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Exploring Work Readiness Key Factors Among Industrial Chemistry Students in Vocational High Schools

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Abstract: The research aims to analyze the correlation between motivation, learning quality, critical thinking skills, industrial work practice quality, and vocational readiness of Industrial Chemistry students at vocational high schools (SMK). The research employs a quantitative approach with a survey method. The research used purposive sampling from industrial chemistry students in Central Java, with a sample consisting of 63 students in grade XI. Data collection is done through questionnaires and tests, then analyzed using Structural Equation Modeling - Partial Least Squares (SEM–PLS). The research results show that vocational readiness is directly influenced by learning quality and industrial work practice quality, while learning quality influences the quality of industrial work practice. The results of indirect influence analysis show that the quality of industrial work practice mediates the influence of learning quality on vocational readiness. In this study, the motivation and critical thinking skills of students are not proven to have an effect on vocational readiness, both directly and indirectly. Schools are advised to optimize the quality of learning and the quality of industrial work practice through industry collaboration and cooperation with higher education institutions (HEIs). The motivation and critical thinking skills of students should also be considered to play a role in their vocational readiness.

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Introduction

Law No. 20 of 2003 on the National Education System explains that vocational education prepares students to enter the workforce in specific fields and also equips them to pursue higher education. The relevance of vocational high school (SMK) graduates to the job market can be measured by how quickly and appropriately they are absorbed into jobs that align with their expertise (Anoraga, 2009). In fact, based on data from the Central Statistics Agency in August 2022, the open unemployment rate is still predominantly attributed to SMK graduates at 9.42%. This indicates that with the continuously increasing unemployment rate, there is a gap between graduates and the workforce.

Currently, most vocational high schools cannot meet all the competency demands of the job market. Expectations remain unmet because SMK graduates still lack skills, motivation, and work readiness (Amalia, 2013). Based on interviews with stakeholders, it was found that during industrial work practice, some students were placed in positions unrelated to their expertise, leading to a lack of experience and knowledge related to industrial chemistry gained during school. Additionally, the school's monitoring is suboptimal. The interview results conclude that the lack of work readiness is due to factors such as insufficient skills with tools and a lack of mastery of basic materials.

Vol. 10, No. 1 : March 2024
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Email: jklppm@undikma.ac.id

Many factors can influence students' work readiness, including learning motivation (Rahmi, 2016; Syarif et al., 2019). Improvement in the quality of industrial work practice is needed to enhance students' work readiness. Hasan (2019) reported a relationship between High Order Thinking Skills (HOTS) and students' work readiness. Higher levels of students' thinking skills indicate higher work readiness. Quality learning can also enhance students' work readiness. Murdayati (2013) concluded in her research that the learning process at school contributes to work readiness. Based on the literature review, work readiness is crucial for graduates entering the workforce. The lack of information about students' perceptions of work readiness in the Industrial Chemistry competency becomes the main reason for this research. The main focus of this research is the alignment between Work-Based Learning (DUDI) and school expectations. This condition necessitates theoretical studies or research on students' work readiness to provide insights to vocational school administrators about the importance of motivation, learning quality, critical thinking skills, industrial work practice experience, and work readiness. The researcher is interested in analyzing the correlation between motivation, learning quality, critical thinking skills, industrial work practice quality, and the work readiness of Industrial Chemistry vocational high school students.

