

The Effect of Digital Literacy on Students' Learning Outcomes: The Mediating Roles of Learning Motivation and Self-Efficacy

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ABSTRACT

Improving student learning outcomes is a major goal of vocational education, especially since digital skills are a critical component of academic success. The purpose of this study is to analyze the influence of digital literacy on Informatics learning outcomes, with learning motivation and self-efficacy as mediating variables. The study adopted a quantitative approach with an explanatory research design to examine the relationships between the variables in the proposed research model. Data collection was conducted with 102 students majoring in Office Management and Business Services (MPLB) and Digital Marketing and Business (BDP) at SMK Negeri 2 Bukittinggi. The data were analyzed using the Structural Equation Modeling–Partial Least Squares (SEM-PLS) method with SmartPLS 4.0 software. The findings of this study reveal that digital literacy has a significant direct impact on improving student learning outcomes ($\beta = 0.214$, $p < 0.05$). A more in-depth analysis shows that learning motivation serves as a crucial bridge linking digital literacy to learning outcomes ($\beta = 0.067$, $p < 0.05$). A similar pattern is also observed for self-efficacy, which significantly mediates the relationship between these two main variables ($\beta = 0.086$, $p < 0.05$). These findings expand the application of social cognitive theory and digital literacy frameworks by demonstrating that the influence of digital literacy on learning outcomes is not merely direct but also operates through motivational and psychological self-belief mechanisms.

INTRODUCTION

Learning is a process through which individuals acquire knowledge, enhance skills, improve behaviors and attitudes, and strengthen their personal development (Hartono et al., 2023). Similarly, learning is a human activity aimed at acquiring knowledge, competencies, and behavioral changes through accumulated experience (Sudirman et al., 2024). Based on these definitions, learning can be understood as a conscious, intentional activity that involves interaction between individuals and their environment, ultimately leading to positive, relatively permanent behavioral changes. These behavioral changes are reflected in students' learning outcomes, which represent the results achieved through educational interactions. According to Bloom (1956), learning outcomes consist of three main domains: cognitive, affective, and psychomotor. In practice, learning outcomes are important criteria for assessing the knowledge and skills students have acquired during the learning process (Wolandari et al., 2022).

The study focuses on the cognitive domain of learning outcomes, as evidenced by students' summative assessment results in informatics courses. Informatics is mandatory for students enrolled in Office Management and Business Services (OMBS) and Digital Business and Marketing (DBM) programs. The Merdeka Curriculum Learning Outcomes Framework (2024) recognizes informatics as the driving force behind digital transformation



in the business and office services sectors. It also forms the basis for computational thinking needed to solve problems in various professions. Technology is therefore crucial in assisting pupils to meet the stringent demands of a technology-dependent labor market.

This study was conducted at SMK Negeri 2 Bukittinggi, a vocational high school that offers several programs to equip students with technical competencies aligned with industry needs. However, this study primarily focuses on two programs, namely Office Management and Commercial Services and Digital Business and Marketing, since the curricula of both programs are extensively linked to the use of information technology. For students in these two programs, computer science is not a general topic but a foundational competency that measures their readiness to enter the digital workforce.

However, the results of student learning outcomes in the Computer Science course at SMK Negeri 2 Bukittinggi are still low compared to the goals in the curriculum. First observations show that student learning outcomes are still below the intended level. This problem is also visible in the outcomes of students' daily assessments in the Computer Science course; see Table 1.

Table 1. Summary of Students' Mastery of Informatics Learning Outcomes in Daily Assessments, Academic Year 2025/2026

Class	Number of Students	Mastery		Non-Mastery	
		Number	%	Number	%
X OMBS 1	34	8	23.5	26	76.5
X OMBS 2	35	5	14.3	30	85.7
X DBM 1	34	9	26.5	25	73.5
X DBM 2	34	4	11.8	30	88.2
Total	137	26	19.0	111	81.0

Source: Informatics Teachers of Grade X OMBS and DBM Programs, SMK Negeri 2 Bukittinggi.

Table 1. indicates that the minimum mastery criterion was attained by only 19% of the participants (26 out of 137), while the vast majority (81%) did not reach the expected performance standard. These results indicate that the learning outcomes of students in the subject of Computer Science are still far from ideal and indicate problems in acquiring the desired capabilities. Therefore, it is important to discover the reasons that cause low learning outcomes in order to improve students' learning outcomes and to fulfil the predetermined learning objectives successfully.

