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Determinants of Work Readiness at Vocational High School Students Majoring in Mechanical Engineering in the Era of Industry 4.0

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ABSTRACT: This study aims to examine the level of work readiness of vocational high school students majoring in Mechanical Engineering in the era of the Industrial Revolution 4.0, and to analyze the influence of learning motivation, industrial work experience, career guidance, learning quality, and mastery of IMTS, both partially and simultaneously, on the work readiness of vocational high school students majoring in Mechanical Engineering in the era of Industry 4.0. This is an ex post facto study using a quantitative approach. The study population was 210 12th-grade vocational high school students majoring in Mechanical Engineering in 2025 who will soon graduate. The sample was drawn using simple random sampling at a significant level of 5%. Data collection was conducted through questionnaire distribution, assignments, and documentation. Instrument validity was tested using Pearson Product Moment correlation analysis. The results indicate that the level of work readiness of most vocational high school students is still in the moderate category. Linear regression analysis shows that motivation variables ($\beta = 0.652$; $t = 6.703$; $p = 0.000$), industrial practice ($\beta = 0.764$; $t = 4.855$; $p = 0.000$), vocational guidance ($\beta = 1.182$; $t = 8.115$; $p = 0.000$), learning quality ($\beta = 0.806$; $t = 3.28$; $p = 0.001$), and IMTS mastery ($\beta = 0.705$; $t = 5.238$; $p = 0.000$) have a positive and significant effect on students' work readiness. Simultaneously, the five independent variables have a significant effect on students' work readiness with an F value of 32.28, a p-value of 0.000, and a coefficient of determination (R^2) of 54.8%. readiness of Mechanical Engineering Vocational School students in facing the demands of the industry 4.0 era.

KEYWORDS-Determinants, Work readiness, Vocational high school, Mechanical Engineering program, Industrial era 4.0.

I. INTRODUCTION

This study aims to examine the level of work readiness of vocational high school students majoring in Mechanical Engineering in the era of the Industrial Revolution 4.0, and to analyze the influence of learning motivation, industrial work experience, career guidance, learning quality, and mastery of IMTS, both partially and simultaneously, on the work readiness of vocational high school students majoring in Mechanical Engineering in the era of Industry 4.0. How individuals can work in the current era of Industry 4.0 and make successful career transitions throughout their working lives has received increasing attention from academics in vocational and organizational psychology over the past few decades (De Vos et al., 2021). According to Chavan (2018), this unemployment rate is influenced by a mismatch between skills and the quality of jobs required by industry. The World Economic Forum explains that by 2025, it is estimated that 50% of workers will need to reskill and intelligently adapt to renewable technologies resulting from the Industrial Revolution 4.0 (Li, 2022).

Observations indicate that work readiness is a crucial aspect in assessing the competency of vocational high school graduates before entering the industrial world. Differentiate between soft skills and hard skills, as they are closely related to individual innovativeness. Soft skills relate to intrapersonal and interpersonal skills, while hard skills relate to technical skills. Both are crucial because they are essential components of Industry 4.0 (Asabeh et al., 2023; Annisa et al., 2023; Wrahatnolo & Munoto, 2018). Understanding student job readiness in the industry 4.0 era is crucial for several reasons related to the significant changes in the world of work triggered by the Industrial Revolution 4.0. Job readiness in today's Industry 4.0 era is not as simple as it was in the past. Global competition and rapid technological advancements also require other aspects of readiness, such as soft skills that align with the needs of the business world and Industry 4.0.

The competencies taught in schools often do not align with the skills required in the industry 4.0 era, indicating a significant educational gap. This gap arises from the rapid advancement of technology and the ever-growing needs of industry, thus requiring educational evaluation to better prepare students to enter the world of work (Kamaludin et al., 2022; Nick et al., 2020). According to Prikshat et al. (2019), job readiness is a major issue affecting unemployed graduates in both developing and developed countries. Beyond these general factors, there are also specific challenges that make vocational high school students majoring in

mechanical engineering unprepared for the workforce. Therefore, based on this background, it is important to conduct research that comprehensively examines the determinants engineering readiness among vocational high school students in mechanical engineering in facing the industry 4.0 era. The determinants of job readiness 4.0 refer to the key factors influencing how well individuals—particularly students or graduates—are prepared to meet the challenges and demands of a digital, automated, and high-tech work environment. By understanding these determinants, schools and related stakeholders are expected to develop more effective strategies for preparing students for a digitally driven future.

