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# Vocational School Level Learning Model for Work Readiness: A Systematic Literature Review

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***Abstract***

*The mismatch between vocational school graduates' competencies and industry needs remains a major cause of youth unemployment. This research aims to provide a comparative view of the learning models used at the vocational school level to prepare students to have a work readiness attitude t aligned with 21st-century industry demands. This research is a systematic review of literature that explains a connection between learning models at the vocational school level to prepare students' work attitudes according to industry demands. There are seven learning models from 14 articles obtained in the research. This research links the vocational school level learning model, 21st century skills to students' work readiness according to industry demand. The research concludes that the Learning and Training Within Industry, Teaching Factory, Blended Learning, Project Based Learning, Problem Based Learning, Lean Based Learning, and Work Based Learning models can meet the criteria for incorporating 21st century skills to increase the work readiness of vocational school graduates so they can be absorbed in industry.*

**Keywords:** Learning Model, Vocational School, 21st Century Skills, Ready to Work
**SDGs:** Goal 4 (Quality Education), Goal 8 (Decent Work and Economic Growth), Goal 9 (Industry, Innovation and Infrastructure), Goal 17 (Partnerships for the Goals)

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## INTRODUCTION

Indonesia is experiencing a human quality crisis which is characterized by multidimensionality. This crisis resulted in a decline in national culture, including a decline in spiritual morals, enthusiasm for business and work, and creativity. If this continues, it will have a negative impact on Indonesia's progress. The quality of a country's human resources must be the main component in improving that country's development (Suroto et al., 2023). Presidential Instruction Number 9 of 2016 concerning the Revitalization of Vocational High Schools (SMK) in the Context of Improving the Quality and Competitiveness of Indonesian Human Resources is becoming a new chapter in the vocational world because the government is intensifying the reduction in the open unemployment rate for vocational school graduates which will reach 1,780,095 in 2023 according to data Central Statistics Agency (BPS). This unemployment figure is truly ironic because vocational school level education is prepared to prepare ready and skilled workforce candidates where vocational school students have carried out the Field Work Program (PKL). Learning at vocational schools also prepares students to get close to and get to know the industry by the expertise program (Yoto et al, 2022).

Many high school and vocational school graduates are unemployed because their qualifications need to match the existing jobs. Vocational school graduates who are prepared to work after graduation are the ones who contribute the most to the unemployment rate compared to other graduates (Coffield, 2024). Stimulating vocational school students to compete in a competitive job market and pay attention to their environment is

very important to provide them with environment-based skills (Muaddab et al., 2024; Tyera et al., 2022). Reducing the unemployment rate can be overcome by providing vocational education.

Vocational education, according to the explanation of Law Number 20 of 2003 concerning the National Education System Article 15, is secondary education that prepares students to work in specific fields. Vocational education can impact the national economy, such as a business incubator that fosters an entrepreneurial ecosystem in Indonesia (Rukmana et al., 2024). The aim of developing vocational education is basically to provide workers who will be employed and independent workers (Rojaki & Yuliana, 2023). To achieve this goal requires improving relations between schools and industry (Lensjø, 2024). Strengthening vocational school education is one way to improve the preparation of Indonesia's human resources in facing Revolution 4.0. so that vocational school level students can have the competencies needed by the times (Arinaitwe, 2021).

The skills of educators in the 4.0 Revolution and the challenges of the fast-paced and instantaneous era are also big homework for vocational school education administrators. Vocational schoolwork includes learning, collaboration with industry, post-graduate study distribution, and limited resources (R. Santoso, 2022). Educators must master the classroom with rapid technological developments and increasingly modern industrial infrastructure, measure learning performance in schools with industry standards, and evaluate everything in vocational school learning (Irsyad & Effendi, 2023). Vocational schools are currently responsible for carrying out tracer studies (Heriyadi, 2021). This is a follow-up to post-graduate students regarding planning and decision making for alumni and industry as input for formulating policies for the next academic year (Qadrini, 2022). Vocational school cannot be separated from the ready-to-work model.