Students' learning outcomes are influenced by several internal and external influences. In the digital era, student learning outcomes are increasingly tied to their capacity to effectively use digital technologies and learning resources (Winarno & Ashari, 2022). This skill, generally referred to as digital literacy, has become an important driver of learning outcomes since it enables students to independently access, evaluate, and use information (Widiastini, 2021). Digital literacy is more than just technical expertise. As Gilster (1997), states, it is the capacity to use digital tools and information sources responsibly in academic, professional and everyday settings. Despite the vast amount of study, there is still a lot we don't know about digital literacy.

First, the actual data on the influence of digital literacy in this context are still quite restricted, owing to the practical requirements of vocational education compared to those of general education. Secondly, there is still minimal in-depth study on digital literacy in Indonesia, thus findings from other countries may not always fully reflect the specific issues experienced by students in Indonesia. Thirdly, and perhaps most crucially, there is little study into the relationship between digital literacy and learning outcomes in computer science, the discipline most associated with digital competence. Although numerous studies have investigated the relationship between learning outcomes and digital literacy, empirical findings are still controversial. As Nurramdhani et al. (2023) reported, the learning outcomes of pupils were notably increased due to digital literacy. Likewise,

Winarno and Ashari (2022) reported that ICT literacy positively affected the learning outcomes. However, Manubey et al. (2022) found no significant relationship between learning outcomes and digital literacy. Contradictory findings suggest that the processes behind the relationship between digital literacy and learning outcomes have not been considered adequately by previous literature. The contradiction creates the assumption that the internal psychological factors that affect academic motivation may play a more important role in the relationship than direct one.

Learning motivation is one of the mediating factors between digital competence and academic achievement ((Zhang, 2025). Learning motivation refers to the intrinsic and extrinsic elements that motivate, direct, and sustain the actions of the learners. Moreover, self-efficacy of the learners greatly impacts how well the learners persevere when facing academic difficulties (Ibrahim & Aldawsari, 2023). As per Bandura's Social Cognitive Theory, self-efficacy is a construct that relates to a person's belief that he or she can execute and accomplish certain tasks. Previous studies have mainly focused on the direct relationship between learning outcomes and digital literacy, but there is a lack of research on the simultaneous mediating roles of self-efficacy and learning motivation. In addition, very few studies have examined these links in the Indonesian vocational high school context. Therefore, there is still a lack of study on how students' learning outcomes are affected by digital literacy. The double mediation model of this study is the original contribution of this study, which explores the effect of digital literacy on learning outcomes based on self-efficacy and motivation. Thus, the study contributes to understanding complex psychological processes affecting academic achievement in the context of vocational education.

The purpose of this study is to analyze the effect of digital literacy on students' learning outcomes in informatics courses at SMK Negeri 2 Bukittinggi with learning motivation and self-efficacy as mediating variables. It is expected that the results will enrich the literature on digital literacy and learning outcomes and make a theoretical contribution. The results may be useful for educators and educational institutions in developing instructional strategies to improve students' digital competences, learning motivation, and self-efficacy, thereby enhancing learning outcomes

HYPOTHESIS DEVELOPMENT

In this study, learning motivation and self-efficacy served as mediating variables. This study hypothesizes to study the effect of digital literacy on student learning outcomes based on the theoretical framework and literature review. Digital literacy is indicated by knowing technology, being able to evaluate information and being able to communicate in digital settings. The hypotheses are designed to test the significance of both direct and indirect relationships between the variables, aiming to provide insight into the role of digital competence in enhancing the academic achievement of students in the Office Management and Business Services (MPLB) and Online Business and Marketing (BDP) majors at SMK Negeri 2 Bukittinggi.

