JPPIPA 11(8) (2025)

Jurnal Penelitian Pendidikan IPA

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Factors Influencing the Success of the Tefa Automotive Program in Improving the Work Skills of Private Vocational School Students Nias Regional Government

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Received: June 11, 2025
Revised: July 22, 2025
Accepted: August 25, 2025
Published: August 31, 2025

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DOI: 10.29303/jppipa.v11i8.12267

Abstract: The misalignment between Vocational High School (SMK) activities and the dynamics of industrial needs is a significant challenge in the vocational education system. This phenomenon not only has an impact on the increasing unemployment rate of vocational high school graduates but also has the potential to hamper innovation and competitiveness of the national industry due to the shortage of skilled workers who match market needs. One crucial problem that often arises in the context of vocational education in Indonesia is the disparity between the competencies produced by Vocational High School graduates and the specific demands required by the industrial world. This study aims to analyze the influence of internal and external factors on the success of the Teaching Factory (TEFA) program in improving student work skills at the Nias Regional Government Private Vocational High School. This study uses a quantitative approach with a correlation method. Data were collected through questionnaires given to students of the Light Vehicle Engineering Expertise Program who have participated in the TEFA program. Data analysis techniques used validity, reliability, and multiple regression tests. The results of the study indicate that internal factors, such as teacher competence, curriculum, facilities, and student involvement, as well as external factors such as industry partnerships, internship programs, and government support, significantly influence the success of TEFA. These findings underscore the importance of synergy between schools, industry, and government in providing vocational education that is responsive to the needs of the workforce.

Keywords: External factors; Internal factors; Teaching Factory; Vocational high school; Vocational education; Work skills

Introduction

Educational relevance relates to the match between the skills acquired through education and job requirements. Relevant education should produce individuals with the potential to overcome the challenges and demands of life today. Education is expected to address existing problems, particularly the societal demand for low educational relevance. (Swennen 2024); (Sultana et al. 2025). In accordance with the statement above, the Private Vocational High School (SMK) of the Nias Regional Development (Pembda) strives to innovate in line with community expectations through the Tefa program. Through Tefa, students gain relevant work experience, learn to collaborate, operate industrial equipment, and produce products or services with market value. Tefa not only aims to improve technical competency according to industry standards but also fosters an entrepreneurial spirit. This equips students with the work habits, culture, and discipline

How to Cite:
Zalukhu, S. J., Ambiyar, Giatman, M., & Irfan, D. (2025). Factors Influencing the Success of the Tefa Automotive Program in Improving the Work Skills of Private Vocational School Students Nias Regional Government. *Jurnal Penelitian Pendidikan IPA*, *11*(8), 1217–1227. https://doi.org/10.29303/jppipa.v11i8.12267

required in the industrial world, making them better prepared to compete in the job market.

The Private Vocational High School (SMK) of the Nias Regional Development (Pembda), for example, has innovated by implementing the Tefa Automotive program, creating a learning environment similar to a workshop for light vehicle repairs, to increase the relevance of education to the needs of society and industry (Suyitno 2022); (Kokkinopoulou, Vrontis, and Thrassou 2025). Although Vocational High Schools (SMK) are designed to prepare graduates ready for work, education in Indonesia faces a significant challenge: low relevance to industry demands. This often leads to a mismatch between graduate competencies and job market needs, ultimately contributing to high unemployment rates among vocational high school graduates and hampering national industrial productivity (Kholifah et al. 2025); (Astuti and Setyonaluri 2022). Law Number 20 of 2003 concerning the National Education System emphasizes the importance of relevant education to produce skilled individuals ready to face global challenges.

To address this challenge, the government launched the SMK Center of Excellence (SMK PK) Program, which focuses on improving the quality of vocational high schools through partnerships with businesses and industry. One key implementation of this program is the Teaching Factory (Tefa). Tefa is a learning approach that integrates theory and practice in an environment that mimics real industry (Anggitan and Gunadi 2025). Learning that integrates theory and practice in an industry-like setting. Through collaboration between schools and industry, students not only learn theoretically but also gain practical experience relevant to job market needs. Tefa activities are ideal for improving student competency (Tanjung et al. 2025); (Surya Patria et al. 2024). This is crucial for preparing students for the workforce, as they are already accustomed to performing similar tasks performed in business and industry (Rizun, Revina, and Meister 2021); (Bhardwaj and Kalia 2021).

Both business and industry encompass activities, work methods, work culture, and work discipline, thus providing competencies aligned with the demands of industry and the workplace (Sarah, Sjahri, and Patisina 2023); (Zhang et al. 2023). Tefa Learning in Vocational High Schools Addresses the Challenges of the Industrial World. This research uses a literature review method. (Pech and Vrchota 2022); (Henriques, Figueiredo, and Nunes 2023), Product- and service-based learning that adheres to industry standards and procedures. In its implementation, the Nias Regional Government Private Vocational School creates a learning environment that mimics industrial working conditions, with students directly involved in the repair process of light vehicles. This not only enhances their understanding of the theory taught in class but also provides much-needed practical experience in the workplace.