Employability skills, representing the knowledge, skills, and attitudes required by the 21st-century workforce, are referred to as work readiness or employability skills (Overtoom, 2000). Modern job characteristics demand initiative, flexibility, and the ability to complete various tasks, making employability skills highly crucial (Harjono & Eden, 2021). This research adopts employability skill indicators according to Harjono (2022), namely thinking and problem-solving (Z-1), technical skills (Z-2), positive attitudes and behavior (Z-3), safety at work (Z-4), entrepreneurship (Z-5), working with others (Z-6), and productivity (Z-7). Motivation is a component that influences individuals to engage in activities to achieve specific goals (Oktiani, 2017). Learning motivation is defined as the driving force within an individual to engage in learning activities to enhance skills, knowledge, and experience (Iskandar, 2012). Motivation plays a role in determining the level of perseverance in learning, meaning individuals motivated to learn something will diligently strive to achieve satisfactory results (Uno, 2016). Motivation measurement uses indicators adapted from Sardiman (2018), Iskandar (2012), and Uno (2016), including the desire and aspiration for success in learning (X-1), enthusiasm and encouragement in learning (X-2), future expectations and aspirations (X-3), recognition in the learning process (X-4), and a supportive learning environment (X-5). Kurniawan (2013) and Rahmi (2016) reported a positive and significant correlation between learning motivation and work readiness. Purba (2018) concluded in his research that there is a significant relationship between learning motivation and the results of industrial work practice, meaning that higher learning motivation leads to better results in industrial work practice. A similar study by Suryani (2018) revealed that learning motivation significantly influences the implementation of industrial work practice. Therefore, having learning motivation during the school learning process can support students' abilities in carrying out industrial work practice in the business and job market.

Learning quality is the systemic and synergistic intensity of the teacher, students, curriculum and learning materials, media, facilities, and learning systems. This aims to create optimal learning outcomes according to curriculum demands (Pebriyenni, 2007). Quality learning processes play a role in determining students' learning success. Learning quality is measured through indicators expressed by Fedynich et al. (2015), including the design and delivery of learning (X2-1), the teacher's role, feedback, and assessment techniques by the teacher (X2-2), the role and responsibility of students (X2-3), and learning management and supporting facilities (X2-4). Facione (2002) defines critical thinking skills as self-regulation assessments that can drive problem-solving processes and decision-making. Critical thinking skills for vocational high school (SMK) students play a role in shaping a mindset that can generate ideas, analyze, and create a product, enabling practical thinking when facing situations in their environment (Dewanto et al., 2018). The indicators for critical thinking skills in this research adopt the indicator development by George Brown College (2015), including problem identification (X3-1), supporting sources (X3-2), analysis (X3-3), conflicting facts (X3-4), personal assumptions (X3-5), and conclusions (X3-6). Hasan's (2019) research also proves a relationship between High Order Thinking Skills (HOTS) and students' work readiness. The higher the level of critical thinking skills in vocational high school students, the higher their work readiness.

Industrial work practice is a collaboration between vocational high schools (SMK) and industries, where industries are entrusted with nurturing students to meet competencies in line with the established curriculum (Wibowo, 2016). The indicators of the quality of industrial work practice refer to the indicators of learning quality adapted from Fedynich (2015), adjusting the learning location, in this case, being in the industry. Therefore, the indicators of the quality of industrial work practice are as follows: the design and delivery of learning (Y-1), the teacher's role, feedback, and assessment techniques (Y-2), the role and responsibility of students (Y-3), and learning management and supporting facilities (Y-4). Pratama (2018) found a positive and significant correlation between industrial work practice and students' work readiness. The research purpose is to delve into and analyze the myriad factors that contribute to enhancing the work readiness of industrial chemistry students. Work readiness stands as the cornerstone of vocational education, particularly in fields like industrial chemistry, where practical skills and real-world application are paramount. However, despite its significance, there exists a need for deeper examination and understanding of the intricate components that shape and bolster students' preparedness for the workforce. The implication of this research is that renewing the industrial work practice implementation system can help improve students' work readiness. As students enhance their mastery of the skills learned, they become more prepared to work in the job market.

Research Method

This research adopts a quantitative approach using a survey method. The research used purposive sampling from industrial chemistry students in Central Java. The research sample was taken using 63 students from grade XI in Cetral Java in the academic year 2022/2023. The latent variables in this study are motivation, learning quality, critical thinking skills, internship quality, and work readiness. Meanwhile, the manifest variables in this study are indicators of each variable. Table 1 shows the research variables.