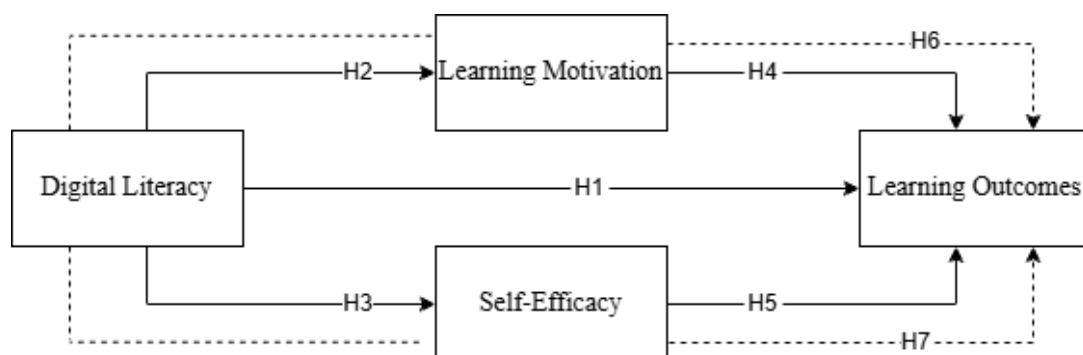


Figure 1. Conceptual Framework

Source: Researchers (2026)

Direct and Indirect Effect Hypotheses

Digital literacy is a crucial ability for locating and utilizing information efficiently; it goes beyond technological proficiency. Digital literacy greatly enhances students' learning outcomes, according to research by Nurramdhani et al., (2023) and Dewi et al. (2024), which is based on Bandura's Social Cognitive Theory (1997), which emphasizes the influence of the learning environment. Additionally, Zhang (2025) and Hana et al. (2025) found that digital literacy increases learning motivation by assisting students in processing knowledge more effectively and engaging in more active participation. According to Zakir et al. (2025) and Yuan et al. (2025), it also increases students' self-efficacy by giving them successful digital task completion experiences. In the end, scholastic achievement is mostly determined by desire and self-efficacy, with both (Zakir et al., 2025).

Based on the theoretical framework and previous empirical findings, the following hypotheses are proposed:

- H1: Digital literacy has a positive and significant effect on students' learning outcomes.
- H2: Digital literacy has a positive and significant effect on students' learning motivation.
- H3: Digital literacy has a positive and significant effect on students' self-efficacy.
- H4: Learning motivation has a positive and significant effect on students' learning outcomes.
- H5: Self-efficacy has a positive and significant effect on students' learning outcomes.

According to Bandura's Social Cognitive Theory (1997), digital literacy makes learning easier as the cognitive load decreases and the pupils are able to focus more. This competency enhances students' confidence to find resources and achieve academic goals, and thus enhances motivation (Zhang, 2025). Students are more successful when they are more motivated and persistent, which implies that motivation helps to close the performance gap between digital literacy and performance. Also, successful use of technology to do tasks increases self-efficacy. (Yuan et al., 2025) found that self-efficacy plays an important role in the relationship between digital literacy and academic achievement because it motivates students to employ more effective study strategies and to persist in the face of challenges.

Based on these theoretical arguments, the following hypotheses are proposed:

- H6: Digital literacy has a positive and significant effect on students' learning outcomes through learning motivation as a mediating variable.
- H7: Digital literacy has a positive and significant effect on students' learning outcomes through self-efficacy as a mediating variable.

METHODS

The study adopted a quantitative approach with an explanatory research design to examine the relationships between the variables in the proposed research model. The purpose of this study is to examine the effect of digital literacy on learning outcomes in Informatics through the mediating variables of learning motivation and self-efficacy. This research was conducted at SMK Negeri 2 Bukittinggi in the academic year 2025/2026. The subjects were tenth-grade students of the Office Management and Business Services (MPLB) and Digital Business and Marketing (BDP) study programs. The population was made up of 137 students in four classes. The Slovin formula was used to select the sample, which consisted of 102 students, with a 5% margin of error. For PLS-SEM, sample adequacy was checked with the 10-times rule (Hair et al., 2022) that suggested a minimum of 30 respondents. The last sample was larger than this threshold, and was considered sufficient for analysis. The participants were selected by proportional random sampling, so that the students of each class were equally represented. There were 25 students of X MPLB 1, 26 students of X MPLB 2, 25 students of X BDP 1 and 26 students of X BDP 2.

