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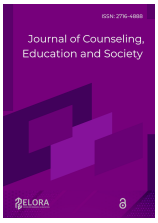

Teacher competency, facilities, and motivation as drivers of vocational graduate work readiness: a PLS-SEM moderation analysis

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ABSTRACT

Vocational education programs in Indonesia face persistent structural misalignment between graduate competencies and industry demands, reflected in the vocational high school graduate unemployment rate of 9.84% despite enrollment of 5.08 million students. This study examined the effects of Teacher Competency (X1), Learning Facilities (X2), and Student Motivation (X3) on Student Work Readiness (Y), the mediating role of Student Motivation, and the moderating and direct effects of Industry Relevance (M). A quantitative explanatory survey design was employed with total sampling involving 350 students at vocational high schools in Indonesia. Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) via SmartPLS 4. All seven hypotheses were supported: Teacher Competency ($\beta = 0.207$, $p = 0.000$) and Learning Facilities ($\beta = 0.211$, $p = 0.000$) significantly predicted Student Motivation; Teacher Competency ($\beta = 0.223$), Learning Facilities ($\beta = 0.270$), and Student Motivation ($\beta = 0.246$) exerted significant direct effects on Work Readiness; Student Motivation mediated X1→X3→Y ($\beta = 0.051$) and X2→X3→Y ($\beta = 0.052$); Industry Relevance moderated Learning Facilities and Work Readiness ($\beta = 0.151$, $p = 0.001$); and Industry Relevance exerted a significant negative direct effect on self-assessed Work Readiness ($\beta = -0.167$, $p = 0.001$), interpreted as a perception gap mechanism. $R^2 = 0.280$ for Student Work Readiness. These findings provide evidence-based guidance for policymakers and school leaders to improve vocational education quality and graduate employability in Indonesia.

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Introduction

Vocational education systems worldwide face mounting pressure to produce graduates who are technically proficient, career-ready, and industry-responsive in rapidly transforming labor markets (UNESCO-UNEVOC, 2022). The economic productivity of nations is fundamentally determined by the alignment between vocational education competencies and actual industry skill demands (Hanushek & Woessmann, 2023). In Indonesia, vocational high schools serve as the primary institutional vehicle for secondary-level workforce preparation. Indonesian Law No. 20 of 2003 on the National Education System mandates that vocational programs produce graduates equipped for immediate industry entry, while Presidential Regulation No. 68 of 2022 reinforces this through the link-and-match principle requiring continuous curriculum alignment with industry competency standards (Indrawati & Kuncoro, 2021).

Despite these policy directives, data from the Indonesian Central Bureau of Statistics (BPS, 2024) reveal a structurally alarming contradiction: the unemployment rate among vocational high school graduates reached 9.84%, significantly exceeding the national average, while total enrollment reached 5.08 million students. This paradox, in which quantitative expansion has not produced commensurate qualitative improvement in graduate work readiness, exposes a systemic failure demanding rigorous empirical investigation.

Three structurally interdependent problems characterize this failure. First, teacher competency remains inconsistent across pedagogical, professional, personal, and social dimensions, producing uneven learning experiences that fail to develop students' technical and employability competencies (Lin et al., 2024; Jaedun et al., 2024). Second, the adequacy and currency of learning facilities workshops, equipment, learning media, and physical infrastructure remain critically insufficient across Indonesian vocational institutions (Pambudi & Harjanto, 2020). Third, student motivation is frequently overlooked despite being a critical determinant of work readiness outcomes (Ryan & Deci, 2020; Kholifah et al., 2025).

Beyond these internal quality dimensions, industry relevance the degree to which curriculum, facilities, partnerships, and graduate competencies align with evolving industry standards constitutes the structural moderating condition within which all other vocational education inputs operate (Becker, 1993; Wardiman, 1994). Existing research has examined industry relevance primarily as an outcome variable rather than as a moderating variable that amplifies or attenuates relationships between educational quality variables and graduate work readiness, constituting a significant theoretical gap.

This study makes three original contributions. Theoretically, it extends Human Capital Theory (Becker, 1993) and Link and Match Theory (Wardiman, 1994) by constructing an integrated moderated structural model. Methodologically, it applies PLS-SEM to simultaneously test seven hypotheses encompassing direct effects, mediation pathways, and moderation effects. Practically, findings provide evidence-based guidance for school principals, curriculum developers, and policymakers implementing the Merdeka Belajar curriculum framework (Afriyanti et al., 2025; Rizal et al., 2025).