A learning model is a method used to make it practical and minimize uncertainty (X. Ma et al., 2024). Learning is a process of interaction between students with educators and learning resources in their learning environment, which allows the learning process to occur within themselves by optimizing the growth and development of their potential (Sarumaha et al., 2022). Students' success in the learning process reflects the results of an education that mixes and matches elements in learning (Sarumaha et al., 2022). The success of an educator in handling students in learning must be distinct from choosing the suitable learning model according to the learning objectives. Although learning at the vocational school level usually pays special attention to aspects of skills, the complexity of learning, which includes cognitive, affective, and psychomotor components, is very important in the way students think to solve problems and find solutions (Iñiguez-Berrozpe & Boeren, 2020). The learning models used in vocational schools must be oriented toward work preparation (T. D. P. Santoso, 2022). Job preparation in the school environment is very important because the spirit of vocational school students is ready to work in industry after graduating from school.

Work preparation is when a person's physical, mental and experience development is aligned to carry out work-related activities (Puspitasari & Bahtiar, 2022). This work preparation statement is inversely proportional to the current condition of vocational school students whose resilience is low (Syifa et al., 2021). The low resilience of vocational school students and graduates results in a lack of job absorption (Oslon et al., 2021). There needs to be an understanding that must be instilled in students so that they have 21st century skills. The 21st century skills required by industry today are literacy, competence and character (González-Pérez & Ramírez-Montoya, 2022). 21st century skills positively and significantly influence students' work readiness (Kaya, E., Karatana, Ö., & Yıldırım, 2023). Based on this statement, work preparation is not only based on industrial material but also on 21st century skills that begin during classroom learning and when carrying out PKL or integrating the two. The current homework is to instill 21st century skills in students through a learning model at the vocational school level that is prepared for work (Suyitno, 2020).

The 21st century skills needed are 1) Literacy consisting of reading and writing, numeracy, science, ICT, finance and culture; 2) Competencies consisting of critical thinking, creative thinking, communicating and collaborating, while the competency dimensions (Moeheriono & Si, 2012) consist of task skills, task management skills, contingency management skills, job role environment skills, and transfer skills; 3) Character consisting of curiosity, initiative, persistence, adaptation, leadership and socio-cultural skills (Marshel & Fauzi, 2021). Educators must embed the three characteristics of 21st century skills in learning by including them in the design of learning models. The aim of this planting is so that students are able to have the 21st century skills that industry needs today. Educators must understand learning management well by understanding competency-based learning and industry 4.0 (Kožuh et al., 2021). Another thing that is of concern is that it is important to increase awareness of scientific and technological progress. If there is a substantial concern, literacy will slowly improve (Mutohhari, F., Sofyan, H., & Nurtanto, 2021). Therefore,

integrating 21st century skills into vocational education is not just an option but a necessity to ensure students are ready to face global challenges and contribute meaningfully to the workforce.

Although various policies have been implemented to improve the quality of vocational school graduates, and numerous studies have highlighted the importance of industry collaboration, curriculum strengthening, and teachers' mastery of technology in supporting students' work readiness, there remains a research gap regarding the comparison of learning models that specifically integrate 21st century skills development with work readiness at the vocational school level. Previous research has mostly focused on curriculum development, industry relations, or general competency measurement, but has not thoroughly examined the effectiveness of particular learning models in fostering the literacy, competencies, and character that are crucial for work readiness. Therefore, further research is needed on how vocational school learning models can optimally support the integration of 21st century skills with work-oriented education.

Based on the background that connects the learning models used in vocational school level learning to prepare students for work. The aim of the research is to provide educators with a view on the comparison of learning models used at the vocational school level to prepare students to have a high work readiness attitude so that the absorption rate into industry can be high. The theoretical benefit of this research is to increase knowledge about various learning models for vocational schools. The practical benefit of this research is that educators are expected to adapt learning materials to the competencies that students are expected to have. The Research Question of this study is "What learning model is used in learning at vocational schools to support work readiness?"

## METHOD

This research uses the Systematic Literature Review method. This research uses Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) adapted from (Page et al., 2021), which can be seen in Figure 1. Systematic reviews are an effective instrument for analyzing data (Balalle, 2024).

Research Question (RQ): What learning models are used in vocational school learning to support work readiness?