The job readiness of vocational high school students in the field of mechanical engineering is influenced by several important factors that must be considered. A literature review revealed that these factors include work motivation, industrial internships, career guidance, learning quality, information, media, and technology skills, and so on. Understanding these elements can help improve students' job readiness in a competitive job market and serve as a reference for creating appropriate vocational education. To obtain factual data regarding the job readiness of vocational high school graduates in the industry 4.0 era, researchers conducted direct observations in industrial environments. The observations were conducted at two companies located in the Yogyakarta region. The first location is PT Hari Mukti, which operates in the Piyungan area and is engaged in the production of washing machines and dryers for other commercial industrial needs. The second location is PT. YPTI, located in Cangkringan, Sleman, Yogyakarta, and is engaged in the molding and metal casting sector. The results of the observations indicate that job readiness is a crucial aspect in assessing the competency of vocational high school graduates before entering the industrial world. This finding is in line with the results of a previous literature review, which stated that job readiness consists of several important elements, both in the form of hard skills and soft skills. Both aspects play a significant role in determining an individual's success in the world of work, especially in the dynamic industrial environment that demands high adaptability in the fourth industrial era. are to face the challenges and demands of a digital, automated, and high-tech workplace in the industry 4.0 era. By understanding these determinants, schools and various related stakeholders are expected to develop more effective strategies in preparing their students for a high-tech future.

II. LITERATURE REVIEW

A. Vocational Education and Vocational High School in Mechanical Engineering

Vocational education refers to a type of education that emphasizes practical skills and specialized expertise in specific fields. Unlike traditional academic education, vocational education primarily focuses on preparing students directly for the workforce. In Indonesia, Vocational High Schools (Sekolah Menengah Kejuruan or SMK) are educational institutions that aim to enhance national quality and produce a reliable, competitive workforce to meet the growing demand for skilled labor. Vocational education spans a wide range of fields, including automotive, electrical engineering, accounting, and many others. One of the primary goals of vocational schools is to meet industry demands by equipping students with relevant and high-level skills, thereby contributing to national development. Over the years, vocational education in Indonesia has grown rapidly. Prior to the year 2000, the number of vocational schools was relatively limited. However, by 2005, the number had increased to 6,025, and as of 2023, it had reached 14,437 institutions.

Conceptually, vocational education has long existed to support labor market demands for specialized professionals such as mechanics, electricians, accountants, graphic designers, and more (Sudana et al., 2019). In essence, technical and vocational education is primarily designed to prepare young people and adults for the world of work, often characterized by its technical and practical orientation. Vocational schools in Indonesia have existed since the colonial era, when they were known as technical schools. However, during the Fourth and Fifth Five-Year Development Plans (1979–1989), the development of vocational education declined. In early 2008, it began to revive following the strategic plan initiated by the Ministry of National Education to increase the number of vocational schools (Suharno, 2020). The peak of vocational school expansion occurred in 2015 and 2016, driven by a wave of student transfers from general education to vocational tracks. Nevertheless, a decline occurred again between 2016 and 2019. More recently, vocational schools have been experiencing growth once more, supported by government revitalization efforts, most notably Presidential Instruction No. 9 of 2016, which aims to strengthen vocational education to support national progress (Ministry of Education and Culture, 2016). One of the concentrations or study programs offered in Indonesian Vocational High Schools (SMK) is Mechanical Engineering. Mechanical Engineering remains a highly demanded field across various industries, such as manufacturing, automotive, and construction. The training continuously evolves to keep pace with the latest advancements in machinery and automation. By offering practical, industry-relevant skills, the Mechanical Engineering program at SMK provides a solid foundation for students aspiring to pursue careers in engineering and industrial sectors.

B. Work Readiness 4.0 In Mechanical Engineering for Vocational High School

The rapid development of information technology, along with the dynamics of today's life, require a careful approach and proper preparation for the industry 4.0 era. In this Industry 4.0 era, competency is not limited to a single field or a single hard

skill. The 21st-century Industry 4.0 era requires relevant competencies that are in line with current developments (Pamungkas et al., 2020). In general, the industry 4.0 era has had a significant and complex impact on human life in various sectors, such as the economy, climate, technology, and affordability (Setiadi et al., 2021). The increasing awareness of digital technology skills can result in job losses caused by technological change. This phenomenon poses a challenge that threatens to create major socio-economic problems in the 21st century and emphasizes the importance of implementing Industry 4.0 strategies in education.

