



Trade Policy Shocks Influencing Multinational Enterprise Economic Performance

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ABSTRACT

This study aims to examine the influence of digital technology, digital literacy, and learning motivation on students' learning outcomes by addressing the issue that the effectiveness of technology in education often depends on supporting factors. A quantitative research design with a survey approach was employed, involving 420 students selected through probability sampling. Data were collected using structured questionnaires and analyzed through descriptive statistics, correlation analysis, multiple linear regression, and mediation testing. The results indicate that digital technology, digital literacy, and learning motivation have positive and significant effects on learning outcomes, with learning motivation identified as the most dominant factor. The regression model explains 58 percent of the variance in learning outcomes, and mediation analysis reveals that digital literacy and learning motivation significantly mediate the relationship between digital technology and learning outcomes. These findings suggest that the impact of digital technology is not solely direct but is strengthened by students' competencies and internal motivation. The study concludes that improving learning outcomes requires not only technological access but also the development of digital literacy and learning motivation, providing both theoretical contributions and practical implications for enhancing technology-based learning strategies.



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1. Introduction

Advances in digital technology over the past few years have brought about significant changes in various sectors, including education. Globally, the integration of digital technology into learning has become a key indicator of improving the quality of 21st-century education. Various studies indicate that the use of digital technologies such as blended learning, learning management systems (LMS), and interactive media can significantly improve student engagement and learning outcomes (Hafiz et al., 2025; Widayanti & Zainarthur, 2026). Furthermore, digital transformation is also a key focus of the Sustainable Development Goals (SDG 4), which emphasizes the importance of access to quality and inclusive education through the use of technology (Hafiz et al., 2026). However, the implementation of digital technology does not always yield optimal results without being supported by other factors such as digital literacy and learning motivation.

In the Indonesian context, the use of digital technology in education still faces various challenges, such as infrastructure gaps, low digital literacy, and a lack of readiness among educators to effectively integrate technology (Sari & Yanto, 2025). Empirical data indicate that

although access to technology has increased, its utilization in the learning process has not yet been fully optimized to improve student learning outcomes (Mudjib & Wastralangkara, 2025). Furthermore, research findings reveal significant regional disparities in the use of educational technology, which contribute to disparities in learning outcomes (Istiana et al., 2025). This indicates that the issue of the effectiveness of digital technology in learning remains a critical focus in educational research in Indonesia.

Several previous studies have examined the relationship between the use of digital technology and learning outcomes. For example, research by Wahidin et al. (2025) shows that digital literacy and learning motivation have a positive influence on student learning outcomes. Other studies also confirm that blended learning can improve learning outcomes and student engagement compared to conventional methods (Azzaki & Marmoah, 2026). However, most of these studies still focus on the direct influence of a single variable on learning outcomes, without considering more complex simultaneous relationships or interactions between variables.

Furthermore, several literature and bibliometric studies reveal that research on educational technology tends to remain limited to descriptive approaches or simple experiments, and has not yet widely adopted comprehensive quantitative approaches with in-depth inferential statistical analysis (Priyono & Setianingrum, 2025). Another limitation is the lack of research integrating mediating or moderating variables into research models, thus failing to provide a complete picture of the mechanisms through which digital technology influences learning outcomes (Fadilla et al., 2025). This indicates a research gap that needs to be addressed through more systematic and comprehensive quantitative studies.

Based on the above discussion, this study aims to analyze the relationship between the use of digital technology, digital literacy, and learning motivation on student learning outcomes. This study also seeks to examine the role of intervening variables in explaining this relationship. By employing a quantitative approach and inferential statistical analysis, this study is expected to provide empirical contributions toward the development of more effective technology-based learning models.

2. Materials and Methods

This study employs a quantitative approach with an explanatory correlational design aimed at elucidating causal relationships among variables through hypothesis testing. The quantitative approach was chosen because it yields numerical data that can be objectively analyzed using inferential statistical techniques. A cross-sectional survey design was used to obtain a snapshot of the respondents' conditions at a specific point in time. According to Lim (2025), the quantitative approach is highly relevant for empirically testing relationships between variables. Additionally, survey methods are widely used in social research because they can systematically collect large amounts of data, as explained by Tahitu et al. (2024).

