Analysis of the Influence of Physical Endurance and Work Competence on the Readiness of Vocational High School Graduates to Face Industry

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Abstract

This study aims to analyze the influence of physical endurance and skill work on industry competencies on the readiness and competitiveness of vocational high school graduates to meet demands and compete in the industrial world, using the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach. Data were collected through an online questionnaire survey of 82 final-year students from three vocational high schools in Malang City. The evaluation of the measurement model showed that all indicators met the criteria for convergent validity, discriminant validity, and reliability. The results of the structural model showed an adjusted R-square of 0.714, indicating that physical endurance and skill work explained 71.4% of the variation in industry competencies. Effect size analysis showed that physical endurance had a large influence on industry competencies ($f^2 = 0.444$), while skill work had a small to moderate influence ($f^2 = 0.103$). Hypothesis testing showed that physical endurance ($\beta = 0.604$; $p < 0.05$) and work skills ($\beta = 0.285$; $p < 0.05$) had positive, significant effects on industry competencies. The goodness-of-fit evaluation yielded an SRMR of 0.084, within the acceptable range. Overall, the study's results indicate that physical endurance is a dominant factor in shaping industry competencies, as supported by students' work skills. This finding underscores the importance of integrating physical development and work skills in vocational education to enhance graduates' readiness to meet the demands of the industrial world.

Keywords

accessibility; Physical endurance; Skill work; industry competences; SEM-PLS

Introduction

The increasingly competitive and productivity-oriented demands of the workplace make physical strength a crucial aspect that cannot be ignored in preparing Vocational High School (SMK) graduates (Mahmudah et al., 2022). Many fields of expertise in vocational schools, such as engineering, manufacturing, construction, and industrial services, require physical exertion, muscular endurance, and the ability to work long hours (Dogara et al., 2019; Nubsaen et al., 2025). However, attention to students' physical strength remains relatively limited and is often given less priority than mastery of technical skills. This creates a gap between graduates' physical readiness and the actual demands of the workplace, potentially reducing performance, increasing the risk of fatigue, and even triggering occupational health problems early on.

On the other hand, changes in adolescent lifestyles, leading to increasingly low physical activity, heighten the urgency of researching the physical strength of vocational high school students (Dogara et al., 2019). Low levels of fitness and muscle strength not only impact long-term health but also affect job competency, competitiveness, and graduates' ability to adapt to physical workloads (Mohamed et al., 2021; Sofyan, 2020). The industrial world is increasingly focusing on non-technical aspects, such as physical strength and fitness, in job-readiness assessments. Therefore, research on the importance of physical strength for vocational school students is urgently needed to provide a scientific basis for curriculum development, particularly in physical education, which should be more context-based and aligned with work needs. The research findings are expected to provide a foundation for schools and stakeholders in designing appropriate physical training programs, so that vocational school graduates are not only skilled but also physically strong and prepared to face the demands of the workplace.

Furthermore, another crucial skill for vocational school students, especially upon graduation, is employability skills (Dogara et al., 2019; Mohamed et al., 2021; Valand et al., 2025). The importance of employability skills for vocational school graduates is increasingly prominent in line with changes in the labor market influenced by technological advances and dynamic industry needs. Graduates are no longer merely equipped with technical vocational skills; they are also required to possess broader work competencies, including the ability to adapt to social, technological, and organizational changes in the workplace (Masran et al., 2025; Subekti & Ana, 2018). Soft skills such as communication, teamwork, honesty, reliability, and problem-solving are crucial factors that significantly influence graduates' job readiness and career opportunities. Various studies have shown a strong relationship between mastery of soft skills and vocational students' job readiness, so improving these skills can directly increase graduates' opportunities to enter and succeed in the workforce (Chodakowska & Polecki, 2025; Kamaruzaman et al., 2025; Noerper et al., 2025). Furthermore, adaptability and creativity are increasingly valued by employers, especially amid rapid technological change and the complexity of the modern work environment.

However, challenges remain in aligning vocational education curricula with the real demands of the job market. Many vocational programs tend to emphasize technical skills, while the development of soft skills and general knowledge that support lifelong learning has not received adequate attention. This gap can affect graduates' long-term adaptability. Therefore, innovative learning approaches such as factory-based learning, work-integrated learning, and direct work experience through internships or industrial practicums are crucial. These approaches have been proven to improve graduates' employability skills, job stability, and career advancement opportunities. Amid the Fourth Industrial Revolution, vocational education must continue to evolve by integrating digital literacy, critical thinking, and a culture of lifelong learning. With curricula aligned with industry needs and an emphasis on developing comprehensive work skills, vocational school graduates will be better prepared to face changes in the job market and achieve long-term career success.