The rapid advancement of information technology, along with the dynamic nature of modern life, necessitates a strategic and well-prepared approach to navigating the challenges of the industry 4.0 era. In this era, competencies are no longer confined to a single discipline or limited to hard skills alone. Instead, the 21st-century workforce must possess relevant and interdisciplinary competencies that align with current technological developments (Pamungkas et al., 2020). Industry 4.0 has had a profound and multifaceted impact on human life, affecting various sectors such as the economy, climate, technology, and social equity (Setiadi et al., 2021). In the context of mechanical engineering, competencies are evolving in response to digitalization and automation. Professionals in this field are now expected to master more advanced technical skills, such as programming Internet of Things (IoT)-enabled machines, utilizing artificial intelligence (AI) for data analysis, and operating and maintaining robotics and automated systems. Despite these advancements, core competencies remain fundamental for vocational high school students in mechanical engineering. These include a strong grasp of basic mechanical principles, conventional machining techniques (e.g., turning, milling, and welding), and the ability to interpret technical drawings. Foundational knowledge in engineering mathematics, basic physics, and the use of precision measuring tools is equally critical to support higher-level technical skills in a digital environment.

Moreover, the development of soft skills—such as discipline, teamwork, communication, and problem-solving—is vital for ensuring success in today's increasingly competitive labor market. By combining strong foundational competencies with adaptability to emerging technologies, vocational school graduates in mechanical engineering can approach the challenges and opportunities of Industry 4.0 with greater confidence and capability (Romero et al., 2015). Work readiness, namely the extent to which graduates possess characteristics and attributes that prepare them for success in the workforce (Fenech et al., 2019). Work readiness is an important selection criterion for prospective employees. It is one of the most important attributes for new undergraduate students or recent graduates (Sagita et al., 2020). Vocational high school students must possess workplace readiness and vocational competencies to reduce unemployment (Susanti et al., 2024). Herbert et al. (2020) explain that work readiness generally emphasizes the skills required by companies. Work readiness is a skill that demonstrates how various influencing components must be coordinated so that an individual can achieve their goals and be able to work immediately after completing their education without the need for lengthy adjustments (Chavan, M., & Carter, L. 2018).

Referring to applicable industrial standards in Indonesia and the National Work Competency Standards of Indonesia (SKKNI)—as mandated by Law Number 13 of 2003 on Manpower, which serves as the legal foundation for developing workforce competencies—vocational education must align closely with industry demands. Furthermore, the BNSP Regulation Number: 2/BNSP/III/2014, along with various literature sources, emphasizes that in the context of the 21st-century Industry 4.0 era, it is not only hard skills that are essential, but also a range of supporting soft skills that are increasingly critical.

Industry 4.0 demands a more complex set of competencies that go beyond technical expertise. Workers must be equipped with a balanced combination of technical skills, non-technical skills, and professional certification and safety awareness to thrive in a digital, automated, and rapidly evolving work environment (Annisa et al., 2023; Li, 2022; Pamungkas et al., 2020; Tang et al., 2020). The essential competencies for Industry 4.0 in the 21st century can be categorized as follows:

1. Technical Competencies (Hard Skills)
   -Fundamentals of Mechanical Engineering
   -Reading and Interpreting Technical Drawings
   -Conventional Machine Operation
   -CNC (Computer Numerical Control) Machine Operation
   -Understanding CAD/CAM-based Manufacturing Processes
   -Welding Techniques
   -Mastery of Precision Measuring Instruments
2. Non-Technical Competencies (Soft Skills)
   -Critical Thinking and Problem-Solving
   -Adaptability to Changing Environments
   -Motivation and Ambition for Continuous Improvement
   -Collaboration and Teamwork
   -Work Discipline and Personal Responsibility
   -Professional Ethics and Attitude

3. Certification Competency

Possession of nationally and/or internationally recognized certifications that validate technical and safety competencies, in accordance with BNSP and SKKNI standards.

4. Occupational Safety and Ethics

Understanding workplace safety standards and adherence to professional codes of ethics to ensure a safe, responsible, and ethical work environment.

C. Factors that influence work readiness

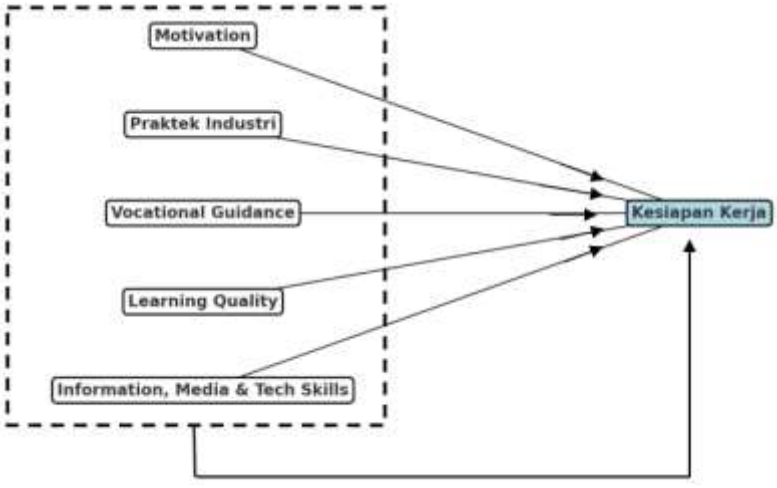
Work readiness is influenced by a combination of internal and external factors that shape an individual's work capabilities. Internally, psychological capital, including self-efficacy, hope, optimism, and resilience, plays a crucial role in preparing individuals to enter the workforce (Prihantoro., 2020). While internal factors such as psychological capital are crucial, external influences such as market conditions and social networks can also create barriers to work readiness, highlighting the complexity of work readiness in the dynamic era of Industry 4.0 (Zarta & Trujillo, 2020).