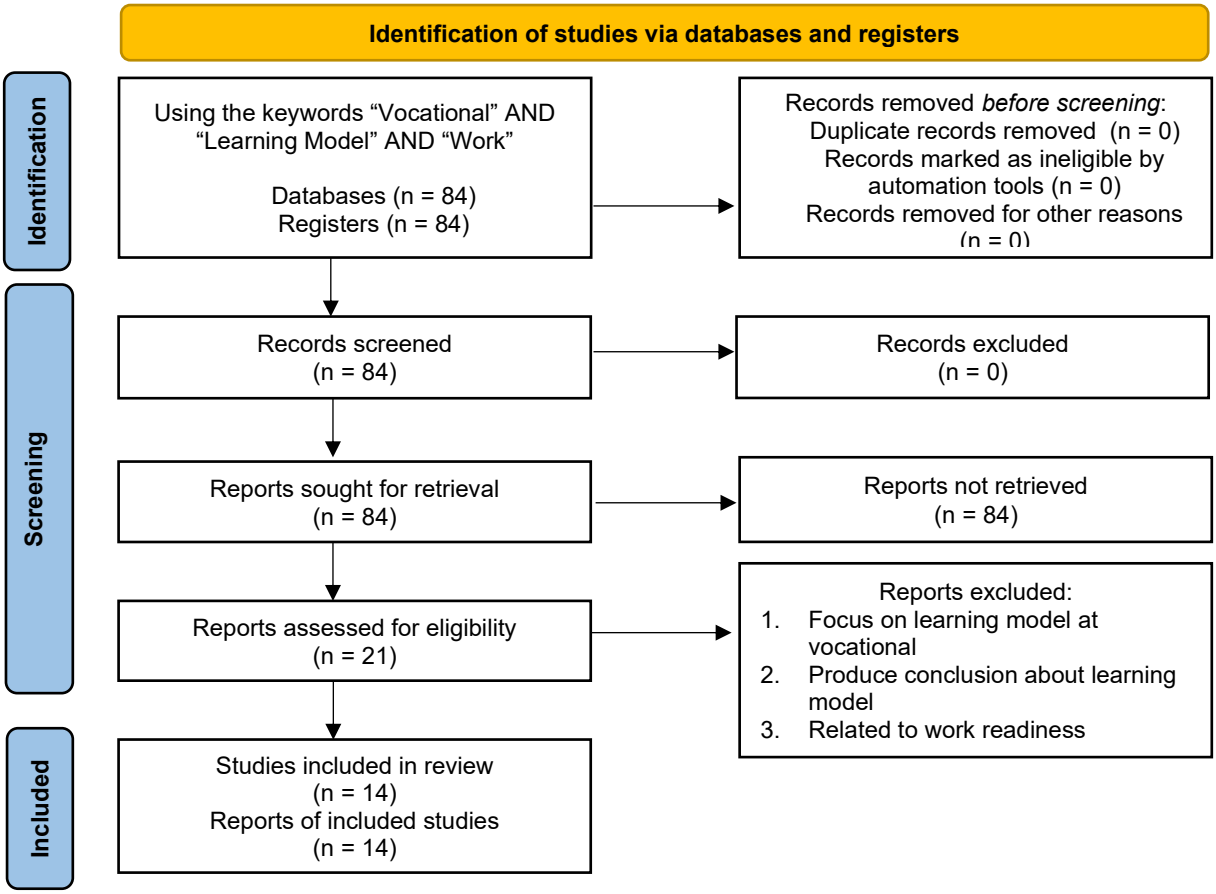


**Figure 1.** Flow of Selection of Articles for Research

Figure 1 illustrates the PRISMA flow diagram used in this study to identify, screen, and select relevant literature. Using the keywords “Vocational,” “Learning Model,” and “Work,” 84 records were initially identified from databases and registers. After screening and assessing eligibility, 21 reports were considered, and 14 studies were ultimately included in the review. The diagram shows that reports were excluded primarily because they focused on vocational learning models, drew conclusions about learning models, or related to work readiness, highlighting the rigorous process undertaken to ensure that only studies directly relevant to the research objective were included (see Figure 1).

**Search Strategy**

This literature review research was searched on the SCOPUS platform on June 1, 2024, using the keywords "Vocational" AND "Learning Model" AND "Work" and produced 84 articles.

**Inclusion and Exclusion Criteria**

The next stage is to carry out filtering using the filter in SCOPUS. The subject area uses social sciences because other subject areas in Scopus are not suitable for this research. Apart from being incompatible, research in the field of education tends to be more directed towards social sciences. Other subject areas in Scopus are Engineering, Computer Science, Physics and Astronomy, Materials Science, Medicine, Arts and Humanities, Psychology, Environmental Science, Earth and Planetary Sciences, Decision Sciences, Business, Management and Accounting, Pharmacology, Toxicology and Pharmaceutics, Nursing, Multidisciplinary, Mathematics, Health Professions, Energy, Chemical Engineering, Biochemistry, Genetics, and Molecular Biology, document type in the form of an article because the research only focuses on research conducted by previous researchers which has a source type in the form of a journal because the researcher wants to focus on articles published in journal, while open access is all open access because it makes it easier for researchers to download articles used for literature reviews which resulted in 21 articles. The next stage is to qualify the filtered articles using the following criteria:

1) focus on the learning model used at vocational school level
2) produce conclusions about the use of learning models
3) articles related to work readiness, and
4) articles in the form of studies, not articles in the form of systematic literature reviews so that this feasibility stage resulted in 14 articles that were ready to be used in research.