Tefa in vocational schools is not specifically developed, but rather through formulating (Widiatna, Utami, and Kemal 2025), utilizing, organizing, and conditioning several components of the National Education Standards (SNP) in schools in such a way that they reflect the factory or workplace ecosystem (Roll and Ifenthaler 2021). Tefa is a learning model believed to be able to improve students' competencies and character according to workplace standards (Heriansyah 2020). Based on this explanation, Tefa can be defined as a learning model that combines competency achievement through school activities and production processes in accordance with workplace procedures and standards, to produce competent and character-based graduates through the completion of products as learning media in the form of goods and services (Zamiri and Esmaeili 2024); (Poláková et al. 2023).

Based on the above background, this study was conducted with the objectives of: Revealing the experiences of teaching staff in the automotive Tefa program at the Nias Regional Government Private Vocational School; Revealing the skills readiness of students in the automotive Tefa program at the Nias Regional Government Private Vocational School; Revealing the effectiveness of the project-based Tefa program in student practical activities; Revealing significant factors that influence the success of the automotive Tefa program at the Nias Regional Government Private Vocational School.

Method

Research Type

This study uses a quantitative correlational method to measure the relationship between variables. The independent variables are Internal Factors (X1) and External Factors (X2), while the dependent variable is Student Work Skills Improvement (Y).

Research Time and Location

The study will be conducted from April 5 to June 28, 2025, at the Nias Regional Government Private Vocational School (SMK Pembda Nias).

Population and Sample

The study population is all students in the Light Vehicle Engineering Expertise Program at the Nias Regional Government Private Vocational School, totaling 177 students (consisting of grades XI TKR 1, XI TKR 2, XII TKR 1, XII TKR 2, and XII TKR 3). The study

sample consists of 123 students, determined using the Taro Yamane formula with a 5% precision level. The sampling technique used is probability sampling, which involves random and proportional clustering.

Operational Definition of Variables

Internal Factors (X1): School capacity to manage resources, curriculum, and learning ecosystems that approximate real industry conditions, to support the implementation of Teaching Factory (TEFA); External Factors (X2): Elements outside the school's control that influence TEFA implementation, including government support (policies, funding, training), partnerships with industry (Business World, Industry World, World of Work - DUDI), and community participation; Vocational High School Student Skills Improvement (Y): Improvement in student abilities, including hard skills (automotive technical skills such as maintenance, repair, diagnosis) and soft skills (communication, teamwork, time management, discipline, work ethic) acquired through the TEFA program.

Research Instrument

The main instrument was a closed-ended questionnaire with a Likert scale with five response options: For variable Y (Vocational High School Student Skills Improvement), the scale used was Very Satisfied (5) to Very Dissatisfied (1); for variable X1 (Internal Factors), the scale used was Very Agree (5) to Strongly Disagree (1); For variable X2 (External Factors), the scale used was Very Satisfied (5) to Very Dissatisfied (1). Each variable had 40 items, for a total of 120 items. The instrument was structured based on indicators and analyzed using SPSS version 30.0.0.

Instrument Trial

The instrument trial was conducted on 30 teachers outside the main sample: Validity: All 120 items of the instrument were declared valid, as the corrected item-total correlation exceeded the r table (0.361); Reliability: All variables demonstrated very high reliability (Cronbach's Alpha) (Y = 0.975; X1 = 0.991; X2 = 0.993), indicating the instrument is reliable and consistent.

Data Collection Techniques

Data were collected through direct questionnaire distribution to respondents. This process included: Instrument development (based on indicators with a Likert scale); Determination of data sources (Principal, Vice Principal for Curriculum, Head of TEFA Workshop, productive teachers, TEFA students, industrial instructors, and consumers); Distribution and collection of questionnaires (in person); Assistance and validation of responses; Data processing and analysis using SPSS.

Data Analysis Techniques

Data were analyzed using correlation regression statistics with SPSS 30.0.0:

Descriptive Analysis

Describing the frequency distribution of data and respondent achievement levels (Very Good, Good, Fair, Poor, Poor) using percentages, mode, median, and mean.

Analysis Requirements Testing:

Normality Test: Checking whether the data is normally distributed (coefficient of variance <30%); Linearity Test: Testing for linear relationships between variables (significance >0.05); Independence: Checking for correlations between independent variables (using product-moment correlation).

Hypothesis Testing:

Hypothesis 1 & 2: Using Product Moment correlation and simple regression to test the relationship and significance between each independent variable (X1, X2) on the dependent variable (Y). A t-test is also performed for individual significance; Hypothesis 3: Using multiple regression to determine the correlation and simultaneous influence of X1 and X2 on Y. An F-test is also performed to examine the effect of the independent variables together; The Coefficient of Determination (R^2) and Contribution Coefficient will be calculated to determine the extent of the independent variable's contribution to the dependent variable; Partial correlation will also be used to examine the relationship of each independent variable with the dependent variable while controlling for other variables.