Based on various research analyses, it is necessary to examine how physical endurance and work skills influence the readiness and competitiveness of vocational high school graduates in meeting demands and competing in the industrial world. This research is important to be conducted to analyze the influence of physical endurance and work skills on the readiness and competitiveness of vocational high school graduates in facing demands and competition in the increasingly complex industrial world, considering that today's industry not only demands mastery of technical skills, but also physical readiness and comprehensive work competencies. At the same time, there is still a gap between the abilities of vocational high school graduates and the real needs of the working world, so the research results are expected to serve as a basis for developing a curriculum and coaching strategy that are more relevant to industrial needs.

Method

1. Research Design and Procedures

This study used a quantitative online survey method, distributing questionnaires to respondents who had expressed their willingness to participate. Before data collection, the study received ethical approval from the relevant institutional research ethics committee, and all respondents provided written informed consent via the Google Forms landing page. This informed consent explained the purpose of the study, guaranteed data confidentiality, and the respondent's right to withdraw at any time without any consequences. Only respondents who explicitly agreed to continue could continue.

The research phase began with the design of a structured questionnaire instrument based on three main research variables: post-internship teacher physical endurance, post-internship teacher work competence, and graduate work readiness. The questionnaire was distributed online via Google Forms and designed to take approximately 10–15 minutes to complete. Each statement was written in clear language and adapted to the context of final-year students at vocational high schools (SMKN) in Malang City, thus requiring no additional clarification during the filling process. The statement items were also contextually modified to be relevant to the experiences of students taught by teachers who had participated in industrial internship programs. Data collected automatically in Google Drive were downloaded and analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) to examine relationships among variables and assess the suitability of the research model. The analysis process included evaluating the measurement model (outer model) and the structural model (inner model) according to standard variance-based SEM procedures. The research results were then interpreted to answer the research objectives and test the formulated hypotheses.

2. Respondents

The population in this study consisted of all final year students at three vocational high schools in Malang City, namely SMKN 3, SMKN 6, and SMKN 8 Malang, with a total of 410 students. The sample was determined using a simple random sampling technique, which provides equal opportunity for each member of the population to be selected as a respondent. The number of samples was determined based on the opinion of Suharsimi (2006), who stated that sampling 20–25% of the total population is sufficient for survey research with a relatively homogeneous population.

Based on these criteria, this study collected data from 82 respondents, representing approximately 20% of the total population. The distribution of respondents per school is as follows: SMKN 3 Malang had 29 respondents (35.4%), SMKN 6 Malang had 37 respondents (45.1%), and SMKN 8 Malang had 16 respondents (19.5%). Regarding gender, there was a balanced distribution between male and female respondents, with 41 respondents in each group (50.0%), as shown in Table 1. This gender balance enhances the sample's representativeness and, if necessary, opens up opportunities for comparative analysis between groups. This sample size is considered adequate for PLS-SEM analysis, which is relatively tolerant of moderate sample sizes and is well-suited for testing the relationships between constructs in the research model.

Table 1. Distribution of Respondents by Gender and School

School	Man	Woman	Total	Percentage (%)
State Vocational School 3 Malang	2	27	29	35.4
State Vocational School 6 Malang	29	8	37	45.1
State Vocational School 8 Malang	10	6	16	19.5
Total	41	41	82	100

3. Research Instruments

The instrument used in this study was a non-test questionnaire developed independently and distributed via Google Forms to all respondents. The questionnaire used a Likert scale from 1 (Strongly Disagree) to 5 (Strongly Agree). The instrument was structured based on three main variables: first, post-internship teachers' physical resilience as the first independent variable (X1), which was measured through the consistency of teachers' attendance, stamina, and physical discipline in the learning process; second, post-internship teachers' work competency as the second independent variable (X2), which was measured through the suitability of the material to the world of work, the use of real-world practices in the classroom, and the introduction of industrial technology to students; and third, graduates' work readiness as the dependent variable (Y), which was measured through students' understanding of the world of work, motivation to participate in internships, and readiness to enter the industry after graduation. After an item selection process based on suitability to the research variables, the final instrument consisted of 18 statement items, evenly distributed across the three variables, with 6 items per variable. A complete description of the item distribution per variable is shown in Table 2 below.

Table 2. Distribution of Questionnaire Statement Items per Variable

Variables	Code	Indicator	Item No.	Amount
Skill Work (X2)	SW	Suitability of materials, real practice, and introduction of industrial technology	1, 2, 3, 4, 5, 6	6
Physical Endurance (X1)	PE	Consistency of attendance, stamina, and physical discipline of teachers after the internship	7, 8, 9, 10, 11, 12	6
Industry Competencies (Y)	IC	Understanding the world of work, internship motivation, and work readiness	13, 14, 15, 16, 17, 18	6
Total				18

4. Data analysis

The data from the questionnaire distribution were then analyzed using a Partial Least Squares Structural Equation Modeling (PLS-SEM) approach with SmartPLS 3. The analysis was carried out in two main stages: the evaluation of the measurement model (*outer model*) and the evaluation of the structural model (*inner model*) (Hair et al., 2019; Henseler et al., 2016). The review of *the outer model* aims to assess the relationship between the latent construct and its measuring indicators using the PLS algorithm. This stage includes testing convergent validity, discriminant validity, and instrument reliability (Ghozali & Latan, 2015). Convergent validity is evaluated using the *loading factor*, with an indicator considered valid if its loading is above 0.6 (Hair et al., 2017).