This literature review research was conducted to avoid bias because a meta-analysis study could not be carried out, so an explanation was carried out followed by comparative analysis and synthesis (Keles et al., 2020). The description is carried out using comparative analysis and synthesis by studying the relationship between learning models at the vocational school level to prepare students to be ready to work according to industry needs. Comparisons between learning models can be done by analyzing syntax, industry involvement in learning, and industry needs for student competencies.

## RESULTS AND DISCUSSION

The discussion in this research focuses on the relationship between the variables "learning model", "vocational or vocational", and "work (readiness)". These three variables are connected to answer the research question. Based on the results of article eligibility, there were 14 articles that formed the population and sample of this research. The first part of this research is to compare the articles used in this research on a comparison table of articles that are suitable for research. Related articles analyzed learning models based on learning syntax that supports work readiness.

**Table 1.** Learning Models Used in Vocational Schools

| No | Learning model | Source | Year |
|---|---|---|---|
| 1 | Learning and Training Within Industry | International Journal of Evaluation and Research in Education | 2024 |
| 2 | Teaching Factory | Educational Horizons | 2023 |
| 3 | Teaching Factory | Social Sciences and Humanities Open | 2023 |
| 4 | Project Based Learning | Interrnational Journal of Evaluation and Research in Education | 2022 |
| 5 | Project Based Learning & School Based Enterprise | International Journal of Learning, Teaching and Educational Research | 2022 |
| 6 | Teaching Factory | Journal of Turkish Science Education | 2022 |

| No | Learning model | Source | Year |
|---|---|---|---|
| 7 | Project Based Learning | Journal of Technical Education and Training | 2021 |
| 8 | Problem Based Learning | International Journal of Emerging Technologies in Learning | 2021 |
| 9 | Teaching Factory | International Journal of Instruction | 2020 |
| 10 | Lean Manufacturing Based Learning | Universal Journal of Educational Research | 2020 |
| 11 | Work Based Learning | International Journal of Instruction | 2019 |
| 12 | Blended Learning | Humanities and Social Sciences Reviews | 2019 |
| 13 | Work Based Learning | International Journal of Training Research | 2016 |
| 14 | Work Based Learning | International Journal of Learning | 2010 |

Based on Table 1, the learning models used are Learning and Training Within Industry, Teaching Factory, Blended Learning, Project Based Learning, Problem Based Learning, Lean Based Learning, and Work Based Learning.

**Learning and Training Within Industry**

General Explanation

The vocational school learning model that is considered reasonable is a learning model that replicates industry, industry-based competencies, and is taught by linear instructors according to their expertise (Munawaroh, 2017; Muslim et al., 2019; Sunggoro et al., 2022). The Learning and Training Within Industry learning model is a learning model that educators use with students to train attitudes, knowledge, skills, and Occupational Health and Safety (K3) in the work environment (Sudarsono et al., 2024). The Training Within Industry (TWI) learning model is suitable for educators to train students to be ready to work according to industry needs. The industrial world must be used as a guide in preparing the vocational school curriculum (Abdullah et al., 2022; Herawan & Suryadi, 2019; Nurjannah et al., 2022; Sudjimat et al., 2021). Based on the dimensions of 21st century skills, the TWI learning model has 5 syntaxes, namely work preparation, demonstration, imitation, practicum, and evaluation. Literacy is needed in various matters when teaching work readiness so that the instructions carried out in learning run as expected. The demonstration, imitation, and practicum stages are taught to fulfill the dimensions of work competency, namely task skills (every time students carry out learning activities, they must be on time according to instructions and SOP), task management skills (can operate tools of different types or specifications, for example brand x drills and drill brand y), contingency management skills (students learn to decide on problems that must be considered with all the consequences), job role environment skills (students learn to collaborate with individuals and groups, as well as other groups so that goals are achieved), and transfer skills (students learn to adapt and get used to the work that has been done previously), while at the evaluation stage, students are taught to have the character of persistence, adaptation, leadership, and social skills. With the evaluation and learning carried out, it can become capital for work readiness in the industrial world.

