Factory network aims to provide a collaborative platform where industry actors (factories) and academics (classrooms) may engage in production-based learning to pursue common commercial goals [19], as presented in Figure 2.

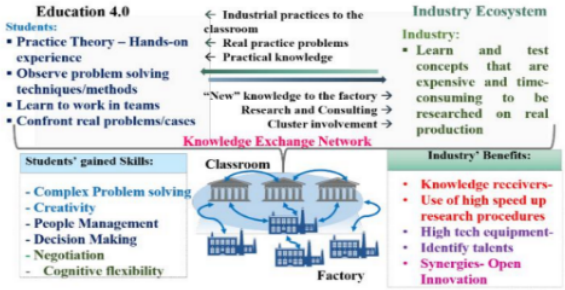

Figure 2. Teaching Factory Learning Concept

Learning Factory

The Learning Factory (LF) is a component of the Teaching Factory model, which utilizes school equipment to create manufacturing facilities that simulate an industrial setting within a school. This allows students and industry professionals to collaborate in specialized courses, fostering the dissemination of new manufacturing concepts, trends, and knowledge in an academic setting. (Leal et al., 2020). Many Learning Factories are built between industry and schools, but only research provides detailed analysis and up-to-date problems (Spillane et al., 2020). The learning factory's motivational, social, and educational structures are highlighted. The definition of the word "learning factory" for the needs of the Industry 4.0 generation of students, appears for a productive transition to digitization (Nardello et al., 2017). The school

provides Generation 4.0 students with state-of-the-art knowledge, skills, and hands-on experience. Utilizing the Learning Factory approach is a highly auspicious choice. Therefore, via the implementation of the Learning Factory concept, the procedure of creating and building industrial processes is fully automated and flexible.

Good School Governance

Good School Governance has an important role in achieving the National Education Standards. The implementation of Good School Governance can assist in systematic planning, implementation, and evaluation in the process of teaching and learning activities according to the standards of the National Education Standards (Farrell, 2014). Good School Governance assessments can be used to identify issues and areas of education that require development to improve performance and effectiveness and ensure that leaders or responsible parties keep abreast of developments in laws and regulations that affect SMK in this case, namely the National Education Standards. (Leechman et al., 2019). There are eight standards that SMK must appropriately manage, namely Content Standards, Process Standards, Graduate Competency Standards, Educational Assessment Standards, Facilities and Infrastructure Standards, Education and Education Personnel Standards, Management Standards, Education Financing Standards (Yuen et al., 2020).

3. Methodology

This study applies the Research and Development (R&D) approach, especially the ADDIE model, which has five separate stages: analysis, design, development, implementation, and evaluation. This technique is widely utilized for the purpose of designing and creating effective learning or training programs (Sugiyono, 2015). Effective communication among all stakeholders, including instructional designers, topic experts, and participants (students, educators, and educational staff), is essential at every level of the ADDIE paradigm. Engaging pertinent stakeholders from the outset and consistently revising the strategy helps facilitate the resolution of obstacles encountered throughout the execution phase. Good school governance encompasses several components such as effective leadership, proficient resource allocation, engaged stakeholder involvement, evidence-based decision making, and a commitment to enhancing educational excellence (Nadiyah & Faaizah, 2015). The ADDIE model consists of several stages, each with its own specific characteristics:

1. Analysis: During this phase, the process involves identifying the learning requirements, comprehending the characteristics of the intended audience, and evaluating the surrounding circumstances in which the learning will occur. At this stage, there are various essential tasks to be performed, including the identification of learning requirements and objectives, the identification of the target audience and their characteristics, and the analysis of available resources and potential barriers that may be encountered. The analysis phase was conducted utilizing two methodologies, specifically interviews and questionnaires, targeting the study subjects. The experts who were selected as subjects (panelists) to conduct the trial were students of SMK Class X-XII totaling 30 people. The research locations for State Vocational Schools in the DKI Jakarta area are: State Vocational School 57 Jakarta, State Vocational School 26, State Vocational School 27 and State Vocational School 30 Jakarta.
2. Design: This step involves creating a comprehensive plan for learning materials, which includes devising effective learning techniques, structuring materials, and selecting appropriate evaluation methods. The design step entails the formulation of precise learning objectives, the creation of a well-organized and informative learning structure

and content, and the selection of appropriate teaching techniques, strategies, and resources.

3. Development: Involves the process of creating learning materials, developing teaching materials, and preparing content according to the design plan. The stages in the development process are creating learning or training materials, and developing teaching materials such as modules, presentations or multimedia materials. At the development stage, researchers use e-learning development software, graphic design, or video editing.
4. Implementation: The learning content is put into practice in the learning environment in accordance with the pre-established plan. The implementation step involves executing a learning or training program and offering technical and logistical assistance throughout the process. The trial of Hybrid learning teaching is one of the important stages in the implementation of research and development (R & D) because this activity will determine whether or not the application developed by the researcher can be used. Through this trial will also be known whether the product developed can achieve the goal or not.
5. Evaluation: The effectiveness of learning is carried out by collecting data and feedback, as well as making improvements or adjustments if necessary. The evaluation step is conducted to assess the efficacy of the learning or training process. Apart from that, this stage is also carried out to obtain feedback from participants and stakeholders.