Referring to Thorndike's Law of Readiness, an individual's readiness for work depends heavily on the extent to which they have developed skills, experience, and a mindset that aligns with industry demands. Understanding work readiness is crucial for students to succeed in their jobs after graduation. To assess students' work readiness, indicators are needed to serve as a benchmark for measuring work readiness. Several key factors influence students' job readiness, including work motivation, industrial internships, career guidance, learning quality, and information, media, and technology (IMT) skills. Understanding these elements is essential for enhancing students' preparedness in an increasingly competitive job market and for serving as a reference in designing relevant vocational education programs.

According to a literature review, work motivation refers to an internal drive that encourages individuals to perform optimally in fulfilling their duties and responsibilities in the workplace (Riyanto et al., 2020). Meanwhile, career guidance provides students with direction and insights into career choices that align with their abilities and interests (Ningsih, 2021). In today's digital era, technological and informational literacy has become a vital skill due to the increasingly technology-driven nature of the modern workplace (Wrahatnolo & Munoto, 2018). Additionally, high-quality learning experiences contribute significantly to the development of relevant, applicable competencies that meet industry standards (Prihantoro, 2020). The integration of these factors—motivation, guidance, technology skills, and learning quality—directly impacts an individual's readiness for employment. This encompasses not only knowledge and skills but also the professional attitudes necessary to compete in the global labor market

D. Problem-Based Framework and Hypotheses

The framework for this study was formed from the birth and development of digital industry 4.0, which has impacted various fields. The digital industry 4.0 era has brought significant changes to the world of work with the advent of automation technology, the Internet of Things (IoT), Artificial Intelligence (AI), and cloud computing (Pamungkas et al., 2020). Understanding Student Employment Readiness in the Industry 4.0 Era is important for several reasons related to the significant changes in the world of work triggered by the Industrial Revolution 4.0. The current aspects of employment readiness in Industry 4.0 are not simple and cannot be compared to those of the past (Nurjanah & Ana, 2021). Based on this, it is assumed that these variables collectively have a positive influence on the employment readiness of Mechanical Engineering Vocational High School students facing the industry 4.0 era. The framework for this study is illustrated as follows:



A hypothesis is an assumption that is tentatively recognized as true at the stage when a phenomenon has been identified and serves as a working foundation and reference in the verification process. Based on the theoretical foundations above, the following research hypotheses are formulated:

1. (Ha): Work to motivation has a significant influence on the work readiness of mechanical engineering vocational high school students in the industry 4.0 era.
2. (Ha): Industrial internships have a significant influence on the work readiness of mechanical engineering vocational high school students in the industry 4.0 era.
3. (Ha): Career guidance has a significant influence on the work readiness of mechanical engineering vocational high school students in the industry 4.0 era.
4. (Ha): Learning quality has a significant influence on the work readiness of mechanical engineering vocational high school students in the industry 4.0 era.
5. (Ha): Information, media, and technology skills have a significant influence on the work readiness of mechanical engineering vocational high school students in the industry 4.0 era.
6. (Ha): Motivation to work, Industrial Work Practice, Performance, Career Guidance, Learning Quality, Information, Media and Technology skills together have an influence on the work readiness of SMK students majoring in Mechanical Engineering in the industrial era 4.0.

III. METHODOLOGY

This study used the Ex Post Facto method with a quantitative descriptive approach. The ex post facto method was chosen because this study aims to analyze the relationship between variables based on data or events that have already occurred, without any direct treatment or manipulation by the researcher. This study used a quantitative approach because the object can be studied specifically and generally in one aspect only. Quantitative research examines the relationship between its research objects, so the research instrument is analyzed using descriptive statistics. Quantitative research methods are systematic approaches that utilize numerical data to analyze and explain certain phenomena (Lenardic, Adrian, and others, 2023).