Information was obtained from primary and secondary sources. Primary data were obtained by means of questionnaires assessing digital literacy, learning motivation and self-efficacy, whereas secondary data consisted of students' Informatics summative assessment scores which represented learning outcomes. The research instruments were derived from established theories and previous studies. Digital literacy was measured by the

DigComp 2.2 framework, which covers dimensions of information and data literacy, communication and collaboration, digital content creation, security, and problem solving. Learning motivation was based on Uno (2021), focusing on aspects of the desire and urge to succeed, the drive and need for learning, hopes and future aspirations, appreciation in learning, engaging learning activities, and a conducive learning environment. Self-efficacy was adapted from Bandura (1997) by assessing magnitude regarding the difficulty level of tasks believed to be achievable, generality regarding the scope of self-belief across various situations, and strength regarding the conviction in one's ability. All items of the questionnaire were designed to reflect the characteristics of vocational high school students and the context of Informatics learning. The instruments were pilot-tested and evaluated for validity and reliability before data collection. Responses were measured on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Data analysis was performed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with the SmartPLS software. Before testing the hypotheses, Common Method Bias (CMB) was examined using Harman's Single-Factor Test and Full Collinearity Variance Inflation Factor (VIF). The analysis began with descriptive statistics and then proceeded to evaluate the measurement model. The evaluation of the measurement model included convergent validity (outer loadings and AVE), discriminant validity (HTMT), construct reliability (Cronbach's Alpha and Composite Reliability) and multicollinearity (VIF).

After the measurement model met the required criteria, the structural model was evaluated using the coefficient of determination (R^2), effect size (f^2), predictive relevance (Q^2), and model fit indices (SRMR and NFI). Hypotheses were tested using the bootstrapping procedure to estimate path coefficients, t-statistics, and p-values for both direct and indirect effects. Total effects were also examined to assess the overall relationships among the variables. The results indicated partial mediation, as both the direct and indirect effects through the mediating variables were statistically significant. All statistical decisions were based on a 5% significance level following Ghazali and Kusumadewi (2023).

RESULTS AND DISCUSSION

Result

This study involved 102 students from the Grade 10 programs of Office Management and Business Services (MPLB) and Digital Business and Marketing (BDP) at SMK Negeri 2 Bukittinggi. The respondents were distributed across four classes: Class X OMBS 1 consisted of 25 students (24.51%), Class X OMBS 2 consisted of 26 students (25.49%), Class X DBM 1 consisted of 25 students (24.51%), and Class X DBM 2 consisted of 26 students (25.49%). Overall, the number of students from the OMBS and DBM programs was relatively balanced, with each program contributing approximately half of the total sample (Primary Data Processed, 2026). Following the demographic profile of the respondents, the next analysis presents descriptive statistics for the research variables: Digital Literacy, Learning Motivation, Self-Efficacy, and Informatics Learning Outcomes. The results are summarized in Table 2.

Table 2. Mean Scores and Classification of Research Variables

Variable	Mean	Classification Score
Digital Literacy	3.96	Moderate
Learning Motivation	4.01	High
Self-Efficacy	3.94	Moderate
Learning Outcomes	37	Low

Source: Primary Data Processed, 2026

Descriptive statistics of the research variables are presented in Table 2. The results show that student motivation is high, but digital literacy, self-efficacy, and learning outcomes are moderate to low. The next section further explores these relationships by analyzing the direct and indirect effects among these variables using Structural Equation Modelling-Partial Least Squares (SEM-PLS).

Table 3. summarizes the outcomes of the assessment of the reflective measurement model for the four constructs: Learning Outcomes (LO), Digital Literacy (DL), Learning Motivation (LM), and Self-Efficacy (SE). The outer loadings analysis showed that all indicators exceeded the acceptable threshold of 0.70, indicating that each item successfully measured its respective construct; hence, no indicators needed to be deleted. Moreover, the construct reliability values were acceptable, with Rho_A coefficients ranging from 0.918 to 0.928 and Composite Reliability (CR) values ranging from 0.924 to 0.938. Because the γ metric exceeded the 0.70 threshold, the model's internal consistency is considered strong.

In addition, convergent validity was established, as the Average Variance Extracted (AVE) for all constructs ranged from 0.671 to 0.835. As these scores are significantly above the minimum criterion of 0.50, it is apparent that each construct captures the bulk of the variance within its associated indicators. Generally, these findings suggest that the measurement model meets the validity and reliability criteria, thereby opening the door to the structural equation modeling phase.

Table 3. Results of The Reflective Measurement Model Analysis

Variables/ construct	Indicator/ Variable Items	Outer Loadings	Rho_A	Composite Reliability (CR)	AVE
LO	LO	1.000	1.000	1.000	1.000
DL	DL1	0.845	0.927	0.935	0.742
	DL2	0.884			
	DL3	0.868			
	DL4	0.900			
	DL5	0.806			
LM	LM1	0.857	0.928	0.924	0.671
	LM2	0.843			
	LM3	0.791			
	LM4	0.784			
	LM5	0.806			
SE	LM6	0.832	0.918	0.938	0.835
	SE1	0.928			
	SE2	0.886			
	SE3	0.927			

Source: Primary Data Processed, 2026

Heterotrait-Monotrait Ratio (HTMT) criterion was used to test the discriminant validity. As shown in Table 4, the correlation values between the constructs are all well below the threshold of 0.90. These results support that each construct is distinct empirically and a unique theoretical entity.