Furthermore, discriminant validity is tested to ensure that each latent construct has a clear conceptual distinction from the others. One approach used is the Fornell-Larcker criterion, which compares the root value of the Average Variance Extracted (AVE) to the correlation between constructs. A construct is considered to have good discriminant validity if the root value of the AVE is higher than the correlation with other constructs (Fornell & Larcker, 1981; Haryono, 2016).

Reliability testing was conducted to assess the internal consistency of the measurement model using Cronbach's Alpha and Composite Reliability. A construct is declared reliable if both values exceed the minimum limit of 0.7 (Hair et al., 2017; Savitri et al., 2021). Meanwhile, *inner-model evaluation* was used to analyze the causal relationships among latent variables developed based on the research's theoretical framework (Hair et al., 2019). Structural model testing was conducted using *bootstrapping* and *blindfolding procedures* in SmartPLS to estimate the significance of relationships among constructs (Chin, 1998). Several key indicators used in *inner model evaluation* include the coefficient of determination (R^2) to measure the ability of exogenous variables to explain endogenous variables, the effect size (f^2) to assess the magnitude of influence between constructs, and hypothesis testing via path coefficients *(*Hair et al., 2017). In addition, the overall model fit was evaluated using the *Goodness of Fit* (GoF) index, which is calculated by multiplying the average AVE by the average coefficient of determination (R^2), then taking the square root of the product. GoF values range from 0 to 1, with interpretations of small (0.10), medium (0.25), and large (0.36) categories (Tenenhaus et al., 2005; Kusuma et al., 2021).

Model fit in SEM is evaluated using several goodness-of-fit indices, such as SRMR, d_ULS, d_G, and NFI. SRMR measures the average standardized difference between observed and model-predicted correlations, with smaller values indicating better model fit. The d_ULS and d_G indices measure the difference between the empirical covariance matrix and the model's estimated covariance matrix, with lower values indicating a better fit. Meanwhile, NFI compares the model fit to the null model, with values closer to 1 indicating a better fit.

In this study, PLS-SEM modeling was applied to two groups of respondents: lecturers and students. The indicators used for each group, as presented in Table 1, were then constructed into latent variables in the PLS-SEM model. Furthermore, research hypotheses were formulated and tested based on the relationships between constructs developed within the research conceptual framework.

Results

Evaluation Results of Measurement Model (*Outer Model*)

In this study, the PLS model uses three indicators (latent variables), including physics endurance, skill work, and industry competencies. Based on the PLS model analysis of all statements for each latent variable, several statements with *loadings* <0.6 were identified as having poor validity, including 1 statement in the latent variable Physics Endurance (PE4). Therefore, these statements were removed from the model. By looking at *the loading factor* for each PLS model, a PLS model was obtained with all latent-variable statements>0.6, as shown in Figure 1 below.