Table 1. Research variable

Latent Variables	Manifest Variables
Motivation (X1)	There is a desire and desire to succeed in learning (X1-1)
	There is enthusiasm and encouragement in learning (X1-2)
	There are hopes and aspirations for the future (X1-3)
	There is appreciation in the learning process (X1-4)
	The existence of an environment that supports the learning process (X1-5)
Quality of learning (X2)	Design and method of delivering learning (X2-1)
	Teacher's role, feedback, and teacher assessment techniques (X2-2)
	Roles and responsibilities of students (X2-3)
	Learning management and supporting facilities (X2-4)

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Jurnal Hasil Penelitian dan Kajian Kepustakaan
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https://e-journal.undikma.ac.id/index.php/jurnalkependidikan/index

Vol. 10, No. 1 : March 2024
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pp. 35-47
Email: jklppm@undikma.ac.id

Critical thinking ability (X3)	Problem identification (X3-1) Supporting sources (X3-2) Analysis (X3-3) Conflicting facts (X3-4) Personal assumptions (X3-5) Conclusion (X3-6)
Quality of internship (Y)	Design and method of delivering learning in internships (Y-1) Teacher role, feedback, and teacher assessment techniques (Y-2) Student roles and responsibilities (Y-3) Learning management and supporting facilities (Y-4)
Job readiness (Z)	Thinking and problem-solving (Z-1) Technical skills (Z-2) Positive attitudes and behavior (Z-3) Work safely (Z-4) Entrepreneurship (Z-5) Working with others (Z-6) Productivity (Z-7)

SmartPLS allows researchers to assess the validity and reliability of the measurement model. This involves examining the relationships between observed indicators (e.g., survey items) and their respective latent constructs to analyze data from industrial chemistry students.

Results and Discussion

This study focuses on analyzing the correlation between motivation, quality of learning, critical thinking skills, quality of industrial work practices, and work readiness of Industrial Chemistry Vocational School students. Research data comes from motivation scores, learning quality, critical thinking skills, internship quality, and work readiness obtained through tests and questionnaires. The previously formulated hypotheses were analyzed using SmartPLS 3.0 software. In Partial Least Square-Structural Equation Modeling, the analysis is carried out in two steps. The first step involves assessing the measurement model (outer model), and the second step focuses on assessing the structural model (inner model).

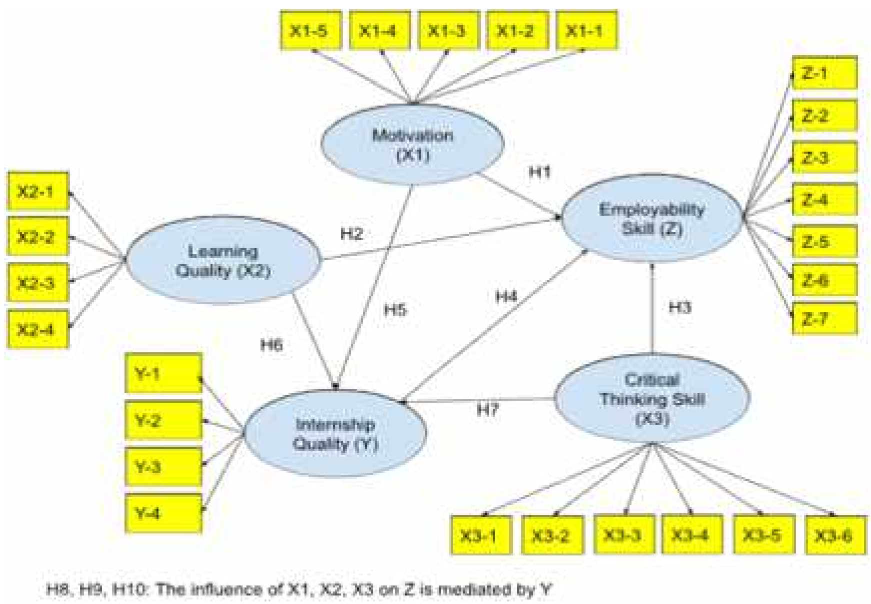

Figure 1. Hypothetical model

Jurnal Kependidikan:
Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran dan Pembelajaran
https://e-journal.undikma.ac.id/index.php/jurnalkependidikan/index
Vol. 10, No. 1 : March 2024
E-ISSN: 2442-7667
pp. 35-47
Email: jklppm@undikma.ac.id

Outer Model Evaluation

Outer model evaluation consists of convergent validity testing, discriminant validity and reliability testing. Convergent validity testing aims to see the value produced by each indicator in the variable it measures. In this research, indicators are considered valid if the loading factor value is >0.60, which means the indicator can measure the construct. Based on the analysis, it can be concluded that all indicators for each variable have met the criteria, so the indicators are said to be valid. The outer loading values from the PLS analysis are listed in Table 2.