Table 4. Discriminant Validity (HTMT Criterion)

Constructs	DL	LM	LO	SE
DL	-	0.300	0.379	0.213
LM	0.300	-	0.379	0.243
LO	0.379	0.379	-	0.542
SE	0.213	0.243	0.542	-

Source: Primary Data Processed, 2026

Conducted a multicollinearity test using the Variance Inflation Factor (VIF) to make sure there was no excessive connection between independent variables that could skew the model. As seen in Table 5, all VIF values are significantly below the threshold of 5.00, with the highest value being only 1.141. This demonstrates that the structural model is reliable and prepared for hypothesis testing since there is no multicollinearity problem.

Table 5. Multicollinearity Test Results for the Structural Model (Inner VIF Values)

Construct	VIF
DL -> LM	1.000
DL -> LO	1.121
DL -> SE	1.000
LM -> LO	1.141
SE -> LO	1.084

Source: Primary Data Processed, 2026

After confirming the validity of the measurement model, the next step is to evaluate the quality of the structural model to see how well the variables in this study perform. The results of the structural model assessment are summarized in Table 6.

Table 6. Results of Structural Model Assessment

Criterion	Indicator	Value
R ² Adjusted	Learning Outcomes	0.366
	Learning Motivation	0.080
	Self-Efficacy	0.032
f ²	Digital Literacy -> Learning Motivation	0.098
	Digital Literacy -> Learning Outcomes	0.066
	Digital Literacy -> Self-Efficacy	0.043
	Learning Motivation -> Learning Outcomes	0.072
	Self-Efficacy -> Learning Outcomes	0.266
Q ² predict	Learning Motivation	0.070
	Self-Efficacy	0.021
	Learning Outcomes	0.115
SRMR	Saturated model	0.070
	Estimated model	0.084
NFI	Saturated model	0.834
	Estimated model	0.830

Source: Primary Data Processed, 2026

Table 6. presents the results of the structural model assessment, covering several key evaluation criteria to ensure the quality of the research model. The R² Adjusted values indicate the amount of variance in the dependent variables explained by the model, with the highest value of 0.366 found in the Learning Outcomes variable. Furthermore, f² measures the strength of the relationships between variables, while the Q² predict values, all of which are positive, confirm that the model possesses accurate predictive power for out-of-sample data. Additionally, the SRMR values ranging from 0.070 to 0.084, along with the NFI values, demonstrate that the research model has a good goodness-of-fit with the empirical data. Overall, these results confirm that the structural model meets the required quality standards and is robust enough to proceed with hypothesis testing.

Table 7. Path Coefficient Estimation results

Hypothesis	Path	Original sample (O)	T statistics (O/STDEV)	P values	Significance
Direct Effects					
H1	DL → LO	0.214	3.304	0.001	Significant
H2	DL → LM	0.299	3.76	0.000	Significant
H3	DL → SE	0.204	2.21	0.027	Significant
H4	LM → LO	0.225	3.246	0.001	Significant
H5	SE → LO	0.421	5.29	0.000	Significant
Mediation analysis					
H6	DL → LM → LO	0.067	2.421	0.016	Significant
H7	DL → SE → LO	0.086	2.045	0.041	Significant

Source: Primary Data Processed, 2026

Table 7. outlines the path analysis results, showing both direct and indirect relationships in our model. The findings confirm that Digital Literacy (DL) has a significant direct impact on Learning Outcomes (LO) (H1).

Furthermore, DL significantly boosts both Learning Motivation (LM) (H2) and Self-Efficacy (SE) (H3). Both LM (H4) and SE (H5) were also found to be crucial contributors to students' academic success. Regarding indirect effects, both LM (H6) and SE (H7) act as significant mediators between Digital Literacy and Learning Outcomes. In short, these results highlight that Digital Literacy is not only a direct driver of academic success but also a vital catalyst that strengthens students' motivation and self-efficacy, ultimately leading to better learning outcomes.