Results and Discussion

Data Description

The following description presents the research data, which includes Improving Vocational High School Students' Skills (Y) as the dependent variable and Internal Factors (X1) and External Factors (X2) as the independent variables. This data description is conducted to describe the condition of each variable, including the following: average score (mean), median, mode, standard deviation, lowest score (minimum), highest score (maximum), and total score (sum). The statistical calculations of the collected data for the three variables can be seen in Table 1 below:

Table 1. Description of Research Data Y, X1 and X2

		Statistics		
		Improving the Skills of Vocational High School Students (Y)	Internal Factor (X1)	External Factors (X)
N	Valid	122	122	122
	Missing	0	0	0
Mean		124.12	142.25	166.40
Median		132.00	2.54	2.72
Mode		132	140.00	169.00
Std. Deviation		30.28	160	160
Variance		917.05	28.117	30.09
Range		121	790.555	905.51
Minimum		44	-.062	-1.83
Maximum		165	.219	.219
Sum		20232	.313	4.29

Based on Table 1. the data of the three variables are described as follows: Improving the Skills of Vocational High School Students (Y). Based on the Job Suitability variable data, it is known that the distribution of scores spreads from the lowest score (minimum) of 66 and the highest of 200, from 122 respondents (N = 122), the average score (mean) is 142.25, the middle value (median) is 140.00, the score that often appears (mode) is 160, the standard deviation (std deviation) is 28.11, and the variance is 790.55. To present the data on Improving the Skills of Vocational High School Students in the form of frequency distribution and histogram, it is necessary to determine the number of classes and class intervals as follows:

Many classes (k)= 1 + 3.30 Log N
= 1 + 3.30 Log 122
= 1 + 3.30 x 2.08
= 1 + 6.88 = 7.80 taken 8

$$Interval = \frac{Highest\ value - Lowest\ value}{Many\ classes} \quad (1)$$

$$= \frac{200 - 66}{8}$$

$$= 16.75\ taken\ 17$$

To clarify the number of interval classes, the calculated interval classes are arranged in a frequency distribution list, as shown in Table 2 below.

Table 2. Frequency Distribution of Scores for Improving Vocational High School Students' Skills (Y)

Interval Class	Frequency	Percentage (%)
66	1	.80
69	1	.80
73	1	.80
77	1	.80
87	1	.80
90	1	.80
101	1	.80
103	1	.80
105	1	.80
109	1	.80
110	1	.80
111	1	.80
114	1	.80
115	2	1.60
116	1	.80
117	2	1.60
118	1	.80
120	3	2.50
121	2	1.60
122	3	2.50
123	3	2.50
124	2	1.60
126	3	2.50
127	2	1.60
128	4	3.30
130	1	.80
131	2	1.60
132	2	1.60
133	2	1.60
134	2	1.60
135	1	.80
136	2	1.60
137	3	2.50
138	2	1.60
139	1	.80
140	4	3.30
141	1	.80
143	2	1.60
144	3	2.50
147	1	.80
148	4	3.30
149	1	.80
151	2	1.60
152	1	.80
153	1	.80
154	3	2.50
155	2	1.6
156	1	.80
157	3	2.5

Interval Class	Frequency	Percentage (%)
158	2	1.60
159	1	.80
160	7	5.70
162	2	1.60
163	1	.80
164	1	.80
169	1	.80
173	1	.80
174	1	.80
175	1	.80
177	1	.80
178	2	1.60
180	2	1.60
181	1	.80
189	1	.80
190	1	.80
193	1	.80
197	1	.80
198	1	.80
199	1	.80
200	4	3.30
Amount	163	100.00

By paying attention to Table 2. above, a histogram can be drawn of the Improvement of Vocational High School Students' Skills as seen in Figure 2.

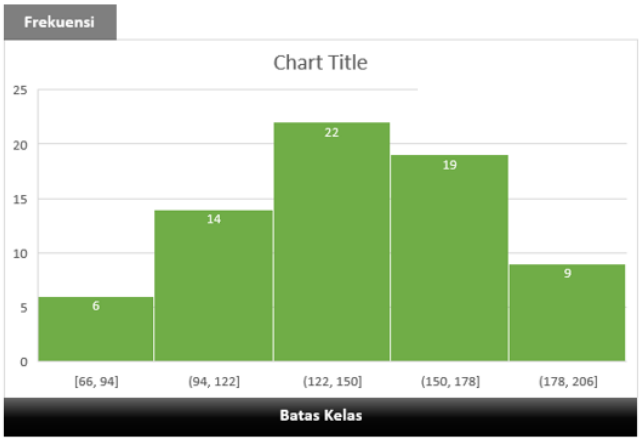

Figure 2. Histogram of Improving Vocational High School Students' Skills

Based on Table 2, the frequency distribution of scores for the variable "Improving Vocational High School Students' Skills" (Y) shows a fairly wide spread, ranging from the lowest score of 66 to the highest score of 200. The total number of respondents was 163. The frequency of scores is distributed with a gradual increasing trend, peaking at a score of 160, with the highest frequency being 7 students (5.7%), followed by scores such as 128, 140, 148, and 200, each with a frequency of 4 students (3.3%). Most scores have a low frequency, with only 1 or 2 students, indicating the diversity of student skill achievement. This distribution pattern is visually depicted in Figure 2 in the form of a histogram, where the distribution tends to spread to the right (positively skewed), although there is a higher concentration of scores in the middle to upper intervals. This indicates that the majority of students have demonstrated significant skill improvement, although a small number of students still have low skill scores. This histogram supports the interpretation that there is a positive trend in improving the skills of the vocational high school students studied.