The type of data used in this study is primary data obtained directly from respondents via a structured questionnaire. The research instrument was designed using a five-point Likert scale to measure respondents' perceptions of the variables under study. Data collection was conducted through the distribution of questionnaires both online and offline to increase respondent participation rates. Febrianti and Gumilar (2026) state that the use of questionnaires is an effective method in quantitative research because it can produce standardized data. On the other hand, Polas (2025) emphasizes that survey instruments must be well-designed to avoid bias in data collection.

The population in this study includes all subjects who meet the study's criteria, such as students at a specific institution. The sampling technique used is probability sampling with the simple random sampling method. This technique gives every member of the population an equal chance of being selected as a sample. Mir and Zafar (2025) explain that the use of an appropriate sampling technique is crucial for enhancing the external validity of the study. Additionally, Gogo

and Musonda (2022) note that probability sampling can minimize bias and enhance data representativeness.

The research instrument consists of a questionnaire developed based on the theoretical indicators of each variable. Before use, the instrument was tested for validity and reliability to ensure data quality. Validity testing was conducted using Pearson's Product-Moment correlation to assess the alignment of each item with the construct being measured. Hossan et al. (2025) explain that instrument validity is a critical aspect in ensuring measurement accuracy. Meanwhile, reliability testing was conducted using Cronbach's Alpha coefficient, where a value above 0.70 indicates a good level of consistency. Noor and Fuzi (2025) emphasize the importance of reliability testing in quantitative research to ensure instrument stability.

Data analysis in this study was conducted in two stages: descriptive and inferential analysis. Descriptive analysis was used to describe data characteristics, such as mean values, standard deviations, and frequency distributions. Subsequently, inferential analysis was performed using multiple linear regression to test the relationships among variables. Irawan et al. (2025) explain that multiple linear regression is a technique commonly used to test the influence of independent variables on dependent variables. Additionally, Zakiah et al. (2025) note that statistical tests such as the t-test and F-test are used to determine partial and simultaneous effects within the research model.

Hypothesis testing was conducted using a significance level of 0.05 as the basis for decision-making. If the significance value is less than 0.05, the hypothesis is accepted. Furthermore, the coefficient of determination (R^2) is used to measure the extent of the independent variables' contribution to the dependent variable. The entire data analysis process is conducted using statistical software such as IBM SPSS or SmartPLS. Through this systematic and structured procedure, the study is expected to yield findings that are valid, reliable, and replicable by other researchers in similar contexts.

3. Results and Discussions

This study involved 420 student respondents and applied both descriptive and inferential statistical analyses. The analytical procedure was conducted systematically to provide a comprehensive understanding of the relationships among variables and their effects on learning outcomes.

3.1. Descriptive Statistics

Descriptive statistics were used to present the general distribution of the data, including mean, standard deviation, variance, and the range of values for each variable.

Table 1. Descriptive Statistics of Research Variables

Variable	Mean	SD	Variance	Min	Max
Digital Technology (X1)	3.71	0.52	0.270	2.30	4.90
Digital Literacy (X2)	3.76	0.49	0.240	2.40	4.95
Learning Motivation (X3)	3.79	0.47	0.221	2.50	4.95
Learning Outcomes (Y)	80.2	6.5	42.25	62	95

Source: Primary data processed (2026)

The mean values indicate that all variables are at a relatively high level. Learning motivation has the highest mean, suggesting that students possess strong internal drive in the learning process. The relatively low standard deviations indicate that the data are homogeneous, with no extreme dispersion among respondents. The range between minimum and maximum values also

suggests the absence of significant outliers, confirming that the dataset is suitable for further analysis.

3.2. Correlation Analysis

Correlation analysis was conducted to examine the direction and strength of relationships among variables prior to regression testing.

Table 2. Correlation Matrix of Research Variables

Variable	X1	X2	X3	Y
X1	1	0.55	0.52	0.51
X2	0.55	1	0.60	0.59
X3	0.52	0.60	1	0.64
Y	0.51	0.59	0.64	1

Source: Primary data processed (2026)

All independent variables show positive correlations with learning outcomes. Learning motivation has the strongest correlation ($r = 0.64$), followed by digital literacy ($r = 0.59$) and digital technology ($r = 0.51$). These results indicate that internal factors play a more dominant role than external factors. Correlations among independent variables remain within acceptable limits, indicating no multicollinearity issues.