Table 8 presents the total effects analysis, which combines the direct and indirect effects of each independent variable on the dependent variable. The results show that all path coefficients are statistically significant, with p-values below 0.05. This indicates that Digital Literacy (DL), Learning Motivation (LM), and Self-Efficacy (SE) each have a statistically significant total effect on students' Learning Outcomes (LO). Among the three variables, Self-Efficacy shows the strongest total effect on Learning Outcomes ($\beta = 0.421$), followed by Digital Literacy ($\beta = 0.367$) and Learning Motivation ($\beta = 0.225$).

Table 8. Total Effects analysis

Path	Original sample (O)	T statistics (O/STDEV)	P values	Significance
DL -> LM	0.299	3.760	0.000	Significant
DL -> LO	0.367	5.735	0.000	Significant
DL -> SE	0.204	2.210	0.027	Significant
LM -> LO	0.225	3.246	0.001	Significant
SE -> LO	0.421	5.290	0.000	Significant

Source: Primary Data Processed, 2026

Figure 2. illustrates the complete structural model resulting from the SEM-PLS analysis, showing the outer loadings of each indicator, the path coefficients between constructs, and the R^2 values of the endogenous variables. All indicators show loading values above 0.70, indicating that each latent variable is well represented by its respective indicators. The model shows that Digital Literacy (DL) has direct effects on Learning Motivation (LM, $\beta = 0.299$), Self-Efficacy (SE, $\beta = 0.204$), and Learning Outcomes (LO, $\beta = 0.214$), while Learning Motivation and Self-Efficacy further influence Learning Outcomes with path coefficients of 0.225 and 0.421, respectively. The model explains 9.0% of the variance in Learning Motivation ($R^2 = 0.090$), 4.2% of the variance in Self-Efficacy ($R^2 = 0.042$), and 38.5% of the variance in Learning Outcomes ($R^2 = 0.385$).