The study population was 210 12th-grade students of Mechanical Engineering Vocational High School in 2025 who were approaching graduation. The sample was taken using simple random sampling at a significance level of 5%, resulting in a sample size of 130 students. Data collection was carried out through questionnaires, assignments, and documentation. Instrument validity was tested using Pearson Product Moment correlation analysis, while reliability was tested using Cronbach's Alpha coefficient with a value above 0.6. Data analysis was conducted using descriptive statistics and regression. This research was conducted at several vocational high schools located in Yogyakarta and Central Java. The primary research sites included SMKN 2 Yogyakarta, located on Jalan R.W. Monginsidi No. 2, Jetis, Yogyakarta. SMKN 2 Depok, located on Jalan STM Pembangunan, Mrican, Caturtunggal, Depok District, Sleman Regency, Special Region of Yogyakarta SMK Cokroaminoto Sukoharjo, located on Jalan Sumbulan Lor, Makamhaji, Kartasura, Sukoharjo, Central Java. to increase the number of respondents and enhance the accuracy and representativeness of the data, additional questionnaires were distributed to students at several vocational schools in Cilacap Regency, Central Java. The data collection process was carried out between March and April 2025. To support the development of research instruments, a pre-constructed instrument blueprint (or instrument grid) is required. The following table presents the instrument grid for the questionnaire items, organized according to the variables used in this study:

Tabel 1 Research Instrument Blueprint

Indicator	**Method**	**Question items and number**
X.1 Motivation to work 1. Having Clear Career Goals and Aspirations 2. Having enthusiasm and drive in learning. 3. Personal interest in the field of expertise being studied. 4. Enthusiasm and passion for learning and practicing 5. Desire to master specific technical skills 6. A sense of responsibility for education and academic assignments. 7. Willingness to Work Hard and Face Challenges.	Questionnaire with Likert Scale (1-4) and test questions	1-13 /(13)
X.2 Industrial Internship 1. Improving technical competence 2. Introduction to the real industrial environment	Questionnaire with Likert Scale (1-4)	14-23 (10)

3. Understanding the performance process in an industrial environment 4. Feedback or assessment from industry 5. Relevance of Material Studied in School to the Industrial World 6. Students' Work Interest.		
X.3 Vocational Guidance 1. Interest Alignment 2. Access to Career Resources 3. Information on Training and Development Opportunities that align with one's potential 4. Able to understand and assess oneself 5. Aware of potential obstacles 6. Students can plan their future	Questionnaire with Likert Scale (1-4)	24- 37 (14)
X.4 Learning Quality 1. Infrastructure & Facilities 2. Teaching Staff & Competencies 3. Curriculum & Learning Materials 4. Learning Methods 5. Student Competencies 6. Student Assessment & Feedback 7. Partnerships with Industry	Questionnaire with Likert Scale (1-4)	38- 49 (12)
X.5 Information, Media, and Technology Skills 1. Digital Literacy and Information Management 2. Digital Communication and Collaboration 3. Digital Content Creation and Processing 4. Digital Security and Ethics 5. Problem-Solving and Technology Adaptation	Questionnaire with Likert Scale (1-4) and test questions	50 – 62 (13)
Y. Work readiness 1. Technical Competencies (Hard Skills) -Fundamentals of Mechanical Engineering -Reading and Interpreting Technical Drawings -Conventional Machine Operation -CNC (Computer Numerical Control) Machine Operation -Understanding CAD/CAM-based Manufacturing Processes -Welding Techniques -Mastery of Precision Measuring Instruments 2. Non-Technical Competencies (Soft Skills) -Critical Thinking and Problem-Solving -Adaptability to Changing Environments -Motivation and Ambition for Continuous Improvement -Collaboration and Teamwork -Work Discipline and Personal Responsibility -Professional Ethics and Attitude 3. Certificate competency 4. Occupational safety and ethic	Questionnaire with Likert Scale (1-4) and test questions	62-90 (27)

IV. RESULT AND DISCUSS

This study aims to examine the influence of several variables on the work readiness of vocational high school mechanical engineering students in the Industrial Era 4.0, using multiple linear regression analysis. The results of the data analysis show that of the five variables tested statistically, the findings illustrate the factors that influence the work readiness of these students in the Industrial Era 4.0. The statistical tests carried out in this study are as follows:

A. Normality test

Based on the results of the normality test for The Kolmogorov-Smirnov test is used to test whether the data is normally distributed. The focus is on the Asymp. Sig. value (2-tailed) at table 2, as shown in the normality test results table. From the table, we find that the Asymp. Sig. value is 0.078. Therefore, because this value is greater than 0.05, the data is considered normally distributed. The histogram above illustrates the distribution of the regression standardized residuals with a superimposed normal curve. Most of the residuals are concentrated around zero, indicating that the data closely approximates a normal distribution. With a sample size of 130 (N = 130), the distribution appears relatively symmetric, and the fitted normal curve aligns well with the histogram bars. Therefore, it can be concluded that the residuals of the regression model are normally distributed, thus satisfying the normality assumption required for regression analysis.