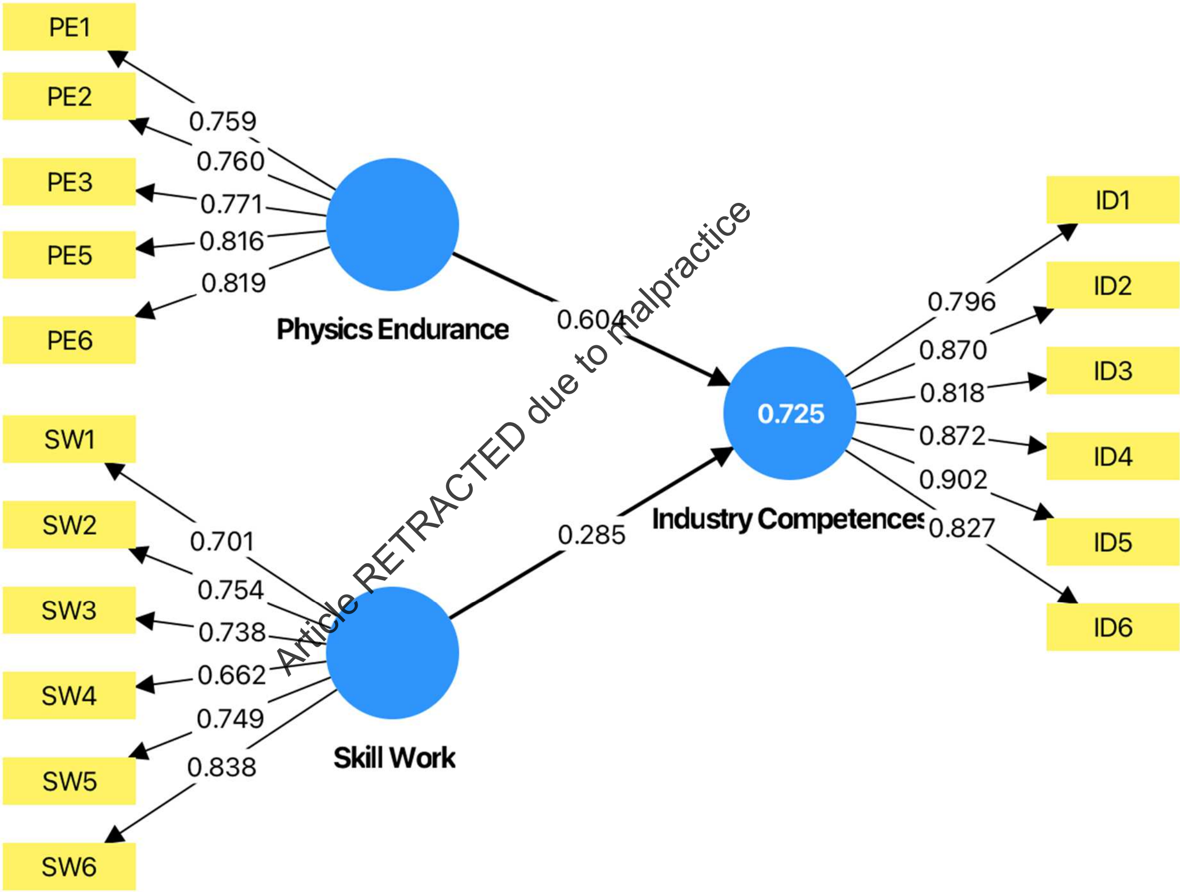

Figure 1. PLS Model of All Statements in Valid Latent Variables

Based on the latest PLS model, all indicators have loading factors> 0.6. This indicates that all indicators are valid. Furthermore, the results of the measurement model evaluation (outer model) for the lecturer's PLS model can be described as follows:

a. *Convergent Validity* Testing

PLS-SEM contains two types of validity: convergent validity and discriminant validity. Convergent validity indicates that a set of statements reflects a single latent variable and is the basis for that latent variable. The results of the convergent validity assessment of the PLS model for lecturers are presented in Table 3 below.

Table 3. Results of *Convergent Validity Testing* of the PLS Model for Lecturers

	Industry Competences	Physics Endurance	Skill Work
ID1	0.796		
ID2	0.871		
ID3	0.817		
ID4	0.873		
ID5	0.901		

ID6	0.827		
PE1		0.725	
PE2		0.747	
PE3		0.764	
PE4		0.593	
PE5		0.827	
PE6		0.819	
SW1			0.701
SW2			0.754
SW3			0.738
SW4			0.662
SW5			0.750
SW6			0.838

The Table 3 shows that *the loading factor value* of all statement items is > 0.6. Thus, it can be concluded that all statement items in the questionnaire are declared convergently valid (Haryono 2016).

b. ***Discriminant Validity* Testing**

Testing *Discriminant validity* can be assessed using the *Fornell-Larcker criterion*. If the square root of the √AVE is higher than the correlation with other constructs, it can be concluded that the construct has good *discriminant validity. The results of the discriminant validity test* for each PLS model variable are shown in Table 4 below.

Table 4. *Fornell Lacker Criterion* Testing of PLS Model Lecturer

Variables	Industry Competences	Physics Endurance
Industry Competences		
Physics Endurance	0.933	
Skill Work	0.878	0.966

Based on the Table 4, the AVE root values for each variable are greater than the correlation between the construct and other constructs. Therefore, it can be concluded that each construct has good discriminant validity (Budhiasa 2016; Haryono 2016; Murniati et al. 2013; Savitri et al. 2021).

c. Reliability Testing

The results of the reliability test for the latent variables used in the PLS model for lecturers are shown in Table 5 below.

Table 5. Results of the Lecturer's PLS Model Reliability Test

Variables	*Cronbach's alpha*	*Composite reliability*
Industry Competences	0.922	0.939
Physics Endurance	0.842	0.884
Skill Work	0.836	0.88

Based on Table 5 above, *Cronbach's Alpha* and *Composite Reliability values* for all variables are > 0.70 (Haryono 2016; Savitri et al. 2021). Therefore, all variables are reliable, and each item is valid in measuring the construct of each variable.

Structural Model Evaluation Results (*Inner Model*)

The evaluation of the PLS-SEM structural model for lecturers is conducted using a *bootstrapping procedure,* as illustrated in Figure 2.