Internal Factor (X1)

Based on the Internal Factor variable data, the distribution of scores is known to be spread from a minimum of 47 to a maximum of 200. From 122 respondents (N = 122), the average score is 166.40, the median is 169.00, the most frequently occurring score (mode) is 160, the standard deviation is 30.09, and the variance is 905.51. To present Internal Factor data in the form of a frequency distribution and histogram, it is necessary to determine the number of classes and their class intervals as follows:

Number of classes (k) = 1 + 3.30 Log N
= 1 + 3.30 Log 122
= 1 + 3.30 x 2.08
= 1 + 6.88 = 7.80, taking 8 as the number of classes

$$Interval = \frac{Highest\ value - Lowest\ value}{Many\ classes} \quad (1)$$
$$= \frac{200 - 47}{8}$$
$$= 19.12\ taken\ 19$$

To clarify the number of interval classes, the calculated interval classes are arranged in a frequency distribution list, as shown in Table 3 below.

Table 3. Frequency Distribution of Internal Factor Variable Scores (X1)

Interval Class	Frequency	Percentage (%)
47	1	.80
61	2	1.60
69	1	.80
80	1	.80
93	1	.80
104	1	.80
107	1	.80
117	1	.80
121	1	.80
123	1	.80
135	1	.80
140	1	.80
143	1	.80
149	2	1.60
152	1	.80

Interval Class	Frequency	Percentage (%)
153	1	.80
154	1	.8
155	3	2.50
156	1	.80
158	3	2.50
159	5	4.10
160	17	13.90
161	2	1.60
162	1	.80
164	4	3.30
165	2	1.60
166	1	.80
167	2	1.60
169	2	1.60
170	4	3.30
171	1	.80
172	1	.8
173	1	.80
174	2	1.60
176	2	1.60
179	2	1.60
180	7	5.70
181	3	2.50
182	2	1.60
183	1	.80
185	1	.80
186	4	3.30
188	1	.80
189	1	.80
190	2	1.60
191	3	2.50
192	2	1.60
193	1	.80
195	2	1.60
198	2	1.60
199	1	.80
200	14	11.50
Amount	163	100.00

By paying attention to Table 3. above, the Internal Factor histogram can be depicted as shown in Figure 3

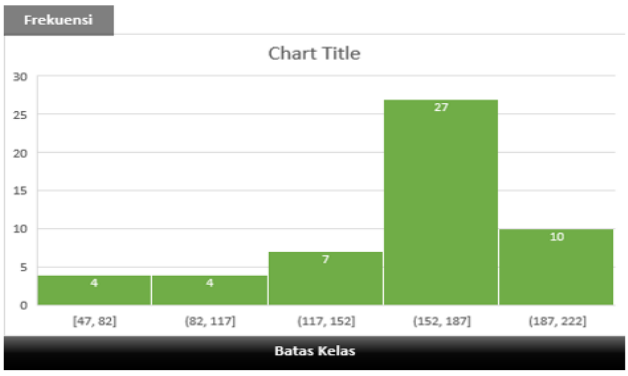

Figure 3. Histogram of Internal Factors

Based on Table 3, the frequency distribution of scores for the Internal Factors variable (X1) shows a fairly even distribution, with scores ranging from 47 to 200. Most scores have a low frequency, with only 1 or 2 respondents. However, there is a prominent peak at score 160, with the highest frequency at 17 respondents (13.9%), followed by score 200 at 14 respondents (11.5%), and score 180 at 7 respondents (5.7%). Several other scores, such as 159, 164, 170, and 186, also have relatively high frequencies compared to the other scores.

External Factors (X2)

Based on the External Factors variable data, the score distribution is spread from a minimum of 49 to a maximum of 200. From 122 respondents (N = 122), the mean score is 163.19, the median is 163.00, the most frequently occurring score (mode) is 160, the standard deviation is 29.590, and the variance is 875.559. To present the External Factors data in the form of a frequency distribution and histogram, it is necessary to determine the number of classes and their class intervals as follows:

Number of classes (k) = 1 + 3.30 Log N
= 1 + 3.30 Log 122
= 1 + 3.30 x 2.08635
= 1 + 6.88 = 7.80, taking 8 as the number of classes.

$$Interval = \frac{NHighest\ value - Lowest\ value}{Many\ classes} \quad (2)$$

$$= \frac{200 - 49}{8}$$

$$= 18.87\ taken\ 19$$

To clarify the number of interval classes, the calculated interval classes are arranged in a frequency distribution list, as shown in Table 4 below.