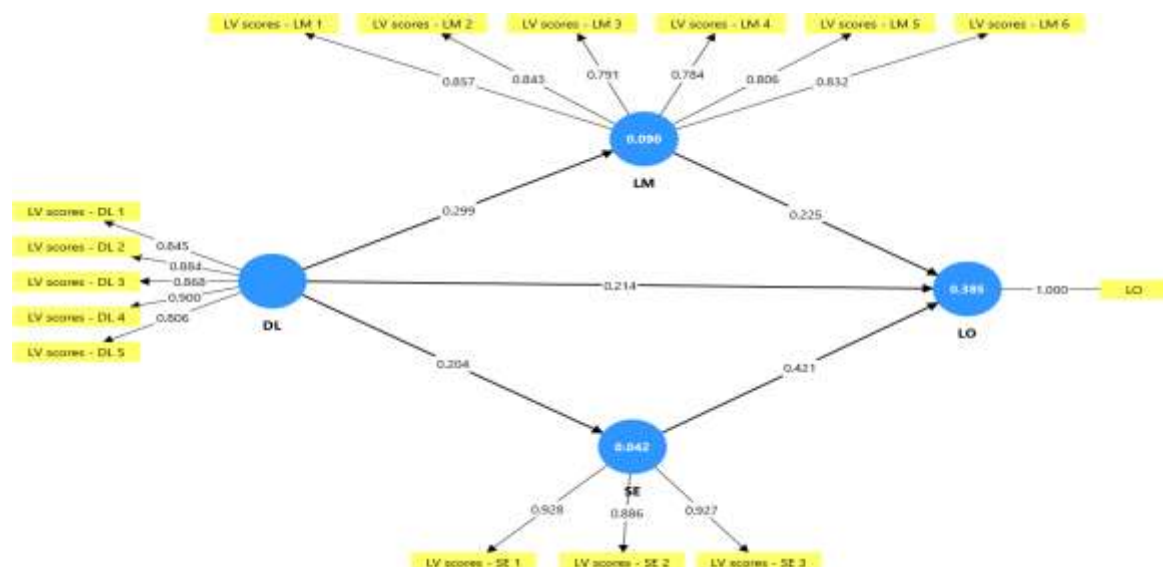


Figure 2. SEM Analysis Results

Source: Process by SEM-PLS 2026

Discussion

The Influence of Digital Literacy on Students' Learning Outcomes

The analytical results indicate that digital culture has a beneficial impact on students' academic performance in computer science ($\beta = 0.214$; $t = 3.304$; $p = 0.001 < 0.05$), hence hypothesis H1 is accepted. This study confirms the importance of digital culture in information processing (Gilster, 1997). Digital literacy is not only academic support for students in the "Office Management and Commercial Services" (MPLB) and "Digital Business and Marketing" (BDP) programmes, but also a very important and irreplaceable technical skill in the use of cloud-based management and e-commerce platforms in the business simulations they conduct. Holm (2025), Aznikhah et al. (2025) note that current educational standards highlight the relevance of digital competencies. This is in line with Chen (2025) argument for the requirement for digital adaption for academic performance. Digital Literacy is the bridge of MPLB and BDP students in Indonesian vocational education to deal with dynamic learning materials (Visser et al., 2023) and integrate technology with practical professional practices Susanti & Laily (2024). Thus, digital literacy helps students to turn their theoretical knowledge into useful skills that are directly connected to the needs of the modern workforce.

The Influence of Digital Literacy on Students' Learning Motivation

The analysis confirms that digital literacy significantly boosts students' learning motivation ($\beta = 0.299$; $p < 0.05$). For students majoring in MPLB and BDP, digital literacy is more than just a technical skill; it is a primary motivator that enables them to independently explore learning materials relevant to their future careers. Research by Mulyati (2023) and Zhang (2025) found that digital competence is important in maintaining the academic spirit. This is supported by the ability to navigate digital business platforms that cultivate a sense of confidence and passion for digital business. Digital literacy is a "internal drive" to sustain student engagement in Indonesian vocational education. Students are more motivated when they are familiar with digital tools for business simulations as they see a direct correlation of their curriculum to the requirements of the current workforce.

The Influence of Digital Literacy on Students' Self-Efficacy

The analysis indicates that digital literacy has a significant effect on the students' self-efficacy ($\beta = 0.204$; $p < 0.05$). Their mastery of digital tools is their main source of self-confidence for MPLB and BDP students. They have expertise with business software, so they are able to be robust when faced with technological challenges such as software faults in digital marketing simulations or administrative data issues. This supports the findings of Yuan et al. (2025) and Zakir et al. (2025), who discovered that digital literacy is a psychological skill that fosters self-confidence. It has been proven that self-confidence is a better predictor of success in vocational school settings than motivation levels; students with good digital skills are better at handling difficult practical tasks. According to Arpa & Anwar (2026), digital literacy is not a technical skill but a cognitive integration that increases students' confidence in their ability to meet the professional demands of the current workforce.

The Influence of Learning Motivation on Students' Learning Outcomes

The analysis shows that learning motivation has a positive effect on students' learning outcomes ($\beta = 0.225$; $p < 0.05$). Motivation is an inner drive that helps MPLB and BDP students to persist with difficult practical tasks. This finding is consistent with the findings of Pertiwi et al. (2023) and Sari et al. (2025) who state motivation is a factor for students to be involved in the context of occupation. Most importantly, these students are motivated by the desire to get skills that will be useful for their careers, as well as the desire to get high grades. According to Arsyad et al. (2023), digital literacy increases motivation because it provides uniformity in technical training. Therefore, motivation is not only an academic advantage for the MPLB and BDP students, but it also provides the mental foundation for the diverse needs of the modern-day workforce.

The Influence of Self-Efficacy on Students' Learning Outcomes

The analysis showed that self-efficacy had a significant effect on learning outcomes ($\beta = 0.421$; $p < 0.05$). For students of MPLB and BDP, self-efficacy is a critical construct that enables them to complete difficult practicals as opposed to merely a matter of confidence. Self-efficacy provides the psychological resilience to continue despite technical issues like software issues or convoluted administrative errors. Motivation is a want to succeed. These findings are supported by Yuan et al. (2025) and Getenet et al. (2024) who highlight that self-efficacy in

digital environments motivates students to participate socially, cognitively and emotionally with Bandura's (1986) thesis. This view is important in the professional setting where students need to be proficient in both theory and technical execution and hence self-confidence is a better predictor of success than motivation alone. MPLB and BDP students are better performers and feel more capable of meeting the rigorous professional standards of the contemporary workforce when they feel in control of their digital tools.