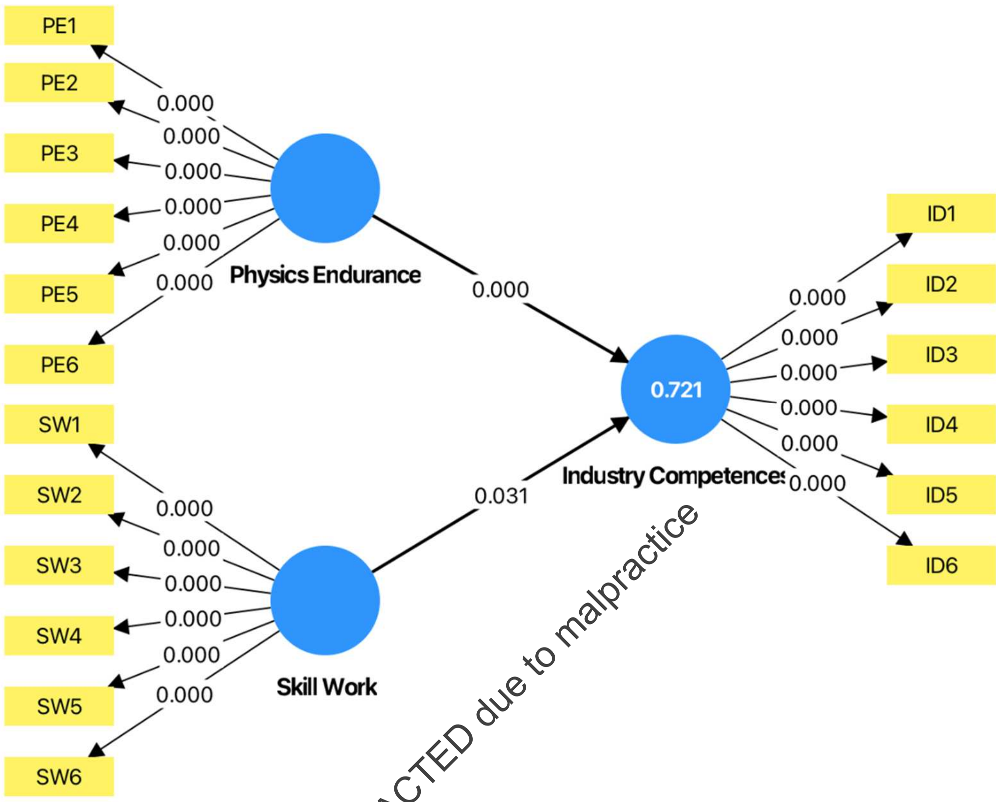

Figure 2. *Bootstrapping* Model for PLS Model Path Analysis

Evaluation of the PLS-SEM structural model for lecturers from this study is as follows:

a. R *Square*

The R *Square* (R^2) value can be used to determine the extent to which exogenous variables explain the variability in endogenous variables. Haryono (2016) and Savitri et al. (2021) *reported R-square values* of 0.67 (strong), 0.33 (moderate), and 0.19 (weak). The results of the R *Square value obtained* for each PLS model variable for lecturers can be seen in Table 6 below:

Table 6. Results of the R Square Test of the PLS Model

Variable	*R-square*	*R-square adjusted*	Information
Industry Competences	0.721	0.714	Moderate

Based on the SEM analysis results in Table 6, the adjusted R-square value for the Industry Competences variable is 0.714. This indicates that 71.4% of the variation in Industry Competences can be explained by the independent variables in the model, namely work skills, physical endurance, and (if used) the interaction between the two in the structural model. Meanwhile, the remaining 28.6% is explained by other factors outside this research model that were not included in the analysis. The adjusted R-square value, which falls in the moderate category, indicates that the structural model has strong predictive ability, suggesting that the exogenous constructs in this study are able to explain industry competencies. Thus, the SEM model constructed can be empirically deemed feasible for representing the relationships among the variables studied (Haryono, 2016; Savitri et al., 2021).

b. *Effect Size* (F *Square)*

F- *square* value is used to calculate the magnitude of the influence between variables using *Effect Size.* The results of the F-test for each variable in the PLS model for lecturers are shown in Table 5 below.

Table 7. Results of the F-*Square* PLS Model Test

Variables	Industry Competences
Industry Competences	
Physics Endurance	0.444
Skill Work	0.103

Based on the effect size (f-square) analysis, the Physical Endurance variable shows a value of 0.444 for Industry Competences. This value is in the large effect category, indicating that physical endurance makes a substantial contribution to explaining variations in industrial competencies. In other words, physical endurance is a dominant factor that significantly influences the formation of industrial competencies in the tested structural model. Meanwhile, the Skill Work variable has an f-square value of 0.103 for Industry Competences, which falls within the small-to-medium effect category. This indicates that although skill work influences industrial competencies, its contribution is relatively minor compared with physical endurance in this model. Overall, these findings confirm that physical endurance plays a more substantial practical role in improving industrial competencies than skill work, although both still contribute to the model.

c. Hypothesis Testing

The results of the PLS model hypothesis test for lecturers are shown in Table 8 below.