Table 4. Frequency Distribution of External Factor Variable Scores (X2)

Interval Class	Frequency	Percentage (%)
49	1	.80
56	1	.80
74	1	.80
78	1	.80
84	1	.80
100	2	1.60
120	2	1.60
124	1	.80
125	1	.80
128	1	.80
130	1	.800
133	1	.80
136	1	.80
137	1	.80
138	1	.800
139	2	1.60

Interval Class	Frequency	Percentage (%)
141	1	.80
142	1	.80
146	1	.80
148	2	1.60
149	2	1.60
151	1	.80
152	1	.80
153	1	.80
154	2	1.60
155	3	2.50
156	1	.80
157	1	.80
160	19	15.60
161	3	2.50
162	3	2.50
164	5	4.10
166	2	1.60
169	1	.80
170	2	1.60
171	2	1.60
172	1	.80
174	1	.80
176	1	.80
177	5	4.10
178	2	1.60
179	4	3.30
180	6	4.90
181	1	.80
182	1	.80
185	2	1.60
188	1	.80
190	1	.80
191	1	.80
192	1	.80
193	1	.80
195	2	1.60
196	1	.80
197	2	1.60
198	2	1.600
200	13	10.70
165	3	1.80
Jumlah	163	100.00

By paying attention to Table 4. above, a histogram of the types of work pursued can be depicted as shown in Figure 4.

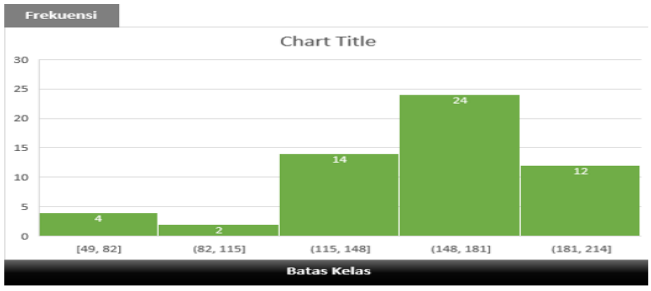

Figure 4. Histogram of External Factors

Based on Table 4, the frequency distribution of scores for the External Factors variable (X2) shows a fairly wide range of values, ranging from 49 to 200. The highest frequency was found at a score of 160, with 19 respondents (15.60%), followed by a score of 200 with 13 respondents (10.70%), and a score of 180 with 6 respondents (4.90%). Several other scores, such as 164 and 177, also showed relatively high frequencies (5 respondents each, or 4.10%). Most of the other scores were distributed at low frequencies, with 1 or 2 respondents, indicating significant variation in the influence of external factors on students. The histogram visualization in Figure 4 shows a relatively left-skewed distribution pattern, indicating that most students scored high on external factors.

Discussion

This section discusses research findings regarding the influence of internal and external factors on the skills of vocational high school students at the Nias Regional Government Private Vocational High School, specifically in the context of the Teaching Factory (TEFA) program. This discussion tests the hypotheses by linking the data analysis results to theory and previous relevant research.

Relationship of Internal Factors to Student Skills

The study shows that Internal Factors (X1), such as student motivation, interest, discipline, and responsibility, have a positive and significant relationship to student skills. Based on a simple regression analysis (Y=78.083+0.386X1), each one-unit increase in Internal Factors increases student skills by 0.386 units, with statistical significance ($p<0.001$). A Pearson correlation coefficient of 0.413 confirms a fairly strong relationship. Internal Factors account for 17% of the variation in student skills, while the remaining 83% is influenced by factors outside the model. These findings are consistent with the theory that internal motivation and discipline are fundamental to practical learning such as TEFA, especially in situations of limited resources. Therefore, strengthening student character, motivation, and discipline, as well as teacher support as facilitators, are crucial to maximizing students' internal potential (Nita Nursinta Dewi 2023); (Ali Sunarso and Winda Khoirunnisa 2023).

Relationship of External Factors to Student Skills

External Factors (X2), including the role of industry, industrial and industrial partnerships, internships, external training, and social support, also showed a positive and significant relationship to student skills. The regression equation (Y^=72.754+0.379X2) indicates that every one-unit increase in External Factors will increase student skills by 0.37 units, with statistical

significance ($p<0.001$). The contribution of External Factors to the variation in student skills is 16.90%. This positive relationship indicates that the stronger the external environmental support, the better the development of student skills (Ourda et al. 2025); (Korpershoek et al. 2020). Industry involvement through internships and training provides real-world experience, while family and community support shape students' mental readiness (Avleeva et al. 2025); (Popov 2025). Therefore, schools need to continue to forge strategic partnerships with industry and strengthen internship systems to continuously improve student skills (Saicharoen et al. 2025); (Banker and Borchardt 2025); (Ruwaida and Putu Sudira 2024).