Teacher Competency and Vocational Education

Teacher competency is the foundational quality input through which all elements of vocational education are converted into student learning outcomes. Indonesian Law No. 14 of 2005 formally defines teacher competency across four dimensions: pedagogical competency, professional competency, personal competency, and social competency. These dimensions interact as a system in which deficiencies in any single dimension constrain the productive impact of strengths in others (Lin et al., 2024). Lin et al. (2024) demonstrated that teachers who transformed their practice in response to competency-based curriculum demands produced students with significantly stronger vocational identity. Jaedun et al. (2024) found that teacher social competency directly influenced students' readiness to develop collaborative skills for Industry 5.0 environments. Based on these findings, H1 posits that teacher competency has a positive and significant effect on student motivation, and H3 posits that teacher competency has a positive and significant direct effect on student work readiness.

Learning Facilities and Student Outcomes

Learning facilities constitute the physical and technological infrastructure through which vocational programs are materially enacted. Pambudi and Harjanto (2020) documented that inadequate workshops and outdated equipment constitute structural barriers to high-quality vocational competency development. Nanda et al. (2025) demonstrated that a mobile QR-EFI simulator within a problem-based teaching factory model significantly enhanced students' 4C competencies (critical thinking, creativity, communication, collaboration). Rizal et al. (2021) established that implementing a Mobile Learning Management System significantly improved student engagement. Accordingly, H2 posits that learning facilities have a positive and significant effect on student motivation, and H4 posits that learning facilities have a positive and significant direct effect on student work readiness.

Student Motivation as a Mediating Variable

Student motivation is a multidimensional psychological construct governing the quality, direction, and persistence of students' engagement with learning. Self-Determination Theory (Deci & Ryan, 1985; Ryan & Deci, 2020) establishes that intrinsic motivation and well-internalized extrinsic motivation predict sustained engagement and positive career outcomes. Kholifah et al. (2025) confirmed through a PLS-SEM study involving 2,587 vocational graduates that motivational structures significantly predicted workforce readiness. Swaramarinda et al. (2025) demonstrated that entrepreneurial motivation predicted students' readiness for the digital economy. Accordingly, H5 posits that student motivation has a positive and significant effect on work readiness, with student motivation positioned as a mediating variable between teacher competency, learning facilities, and work readiness.

Industry Relevance as a Moderating Variable

Industry relevance refers to the degree to which a vocational program's curriculum, instructional processes, facilities, partnerships, and graduate competencies are aligned with evolving industry standards. Human Capital Theory (Becker, 1993) establishes that education investments produce returns proportional to market alignment. Link and Match Theory (Wardiman, 1994) operationalizes this principle by requiring active business and industry sector participation in curriculum synchronization, competency assessment, and graduate placement. Yoto et al. (2024) demonstrated that Link and Match collaboration between vocational schools and industries produced distinctively higher holistic workforce readiness. Accordingly, H6 posits that industry relevance moderates the relationship between learning facilities and work readiness, and H7 posits that industry relevance has a significant direct effect on work readiness.

Student Work Readiness as the Endogenous Variable

Student work readiness is defined as the degree to which a vocational graduate possesses the knowledge, skills, attitudes, and orientations required to enter and perform effectively in industry-relevant occupational roles immediately upon graduation. Cavanagh et al. (2015) established the foundational operationalization of work readiness as encompassing four dimensions: technical skills, referring to the mastery of occupation-specific psychomotor and cognitive competencies aligned with industry standards; work attitude, referring to the professional dispositions, discipline, and behavioral orientations that employers expect in entry-level employees; employability, referring to the broader set of transferable competencies including communication, problem-solving, teamwork, and adaptability; and career readiness, referring to the degree to which graduates are oriented, motivated, and prepared to navigate the entry-level employment process and sustain career development over time.

Empirical research confirms that student work readiness in vocational settings is the product of integrated educational inputs and processes. Kholifah et al. (2025) demonstrated through PLS-SEM analysis that the digital employability skills of vocational graduates constituted a valid and comprehensive operationalization of workforce readiness within a human capital investment framework. Harianto et al. (2025) confirmed through a systematic review that industry collaboration, competency certification, and academic engagement were the three primary structural predictors of student work readiness. Anto et al. (2024) found a significant positive relationship between employability skills and student work readiness in a vocational secondary school context. In this study, student work readiness is operationalized through four reflective indicators: technical skills, work attitude, employability, and career readiness, constituting the primary endogenous variable in the structural model.