Discriminant validity testing aims to see whether the indicators of each construct are not highly correlated with other constructs. In testing, discriminant validity was tested using cross-loading values and Average Variance Extracted (AVE). The AVE value criterion for a construct to be said to be valid is >0.50. The greater the AVE value, the higher its ability to explain the value of the indicators that measure the construct. The results of the AVE test are listed in Table 2. The results of the discriminant validity analysis in Table 2 and Table 3 reveal that all variables have met the test criteria so that all indicators for each variable can be maintained and are considered valid.

Reliability tests are used to evaluate the reliability and consistency of the indicators used in research. The reliability test results are viewed from the Cronbach's Alpha value supported by the Composite Reliability value with the condition ≥0.70. The results of reliability testing are presented in Table 2. Based on reliability testing using Cronbach's Alpha and Composite Reliability in Table 2, it can be seen that all variables have met the criteria, namely ≥0.70. In the test, it was found that each variable had passed the composite reliability test, which indicated that each variable was considered reliable.

Table 2. Outer loadings

Indicator	Loading Factor	Cronbach's alpha	Composite Reliability	AVE
X1-1	0.750			
X1-2	0.758			
X1-3	0.745	0.812	0.866	0.564
X1-4	0.772			
X1-5	0.731			
X2-1	0.873			
X2-2	0.777	0.842	0.894	0.678
X2-3	0.842			
X2-4	0.797			
X3-1	0.669			
X3-2	0.754			
X3-3	0.643	0.836	0.877	0.547
X3-4	0.782			
X3-5	0.860			
X3-6	0.707			
Y-1	0.897			
Y-2	0.831	0.865	0.908	0.711
Y-3	0.826			
Y-4	0.816			
Z-1	0.831			
Z-2	0.712			
Z-3	0.818	0.901	0.922	0.629
Z-4	0.835			
Z-5	0.739			
Z-6	0.803			

Jurnal Kependidikan:
Jurnal Hasil Penelitian dan Kajian Kepustakaan
di Bidang Pendidikan, Pengajaran dan Pembelajaran
https://e-journal.undikma.ac.id/index.php/jurnalkependidikan/index

Vol. 10, No. 1 : March 2024
E-ISSN: 2442-7667
pp. 35-47
Email: jklppm@undikma.ac.id

Z-7	0.806			

Table 3. Cross-Loadings

Indicator	Motivation	Quality of learning	Critical Thinking Ability	Quality of Prakerin	Working readiness	Information
X1-1	0.750	0.499	0.007	0.459	0.463	Valid
X1-2	0.758	0.500	0.122	0.240	0.415	Valid
X1-3	0.745	0.449	0.213	0.250	0.380	Valid
X1-4	0.772	0.604	0.040	0.455	0.453	Valid
X1-5	0.731	0.534	-0.218	0.561	0.522	Valid
X2-1	0.599	0.873	0.224	0.616	0.561	Valid
X2-2	0.530	0.777	0.056	0.501	0.443	Valid
X2-3	0.719	0.842	0.233	0.490	0.611	Valid
X2-4	0.407	0.797	0.252	0.357	0.471	Valid
X3-1	-0.006	0.187	0.669	-0.028	-0.096	Valid
X3-2	0.036	0.112	0.754	-0.129	-0.064	Valid
X3-3	-0.070	0.099	0.643	-0.079	-0.086	Valid
X3-4	0.125	0.223	0.782	-0.134	-0.046	Valid
X3-5	-0.065	0.139	0.860	-0.123	-0.124	Valid
X3-6	0.008	0.267	0.707	-0.168	-0.055	Valid
Y-1	0.401	0.481	-0.203	0.897	0.578	Valid
Y-2	0.371	0.460	-0.190	0.831	0.484	Valid
Y-3	0.613	0.689	0.018	0.826	0.664	Valid
Y-4	0.458	0.371	-0.206	0.816	0.594	Valid
Z-1	0.467	0.450	-0.152	0.568	0.831	Valid
Z-2	0.437	0.314	-0.185	0.520	0.712	Valid
Z-3	0.667	0.512	-0.087	0.611	0.818	Valid
Z-4	0.390	0.520	-0.109	0.539	0.835	Valid
Z-5	0.353	0.475	-0.130	0.446	0.739	Valid
Z-6	0.617	0.636	0.099	0.582	0.803	Valid
Z-7	0.389	0.601	-0.059	0.576	0.806	Valid