The Relationship between Internal and External Factors and Student Skills

Simultaneously, Internal Factors (X1) and External Factors (X2) had a significant relationship with student skills. The combination of these two factors explained 17.40% of the variation in student skills ($R2=0.17$), with the remaining 82.60% influenced by factors outside the model. The F-value of 12.50 ($p<0.001$) confirmed the significance of this multiple regression model. Both Internal Factors ($b=0.27$) and External Factors ($b=0.27$) contributed relatively equally and significantly to improving student skills, indicating that they complement each other (Wang and Eccles 2013); (Margot and Kettler 2019); (Shih 2024). Partial correlation tests also showed a strong and significant relationship between each factor and student skills, even after controlling for other factors ($r=0.685$). Consequently, improving student skills at Nias Regional Government Private Vocational High Schools requires an integrated (Hung and Pan 2025); (Torsdottir et al. 2024); (Almulla 2020), holistic approach. Schools must simultaneously develop students' internal aspects (character, motivation, discipline) and strengthen external support (industry partnerships (Zafeer et al. 2024); (Darling-Hammond et al. 2020); (Xu et al. 2025), internships, and practical training facilities). The synergy of these two factors is crucial for producing graduates who are relevant and competent in the workforce (Paredes-Saavedra et al. 2024); (Verhoeven, Poorthuis, and Volman 2019).

Research Limitations

This study has several limitations: Purely quantitative approach: Does not capture in-depth qualitative aspects such as personal motivation or interaction dynamics; Limited location coverage: Only one school, making the results difficult to generalize to other vocational schools; Limited variables: Only internal and external factors are examined, while many other factors influence student skills (e.g., teacher competence, economic background); Reliance on respondent honesty: Potential bias in completing the questionnaire; Non-causal: Results are associative, unable to conclude absolute cause-and-effect relationships; Time constraints: May affect the depth of respondents' responses; Indicators do not yet cover the latest technology: Does not include digital literacy or green technology; Early stages of TEFA implementation: Skills measurement does not reflect the program's long-term effectiveness; Lack of analysis of actor roles: Does not delve into the roles of teachers, industry instructors, or school management.

Conclusion

This study concludes that internal factors (motivation, discipline, student responsibility) and external factors (industry support, internships, training) significantly impact student skills at private vocational schools in the Nias Regional Government, both individually and collectively. Partially, the better a student's internal factors, the higher their skills in the Teaching Factory (TEFA) program. Similarly, active support from external factors significantly shapes students' employability skills to meet industry needs. Together, these two factors contribute 17.4% to student skills. This indicates that the success of vocational high school students at private vocational schools in the Nias Regional Government depends not only on individual readiness but also greatly on the external environment that supports learning. Therefore, the success of the TEFA program depends heavily on the synergy between internal and external factors to produce graduates who are work-ready and relevant to industry demands.

Acknowledgments

We would like to thank all parties who supported this research. We hope this research is beneficial.

Author Contributions

Conceptualization; methodology; validation; formal analysis; investigation; resources; Data curation: writing—original draft preparation. Writing—review and editing: visualization: S. J. Z., A., M. G., D. I All authors have read and approved the published version of the manuscript.

Funding

The researchers funded this research independently.

Conflicts of Interest

The researchers funded this research independently.

References

Ali Sunarso and Winda Khoirunnisa. 2023. "Strengthening Discipline Character Value of Students During The Covid-19 Pandemic." *Mimbar Ilmu* 28(2):300–307. doi:10.23887/mi.v28i2.52734.

Almulla, Mohammed Abdullatif. 2020. "The Effectiveness of the Project-Based Learning (PBL) Approach as a Way to Engage Students in Learning." *Sage Open* 10(3):2158244020938702. doi:10.1177/2158244020938702.

Anggitan, Titis and Gunadi. 2025. "Mediation Effect of Teaching Factory Implementation on Student Work Readiness with Individual Readiness to Change." *Jurnal Pedagogi Dan Pembelajaran* 8(1):144–54. doi:10.23887/jp2.v8i1.84534.

Astuti, Nurul Fajri Vidi, and Diahhadi Setyonaluri. 2022. "Labor Market Outcomes of Vocational High Schools (SMK) and General High Schools (SMA) during the COVID-19 Pandemic." *The Journal of Indonesia Sustainable Development Planning* 3(3):278–93. doi:10.46456/jisdep.v3i3.328.

Avleeva, Evelina, Jessica Wickey Byrd, Stephen Pratt, and Vanessa Gonzalez. 2025. "The Internship Experience: Students' Self-Evaluations of Soft Skill Development during Hospitality Internships." *Journal of Hospitality, Leisure, Sport & Tourism Education* 36:100552. doi:10.1016/j.jhlste.2025.100552.

Banker, Deborah, and Jamie Borchardt. 2025. "Students' Perspectives on an Internship Experience." *Journal of Research in Innovative Teaching & Learning*. doi:10.1108/JRIT-07-2024-0198.

Bhardwaj, Bhawana, and Namrita Kalia. 2021. "Contextual and Task Performance: Role of Employee Engagement and Organizational Culture in Hospitality Industry." *Vilakshan - XIMB Journal of Management* 18(2):187–201. doi:10.1108/XJM-08-2020-0089.