Table 8. Summary Results of the Lecturer's PLS Model Hypothesis Test

	Path Coefficient	T Statistics	P Values
Physics Endurance -> Industry Competences	0.604	4,835	0
Work Skills -> Industry Competences	0.285	2,084	0.037

Based on the SEM results for the structural model, the Physical Endurance variable has a positive and significant effect on Industry Competences, with a path coefficient of 0.604, a T-statistic of 4.835, and a p-value of 0.000 ($p < 0.05$). These results indicate that increasing physical endurance can significantly improve industry competence. Thus, the hypothesis that physical endurance affects industry competencies is accepted.

Furthermore, the Skill Work variable also shows a positive and significant influence on Industry Competences, with a path coefficient value of 0.285, a T-statistic of 2.084, and a p-value of 0.037 ($p < 0.05$). This finding indicates that work skills contribute significantly to improving industry competencies, although the magnitude of their influence is relatively smaller than that of physical endurance. Therefore, the hypothesis stating that skill work influences industry competencies is also accepted. Overall, the results of the hypothesis test confirm that both physical endurance and skill work are essential determinants of industry competencies, with physical endurance exerting a more dominant influence in the SEM model tested.

d. *Goodness of Fit* (GoF)

Table 9. Results of SEM Model Goodness of Fit Evaluation

	Saturated model	Estimated model
SRMR	0.084	0.084
d_ULS	1,213	1,213
d_G	0.854	0.854
NFI	0.703	0.703

Based on the results of the goodness of fit evaluation, the Standardized Root Mean Square Residual (SRMR) value was obtained at 0.084 for both the saturated model and the estimated model. This value is slightly above the ideal limit of 0.08 but still in the acceptable fit category, indicating that the model generally has a good level of fit between the empirical data and the constructed model structure. Furthermore, the d_ULS (Unweighted Least Squares discrepancy) value of 1.213 and the d_G (Geodesic discrepancy) value of 0.854 indicate a relatively small difference between the observed and predicted covariance matrices, suggesting that the structural model has an adequate fit. Meanwhile, the Normed Fit Index (NFI) of 0.703 indicates that the model explains approximately 70.3% of the relative fit compared to the null model. Although it has not met the ideal criterion (>0.90), this value is still acceptable in the PLS-SEM approach, which places greater emphasis on the model's predictive ability. Overall, the goodness-of-fit results indicate that the SEM model has a good fit and is suitable for further structural analysis, particularly for testing the relationships among physical endurance, work skills, and industry competencies.

Discussion

Physical endurance is a fundamental aspect for vocational school graduates, especially those entering highly physically demanding jobs such as construction and plumbing (Kozina et al., 2023; Sobko et al., 2022). In these jobs, graduates are faced with repetitive, strenuous activities over long periods, requiring peak physical condition to complete tasks effectively and safely. A good level of endurance allows workers to maintain performance without fatigue, which ultimately affects productivity and workplace safety (Mawangi & Pramudhita, 2023; Prianto et al., 2025). Therefore, various vocational fields use standardized fitness tests, such as running tests, strength tests, and other measures of physical capacity, as indicators of work readiness. Establishing clear endurance standards aligned with industry needs is crucial to ensuring that graduates truly meet the physical requirements of the workplace and adapt to job demands from the outset of their professional careers.

Beyond influencing employability, physical endurance also plays a significant role in the health, well-being, and long-term career sustainability of vocational school graduates (Mizoguchi et al., 2022; Somerville et al., 2019). Individuals with good physical endurance tend to have better health and a lower risk of conditions such as obesity and cardiovascular disease, which often result from a lack of physical activity. Regular physical activity not only impacts physical health but also positively correlates with mental health, including reduced stress and depression levels and improved emotional well-being. In this context, vocational schools play a strategic role in integrating structured physical training programs into the curriculum, whether through physical education, endurance training, or technology such as fitness apps. Programs that include measurable assessment systems and standards, and take into account the differences in student characteristics, including gender, will make training more effective. Thus, strengthening physical endurance not only prepares graduates for the physical demands of the job but also supports their long-term health and career sustainability.

The importance of physical endurance for vocational school graduates is gaining increasing attention as physical demands increase in various industrial sectors, particularly construction and manufacturing (Grote, 2006; Mutohhari et al., 2021; Widiaty et al., 2021). In a workplace characterized by manual labor, heavy lifting, working in specific positions, and maintaining performance over long hours, physical endurance is a determining factor in graduates' employability. Employers tend to seek workers who not only possess technical skills but can also meet the physical demands of the job without quickly experiencing fatigue or injury. Graduates with high levels of physical fitness and endurance have been shown to achieve optimal work performance, have a lower risk of workplace accidents, and be more productive. Furthermore, physical endurance contributes to psychological resilience, including the ability to maintain focus, consistency, and work efficiency under challenging working conditions. Therefore, physical endurance cannot be viewed simply as a health aspect, but rather as an integral part of job competencies that significantly impact graduates' performance and success in the job market.