Tabel 2 Normality Test

Statistical Result	Score
N	128
Mean	0.000
Std. Deviation	7.705
Most Extreme Differences (Absolute)	0.074
Test Statistic	0.074
Asymp. Sig. (2-tailed)	0.078

B. Heteroscedasticity test

Tabel 3 Heteroscedasticity Test Result

V. VARIABLE	B	Std. Error	Beta	T	Sig.
Constant	1.303	2.944	–	0.443	0.659
Variable_X	0.011	0.026	0.038	0.428	0.670

Note: *The significance value (Sig.) > 0.05 indicates that heteroskedasticity is not present.*

The heteroscedasticity test using the Park method is conducted by regressing the log of the squared residual (in this case: LN_RES) against an independent variable (VAR_X). From the calculation results using the SPSS application, it is known that the calculated t value and the Sig. value used have values above the t-table because the independent variable VAR_X does not have a significant effect on the squared residual value (sig. = 0.670 > 0.05) so that it is in accordance with the assumption requirements and there are no symptoms of heteroscedasticity.

C. *Linierity Test*

Tabel 4 Linierity Test Result

Variable	F	Sig.
Motivation	20.668	0,000
Industrial Practice	27.685	0,000
Learning Quality	19.609	0,000
Career Guidance	24.859	0,000
IMTS	4.918	0,029

The results of the linearity test for all variables show that Motivation, Industrial Practice, Learning Quality, and Career Guidance: Each has a Sig. value of .000. Because .000 < .050, the relationship between these variables and the dependent variable is not linear. The IMTS variable has a Sig. value of .029. Because .029 < .050, the relationship between IMTS and the dependent variable is also not linear. In conclusion, based on this data, none of the independent variables have a linear relationship with the dependent variable.

D. Work Readiness Categorization

Tabel 5 Work Readiness Index Categorization

Category	Frequency	Percentage (%)	Description
Very Low	5	3.85%	Performance is far below the group average
Low	29	22.31%	Performance is below the group average
Moderate	65	50.00%	Performance approaches the group average (majority)
High	24	18.46%	Performance is above the group average
Very High	7	5.38%	Performance is far above the group average
Total	**130**	**100%**	–

The researcher determined the categories of students' work readiness levels based on the Norm-Referenced Evaluation (NRE) approach. This approach is used to interpret the results of questionnaire and test scores by comparing individual scores to the score distribution within the same group or population, namely the actual average of the entire sample along with the data's standard deviation, rather than referring to absolute or fixed standards (Azwar, 2018). Student work readiness level categories are determined based on the distribution of respondent scores using the mean (μ) and standard deviation (σ). With this method, individual scores are not compared to an absolute standard, but to the group distribution.

The distribution of data on the job readiness of vocational high school mechanical engineering students in the industry 4.0 era indicates that most respondents fall within the medium and low readiness levels. This highlights the need for enhanced guidance and more intensive educational interventions to improve student job readiness, particularly toward the high and very high categories, in line with the competency demands of Industry 4.0. Based on the diagram, most respondents are in the medium category (50.0%), followed by low (22.3%) and high (18.5%). Meanwhile, only 5.4% are in the very high category, and 3.8% are in the very low category.

Tabel 6 Linear Regression Analysis

Variable	B	Std. Error	Beta	t	Sig.
Constant	9.060	13.332	–	0.680	0.498
Motivation	0.652	0.097	0.402	6.703	0.000
Industrial Practice	0.764	0.157	0.303	4.855	0.000
Learning Quality	0.806	0.246	0.208	3.280	0.001
Information, Media, and Technology Skills	0.705	0.135	0.331	5.238	0.000
Career Guidance	1.182	0.146	0.500	8.101	0.000

Influence of motivation to work on the work readiness of mechanical engineering vocational high school students in the industry 4.0 era.

Motivation is one of the internal factors examined in this study and is found to have a significant positive influence on the work readiness of vocational high school mechanical engineering students in the industry 4.0 era. Previous studies (Riyanto et al., 2021; Kaibori et al., 2016; Pantzos et al., 2023) consistently show that motivation plays a crucial role in enhancing students' preparedness for the workforce. motivation—both intrinsic and extrinsic—encourages students to actively, consistently, and responsibly acquire knowledge, skills, and competencies relevant to their vocational field (Nick et al., 2020). The regression analysis from table 6 in this study revealed that the motivation variable achieved a t-value of 6.703, supporting the hypothesis that motivation significantly affects work readiness. This finding aligns with Maslow's theory (1943), which emphasizes motivation as a driver for personal growth and achievement, and the Self-Determination Theory (Ryan, 2020), which highlights the role of intrinsic motivation in fostering active engagement and responsibility in learning, ultimately improving work readiness

Influence of industrial pratice on the work readiness of mechanical engineering vocational high school students in the industry 4.0 era.