Darling-Hammond, Linda, Lisa Flook, Channa Cook-Harvey, Brigid Barron, and David Osher. 2020. "Implications for Educational Practice of the Science of Learning and Development." *Applied Developmental Science* 24(2):97–140. doi:10.1080/10888691.2018.1537791.

Henriques, Rita, Filipa Figueiredo, and João Nunes. 2023. "Product-Services for a Resource-Efficient and Circular Economy: An Updated Review." *Sustainability* 15(15):12077. doi:10.3390/su151512077.

Heriansyah, Masnurrima. 2020. "Proactivity Inventory Development for Senior High School Students." *JPPI (Jurnal Penelitian Pendidikan Indonesia)* 6(1):27–30. doi:10.29210/02020344.

Hung, Li-Ching, and Hsiang-Ju Pan. 2025. "Innovative Approach to ESD Integration into School-Based Curriculum Development Modules for Elementary Schools." *Sustainability* 17(4):1427. doi:10.3390/su17041427.

Kholifah, Nur, Muhammad Nurtanto, Valiant Lukad Perdana Sutrisno, Nuur Wachid Abdul Majid, Hani Subakti, Rihab Wit Daryono, and Achmadi Achmadi. 2025. "Unlocking Workforce Readiness through Digital Employability Skills in Vocational Education Graduates: A PLS-SEM Analysis Based on Human Capital Theory." *Social Sciences & Humanities Open* 11:101625. doi:10.1016/j.ssaho.2025.101625.

Kokkinopoulou, Emmanouela, Demetris Vrontis, and Alkis Thrassou. 2025. "The Impact of Education on Productivity and Externalities of Economic Development and Social Welfare: A Systematic Literature Review." *Central European Management Journal*. doi:10.1108/CEMJ-04-2024-0124.

Korpershoek, H., E. T. Canrinus, M. Fokkens-Bruinsma, and H. De Boer. 2020. "The Relationships between School Belonging and Students' Motivational, Social-Emotional, Behavioural, and Academic Outcomes in Secondary Education: A Meta-Analytic Review." *Research Papers in Education* 35(6):641–80. doi:10.1080/02671522.2019.1615116.

Margot, Kelly C., and Todd Kettler. 2019. "Teachers' Perception of STEM Integration and Education: A Systematic Literature Review." *International Journal of STEM Education* 6(1):2. doi:10.1186/s40594-018-0151-2.

Nita Nursinta Dewi. 2023. "STRENGTHENING THE CHARACTER OF STUDENTS' LEARNING DISCIPLINE THROUGH YOUTUBE MEDIA." *Perspektif Ilmu Pendidikan* 37(2):103–10. doi:10.21009/PIP.372.3.

Ourda, Despoina, Anna Kavoukoglou, Athanasios Gregoriadis, and Vassilis Barkoukis. 2025. "The Role of School Environment on the Sustainable Development of Pre-Schoolers' Motor Creativity." *Sports* 13(7):229. doi:10.3390/sports13070229.

Paredes-Saavedra, Maribel, María Vallejos, Salomón Huancahuire-Vega, Wilter Morales-García, and Luis Geraldo-Campos. 2024. "Work Team Effectiveness: Importance of Organizational Culture, Work Climate, Leadership, Creative Synergy, and Emotional Intelligence in University Employees." *Administrative Sciences* 14(11):280. doi:10.3390/admsci14110280.

Pech, Martin, and Jaroslav Vrchota. 2022. "The Product Customization Process in Relation to Industry 4.0 and Digitalization." *Processes* 10(3):539. doi:10.3390/pr10030539.

Poláková, Michaela, Juliet Horváthová Suleimanová, Peter Madzík, Lukáš Copuš, Ivana Molnárová, and Jana Polednová. 2023. "Soft Skills and Their Importance in the Labour Market under the Conditions of Industry 5.0." *Heliyon* 9(8):e18670. doi:10.1016/j.heliyon.2023.e18670.

Popov, Jelena. 2025. "Motivation in Internship: Working to Learn and Learning to Work." *Journal of Vocational Education & Training* 1–21. doi:10.1080/13636820.2025.2462957.

Rizun, Nina, Aleksandra Revina, and Vera G. Meister. 2021. "Analyzing Content of Tasks in Business Process Management. Blending Task Execution and Organization Perspectives." *Computers in Industry* 130:103463. doi:10.1016/j.compind.2021.103463.

Roll, Michael, and Dirk Ifenthaler. 2021. "Learning Factories 4.0 in Technical Vocational Schools: Can They Foster Competence Development?" *Empirical Research in Vocational Education and Training* 13(1):20. doi:10.1186/s40461-021-00124-0.

Ruwaida, Rahmiati and Putu Sudira. 2024. "School Partnership Management with Industry and the World of Work to Improve Student Automotive Skills Competency." *Jurnal Pendidikan Dan Pengajaran* 57(1):183–94. doi:10.23887/jpp.v57i1.61034.