Job Competencies and Future Projections

The work competencies that must be emphasized in this learning model are managerial and leadership abilities. Imitation, practicum, and evaluation syntax requires strategic planning and decision making. This competency is needed and in the future must be collaborated with mastery of technology. These technologies are programming, artificial intelligence, and translation of practical work into information that is easy for all parties to understand. This model will be successful in increasing work readiness if students have a high level of self-awareness to develop managerial and leadership abilities.

**Teaching Factory**

General Explanation

The Teaching Factory (TEFA) learning model is a learning model that connects schools with industry and acts as a bridge to help students fulfill work readiness qualifications (Mavrikios et al., 2019; Sani, 2023). TEFA directs work readiness, specifically including subjects, communication, understanding, relevant skills, adaptability, flexibility, and willingness to work well (Hanafi, 2012; Sasmito et al., 2015). TEFA is suitable for educators to train students in preparing for work according to industry and standards (Chen, 1998; Diwangkoro, 2020; Mason, 2009). TEFA's syntax is planning or setting performance criteria, learning objectives, implementing process learning, and assessment involving industry practitioners (Rosidah &

Sutirman, 2023). TEFA is suitable as a learning model that stimulates work readiness and entrepreneurship because it has several aspects such as internships, production-based education and training, school-based businesses, cooperative education placements in business and industry, as well as learning about service (Fioravanti et al., 2018; Prianto et al, 2021; Prianto et al., 2022). In other research, TEFA can stimulate attitudes that support 21st century skills needed by industry such as academic achievement, metacognitive skills and critical thinking abilities (Maksum et al., 2022). TEFA can spur attitudes that support 21st century skills needed by the job market, namely critical thinking, creativity, collaboration, communication, information literacy, media literacy, technological literacy, flexibility, leadership, initiative, productivity and social skills (Damarjati, 2017; Isnandar et al., 2023).

General Skills

It can be concluded that the TEFA learning model can support the 21st century skills needed by industry. TEFA can fulfill aspects, namely literacy and numeracy, which function to manage orders from customers because in TEFA, students are taught to receive orders like an industry that carries out buying and selling goods or services. In relation to the dimensions of work competency, TEFA meets the 21st century skills needed by industry because it trains students to think critically and creatively and fulfill task skills (every time students carry out learning activities they must be on time according to instructions and SOPs like activities carried out in industry), task management skills (students are trained to be able to operate tools of different types or specifications such as those in industry), contingency management skills (students learn to decide problems when receiving orders from customers), job role environment skills (students learn to work together with individuals and groups, as well as other groups so that goals are achieved), and skills transfer (students learn to adapt to new environments in the business unit section at TEFA). Meanwhile, the characters trained in the TEFA learning model are initiative and cooperation in carrying out orders from customers by prioritizing shared goals, not individual egos.

Job Competencies and Future Projections

The work competency that must be possessed in implementing the TEFA learning model is continuous self-development. This is done to find out what products are needed by the community. Curiosity and excellent service attitude are competencies that must be emphasized in this learning model. Meanwhile, in the future, students must learn digital marketing to market the products they produce. Starting from content production and marketing online. This model will be successful in increasing work readiness if students have an attitude of cooperation, tenacity, and responsibility in completing the given project.

**Blended Learning**

General Explanation

The blended learning model is a learning model that combines face-to-face learning and information technology or IT-based learning (Lo et al., 2024). Blended learning is a unique approach to the characteristics of today's students who are familiar with technology (Tian & Song, 2024). Blended learning is a learning facility that combines various delivery methods, teaching models, and learning styles. This model is the most efficient model to use in vocations (Hu et al., 2024). Blended learning trains students to create learning environments that are usually done physically, online, or online. Blended Learning requires training or mastery of information technology in implementing independent learning (Z. Ma et al., 2024). Blended learning helps vocational school students still be able to receive learning material from educators at school during the implementation of Field Work Practices (PKL), both traditional and IT learning (Kulju et al., 2024). The form of blended learning can vary depending on the needs of students when implementing PKL, such as learning via video conference applications, using a learning management system (LMS), learning videos, and so on.