The Industrial Work Practice (Prakerin) program in vocational high schools is designed to bridge theory and practice, providing students with direct exposure to the workplace in line with the vocational education policy emphasizing a *link and match* between schools and industry (Noor et al., 2019). Regression analysis results from table 6 indicate that industrial work practice has a positive and significant effect on the work readiness of mechanical engineering students in the industry 4.0 era, with

a t-value of 4.85 and a significance level of 0.000. The beta coefficient of 0.764 reflects a substantial positive contribution, indicating that the more intensive the fieldwork experience, the higher the students' work readiness. This aligns with Experiential Learning Theory, which posits that real-world experience enhances understanding, skills, and readiness to face professional challenges. Similar findings were reported by Baker & Fitzpatrick (2022) and Rogers et al. (2021), showing that internships or fieldwork significantly prepare students for employment by enabling them to apply classroom knowledge in practice. Statistical evidence from this study also corresponds with Pratama & Sudarsono (2024) and De Vos et al. (2021), who note that industrial work practice is positively associated with improved work readiness, serving as a vital preparation tool for vocational graduates entering the workforce.

Influence of Vocational Guidance on the work readiness of mechanical engineering vocational high school students in the industry 4.0 era.

The regression analysis shows that the vocational guidance variable has a positive and significant effect on the work readiness of vocational high school mechanical engineering students in the Industry 4.0 era, from table 6 with a t-value of 8.115, significance level of 0.000 (<0.05), and |t-count| > t-table (1.980), thus confirming the hypothesis. According to Ginzberg's Career Development Theory (Ginzberg et al., 1951), effective career guidance helps students understand their interests, potential, and suitable career opportunities. Prior research (Arhipova, 2024; Soika, 2014) emphasizes that vocational guidance fosters self-determination, aligns student learning with career goals, and increases understanding of labor market dynamics. In the context of Education 4.0—driven by technological change, automation, and AI—vocational guidance becomes essential in navigating global career turbulence, addressing complex 21st-century job requirements, and bridging the mismatch between graduates and job demands (Mutohhari et al., 2021). By equipping students with adaptability, soft skills, and readiness for reskilling, vocational guidance not only prepares them for immediate employment but also for continuous learning in a rapidly evolving labor market.

Influence of Learning Quality on the work readiness of mechanical engineering vocational high school students in the industry 4.0 era.

Learning quality is one of the key factors influencing the work readiness of vocational high school mechanical engineering students in the industry 4.0 era. Regression analysis shows from table 6 that the Learning Quality (LQ) variable has a positive and significant effect, with a t-value of 3.28, a significance level of 0.001 (<0.05), and a beta coefficient of 8.06, confirming the hypothesis. This finding aligns with Instructional Quality Theory, which emphasizes clarity of material, relevance to job requirements, student engagement, and active learning methods (Senden et al., 2021). Previous studies (Guo et al., 2024; Singh et al., 2023; Susanti et al., 2024) indicate that high-quality learning in vocational education positively impacts students' academic experiences, skill acquisition, and adaptability to industry demands. The integration of school-based learning and workplace learning is crucial for developing professional competencies and ensuring that students are better prepared for employment in the industry 4.0 era. The regression results showing a positive coefficient on the learning quality variable as a factor make perfect theoretical sense. Therefore, the regression results showing learning quality as the most dominant factor make perfect theoretical sense. Improving the quality of education in vocational schools is crucial for producing graduates capable of meeting the needs of today's workforce.

Influence of IMTS on the work readiness of mechanical engineering vocational high school students in the industry 4.0 era.

The integration of Information, Media, and Technology Skills (IMTS) in mechanical engineering education is essential to prepare students for Industry 4.0 challenges. Statistical analysis from table 6 reveals a t-value of 5.238 with a significance level of 0.009 (<0.05), confirming that IMTS has a significant positive effect on students' work readiness in the industry 4.0 era. UNESCO and the World Economic Forum recognize digital literacy and IMTS as core skills, on par with reading, writing, and numeracy, emphasizing that "digital skills are no longer optional; they are foundational" (UNESCO Institute for Statistics, 2018). Studies indicate that 60% of engineering jobs will undergo digital augmentation, and graduates with strong IMTS are more competitive, particularly in smart manufacturing and digital maintenance, although a digital divide still exists (OECD, 2020).

