



Education and Enterprise Empowerment: The Mediating Role of Digital Skills among Indonesian Micro- Small Entrepreneurs

Afif Zaerofi¹, Aminah Nuriyah², Shofi Arofatul Marits³, Abdullah Haidar⁴

Universitas Islam Tazkia, Bogor, Indonesia^{1,2}

Sekolah Tinggi Agama Islam (STAI) Al-Fatah Cileungsi, Bogor, Indonesia³

Süleyman Demirel University, Isparta, Turkiye⁴

Article History:	Abstract
Corresponding Author: Shofi Arofatul Marits shofiarofatulm@gmail.com Submitted: April 2nd, 2026 Revised: June 18th, 2026 Accepted: June 21st, 2026 Published: June 29th, 2026 Copyright: ©2026. Afif Zaerofi, Aminah Nuriyah, Shofi Arofatul Marits, Abdullah Haidar  This article is licensed under the Creative Commons Attribution- Share Alike 4.0 International License. http://creativecommons.org/licenses/by-sa/4.0/	Objective: Education and digital skills are increasingly recognized as key resources for strengthening entrepreneurial capacity and business sustainability. This study examines the influence of education on Micro-Small Entrepreneurs empowerment and investigates the mediating role of digital skills among micro-small entrepreneurs in Indonesia. Method: This study employed a quantitative approach using Structural Equation Modelling Partial Least Squares (SEM-PLS). Data were collected from 108 valid micro-small entrepreneurs operating in the food, fashion, and retail sectors across West Java Province, Indonesia. The proposed model assessed the relationships among education, digital skills, and Micro- Small Entrepreneurs empowerment. Results: The results indicate that education has a positive and significant effect on digital skills and Micro- Small Entrepreneurs empowerment. Digital skills also significantly enhance Micro- Small Entrepreneurs' empowerment. Furthermore, digital skills partially mediate the relationship between education and Micro- Small Entrepreneurs empowerment, suggesting that educational attainment contributes to entrepreneurial empowerment both directly and indirectly through improved digital capabilities. Implications: The findings highlight the importance of strengthening entrepreneurship education and digital literacy programs to foster inclusive and sustainable Micro- Small Entrepreneurs development. Policymakers, educational institutions, and development agencies should prioritize initiatives that simultaneously enhance educational attainment and digital competencies among micro-entrepreneurs Originality or Novelty: This study extends the Micro- Small Entrepreneurs empowerment literature by integrating education and digital skills within a single analytical framework and empirically demonstrating the mediating role of digital skills in explaining how education translates into entrepreneurial empowerment among Indonesian micro-small enterprises. Keywords: Education; Digital Skills; Micro-Small Empowerment; Modelling Partial Least Squares.

Introduction

Micro-small enterprises (MSEs) constitute the backbone of Indonesia's economy, contributing significantly to employment generation, income distribution, and economic growth. Despite their strategic role, many MSEs continue to face challenges in improving productivity, competitiveness, and long-term sustainability (Kurniawan & Anwar, 2025). These challenges have become increasingly evident in the era of digital transformation, where businesses are required to adopt digital technologies and develop new competencies to remain competitive.

Digital transformation has created substantial opportunities for MSEs to expand market reach, improve operational efficiency, and enhance customer engagement (Amyulianthy et al., 2025). However, the benefits of digitalization are not evenly distributed. Many micro-small enterprises still experience limitations in adopting digital technologies due to inadequate knowledge, limited access to training, and insufficient digital capabilities (Rachmatulloh et al., 2025). Consequently, the ability of entrepreneurs to leverage digital opportunities depends not only on technological availability but also on the quality of human capital they possess.

Human capital theory (Aboobaker & Renjini, 2020) suggests that education enhances individuals' knowledge, skills, and competencies, thereby improving their ability to make strategic decisions and adapt to changing business environments. In the context of entrepreneurship, education contributes to opportunity recognition, innovation, and business development. At the same time, digital skills have emerged as a critical entrepreneurial resource, enabling business owners to utilize digital platforms for marketing, communication, financial management, and operational activities. Entrepreneurs with stronger digital competencies are generally better positioned to respond to market changes and exploit opportunities in the digital economy.

Previous studies (Rachmatulloh et al., 2025; Raharjo et al., 2023; Ramdan et al., 2025) have demonstrated that education positively influences entrepreneurial capability and business performance, while digital literacy contributes to innovation, competitiveness, and firm growth. However, existing studies have predominantly examined education and digital skills as separate determinants of entrepreneurial outcomes. Most research focuses either on the direct relationship between education and entrepreneurial performance or on the influence of digital literacy on MSE success. As a result, limited empirical evidence explains how education translates into MSE empowerment through the development of digital skills, particularly in the context of micro-small enterprises in developing economies.