Conceptual Framework

Research Gaps and Hypotheses

The reviewed literature reveals three specific and compounding gaps addressed by this study. First, no existing study has simultaneously examined teacher competency, learning facilities, and student motivation as integrated structural predictors of student work readiness while positioning industry relevance as a moderating variable within a single empirically tested PLS-SEM model. Prior research has examined these variables in isolation or in partial combinations, preventing an integrated understanding of the causal architecture through which vocational education programs produce work-ready graduates. Second, the application of PLS-SEM to evaluate integrated quality dimensions of vocational education programs in Indonesia remains underdeveloped, leaving policymakers without the methodological basis to understand complex, multi-variable relationships among program inputs and graduate outcomes (Hair et al., 2022; Herayono et al., 2026). Third, the specific institutional and policy context of Indonesian vocational high schools under the Merdeka Belajar curriculum framework has not been systematically examined in Scopus-indexed research using an integrated evaluative structural model.

Based on the theoretical framework and prior empirical evidence, seven hypotheses are proposed: H1: Teacher competency has a positive and significant effect on student motivation; H2: Learning facilities have a positive and significant effect on student motivation; H3: Teacher competency has a positive and significant direct effect on student work readiness; H4: Learning facilities have a positive and significant direct effect on student work readiness; H5: Student motivation has a positive and significant effect on student work readiness; H6: Industry relevance moderates the relationship between learning facilities and student work readiness; H7: Industry relevance has a positive and significant direct effect on student work readiness.

The conceptual framework integrates four theoretical pillars: Human Capital Theory (Becker, 1993), Self-Determination Theory (Ryan & Deci, 2020), Link and Match Theory (Wardiman, 1994), and the Vocational Education Ecosystem Framework (2021–2026). The model positions Teacher Competency (X1) and Learning Facilities (X2) as exogenous variables with direct effects on Work Readiness (Y) and indirect effects through Student Motivation (X3). Industry Relevance (M) operates as both a direct predictor and a moderating variable. Seven research hypotheses (H1–H7) are derived from this framework, as illustrated in Figure 1.

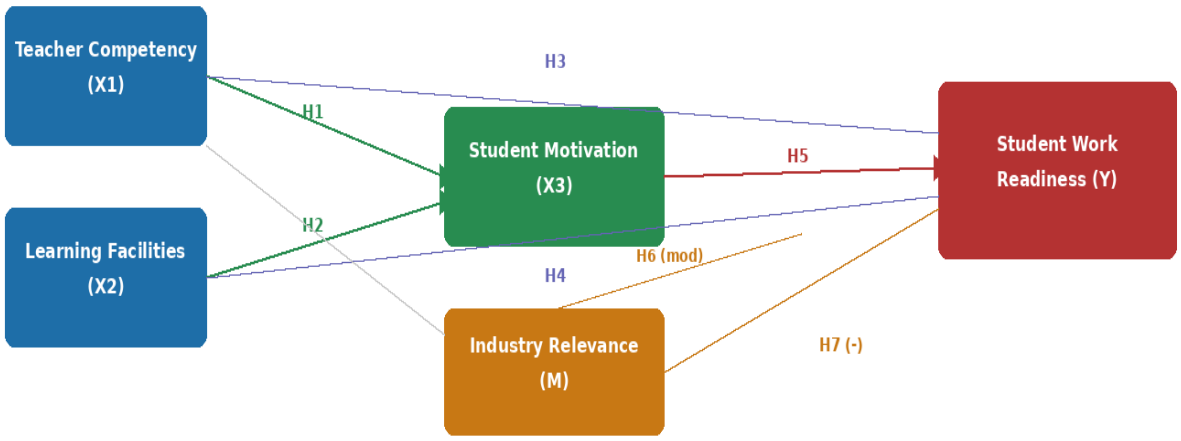

Figure 1. Conceptual Framework of the Study

Method

Research Design

This study employed a quantitative approach with an explanatory survey research design to test causal relationships among variables through systematic empirical hypothesis testing (Hair & Alamer, 2022). The research procedure was executed across ten sequential stages as illustrated in Figure 2, covering problem identification, literature review, hypothesis formulation, instrument development and validation, data collection, PLS-SEM analysis, measurement model evaluation, structural model evaluation, hypothesis testing, and conclusion formulation.