Saicharoen, Noppong, Chin Eang Ong, Kwok Hung Lau, and Say Yen Teoh. 2025. "Beyond Individual Skills: Cultivating Competence Synergies in Thai Automotive Production." *Employee Relations: The International Journal* 47(9):147–72. doi:10.1108/ER-07-2024-0379.

Sarah, Hotmauli, Effendy Sjahri, and Patisina. 2023. "The Influence Of Work Culture And Work Discipline On Employee Performance At Advent Hospital Medan." *International Journal of Science, Technology & Management* 4(5):1340–50. doi:10.46729/ijstm.v4i5.926.

Shih, Yi-Huang. 2024. "Children's Learning for Sustainability in Social Studies Education: A Case Study from Taiwanese Elementary School." *Frontiers in Education* 9:1353420. doi:10.3389/feduc.2024.1353420.

Sultana, Rebaka, Mohammad Faruk, Md. Saiful Islam, and Md. Asif Khaled. 2025. "Does Motivation Theory Really Play Any Significant Role on Explaining University Teachers' Performance: Understanding Bangladeshi Context." *Asian Management and Business Review* 47–59. doi:10.20885/AMBR.vol5.iss1.art4.

Surya Patria, Asidigisianti, Nova Krisitiana, Ekohariadi Ekohariadi, Any Sutiadiningsih, and Muchammad Bayu Tejo Sampurno. 2024. "Teaching Factory Management on Vocational High School Case Study: Arts and Creative Industry Competency." *SAR Journal - Science and Research* 29–35. doi:10.18421/SAR71-05.

Suyitno, Suyitno. 2022. "Investigation of Teaching Factory (TEFA) Implementation in Vocational Education." *VANOS Journal of Mechanical Engineering Education* 7(1). doi:10.30870/vanos.v7i1.14202.

Swennen, Anja. 2024. "Education Is Not the Problem, but Part of the Solution." *European Journal of Teacher Education* 47(4):633–37. doi:10.1080/02619768.2024.2402613.

Tanjung, Dahri, Asty Khairi Inayah Syahwani, Gilang Ayuningtyas, Walidatush Sholihah, and Disya Ayu Rivtryana. 2025. "Evaluating the Impact of the Teaching Factory Model on Vocational High School Student Competencies in the SMK Centre of Excellence Program" edited by A. Jayanegara, V. Niderkorn, W. Caesarendra, A. Gusrialdi, N. Huda, A. Pratiwi, M. Abduh, K. Srikulnath, D. H. E. Setiamarga, Y. S. Hadi, V. M. Venturina, A. Kan, and K. Lisao. *BIO Web of Conferences* 171:04015. doi:10.1051/bioconf/202517104015.

Torsdottir, Ane Eir, Astrid Tonette Sinnes, Daniel Olsson, and Arjen Wals. 2024. "Do Students Have Anything to Say? Student Participation in a Whole School Approach to Sustainability." *Environmental Education Research* 30(4):519–43. doi:10.1080/13504622.2023.2213427.

Verhoeven, Monique, Astrid M. G. Poorthuis, and Monique Volman. 2019. "The Role of School in Adolescents' Identity Development. A Literature Review." *Educational Psychology Review* 31(1):35–63. doi:10.1007/s10648-018-9457-3.

Wang, Ming-Te, and Jacquelynne S. Eccles. 2013. "School Context, Achievement Motivation, and Academic Engagement: A Longitudinal Study of School Engagement Using a Multidimensional Perspective." *Learning and Instruction* 28:12–23. doi:10.1016/j.learninstruc.2013.04.002.

Widiatna, Alexius Dwi, Purwani Puji Utami, and Isthifa Kemal. 2025. "Implementing and Managing the Teaching Factory Learning Model at Vocational Schools." *Jurnal Penelitian Pendidikan IPA* 11(5):341–51. doi:10.29303/jppipa.v11i5.10944.

Xu, Shun, Tiehao Zhao, Zhongmei Zheng, and Sha Zhu. 2025. "Modeling the Effects of Interrelations Among External Support and Internal Factors on Teachers' ICT Integration Ability in Less Developed Areas of China." *Sage Open* 15(1):21582440251318570. doi:10.1177/21582440251318570.

Zafeer, Hafiz Muhammad Ihsan, Samra Maqbool, Yu Rong, and Sufyan Maqbool. 2024. "Mapping the

Relationship and Influence of School Internal Factors with an Eye towards Students' Science Academic Outcomes." *Heliyon* 10(19):e38696. doi:10.1016/j.heliyon.2024.e38696.

Zamiri, Majid, and Ali Esmaeili. 2024. "Strategies, Methods, and Supports for Developing Skills within Learning Communities: A Systematic Review of the Literature." *Administrative Sciences* 14(9):231. doi:10.3390/admsci14090231.

Zhang, Wen, Xiaoshuang Zeng, Huigang Liang, Yajiong Xue, and Xuanze Cao. 2023. "Understanding How Organizational Culture Affects Innovation Performance: A Management Context Perspective." *Sustainability* 15(8):6644. doi:10.3390/su15086644.