This research gap is particularly relevant in Indonesia, where significant disparities remain in educational attainment and digital readiness among MSE actors. West Java, one of Indonesia's largest economic regions and home to a substantial number of micro- and small enterprises, provides an important context for examining these issues. Although digital infrastructure and government support programs have expanded considerably, many entrepreneurs continue to utilize digital technologies primarily for basic communication rather than for strategic business development. Understanding the mechanisms through which education and digital skills contribute to MSE empowerment is therefore essential for designing effective entrepreneurship and digital inclusion policies.

The present study addresses this gap by developing an integrated framework linking education, digital skills, and MSE empowerment. Unlike previous studies that investigate these variables independently, this study examines the mediating role of digital skills in the relationship

between education and MSE empowerment. The study contributes to the literature in three ways. First, it integrates education and digital skills within a single empowerment model. Second, it provides empirical evidence regarding the mediating mechanism through which education enhances entrepreneurial empowerment. Third, it offers insights from the context of Indonesian micro-small enterprises, a setting that remains underrepresented in the digital entrepreneurship literature.

Accordingly, this study seeks to answer the following research questions: To what extent does education significantly influence digital skills among micro-small entrepreneurs? To what extent do digital skills significantly influence MSE empowerment? To what extent does education significantly influence digital skills among micro-small entrepreneurs? How digital skills mediate the influence of education on MSE empowerment?

The findings are expected to enrich the literature on digital entrepreneurship and MSE empowerment while providing practical implications for policymakers, educational institutions, and development agencies seeking to strengthen the competitiveness and sustainability of micro-enterprises in Indonesia

Literature Review

Empowerment for MSEs is fundamentally about enhancing their capacity to access critical resources, make informed strategic decisions, and achieve sustainable economic outcomes. According to (Raharjo et al., 2023) This empowerment is multifaceted, encompassing access to financing, digital visibility, market expansion opportunities, and decision-making autonomy (Raharjo et al., 2023). The acknowledgment that these aspects significantly influence MSEs' viability and growth is vital for shaping policies aimed at fostering a robust entrepreneurial ecosystem. Research conducted by (Sudrajad et al., 2023) emphasizes the importance of community-based initiatives in facilitating digital literacy and financial knowledge, which are vital for empowering local businesses through transformative practices and adequate access to digital technologies (Sudrajad et al., 2023).

Education, whether formal or informal, plays a pivotal role in shaping the entrepreneurial capabilities of business owners. Education significantly contributes to entrepreneurial intention and capability development (Sudrajad et al., 2023). Evidence from Indonesia corroborates this, suggesting that entrepreneurs with at least a high school diploma are more likely to engage in innovative practices, thereby enhancing their competitive edge in the market. This underscores the necessity of integrating entrepreneurship education within formal curricula to cultivate a workforce capable of navigating contemporary business challenges. Furthermore, effective education systems must evolve to incorporate digital literacy comprehensively. As outlined by (Isabella et al., 2024) The integration of digital platforms in educational contexts is crucial for fostering engagement and enhancing learning outcomes, particularly in developing nations where educators may require further training to utilize these tools effectively (Isabella et al., 2024). Consequently, scalable educational programs that equip MSEs with the necessary skills are essential to drive innovation and productivity within the sector.

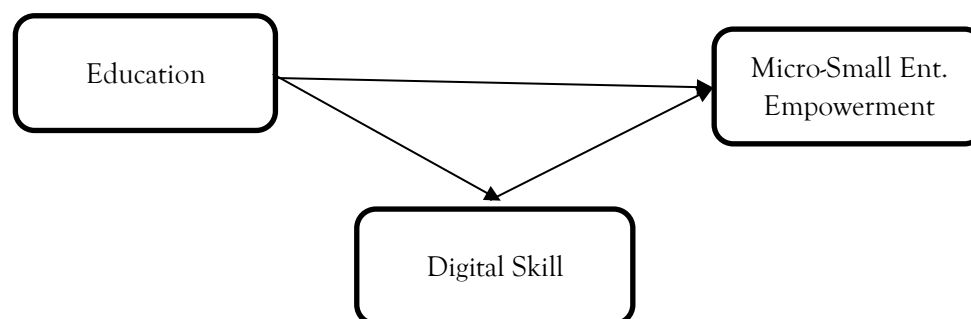
Digital literacy has emerged as a cornerstone for MSE sustainability and growth. According to research by (Sudrajad et al., 2023), MSEs that engage in online training related to digital competencies exhibit remarkable improvements in perceived financial performance (Sudrajad et

al., 2023). Given that digital competency fosters data-driven decision making, MSEs gain the ability to leverage technologies for marketing, financial management, and operational efficiency. MSEs with moderate digital skills report significantly higher profitability than those lacking such competencies, illustrating the direct correlation between digital proficiency and economic outcomes (Isabella et al. 2024).