General Skills

Blended learning can support the 21st century skills needed by industry because it fulfills aspects of digital literacy. Digital literacy requires good ownership and mastery of technology. In the work competency dimension, blended learning can train transfer skills (students learn to adapt to the new environment in which they are placed). The character trained in the blended learning model is responsible for carrying out instructions given by educators to students. Time responsibility is one of the work cultures required by the industry.

Job Competencies and Future Projections

The work competencies needed to apply the blended learning model are thinking critically and analytically. This is used to sort devices that support blended learning. When students can sort work equipment, students have also learned about efficiency at work. In the future, what students must master are skills in the IT field so they are able to work more optimally and efficiently in accordance with learning and work demands. This model will successfully increase work readiness if students have a high level of curiosity and responsibility in completing the tasks given.

**Project Based Learning**

General Explanation

The project based learning (PjBL) learning model is a learning model that trains students to create or work on projects that have been set on learning objectives determined with educators. This PjBL learning model can encourage students to increase their creativity by producing products in natural form (Amorati & Hajek, 2021; Muchsin & Mariati, 2020; Priyatni & As'ari, 2019; Safitri, 2018; Usmeldi & Amini, 2022). Implementing PjBL with deeper learning competencies is able to stimulate expected competencies such as mastery of core material, problem solving skills, practical communication skills, learning to understand each other, collaboration, and academic mindset (Prianto et al, 2021; Starko, 2021; Viswambaran & Shafeek, 2019). The PjBL learning model emphasizes work insight, including product planning, creating work steps, cost planning, and product quality control (Hamdani & Suherman, 2021).

General Competencies

Job orientation training with PjBL can support the 21st century skills needed by industry because it meets literacy, numeracy and IT aspects. This aspect functions to support projects carried out by students. In the work competency dimension, PjBL can train task management skills (managing planning and activities in projects individually or in groups), contingency management skills (students learn to handle and decide problems on the projects they work on), and transfer skills (students learn to adapt to new environments wherever placed). The characters trained in the PjBL learning model are adaptation and leadership in managing a project in a group. In a group, there are many individual characteristics that support or hinder the project. Therefore, a leader or manager must divide tasks proportionally based on the potential of the group members.

Job Competencies and Future Projections

The work competencies that must be mastered in implementing the PjBL learning model are managerial and leadership abilities. This must be mastered because carrying out a project must be based on the individual's ability to carry out the tasks given and the managerial ability to delegate tasks. Individuals as leaders and individuals as implementers must be regulated firmly. This is because the world of work requires certainty in carrying out its duties. Meanwhile, in the future, students must master artificial intelligence to facilitate the work they are faced with. Mastery of Artificial Intelligence can make work more efficient. This model will be successful in increasing work readiness if students have a responsible attitude and high awareness of the projects assigned to them.

**Problem Based Learning**

General Explanation

The problem based learning (PBL) learning model is a learning model that is student-centered by equipping students to be able to solve the problems they are faced with (Kladchuen & Srisomphan, 2021; Schmidt, 1983). This allows students to practice thinking, analyzing, and solving problems (Miliou et al., 2022). Solving problems together can help students to gain knowledge and develop problem-solving skills. To solve problems in unknown situations, students must be able to think collaboratively and reflectively (Jiang et al., 2024). The PBL learning model contains the syntax of identifying and analyzing problems, an important step in the learning model (Stoeva & Stoev, 2022). Identifying and analyzing problems is finding the core of a problem, what you want to do with the problem, where you want to take the problem, and what you should do to solve the problem (Su & Chen, 2022). This is not easy if done hastily and without consideration and a strong basis.

General Competencies

The PBL learning model can support 21st century skills needed by industry because it meets literacy and IT aspects. This aspect functions to find a solution to the problems faced by the group that has been divided. The use of IT is very important to help and add reference material in solving problems. Use of IT can take the form of using online libraries, searching for journals and other references. In the work competency dimension, PBL can train task management skills (students can use IT and look for references from various sources), contingency management skills (students learn to decide on problems that must be considered with all the consequences), job role environment skills (students learn cooperation between individuals in groups), and transfer of skills (students learn to adapt and get used to the work they have done previously). The characters trained in the PBL learning model are curiosity which underlies problem solving, persistence in seeking answers in problem solving, and social skills in managing groups.