The DKI Jakarta region was selected due to its status as the focal point of economic, business, and industrial endeavors in Indonesia. The DKI Jakarta region serves as a prominent hub for the economy, commerce, and industry in Indonesia. Consequently, the effectiveness of vocational secondary education in this area is crucial in meeting the demands of the national employment market. The province of DKI Jakarta has a wide range of economic sectors, including banking, commerce, tourism, and manufacturing, which necessitate a diversified set of abilities from graduates of vocational secondary school.

The research site was selected at SMKN 57, SMKN 26, SMKN 27, and SMKN 30 Jakarta due to their status as centers of excellence and their implementation of effective school governance in DKI Jakarta. These schools possess comprehensive infrastructure and have established partnerships with the business sector and industry. Additionally, they incorporate foreign teachers as guest instructors in the learning process and facilitate teacher and student exchanges for internships with the industrial sector.

4. Results

Virtual education refers to the practice of teaching and learning using online platforms and digital services. The effectiveness of online education relies on the presence of high-speed and dependable internet connection, educational software, proficiency in digital skills, cost, and access to technology. This study presents a framework for a hybrid teaching-learning approach that was successfully applied and validated during the COVID-19 pandemic lockdown phase and until the transition to the new normal. Implementation of a hybrid learning teaching factory for students at SMK DKI Jakarta Province, Indonesia is as follows:

Model 1	Model 2	Model 3	Model 4	Model 5
Fully online curriculum with options for face-to-face instruction	Mostly or fully online curriculum with some time required in either the classroom or classroom lab	Mostly or fully online curriculum with students meeting daily in the classroom or computer lab	Classroom instruction with substantial required online components that extend beyond the classroom and/or the school day	Classroom instruction that includes online resources, with limited or no requirements for students to be online

Figure 3. Hybrid Learning Teaching Factory Model

The deployment of hybrid learning, as seen in Figure 3, has been tailored to accommodate the specific circumstances of the institution. Below is a comprehensive overview of each model utilized in hybrid learning:

a) Model 1; This model is a hybrid learning approach that fully utilizes online resources throughout all learning activities.. This model requires students and teachers to always stand by on the internet. All teaching and learning activities are carried out via the internet, for example via videoconferencing. However, implementation instructions are carried out face-to-face. This model can be applied to higher education institutions where teachers and students or lecturers and students are not in class.
b) Model 2; This is a hybrid learning approach that utilizes internet resources, either exclusively or intermittently. This technique enables students and professors to abstain from utilizing the internet during each session. This model is sometimes inserted face-to-face learning, for example when carrying out exams or collecting assignments in the form of papers or research reports. This model is also used in universities.
c) Model 3; This model is an application of hybrid learning that heavily relies on internet resources for learning activities. Face-to-face learning occurs during class discussions or practical exercises conducted in person. The internet usage in this model is consistent with that of model 1 and model 2, where both students and professors, or lecturers and students, are highly engaged in using the internet..
d) Model 4; This model is a rather straightforward implementation of hybrid learning. This approach continues to utilize internet resources for educational purposes, while still incorporating a significant amount of in-person interaction between students and professors. In this paradigm, the internet serves as a tool to facilitate learning. For instance, during class discussions, the teacher prompts students to search for relevant information on the internet and then share their findings.
e) Model 5, This model exemplifies hybrid learning in itssimplest form. This strategy does not need constant internet connectivity for students during the learning process. This concept facilitates students' access to online information provided by the teacher, even when they are not physically present in the classroom or school. The presence of the Internet is nonexistent in this classroom paradigm. Furthermore, classroom interactions between students and teachers persist in employing traditional face-to-face instruction, supplemented by educational resources accessible through online platforms, including videos, music, films, animations, photographs, and various other things.

The adoption of hybrid learning has a significant influence on both students and instructors. The effects of hybrid learning on teaching factory learning are as follows: (1) Hybrid learning effectively addresses the challenges and constraints faced by teachers and students during the learning process by utilizing online resources, (2) Hybrid learning fosters innovation in learning by providing diverse opportunities for interaction and discussion, and (3) Hybrid learning creates a conducive classroom environment, promoting student engagement and satisfaction.