Notes:
Motivation (X1), Quality of Learning (X2), Critical Thinking Ability (X3), Quality of internship (Y), Work Readiness (Z).

Inner Model Evaluation

After testing the outer model, a final model was produced with all indicators that were valid and reliable for use in evaluating the inner model. This evaluation is used to confirm that the hypothesized model is correct. In this evaluation, the relationship between constructs is also estimated using a bootstrapping process so that the correlation of exogenous variables with endogenous variables is obtained. Empirical model output in Figure 2.

Jurnal Kependidikan:
Jurnal Hasil Penelitian dan Kajian Kepustakaan
di Bidang Pendidikan, Pengajaran dan Pembelajaran
https://e-journal.undikma.ac.id/index.php/jurnalkependidikan/index

Vol. 10, No. 1 : March 2024
E-ISSN: 2442-7667
pp. 35-47
Email: jklppm@undikma.ac.id

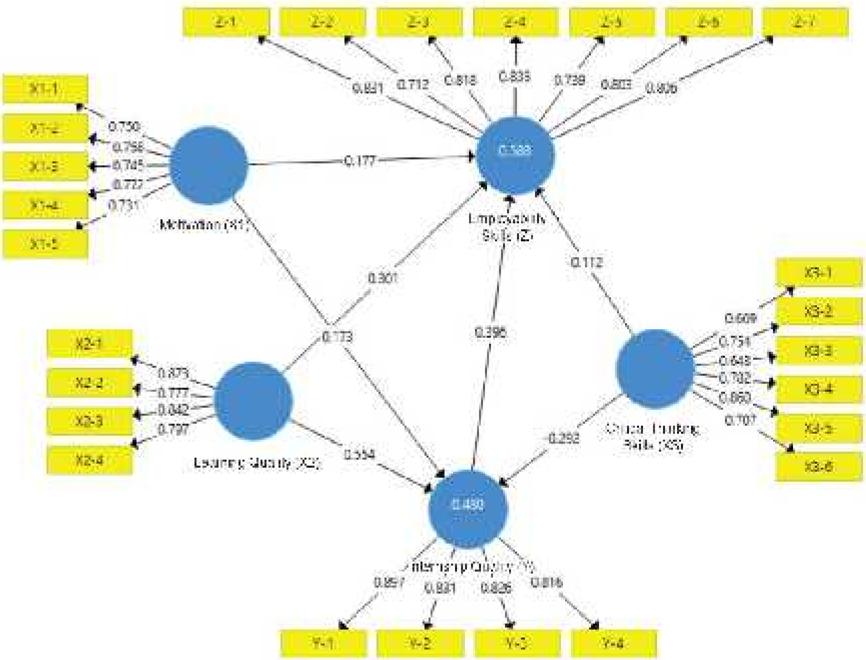

Figure 2. Empirical model output

R-Square

The R-square (R2) value is used to determine the magnitude of the influence of certain exogenous latent variables on endogenous latent variables. The closer the value is to 1, the greater the percentage influence. Table 4 shows the R-square values obtained from the PLS algorithm analysis.

Table 4. R-Square Value

Construct	**R-Square**
Job readiness (Z)	0.588
Quality of internship (Y)	0.480

Based on the calculations in Table 4, the variables of work readiness and quality of industrial work have been explained well. The R-square values are 0.588 or 58.8% and 0.480 or 48.8% respectively. According to Hair et al. (2011) in Ghozali (2021), this influence is identified as a moderate category.