Research by Yulando et al. (2024) shows that integrating digital technology into the mechanical engineering curriculum significantly improves graduate work readiness, while Nurjanah et al. (2022) highlights the importance of technology adoption, communication, and collaboration skills. Strong IMTS enables students to quickly adapt to new technologies—an essential ability in an evolving labor market shaped by Industry 4.0 (Sudarmanto et al., 2022; Santolamazza & Introna, 2023). Overall, statistical findings and literature review confirm that IMTS plays a critical role in shaping young workers' readiness, where mastery of digital literacy, cloud computing, artificial intelligence, and 21st-century 4C skills (critical thinking, creativity, collaboration, communication) substantially increases their adaptability and competitiveness in the modern job market.

Influence of Motivation to work, Industrial Work Practice, Performance, Career Guidance, Learning Quality, Information, Media and Technology skills together on the work readiness of mechanical engineering vocational high school students in the industry 4.0 era.

Tabel 7 Multiple Linier Regression Analysis

Model	Sum of Squares	df	Mean Square	F	Sig.	R	R Square	Adjusted R Square
Regression	6851.529	5	1370.306	32.284	0.000	0.752	0.566	0.548
Residual	5263.248	124	42.446					
Total	**12114.777**	**129**						

Dependent Variable: Work Readiness 4.0

An F-value of 32.284 with a significance level (Sig.) of 0.000 was found during the ANOVA (Analysis of Variance) test from table 7, which was used to assess the significance of the simultaneous regression model. This significance level is far below the critical threshold of 0.05, indicating that the constructed regression model is statistically significant. From this result, it can be concluded that the hypothesis (Ha)—that Work Motivation, Industrial Work Practice, Performance, Career Guidance, Learning Quality, and Information, Media, and Technology Skills collectively influence the work readiness of vocational high school mechanical engineering students in the industry 4.0 era—can be accepted. The significance of this regression model confirms that these five independent variables play an important joint role in explaining the variation in work readiness levels in the Industry 4.0 era for mechanical engineering students. This reinforces the finding that work readiness in the industry 4.0 era is not solely determined by technical aspects but also by supporting factors such as practical experience, character development, digital literacy, as well as spiritual and moral understanding. *The regression equation obtained in this study is from table 6: Work Readiness = 9.060 + 0.652(Motivation) + 0.764(Industrial Practice) + 0.806(LQ) + 0.705(IMTS) + 1.182(BK). This finding indicates the importance of strengthening these factors to improve the work readiness of Mechanical Engineering Vocational School students in facing the demands of the industry 4.0 era.*

Based on the results of the coefficient of determination test, we can conclude that the multiple regression analysis produced an R Square value of 0.548. This means that 54.8% of the variation in work readiness in the industry 4.0 era for mechanical engineering students can be simultaneously explained by the independent variables: Information, Media, and Technology Skills (IMTS), industrial work practice experience, vocational guidance (VOCGUIDE), learning motivation, and learning quality. Meanwhile, the remaining 45.2% is explained by other factors outside the model that were not examined in this study, such as family background, social environment, or individual personality traits.

CONCLUSIONS

The results of this study provide important insights for schools, teachers, and education policymakers regarding the key factors influencing vocational high school students' job readiness, particularly in mechanical engineering, in the industry 4.0 era. Variables such as motivation, career guidance, learning quality, internship experience, Information, Media, and Technology Skills have been shown to significantly contribute to students' readiness levels. By understanding these factors, schools can be more focused in designing educational programs and student development that support readiness to enter the workforce. Based on the analysis, data discussion, and literature review outlined in the previous chapter, it can be concluded that the level of job readiness of vocational high school students in Mechanical Engineering in the Industry 4.0 era is largely still in the moderate category. This study shows that motivation has a positive and significant influence on job readiness, with a calculated t-value of 6.703 and a p-value of 0.000, contributing 26.6%. Industrial internships also have a positive and significant influence (calculated t-value = 4.855; p-value = 0.000), contributing 16%. Furthermore, vocational guidance has a positive and significant influence (t-count = 8.115; p-value = 0.000) with a contribution of 34.5%. The learning quality variable also has a positive and significant influence (t-count = 3.28; p-value = 0.001) with a contribution of 8%. Similarly, the IMTS variable has a positive and significant influence (t-count = 5.238; p-value = 0.000) with a contribution of 18.1%. Simultaneously, the variables of career guidance, learning quality, motivation, industrial practice, and IMTS have a positive and significant influence on student work readiness in the field of Mechanical Engineering in the Industry 4.0 era, with an F-value of 32.28, a p-value of 0.000, and a coefficient of determination (R^2) of 54.8%.

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