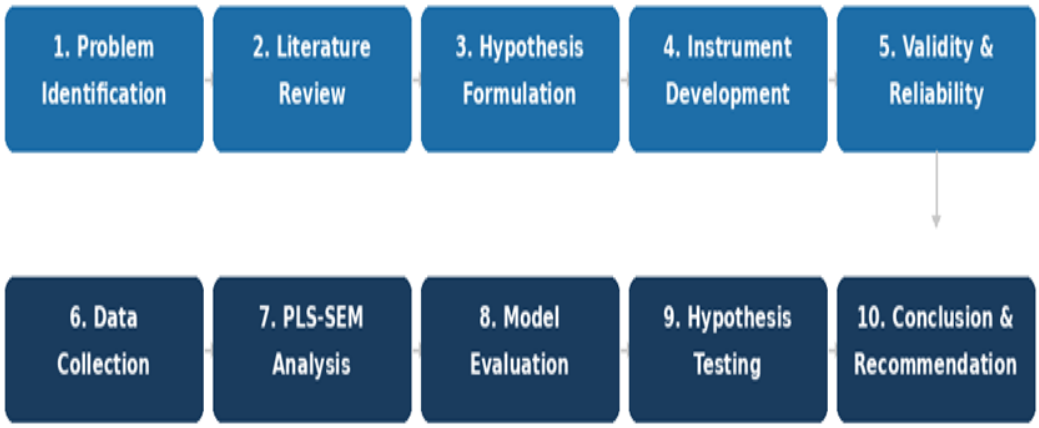

Figure 2. Research Procedure Flowchart

Participants

The research population consisted of all 350 students enrolled in vocational high school programs at the study location in Indonesia. Total sampling was applied because the population size was sufficiently bounded to allow complete enumeration, maximizing data representativeness and eliminating sampling error (Hair & Alamer, 2022). All 350 questionnaires were returned and declared complete and usable for analysis, yielding a response rate of 100%.

Instrumentation

Data were collected using a structured questionnaire on a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). The Teacher Competency (X1) instrument covered four dimensions per Law No. 14/2005: pedagogical, personality, professional, and social competency. The Learning Facilities (X2) instrument covered

workshops, equipment, learning media, and infrastructure. The Student Motivation (X3) instrument was grounded in Self-Determination Theory across intrinsic motivation, extrinsic motivation, career aspiration, and persistence. The Industry Relevance (M) instrument covered five dimensions: curriculum alignment, industry partnership, work-based learning quality, graduate absorption rate, and industry standard compliance. The Student Work Readiness (Y) instrument followed Cavanagh et al.'s (2015) framework: technical skills, work attitude, employability, and career readiness. Content validity was established through expert review prior to field administration. Prior to full-scale distribution, the instrument was pilot-tested with 30 students outside the main sample; items with corrected item-total correlations below 0.30 or ambiguous wording flagged during cognitive interviews were revised or removed, yielding the final item set used in this study. The 100% usable response rate reflects the survey's administration under direct researcher supervision in a single classroom sitting per school, which limited missing data but does not rule out social desirability bias; this constraint is addressed in the Limitations subsection.

Data Analysis

PLS-SEM was selected via SmartPLS 4 for its suitability for complex structural models with multiple latent constructs and moderation paths, robustness with heterogeneous sample distributions, and established appropriateness for simultaneously testing direct effects, mediation, and moderation within a single integrated model (Hair et al., 2022; Herayono et al., 2026). Analysis proceeded in two stages: (1) measurement model evaluation assessing convergent validity (AVE ≥ 0.50), internal consistency reliability (Cronbach's Alpha ≥ 0.70; CR ≥ 0.70), discriminant validity (HTMT < 0.90), and multicollinearity (VIF < 5.00); and (2) structural model evaluation testing seven hypotheses through bootstrapping with 5,000 subsamples, examining path coefficients, T-statistics, p-values, R^2, and effect sizes (f^2).

Results and Discussions

Prior to structural model testing, the measurement model was evaluated to confirm validity and reliability of all five constructs. Table 1 presents convergent validity and internal consistency reliability results.

Table 1. Construct Validity and Reliability Results

Variable	Cronbach's Alpha (α)	Rho_a	Composite Reliability (Rho_c)	AVE
X1 – Teacher Competency	0.878	0.883	0.916	0.732
X2 – Learning Facilities	0.877	0.879	0.915	0.730
X3 – Student Motivation	0.871	0.880	0.911	0.720
M – Industry Relevance	0.897	0.908	0.924	0.708
Y – Student Work Readiness	0.866	0.869	0.909	0.713

All Cronbach's Alpha values ranged from 0.866 to 0.897, Composite Reliability (Rho_c) values ranged from 0.909 to 0.924, and AVE values ranged from 0.708 to 0.732. All values exceeded minimum thresholds (α ≥ 0.70, CR ≥ 0.70, AVE ≥ 0.50), confirming convergent validity and internal consistency for all constructs.