Goodness of Fit Model

Model fit aims to analyze the feasibility of the model being tested. In general, the SRMR value exceeds 0.1, but in this study, it is still acceptable. So, the model is in the fit category.

Table 5. Fit Models

	Saturated Model	**Estimated Model**
SRMR	0.104	0.104
d_ULS	3,831	3,831
d_G	2,131	2,131
Chi-Square	574,970	574,970
NFI	0.567	0.567

Path Coefficient

The path coefficient test is aimed at seeing the influence of endogenous variables influenced by exogenous variables. The analysis used is through bootstrapping analysis so

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Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran dan Pembelajaran
https://e-journal.undikma.ac.id/index.php/jurnalkependidikan/index

Vol. 10, No. 1 : March 2024
E-ISSN: 2442-7667
pp. 35-47
Email: jklppm@undikma.ac.id

that a correlation is obtained between motivation variables, learning quality, critical thinking skills and work readiness, as presented in Table 6.

Table 6.Path coefficient

No	Construct	Original Sample	Sample Mean	T Statistics	P-Values
Directly					
1	Motivation->work readiness	0.177	0.174	1,382	0.168
2	Quality of learning -> work readiness	0.301	0.279	2,032	0.043
3	Critical thinking skills-> work readiness	-0.112	-0.128	0.906	0.365
4	Quality of industrial work-> work readiness	0.396	0.414	3,435	0.001
5	Motivation->quality of internship	0.173	0.194	1,055	0.292
6	Quality of learning->quality of internship	0.554	0.529	3,634	0,000
7	Critical thinking skills->quality of industrial work	-0.292	-0.269	1,885	0.060
Indirectly					
8	Motivation->quality of internship>work readiness	0.069	0.083	0.886	0.376
9	Quality of learning->quality of internship->work readiness	0.220	0.218	2,467	0.014
10	Critical thinking skills->quality of industrial work->work readiness	-0.116	-0.106	1,677	0.094

The results of hypothesis testing have been used to analyze correlations between correlation variables directly (direct effect) and indirectly (indirect effect). A summary of the results of hypothesis testing is presented in Figure 3.

It is known in Figure 3 that motivation does not correlate positively and significantly with work readiness. In line with Pratiwi's (2019) research, work readiness does not have a direct influence on motivation. It is suspected that work readiness is not related to motivation in the subjects studied. Someone who already has work readiness is not supported by motivation because someone who already feels ready to work does not need encouragement within themselves because they have been prepared to have mature readiness and are able to carry out tasks well without needing motivation. On the other hand, the findings of Zuniarti (2013) and Suryani (2018) confirm that there is a positive and significant influence between learning motivation and work readiness. High motivation in students will encourage students to be involved seriously and continuously in the learning process, especially when they have strong motivation to prepare themselves for the world of work. The results of this research indicate that learning motivation is not a factor that greatly influences work readiness. High learning motivation does not necessarily increase students' work readiness. However, there are many other factors that have a greater influence on students' work readiness, such as skills acquired during industrial work practices, information about the world of work, and expectations for entering the world of work (Syarif et al., 2019).

Jurnal Kependidikan:
Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran dan Pembelajaran
https://e-journal.undikma.ac.id/index.php/jurnalkependidikan/index
Vol. 10, No. 1 : March 2024
E-ISSN: 2442-7667
pp. 35-47
Email: jklppm@undikma.ac.id