The Mediating Role of Learning Motivation in the Influence of Digital Literacy on Students' Learning Outcomes

The study shows that learning motivation is a bridge or mediator between learning outcomes and digital literacy ($\beta = 0.067$; $p < 0.05$). For MPLB and BDP students, digital literacy is not just a technical skill, it makes them feel good about themselves. The process of this mediation shows a great psychological transformation. First, students' familiarity with digital technologies makes them feel competent to cope with technical business assignments, which is in line with Self-Determination Theory (Ryan & Deci, 2020). Zhang (2025) suggests that this ability is developed into intrinsic motivation, encouraging students to take on difficult tasks such as complex administrative data management or long-term digital marketing campaigns. Motivation is the internal engine to keep the effort going and digital literacy is just a psychological trigger to remove the technical obstacles according to Dewi et al. (2024). In other words motivation provides the why for success, digital literacy provides the how. According to (Aznikhah et al. (2025) and Pala & Başbüyük (2021), this synergy successfully leads pupils to the best possible learning outcomes.

The Mediating Role of Self-Efficacy in the Influence of Digital Literacy on Students' Learning Outcomes

The research shows that self-efficacy significantly mediates the effect of digital literacy on learning outcomes ($\beta = 0.086$; $p = 0.041 < 0.05$). For MPLB and BDP students, digital literacy is not just technical competency; it is the psychological foundation of self-confidence. This mediation mechanism suggests that the digital competence serves as a "buffer" to reduce anxiety based on Bandura's (2012) self-efficacy theory. According to Yuan et al. (2025), when students feel proficient with business software, they are less afraid of administrative mistakes or technological difficulties in marketing simulations, which promotes more active participation in the learning process. This study highlights one's own effectiveness as a mediator that is more powerful than motivation. Digital literacy in professional education requires "confidence in one's ability to complete tasks" (self-efficacy), as opposed to the "desire to learn" (motivation). Self-efficacy offers steady cognitive resilience, whereas motivation is frequently emotional and erratic. Self-efficacy helps students stay composed and concentrated on troubleshooting rather than giving in to irritation when they come across software faults or complicated system obstacles. According to Getenet et al. (2024), who describe self-efficacy as the fundamental motivation for attaining professional competency standards, self-efficacy serves as a stronger bridge, transforming digital literacy into tangible achievement.

CONCLUSION

The purpose of this study was to analyze the effect of digital literacy on learning outcomes with learning motivation and self-efficacy as mediating variables. The result shows that digital literacy plays a very important role in improving learning outcomes either directly or indirectly through the mediating effect of learning motivation and self-efficacy. This suggests that students with stronger digital skills are more motivated and more self-confident to achieve learning tasks. This results in better learning outcomes. These findings are consistent with Social Cognitive Theory that digital literacy produces positive outcomes through motivation and self-efficacy. Students with high digital literacy are more motivated in engaging with learning materials and have greater confidence in their own ability to overcome academic challenges. Thus, the combination of digital competence and the improvement of psychological factors is a powerful way to optimize student achievement.

Certain limitations should be recognized. First, the questionnaire data used in this study was self-reported only, which may be subject to common method bias, social desirability bias, and respondents' subjective perceptions. This means that the relationships reported may not fully capture students' actual learning behaviors in the real world. Second, the sample was limited to two majors at one school, which may limit the generalizability of the findings. It is recommended that future studies recruit a wider range of students to increase the diversity of participants in order to improve the generalizability of the results to different educational contexts.

AUTHOR CONTRIBUTION

All authors contributed equally to this work. Aini Saputri was responsible for conceptualization, methodology, data collection, formal analysis, and writing original draft. Armianti contributed to validation, review & editing, and supervision. All authors have read and agreed to the published version of the manuscript.

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DATA AVAILABILITY

The data that support the findings of this study are available upon reasonable request from the corresponding author. The data are not publicly available due to privacy and ethical restrictions.

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COMPETING INTEREST

The authors declare that there is no conflict of interest regarding the publication of this article.

ETHICAL CLEREANCE

This study obtained permission from SMK Negeri 2 Bukittinggi prior to data collection. Informed consent was obtained from all student participants, and the confidentiality of their identities and responses was strictly maintained throughout the research process for academic purposes only.

AI STATEMENT

The authors declare that Artificial Intelligence (AI)-assisted tools were used during the preparation of this manuscript solely for the purposes of grammar checking, language editing, and proofreading. All AI-generated suggestions were carefully reviewed, edited, and verified by the authors. The AI tools were not used for data collection, data analysis, interpretation of results, or drawing scientific conclusions. The authors take full responsibility for the integrity, originality, and accuracy of the published work.

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