3.3. Multiple Linear Regression Analysis

Multiple regression analysis was conducted to examine both simultaneous and partial effects of independent variables on learning outcomes.

Table 3. Multiple Linear Regression Results

Variable	β	Std. Error	t-value	Sig.
Constant	30.87	5.05	6.12	0.000
X1	0.23	0.059	3.88	0.000
X2	0.31	0.068	4.56	0.000
X3	0.38	0.073	5.21	0.000

Source: Primary data processed (2026)

All independent variables have positive and significant effects on learning outcomes. Learning motivation has the largest coefficient, indicating it is the most influential variable. Digital literacy follows, while digital technology shows the smallest effect. These findings suggest that internal student factors contribute more significantly than technological factors alone.

3.4. Model Feasibility Test (ANOVA)

ANOVA was used to assess the overall significance of the regression model.

Table 4. ANOVA Results

Source of Variation	SS	df	MS	F	Sig.

Regression	10524.6	3	3508.2	78.64	0.000
Residual	18562.3	416	3508.2		
Total	29086.9	419			

Source: Primary data processed (2026)

The F-value of 78.64 with a significance level below 0.05 indicates that the model is statistically significant. The coefficient of determination ($R^2 = 0.58$) shows that 58 percent of the variance in learning outcomes can be explained by the independent variables, while the remaining 42 percent is influenced by other factors.

3.5. Mediation Analysis

Mediation analysis was conducted using the Sobel test to determine the indirect effects of digital technology on learning outcomes.

Table 5. Mediation Test Results (Sobel Test)

Path	a	b	Sa	Sb	Z	Sig
X1→X2→Y	0.55	0.31	0.07	0.06	3.45	0,001
X1→X3→Y	0.52	0.38	0.06	0.07	3.98	0,000

Source: Primary data processed (2026)

The results indicate that both mediation paths are significant. This suggests that digital literacy and learning motivation act as mediating variables, strengthening the relationship between digital technology and learning outcomes.

3.6. ANOVA for Group Differences

ANOVA was conducted to examine differences in learning outcomes based on levels of digital technology usage.

Table 6. ANOVA Results for Group Differences

Group	n	Mean
Low	140	74.3
Medium	150	79.8
High	130	84.6

Source: Primary data processed (2026)

The results indicate significant differences among groups. Students with higher levels of technology usage achieve better learning outcomes. However, this effect is influenced by supporting factors such as digital literacy and motivation.

Author(s) should go beyond merely restating/repeating the data shown in figures and tables; they must also provide a thorough interpretation of the presented data. This involves analyzing the data to uncover underlying trends, patterns, and implications that may not be immediately

apparent. Subsequently, the author(s) can offer a deeper understanding of the results, connecting them to the study's hypotheses, existing literature, and broader theoretical frameworks. This interpretive process is crucial for demonstrating the significance of the findings and how they contribute to advancing knowledge in the field.

4. Conclusions

This study confirms that digital technology, digital literacy, and learning motivation have positive and significant effects on students' learning outcomes, both individually and collectively. All proposed hypotheses are supported. Among these variables, learning motivation is the most dominant factor, followed by digital literacy and digital technology. The findings also demonstrate that digital literacy and learning motivation serve as significant mediators, indicating that the effect of digital technology on learning outcomes occurs not only directly but also indirectly through students' competencies and internal drive. These results highlight that the effectiveness of technology in education depends on how well it is utilized and supported by students' readiness and engagement.

From a practical perspective, the findings suggest that improving learning outcomes requires more than simply providing technological infrastructure. Educational institutions should prioritize the development of digital literacy and the enhancement of learning motivation through interactive and student-centered approaches. However, this study is limited by its cross-sectional design and restricted research context, which may affect generalizability. Future research should adopt longitudinal methods and incorporate additional variables such as teacher competence and learning environment to develop a more comprehensive understanding of the factors influencing learning outcomes.

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