Job Competencies and Future Projections

The work competencies that must be mastered in implementing the PBL learning model are the ability to think critically and analytically. This relates to the problem that must be solved. Problems will be seen from a different angle by getting used to critical thinking. This will have an impact on how to solve problems from different points of view. You will get used to solving problems immediately by honing critical thinking skills. In the future, the ability that students must have to apply the PBL learning model is the ability to master IT and AI. This is used to make it easier to identify problems, find solutions to problems, and communicate solutions to existing problems. This model will be successful in increasing work readiness if students have a high level of curiosity and the ability to find solutions to problems.

**Lean Manufacturing Based Learning**

General Explanation

The lean manufacturing-based learning model is designed to hone students' work skills at the vocational school level (Hartanto, 2023). The lean learning model is an industrial management system used for education at the school or industrial level. By applying it directly to industry, vocational students must understand lean concepts theoretically and practically. This concept underlies all learning activities, including cognitive, affective, and psychomotor aspects. The lean-based learning model provides a solution to realize the development of students' work skills in vocational schools. Learning in schools must be integrated with industry to be able to develop knowledge, skills and attitudes in accordance with the goals of vocational education (Hartanto et al., 2020). Based on this statement, the lean manufacturing based learning model is a learning model that prepares work readiness according to industry needs.

General Competency

The lean manufacturing based learning model can support the 21st century skills needed by industry because it meets aspects of literacy, science and IT. This aspect functions to find solutions to problems faced by groups that have been divided. Science, in this learning model, is used to guide students in carrying out practical activities based on a scientific attitude. The use of IT is very important to help and add reference material in updating the latest information about the world involved in vocations. Some examples of updates are related to the material and equipment, models, and so on. In the work competency dimension, lean manufacturing based learning can train task management skills (students can use equipment from different brands with the same function), contingency management skills (students learn to decide on problems that must be considered all the consequences), job role environment skills (students learn to work together with individuals and groups to achieve goals), and transfer skills (students learn to adapt and get used to the work they do). The character trained in the lean manufacturing based learning model is adaptation in accepting new environments and adapting to existing work instructions in the industry.

Job Competencies and Future Projections

Work competencies that must be mastered in implementing the lean learning model manufacturing based learning is the ability for team work, adaptation to new places, and time management. This is necessary so that students are able to appreciate the work culture required by industry which is required to complete tasks with targets. In the future, students must have the skills to apply the lean learning model Manufacturing based learning is the ability to adapt to the environment quickly. By adapting, students will get used to rapid changes. When rapid changes can be accepted, it will be easy for students to do work quickly too. This model will

successfully increase work readiness if students have a high level of discipline and adaptability. This is done to train students' mental readiness.

**Work Based Learning**

General Explanation

The work based learning (WBL) learning model is a learning model that develops attitudes, knowledge and skills from experience in two places, namely at school and the workplace/industry, while learning can also be done with real life work activities (Lynch, R. L., & Harnish, 1998). Learning with WBL is learning based on experience obtained when carrying out practicums or training in industry by using experience as learning material in formal learning environments such as schools (Chaiyong & Moonpa, 2024). These experiences are evaluated and compared based on the theory or material studied (Zulch, D., Saunders, R., Peters, J., & Quinlivan, 2016). Experience at work and school are both valuable because they complement each other so that learning goals can be achieved. Experience in the workplace and school must be taken into account equally so that the existing experience can become a finding and discussion material as a guide for carrying out practicum or training at the next opportunity (Alseddiqi, M., Mishra, R., & Abdulrasool, 2010). Based on these statements, it can be concluded that the experience during practicum and learning at school can make students confident to enter the industry (Kaske et al., 2022).

General Competencies

The WBL learning model can support the 21st century skills needed by industry because it meets literacy, science and IT aspects. This aspect functions to find comparisons of experiences or problems faced by the group. Science, in this learning model, is used to guide students in carrying out practical activities in industry based on a scientific attitude. The use of IT is very important to help and add reference material in updating the latest information about the world involved in vocations. Some examples of updates are regarding equipment, models, and so on related to the material. In the work competency dimension, WBL can train task management skills (students can use equipment from different brands but have the same function), contingency management skills (students learn to decide on problems that must be considered with all the consequences), job role environment skills ( students learn to work together with individuals and groups so that goals are achieved), and transfer skills (students learn to adapt and get used to the work they do). The character trained in the WBL learning model is adaptation in accepting new environments and being able to adapt to existing work instructions in the industry. Students are expected to be curious so that the experience gained during training or practicum can be filtered for lessons learned.