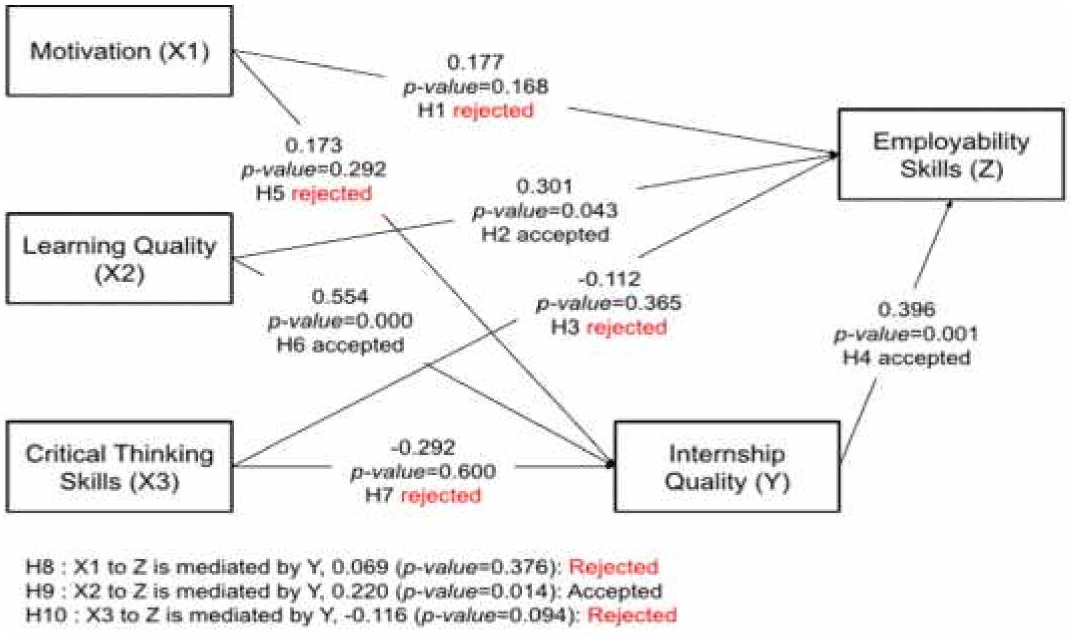

Figure 3. Summary of hypothesis testing results

Motivation also has no effect on the quality of the internship. This is in contrast to Purba et al. (2018), who state that learning motivation influences internship learning outcomes in the sense that the higher the student's learning motivation, the better the student's internship learning outcomes. Students who have strong learning motivation will tend to make various efforts to master the field being studied. Based on the conditions, students still feel unprepared when taking lessons; that is, they do not pay attention to the teacher's explanations during distance learning, so when they practice industrial work, students are less ready to carry it out. As in Moslem's findings (2019), students' ability to understand learning material is one of the factors that influence learning motivation. If desires are not accompanied by the ability to achieve them, students tend to give up, and as a result, motivation becomes low. Mazda's (2011) previous research also revealed that fields where you feel capable provide strong motivation in mastering and developing your abilities.

The quality of learning has a positive and significant correlation with the quality of internship and work readiness. This supports a study by Mahfud et al. (2019) which revealed that the quality of learning and learning goal orientation contribute to vocational students' career choices. In this research, it is proven that the quality of learning has a positive and significant effect on the quality of industrial work. This research is in accordance with previous research by Ariwibowo et al., (2022), that there is an influence between learning models and vocational readiness. The uitability of the learning model will increase students' readiness to carry out industrial work.

Critical thinking skills do not have a positive correlation with students' work readiness. This is in line with the findings of Aguila (2019), which states that there is no significant relationship between student academic performance and performance responsibilities in companies. Students with high or low academic performance have varying degrees of assessment of their ability to perform their responsibilities in the workplace. Critical thinking ability also does not have a positive and significant correlation with the quality of industrial work. Students' high critical thinking abilities actually have the opposite effect with a negative relationship direction, namely -0.292. This research emphasizes that students with a high level of critical thinking ability are not able to improve the quality of

Jurnal Kependidikan:
Jurnal Hasil Penelitian dan Kajian Kepustakaan
di Bidang Pendidikan, Pengajaran dan Pembelajaran
https://e-journal.undikma.ac.id/index.php/jurnalkependidikan/index
Vol. 10, No. 1 : March 2024
E-ISSN: 2442-7667
pp. 35-47
Email: jklppm@undikma.ac.id

industrial work. For students with high critical thinking skills but low quality of internship, it can be said that even though students have difficulty in solving problems, it does not weaken the quality of the student's internship. This is in line with Sulastri's (2021) research, where a negative relationship was found, indicating that the relationship between industrial work practice variables and soft skills does not go in one direction and shows that students' industrial work practices do not have an influence on students' soft skills.