Table 2. Discriminant Validity: HTMT Ratio Results

Construct	M	X1	X2	X3	Y	M × X2
M – Industry Relevance						
X1 – Teacher Competency	0.404					
X2 – Learning Facilities	0.060	0.222				
X3 – Student Motivation	0.061	0.279	0.289			
Y – Work Readiness	0.066	0.309	0.431	0.407		
M × X2 (Interaction)	0.062	0.034	0.067	0.037	0.148	

All inter-construct HTMT values ranged from 0.034 to 0.431, well below the maximum threshold of HTMT < 0.90, confirming adequate discriminant validity. All VIF values across all indicators ranged from 1.000 to 2.616, well below the threshold of VIF < 5.00, confirming the absence of serious multicollinearity.

Table 3. Collinearity Test (VIF) Results

Indicator	VIF	Indicator	VIF	Indicator	VIF
X1.1 – Pedagogical	2.376	X2.1 – Workshops	2.522	X3.1 – Intrinsic Motivation	2.343
X1.2 – Personality	2.008	X2.2 – Equipment	2.115	X3.2 – Extrinsic Motivation	2.098
X1.3 – Professional	2.173	X2.3 – Learning Media	2.257	X3.3 – Career Aspiration	2.219
X1.4 – Social	2.263	X2.4 – Infrastructure	1.961	X3.4 – Persistence	1.874
M1 – Curriculum Align.	2.201	M2 – Industry Partner.	2.310	Y1 – Technical Skills	2.087
M3 – WBL Quality	2.176	M4 – Grad. Absorption	2.616	Y2 – Work Attitude	2.343
M5 – Std. Compliance	2.117	M×X2 – Interaction	1.000	Y4 – Career Readiness	1.891

Structural Model Evaluation

The PLS-SEM structural model output is presented in Figure 3. The coefficient of determination (R^2) for Student Work Readiness (Y) was 0.280 (adjusted R^2 = 0.270), indicating that 28.0% of variance in Work Readiness is explained by the combined effects of all predictor variables. The R^2 for Student Motivation was 0.104 and for Industry Relevance was 0.132, confirming adequate explanatory power.

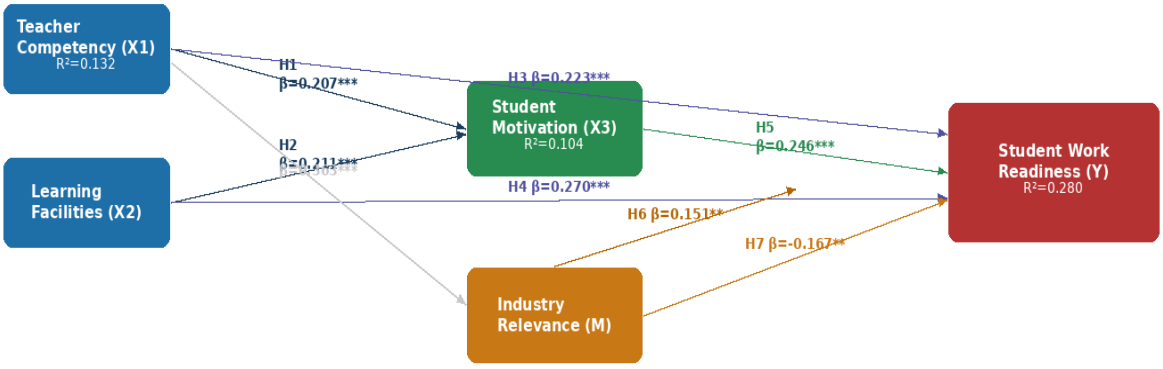

Figure 3. Graphical Output of PLS-SEM Structural Model

Table 4. Coefficient of Determination (R^2) Results

Endogenous Variable	R^2	R^2 Adjusted	Classification
X3 – Student Motivation	0.104	0.099	Moderate
M – Industry Relevance	0.132	0.130	Moderate
Y – Student Work Readiness	0.280	0.270	Moderate–Substantial

Table 5. Effect Size (f^2) Results

Structural Path	f^2	Classification
X1 → M (Teacher Competency → Industry Relevance)	0.152	Medium
X2 → Y (Learning Facilities → Work Readiness)	0.093	Small–Medium
X3 → Y (Student Motivation → Work Readiness)	0.075	Small–Medium
X1 → Y (Teacher Competency → Work Readiness)	0.055	Small–Medium
X2 → X3 (Learning Facilities → Student Motivation)	0.048	Small
X1 → X3 (Teacher Competency → Student Motivation)	0.046	Small
M → Y (Industry Relevance → Work Readiness)	0.033	Small
M × X2 → Y (Moderation Effect)	0.028	Small

Hypothesis Testing

Hypothesis testing was conducted through bootstrapping with 5,000 subsamples. The graphical output of bootstrapping results is presented in Figure 4. Table 6 presents direct path coefficients and hypothesis decisions for all seven hypothesized paths.