Job Competencies and Future Projections

The work competencies that must be mastered in implementing the work-based learning model are working in teams, adapting to new places, and time management. This is necessary so that students are able to appreciate the work culture required by industry which is needed to complete tasks with targets. In the future, the ability that students must have to apply the work-based learning model is the ability to adapt to the environment quickly. By adapting, students will get used to rapid changes. When rapid changes are accepted, it will be easy for students to do work quickly, too. This model will successfully increase work readiness if students have a high level of discipline and adaptability. This is done to train students' mental readiness.

This article has several limitations that can be used as a basis for further research regarding learning models in vocational schools, including 21st century skills to prepare students to be work ready. The first limitation is that this research only focuses on vocational schools in general, not vocational schools specifically on specific skills programs. Based on data, there are 128 skill programs or majors in vocational schools, which are summarized into 7 priority sectors in the Center of Excellence Vocational School program, namely creative economy, machining and construction, hospitality, care services, maritime, agriculture, and foreign cooperation (Apriyani et al., 2024). The second limitation is that researchers need to present the most effective learning model for vocational schools that includes 21st century skills to prepare students for work because it requires further research. The third limitation is the small sample size in this study due to limited filtered articles and article eligibility. Based on these limitations, the researcher recommends that further research focus on vocational programs or certain groups by comparing learning models that include 21st century skills to support the work readiness of vocational school graduate students to suit industry needs.

Vocational high school learning models that support work readiness significantly contribute to achieving the Sustainable Development Goals (SDGs), particularly the goals of quality education (Goal 4) and decent work and economic growth (Goal 8). Through an industry-based approach, collaboration with the workplace, and the development of soft skills, vocational high school graduates are prepared to enter the professional world directly. This helps reduce youth unemployment and boost national productivity. Curricula integrated with industry needs also ensure equal employment opportunities for all students without discrimination. Thus, vocational high schools play a strategic role in strengthening the synergy between education, the economy, and sustainable development.

## CONCLUSION

Based on questions from the research question, the Learning and Training Within Industry, Teaching Factory, Blended Learning, Project Based Learning, Problem Based Learning, Lean Based Learning, and Work Based Learning models can meet the criteria for incorporating 21st century skills to increase work readiness of vocational school graduates so that it can be absorbed in the industry. Educators must pay attention to the learning model used, especially the syntax. The learning model must instill 21st century skills without exception. Current conditions state that digital literacy must be prioritized with stricter information filtering to support learning materials. Students must be taught literacy and numeracy because, in 2023, they will still be at a moderate level. The 21st century skills that students must have are competencies that have 5 dimensions of competency. These dimensions are needed by students when working in industry, in other words students must have a work attitude according to industry needs. The final 21st century skill that educators must pay attention to for students to apply is character, namely the attitude of students when doing work, including how they treat themselves, their friends, their superiors, and their work units in order to support the success of the industry which currently requires strong character and a strong mentality. Based on the conclusions above, it can be concluded that the principal must be able to manage the school so that the school is able to have cooperation with relevant industries. Educators can ensure the industry's need for a workforce that is ready to work, and synchronize the school and industry curriculum. Industry is expected to support schools in fulfilling practical tools that are in accordance with field needs. Students are able to be more proactive in implementing digital literacy, developing soft skills and hard skills needed by industry in the future.

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## AUTHOR CONTRIBUTIONS

**Lukman Affandi**: Conceptualization, Methodology, Investigation, Data Curation, Formal Analysis, and Writing – Original Draft; **Mintasih Indriayu**: Methodology, Formal Analysis, and Resources; and **Salman Alfarisy Totalia**: Methodology, Formal Analysis, and Resources**.** All authors have read and approved the final version of this manuscript.

## DECLARATION OF COMPETING INTEREST

The authors declare no known financial conflicts of interest or personal relationships that could have influenced the work reported in this manuscript.

## DECLARATION OF ETHICS

The authors declare that the research and writing of this manuscript adhere to ethical standards of research and publication, in accordance with scientific principles, and are free from plagiarism.

## DECLARATION OF ASSISTIVE TECHNOLOGIES IN THE WRITING PROCESS

The authors declare that generative artificial intelligence (Gen AI) and other AI-assisted tools were used prudently, not excessively, during the research and preparation of this manuscript. Specifically, Quillbot was used to paraphrase a sentence; Chat GPT for data comparison; and Grammarly for language check. All AI-generated material was reviewed and edited for accuracy, completeness, and compliance with ethical and scholarly standards. The authors accept full responsibility for the final content of the manuscript.

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