Table 1. Implementation of the Hybrid Learning Teaching Factory Model Based on Good School Governance in DKI Jakarta Province

Dimension	Indicator	Corrected Item-Total

		Correlation
Curriculum	Completeness of curriculum documents	0.522
	Completeness of curriculum device documents	0.583
	Completeness of curriculum supporting documents	0.525
Learning Process	Lesson Planning	0.618
	Learning Implementation	0.527
	Assessment of learning outcomes	0.669
	Supervision of the learning process	0.438
Graduate Competency	Academic achievement, related to the graduation rate of students in the last year, and the absorption of graduates by the business and industry world	0.577
	Non-academic achievements, related to students' success in winning various fields of student competitions in extracurricular activities	0.864
Assessment	Assessment conducted by educators	0.864
	Assessment conducted by the educational unit	0.864
	Assessment conducted by the Government	0.764
Teachers and educational staff	The academic quality of educators and education workers is relevant to their sector of employment.	0.504
	The relevance of the field of expertise of educators and education personnel to the field of work	0.403
	Attendance rate of educators and education personnel	0.565
	The level of effectiveness of completing the tasks of educators and education staff	0.565
	The level of discipline of educators and education staff in carrying out their duties	0.602
Physical amenities and structures	Completeness and adequacy of physical facilities (such as classrooms, laboratories, teacher rooms and library rooms)	0.745
	Completeness and adequacy of tools/practice	0.777
	Completeness and adequacy of the library	0.745
Administration	Availability of School Development Plans (RPS)	0.535
	Implementation and successful implementation of the program	0.525
	Principal supervision is related to the completeness of the principal's supervision instrument, and the frequency of principal's supervision	0.535
Funding	Allocation of use of funds	0.412
	Transparency	0.882
	Accountability	0.764

The hybrid learning teaching factory concept is facilitated by several forms of multimedia. The multimedia is in the form of macromedia flash, simulation/virtual, video, audio, and others. Multimedia has a big impact on the teaching and learning process [51]. One of the hybrid learning teaching factory models is through Moodle, which has several functions, namely: a) facilitating communication and interaction between students and teaching staff and industry, b) increasing collaboration between students to form learning communities, c) encouraging students to independently seek resources learning, d) providing feedback through space and time, and e) helping students build their knowledge through active and interactive learning(Davy Tsz Kit et al., 2022).

The Teaching Factory trial consisted of individual sessions for each team, during which the student team engaged with industry instructors and teachers using a video conferencing platform (Google Classroom). They were instructed to solve remote-controlled teaching factory product challenges online.Siagian et al. (2020) found that the majority of SMK students frequently choose for studying in the convenience of their own homes, allowing them to have easy access to all resources without the need to physically move from their seats (Alim et al., 2021) (Makhubele & Simelane-Mnisi, 2020). Finally, each team can guide industry technicians/supervisors through the combination of the ICT as mentioned earlier.

Digital manufacturing technology plays a crucial role in the continuous endeavor to decrease the time and expenses involved in product creation, while also providing more opportunities for product customisation (Brzezicki, 2020). Hence, the adoption of the suggested digital hybrid model outlined in this research presents a remarkable prospect for users (such as students, instructors, industry professionals, researchers, and others) to expedite the enhancement of their employable abilities, as it will be actively promoted in the aftermath of the COVID-19 epidemic. Suppose students demonstrate their ability to work in unconventional, innovative methods and convey their learning in novel ways, but educators continue to work in traditional ways. Under those circumstances, the teacher's function in the educational process will be reevaluated. Furthermore, the global outbreak of the coronavirus has prompted a vast number of students to engage in remote learning from their homes. The house has always served as the central hub for learning, particularly in informal education, making this phenomena not a recent occurrence (Lewis et al., 2021). Siagian et al. (2020) found that the majority of SMK students frequently opt to study in the convenience of their own homes, enabling them to have easy access to all resources without the need to physically move from their seats (Siagian et al., 2020).

Hybrid learning refers to the integration of traditional in-person instruction with computer-based and internet technologies. Hybrid learning encompasses all scientific disciplines, facilitating the instruction and learning activities for both students and teachers. The hybrid learning paradigm fosters increased student engagement and a student-centered approach to learning through the inclusion of additional student activities. Teacher roles in hybrid learning include acting as facilitators and student mentors. Prior to adopting hybrid learning, it is important to first modify the school's conditions in accordance with the specific forms of hybrid learning.

The findings of this study support the framework and Hybrid Teaching Model proposed by the Teaching Factory concept during the post-covid-19 pandemic adjustment to a new normal. The success of the Hybrid Teaching Factory pilot is viewed favorably by both students and teachers enrolled in one of the teaching factory learning programs, while industrial instructors improve their skills and contribute to collaborative platforms that provide valuable services such as Augmented Reality and Virtual Reality Applications. The pandemic has clearly created opportunities for adapting to the new normal, as evidenced by the rise of collaborating online educational systems, the enhancement of partnerships between the public and private sectors, and the development of interpersonal competencies such as adaptability, versatility, and accountability in teachers, students, schools, and industry.

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