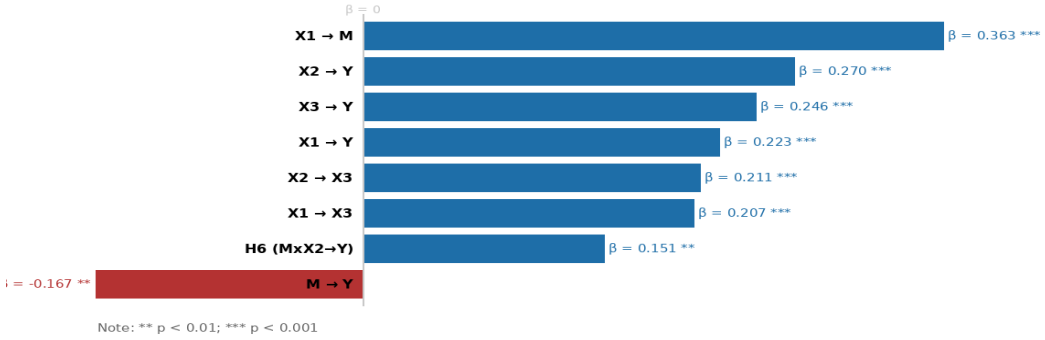

Figure 4. Graphical Output of Bootstrapping Results (5,000 Subsamples)

Table 6. Direct Path Coefficients and Hypothesis Testing Results

Hypothesis	Direct Path	β	SD	T-Statistic	p-Value	Decision
H1	X1 → X3 (Teacher Comp. → Motivation)	0.207	0.047	4.376	0.000	Supported
H2	X2 → X3 (Facilities → Motivation)	0.211	0.051	4.154	0.000	Supported
H3	X1 → Y (Teacher Comp. → Work Readiness)	0.223	0.052	4.266	0.000	Supported
H4	X2 → Y (Facilities → Work Readiness)	0.270	0.048	5.626	0.000	Supported
H5	X3 → Y (Motivation → Work Readiness)	0.246	0.044	5.646	0.000	Supported
H6	M × X2 → Y (Industry Rel. Moderates X2→Y)	0.151	0.046	3.283	0.001	Supported
H7	M → Y (Industry Relevance → Work Readiness)	□0.167	0.050	3.373	0.001	Supported*

Note: *H7 is statistically significant (p = 0.001) with a negative path coefficient (β = □0.167), interpreted as a perception gap mechanism. All seven hypotheses were supported. *** p < 0.001; ** p < 0.01.

Table 7. Total Effects Mean, STDEV, T-Statistics, P-Values, and 95% Confidence Intervals

Path	β	Mean (M)	SD	T-Stat	p-Val	2.5% CI	97.5% CI
M → Y	−0.167	−0.167	0.050	3.373	0.001	−0.264	−0.070
X1 → M	0.363	0.366	0.049	7.413	0.000	0.270	0.459
X1 → X3	0.207	0.208	0.047	4.376	0.000	0.113	0.300
X1 → Y	0.213	0.213	0.053	4.062	0.000	0.122	0.326
X2 → X3	0.211	0.214	0.051	4.154	0.000	0.114	0.314
X2 → Y	0.322	0.325	0.049	6.546	0.000	0.176	0.365
X3 → Y	0.246	0.247	0.044	5.646	0.000	0.158	0.331
M×X2 → Y	0.151	0.152	0.046	3.283	0.001	0.057	0.240

Table 8. Specific Indirect Effects (Mediation Analysis)

Hypothesis	Indirect Path	β	SD	T-Statistic	p-Value	Decision
H1→H5	X1 → X3 → Y (Motivation mediates TC→WR)	0.051	0.014	3.559	0.000	Mediation Supported
H2→H5	X2 → X3 → Y (Motivation mediates LF→WR)	0.052	0.016	3.257	0.001	Mediation Supported
H1→H7	X1 → M → Y (Industry Rel. indirect path)	□0.061	0.020	2.994	0.003	Significant (□)

Note: The negative indirect effect of X1 → M → Y (β = □0.061) reflects the suppressing role of Industry Relevance when operating as an intervening pathway, contrasting with the positive direct effect of X1 → Y (β = 0.223).