In this context, vocational schools have a strategic role in preparing students to develop physical endurance that meets industry needs. Integrating physical endurance training into vocational curricula, particularly through structured and contextualized physical education programs, is a crucial step that needs to be developed. These programs can be designed through regular fitness assessments, training tailored to the field of expertise, and collaboration with industry to ensure alignment between school training and the physical demands of the workplace. Furthermore, implementing practical learning through real-life physical activities, such as model factory teaching, fieldwork, and outdoor games, can improve students' endurance and employability skills. From an employer's perspective, physical endurance is highly valued because it affects workers' long-term performance and careers. Therefore, strengthening physical endurance through vocational education not only improves graduates' readiness to enter the workforce but also supports their career sustainability and competitiveness in physically demanding industries.

In addition to physical endurance, vocational school students must also master work skills. Furthermore, vocational school graduates are required to possess a combination of technical and soft skills to compete effectively in the manufacturing industry and other ever-evolving sectors. In terms of technical skills, mastery of specific competencies within their field of expertise is a key foundation, including proficiency in information technology, digital literacy, and foreign language proficiency relevant to global industry needs. This is increasingly important in the context of the Industrial Revolution 4.0, which emphasizes automation, digital systems, and the integration of smart technology into production processes. Today's industrial world requires a workforce capable not only of operating modern equipment but also of understanding digital technology-based production systems. Furthermore, practical learning experiences such as internships, industrial work experience, and factory-based teaching play a crucial role in equipping students with real-world experience. Through these hands-on experiences, students not only hone their technical skills but also develop a work ethic, discipline, and an understanding of industrial culture, significantly enhancing graduates' readiness and competitiveness in the job market.

In addition to technical skills, soft skills are a determining factor in the success of vocational school graduates in the modern workforce (Dogara et al., 2019; Schepper et al., 2021). Communication, teamwork, problem-solving, and adaptability to the work environment are competencies increasingly prioritized by employers, often even alongside technical skills in the recruitment process. The industrial work environment demands cross-divisional collaboration and effective communication to ensure efficient work processes. Therefore, vocational education institutions need to integrate soft skills training into their curriculum through interactive, participatory, and project-based learning methods that encourage students to communicate and collaborate actively. Furthermore, holding industry certifications and participating in continuing education are significant added value for graduates, demonstrating both recognized competence and a commitment to staying abreast of technological developments and industry needs. Aligning the curriculum with the needs of the business and industrial world, through close collaboration between schools and industry stakeholders, is key to producing graduates who are not only technically competent but also possess strong soft skills relevant to today's job market demands. Based on Research findings regarding the Influence of physical endurance and work skills on the competitiveness of vocational high school graduates in the industrial world, it is recommended that teachers not only focus on mastering technical Material, but also integrate the development of work skills such as discipline, teamwork, responsibility, and problem-solving as well as the habituation of activities that support physical endurance through contextual learning with industry needs. Schools are expected to strengthen policies and programs for physical development and work skills in a structured and sustainable manner by adapting practice-based curricula, teaching factories, and industrial work practices, supported by adequate infrastructure and regular evaluations of students' physical readiness and competency. Meanwhile, the government needs to use the results of this research as a basis for formulating a more comprehensive vocational education policy by balancing the development of technical skills, work skills, and physical endurance, strengthening partnerships between vocational high schools and the industrial world, and providing support in the form of teacher training, standardization of graduate competencies, and provision of resources so that vocational high schools can produce healthy, competent, and highly competitive graduates.

Conclusions

Based on the SEM analysis results, it can be concluded that physical endurance and skill work play a significant role in shaping the industry competencies of vocational high school students. The research model demonstrated strong predictive ability, with both exogenous variables accounting for more than 70% of the variation in industry competencies. Physical endurance was found to have the greatest influence on industry competencies, with a large effect size, indicating that it is a crucial factor in supporting students' work readiness in industrial environments that demand continuous physical activity. Meanwhile, skill work also had a positive and significant effect, though its contribution was smaller than that of physical endurance. The goodness-of-fit evaluation results indicated that the SEM model developed had an adequate level of fit and was suitable for use in structural relationship analysis.

Overall, this study confirms that vocational high school students' industry competencies are not only determined by work skills but also significantly influenced by physical readiness. Therefore, the development of vocational education curricula needs to systematically integrate programs to improve physical fitness and endurance, along with strengthening work skills, to produce graduates who are better prepared, more productive, and more competitive in the industrial world.

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Notes On Revisions That Have Been Made

No.	Part of the article	Reviewer's Notes	Revision
1	Method	There are NO ethical issues or whether the questionnaire was approved by the relevant committee, or any reference to informed consent.	The methods subtopic states that the study received ethical approval from the relevant institutional research ethics committee (The research permit letter is provided as evidence of ethical issues, indicating that the study had been approved by the relevant committee in **Appendix 1.**), and all respondents provided written informed consent via the Google Forms landing page. (This is evidenced by a screenshot of the initial Google Form in **Appendix 2**)
		The Google Forms questionnaire used lacks details regarding its duration, whether questions were clarified in any way, whether some questions were contextualized, etc.	The questionnaire's data collection process, including duration and clarification of statements tailored to the respondents (high school students), has been narrated.
		There were 82 respondents, but it would be interesting to highlight any differences between men and women, as this information could be valuable.	This has been added to the Respondents subtopic in Table 1.
2	Method and Result	In Table 1 (and other tables), it is worth considering removing the vertical lines and using only horizontal lines.	The table has been adjusted according to the reviewer's notes (removing the vertical lines and using only horizontal lines).