The quality of industrial work has a positive and significant correlation with work readiness. Higher-quality internships increase students' work readiness to enter the world of work. This is because when students practice industrial work, they can apply theory through practice in industry. During an internship, you are equipped with not only hard skills but also soft skills, which play an important role in work readiness. Similar research by Armaulana (2022) shows that students' work readiness is influenced by internships and skills competency tests. Higher quality internships and student skill competency tests will increase students' readiness to enter the business or industrial world. The quality of internships has been proven to mediate the influence of learning quality on work readiness. The correlation between the quality of learning and the quality of internship has a linear form, meaning that by providing quality learning, the quality of internship will increase, which in turn will make students' work readiness more optimal. Thus, work readiness will be successfully achieved if the factors that support the achievement of learning quality and industrial work quality can interact and complement each other.

On the other hand, the quality of industrial work is not able to mediate the correlation between motivation and work readiness. So, it can be concluded that motivation has no direct or indirect influence on work readiness. These findings support the research of Pragiwani et al. (2020) and Hidayat (2021), who state that motivation has an insignificant impact on performance, indicating that the expected contribution from motivation has not been realized in supporting performance. Based on the hypothesis test, critical thinking skills do not have a positive and significant correlation with work readiness through the quality of industrial work. So, the results obtained showed that critical thinking skills had no direct or indirect influence on students' work readiness. The quality of internships that are classified as good is not enough to make the quality of internships a mediator between critical thinking skills and work readiness.

Conceptually, the findings emphasize the critical role of motivation in enhancing students' work readiness. The research suggests a need for a fundamental shift in how vocational schools conceptualize and address student motivation. By recognizing motivation as a key determinant of success, policymakers can develop strategies and initiatives aimed at fostering a motivating learning environment. This could involve implementing engaging activities, setting clear goals, and providing support systems to sustain students' motivation levels throughout their education. Moreover, the research underscores the importance of learning quality in shaping students' readiness for the workforce. Policymakers should prioritize efforts to enhance the overall quality of education in vocational schools. This may include investing in innovative teaching methods, updating curriculum content to align with industry needs, and providing resources that support effective learning outcomes.

Conclusion

In line with the results and discussion, conclusions can be drawn: 1) motivation is not positively and significantly correlated with work readiness with a correlation path coefficient index of 0.177; 2) learning quality is positively and significantly correlated with work readiness with a correlation path coefficient index of 0.301; 3) critical thinking skills do not correlate positively and significantly with work readiness with a correlation path coefficient index of -0.112; 4) the quality of industrial work is positively and significantly correlated with work readiness with a correlation path coefficient index of 0.396; 5) motivation does not correlate positively and significantly with the quality of industrial work with a correlation path coefficient index of 0.173; 6) the quality of learning is positively and significantly correlated with the quality of industrial work with a correlation path coefficient index of 0.554; 7) critical thinking skills do not correlate positively and significantly with the quality of industrial work with a correlation path coefficient index of -0.292; 8) the quality of the internship does not mediate the positive and significant correlation between motivation and work readiness with a correlation coefficient index of 0.069; 9) the quality of internship is able to mediate positively and significantly between the quality of learning and work readiness with a correlation coefficient index of 0.220; 10) the quality of industrial work does not mediate positively and significantly the ability to think critically on work readiness with a correlation coefficient index of -0.116.

Recommendation

In light of the conclusions drawn from the results and subsequent discussion, several key recommendations emerge. Firstly, there is a need to bolster motivation strategies among students, as the observed non-significant correlation with work readiness suggests room for improvement. This could involve the implementation of engaging activities, clear goal-setting, and the establishment of support systems to foster and sustain motivation levels. Additionally, given the positive and significant correlation between learning quality and work readiness, institutions should prioritize efforts to strengthen overall learning experiences. This may include adopting innovative teaching methods, updating curriculum content, and providing resources that enhance the effectiveness of learning. Policymakers should encourage and facilitate partnerships between educational institutions and industry stakeholders. Collaborative initiatives such as internships, industry-sponsored projects, and guest lectures can provide students with valuable real-world experiences and insights, thereby bridging the gap between academia and industry expectations.

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