Conclusions

The finding that Teacher Competency exerts a positive and significant effect on Student Motivation (β = 0.207, T = 4.376, p = 0.000) confirms H1. Higher quality teacher competency across pedagogical, personality, professional, and social dimensions systematically activates students' intrinsic motivation, extrinsic motivation, career aspiration, and persistence. This is consistent with Lin et al. (2024), who demonstrated that pedagogically transformed teachers produced students with stronger vocational identity, and Jaedun et al. (2024), who established that teacher social competency directly influenced adaptive skill development. The small-to-medium effect size (f^2 = 0.046) is interpretable within Self-Determination Theory's proposition that teacher competency is one of multiple need-satisfying conditions that jointly activate student motivation (Ryan & Deci, 2020). Rizal et al. (2025) confirmed in the Indonesian context that structured professional development produces measurable improvements in teacher competency that translate into observable improvements in student engagement. Learning Facilities exert a positive and significant effect on Student Motivation (β = 0.211, T = 4.154, p = 0.000), confirming H2. Nanda et al.'s (2025) mobile QR-EFI simulator significantly enhanced students' competency and motivational engagement, while Rizal et al. (2021) established that a Mobile Learning Management System significantly improved learning engagement. The comparable effect sizes of X2 on X3 (f^2 = 0.048) and X1 on X3 (f^2 = 0.046) confirm that teacher competency and learning facilities make approximately equivalent contributions to student motivation, with direct practical significance for vocational education resource allocation decisions. Self-Determination Theory (Ryan & Deci, 2020) explains this through the competence need-satisfaction mechanism: modern, industry-standard learning environments provide the authentic mastery experiences foundational to intrinsic motivation development. Teacher Competency exerts a positive and significant direct effect on Work Readiness (β = 0.223, T = 4.266, p = 0.000), confirming H3. Including the indirect path through Student Motivation (β = 0.051), the total effect of Teacher Competency on Work Readiness is 0.213. Learning Facilities emerged as the strongest direct predictor (β = 0.270, T = 5.626, p = 0.000), confirming H4, with a total effect of 0.322 representing the largest total effect in the model. These findings are consistent with Human Capital Theory (Becker, 1993): teacher competency and learning facilities constitute the primary human capital investment mechanisms through which educational programs convert curriculum intentions into productive graduate competencies. The practical implication is unambiguous: investment in modernizing and industry-aligning learning facilities produces the most substantial returns in graduate work readiness. Student Motivation exerts a positive and significant effect on Work Readiness (β = 0.246, T = 5.646, p = 0.000), confirming H5. The confirmation of Student Motivation as a significant mediator through both indirect paths X1 → X3 → Y (β = 0.051, p = 0.000) and X2 → X3 → Y (β = 0.052, p = 0.001) establishes motivation as a structural mechanism through which educational input quality is converted into graduate employability outcomes. Self-Determination Theory (Ryan & Deci, 2020) explains this: students who develop well-internalized career aspirations approach learning with greater persistence, invest deeper effort in mastering technical competencies, and develop stronger professional work attitudes recognized by employers as markers of work readiness. Industry Relevance significantly moderates the relationship between Learning Facilities and Work Readiness (M × X2 → Y: β = 0.151, T = 3.283, p = 0.001), confirming H6. This confirms that the same facility investment generates substantially stronger work readiness outcomes in programs with high curriculum alignment, active industry partnerships, quality work-based learning, and industry standard compliance, compared to programs where these conditions are absent. Link and Match Theory (Wardiman, 1994) establishes that the productive value of educational infrastructure investments is contingent on structural alignment with actual industry operating standards. Yoto et al. (2024) provided empirical support demonstrating that vocational schools with stronger industry partnerships produced substantially higher graduate workforce readiness. The practical implication is that facility investment decisions should be systematically accompanied by industry relevance development strategies. Industry Relevance exerts a statistically significant but negative