Appendix 1.

KEMENTERIAN PENDIDIKAN TINGGI, SAINS
DAN TEKNOLOGI
UNIVERSITAS NEGERI MALANG (UM)
FAKULTAS ILMU PENDIDIKAN (FIP)
Jalan Semarang 5, Malang 65145
Telpon: 0341 551312 Psw. 1215, Faksimile: 0341-565434
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Nomor : 11.2.1/UN32.1.1/KM/2024 11 Februari 2025
Hal : Permohonan Izin Penelitian a.n. Winda Fashihah, S.Pd., M.M

Yth. Kepala Sekolah SMKN 3 Kota Malang
Jalan Surabaya No. 1, Gadingkasri, Kecamatan Klojen, Kota Malang, Jawa Timur

Dengan hormat kami beritahukan bahwa mahasiswa Fakultas Ilmu Pendidikan Universitas Negeri Malang:

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"Strategi Program Guru Magang Berbasis Industri Dalam Meningkatkan Kualitas Lulusan Yang Siap Kerja (Studi SMKN Kota Malang)"

Dosen Pembimbing I : Prof. Dr. A. Supriyanto, M. Pd, M.Si
Dosen Pembimbing II :Dr. Agus Timam, M.Pd
Dosen Pembimbing III : Dr. Syamsul Hadi, M.Pd., M.Ed

Waktu pelaksanaan penelitian dilaksanakan pada 17 Februari 2025-17 Agustus 2025 bertempat di SMKN 3 Kota Malang.

Untuk keperluan tersebut, kami mohon Bapak/Ibu berkenan memberikan ijin kepada mahasiswa yang bersangkutan untuk melaksanakan kegiatan yang dimaksud.

Atas perhatian dan kerjasama yang baik, kami sampaikan terima kasih

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Untuk keperluan tersebut, kami mohon Bapak/Ibu berkenan memberikan ijin kepada mahasiswa yang bersangkutan untuk melaksanakan kegiatan yang dimaksud.

Atas perhatian dan kerjasama yang baik, kami sampaikan terima kasih

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"Strategi Program Guru Magang Berbasis Industri Dalam Meningkatkan Kualitas Lulusan Yang Siap Kerja Di Kota Malang (Studi Multi Situs SMKN 3, 6, dan 11 Kota Malang)"

Dosen Pembimbing I : Prof. Dr. A. Supriyanto, M. Pd, M.Si
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Waktu pelaksanaan penelitian dilaksanakan pada 17 Februari - 17 Agustus 2025 bertempat di SMKN 6 Kota Malang.

Untuk keperluan tersebut, kami mohon Bapak/Ibu berkenan memberikan ijin kepada mahasiswa yang bersangkutan untuk melaksanakan kegiatan yang dimaksud.

Atas perhatian dan kerjasama yang baik, kami sampaikan terima kasih

a.n. Dekan
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UNIVERSITAS NEGERI MALANG
KEMENTERIAN PENDIDIKAN, KEBUDAYAAN, RISET, DAN TEKNOLOGI

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Universitas Negeri Malang

Appendik 2.

ANGKET PENELITIAN UNTUK SISWA

Penelitian ini mengkaji **pengaruh ketahanan fisika (physical endurance) dan kompetensi kerja (work competence) guru pasca magang industri** terhadap kesiapan kerja lulusan SMK dalam menghadapi dunia industri. Angket ini terdiri dari **18 pernyataan** dan membutuhkan waktu **10–15 menit**.

Pernyataan Persetujuan Partisipasi (Informed Consent)

Dengan melanjutkan pengisian angket ini, Anda menyatakan bahwa:

1. Anda berpartisipasi secara **sukarela** tanpa tekanan dari pihak manapun.
2. Seluruh data yang Anda berikan akan **dijaga kerahasiaannya** dan hanya digunakan untuk keperluan akademik.
3. Identitas pribadi Anda **tidak akan dipublikasikan** dalam bentuk apapun.
4. Anda berhak **mengundurkan diri** sewaktu-waktu tanpa konsekuensi apapun.
5. Penelitian ini telah mendapat **persetujuan etik** dari komite etik [Nama Institusi], No. [xxx/xxx/xxxx].

* Indicates required question

Saya telah membaca, memahami, dan **menyetujui** untuk berpartisipasi dalam penelitian ini. *

☐ Option 1

Nama *

Your answer

Nomor Telepone (WA) *

Your answer

Jenis Kelamin *

○ Laki-Laki

○ Perempuan

Usia (tahun) *

Your answer

Nama Sekolah *

Your answer