direct effect on self-assessed Work Readiness (β = □0.167, T = 3.373, p = 0.001; 95% CI: [□0.264, □0.070]), confirmed by H7. This finding is explained through two complementary mechanisms. First, the suppressor effect mechanism suggests that Industry Relevance redistributes its positive effect on work readiness primarily through the moderation interaction pathway (M × X2 → Y: β = 0.151) rather than through a direct additive path, producing a suppressor-type negative direct coefficient reflecting statistical partitioning (Hair et al., 2022). Second, a perception gap mechanism may be operative: students in high-relevance programs encounter more demanding industry benchmarks and develop more conservative self-assessments of their work readiness compared to students in lower-relevance programs who may overestimate their readiness. The indirect path X1 → M → Y (β = □0.061, p = 0.003) further confirms that Teacher Competency's contribution to Industry Relevance amplifies this suppressor mechanism. These findings align with Maulina and Yoenanto (2022), who argued that optimizing link-and-match mechanisms raises industry standards expectations in ways that create short-term perception gaps. This study contributes three dimensions of novelty to the vocational education literature. First, it is the first study to simultaneously test Teacher Competency, Learning Facilities, and Student Motivation as integrated structural predictors of Student Work Readiness while positioning Industry Relevance as both a direct predictor and a moderating boundary condition within a single comprehensive PLS-SEM model in Indonesian vocational high school programs. This fills a theoretical and empirical gap that prior fragmented research has left unaddressed (Hair et al., 2022; Herayono et al., 2026). Second, the empirical confirmation of the dual-pathway architecture in which Teacher Competency and Learning Facilities exert both direct effects on Work Readiness and indirect effects through Student Motivation as the mediating variable extends Self-Determination Theory and Human Capital Theory into the Indonesian vocational high school context. This provides a more complete explanatory model of how educational quality investments produce graduate work readiness outcomes than prior single-variable or partial-model studies have been able to establish (Kholifah et al., 2025; Swaramarinda et al., 2025). Third, the discovery of the negative direct effect of Industry Relevance on self-assessed Work Readiness alongside its positive moderating effect on the Learning Facilities–Work Readiness relationship constitutes a theoretically significant finding that advances understanding of how industry alignment conditions simultaneously elevate program quality and reshape student self-assessment frameworks. This dual effect has not previously been empirically documented in the vocational education literature. Practically, structured teacher professional development has been demonstrated to produce measurable improvements in teaching performance (Rizal et al., 2025; Helmina et al., 2024), innovative facility development has been confirmed to enhance student competency outcomes (Nanda et al., 2025; Rizal, 2024), and curriculum evaluation frameworks must account for the complex interplay between industry alignment and student outcome self-assessment to accurately capture program effectiveness (Sari et al., 2025; Afriyanti et al., 2025). This study is subject to several limitations that should qualify interpretation of the findings. First, the cross-sectional design precludes causal inference; the observed relationships among Teacher Competency, Learning Facilities, Student Motivation, Industry Relevance, and Work Readiness are consistent with the hypothesized model but cannot rule out reverse or reciprocal causation. Second, the sample was drawn from a single study location using total sampling of 350 students, which limits generalizability to vocational high schools with different regional, institutional, or industry-sector characteristics. Third, all constructs were measured through self-report Likert-scale instruments, which introduces potential common method bias and may explain part of the perception-gap pattern observed for Industry Relevance. Fourth, the moderate R^2 values (10.4%-28.0%) indicate that unmeasured variables, such as socioeconomic background, school leadership quality, or labor market conditions, likely contribute to Work Readiness outcomes. Future research should employ longitudinal or multi-site designs, incorporate objective work-readiness indicators alongside self-report measures, and test the model across diverse vocational school types to establish the boundary conditions of these findings.

Conclusion

This study examined the effects of Teacher Competency, Learning Facilities, and Student Motivation on Student Work Readiness, positioning Industry Relevance as both a moderating variable and direct predictor within an integrated PLS-SEM model. All seven hypotheses were supported. Learning Facilities emerged as the strongest predictor of Work Readiness (β = 0.270 direct; β = 0.322 total), followed by Student Motivation (β = 0.246) and Teacher Competency (β = 0.223). Student Motivation was confirmed as a significant partial mediator in both the teacher competency pathway (β = 0.051) and the learning facilities pathway (β = 0.052). Industry Relevance significantly moderated the Learning Facilities–Work Readiness relationship (β = 0.151), while its negative direct effect (β = □0.167) was interpreted as a perception gap mechanism arising from elevated industry benchmark exposure. The structural model explained 28.0% of variance in Student Work Readiness (R^2 = 0.280). These findings contribute theoretically by integrating Human Capital Theory, Self-Determination Theory, and Link and Match Theory into a unified moderated structural model not previously formalized in the Indonesian vocational education literature. Practically, policymakers and school leaders should prioritize: (1)

modernizing learning facilities in alignment with current industry standards; (2) investing in structured teacher professional development programs; and (3) cultivating active industry partnerships encompassing competency assessment, work-based learning quality improvement, and graduate placement pathway development. Future research should apply this model longitudinally, across different regional and school-type contexts, and with expanded sample sizes to validate and generalize these findings beyond the Indonesian vocational high school context

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