Moreover, the need for comprehensive digital literacy training is imperative, as many MSEs in Indonesia face structural challenges, such as a limited understanding of digital tools for strategic business use. The study conducted by (Hairunisya et al., 2023) highlights the transformative potential of entrepreneurship management training in strengthening digital skills among MSE actors, ultimately enhancing their empowerment and performance (Hairunisya et al., 2023). The integration of digital skills into entrepreneurship education is essential, with digital marketing development models reinforcing the importance of digital literacy as a mediating factor, improving MSE performance (Umboh & Aryanto, 2023).

Drawing on human capital theory and prior empirical studies, education is expected to enhance individuals' ability to acquire and utilize digital skills, which are essential for business development in the digital economy. Furthermore, digital skills enable entrepreneurs to improve operational efficiency, expand market access, and foster innovation, thereby strengthening MSE empowerment. In addition, education may also directly influence MSE empowerment by equipping entrepreneurs with knowledge, problem-solving abilities, and strategic decision-making skills. The proposed research model illustrating these relationships is presented in Figure 1.

Figure 1. Research Model



Based on the above research model, the following hypotheses are proposed:

H1: Education positively influences digital skills.

H2: Digital skills positively influence MSE empowerment.

H3: Education positively influences MSE empowerment.

H3: Digital skills mediate the influence of education on MSE empowerment.

Research Methodology

This study employed a quantitative research design to examine the relationships among Education (EDU), Digital Skills (DS), and MSE Empowerment (MSEE) among Micro-Small entrepreneurs in West Java, Indonesia. The study utilized Partial Least Squares Structural Equation Modelling (PLS-SEM) through SmartPLS 4.0. PLS-SEM was selected since it is suitable

for prediction-oriented research, mediation analysis, and studies involving relatively complex models with moderate sample sizes (Hair et al., 2017).

The target population comprised micro- and small entrepreneurs operating in the food, fashion, and retail sectors in West Java Province. These sectors were selected because they represent a substantial proportion of micro-small enterprises and are among the sectors most affected by digital transformation. A purposive sampling technique was employed to ensure that respondents possessed characteristics relevant to the research objectives. The sampling was established to ensure that participants possessed sufficient entrepreneurial and digital experience to evaluate the influence of education and digital skills on MSE empowerment. The inclusion criteria were as follows: 1) The respondent was the owner or manager of a micro-small enterprise, 2) The business had been operating for at least one year, 3) The respondent had experience using digital technologies for business activities, such as social media, e-commerce platforms, or digital payment systems, and 4) The respondent was willing to participate voluntarily in the survey.

Data collection was conducted between January and March 2025 using both online and offline questionnaires. A total of 118 questionnaires were collected. After data screening, including completeness and response consistency checks, 108 valid questionnaires were retained for analysis. The final sample size of 108 respondents exceeds the minimum requirement recommended for PLS-SEM. Following (Gufran & Hairi, 2019) The sample size satisfies the statistical power requirements for estimating the proposed structural model and provides reliable parameter estimates.

The questionnaire consisted of two sections. The first section collected respondents' demographic information, including age, gender, educational background, business sector, business age, and location. The second section measured the latent constructs used in the conceptual model. All measurement items were adapted from previously validated studies to ensure content validity and construct reliability. Education (EDU) was measured using three indicators reflecting formal education, participation in entrepreneurship training, and self-directed learning activities. Digital Skills (DS) were measured using three indicators related to digital application usage, digital marketing competence, and internet utilization for business operations. MSE Empowerment (MSEE) was measured using three indicators: strategic decision-making capability, market expansion, and innovation capacity.

The questionnaire was developed in English and translated into Bahasa Indonesia using a back-translation procedure to maintain conceptual equivalence. Prior to the main survey, a pilot study involving 30 micro-small entrepreneurs was conducted to evaluate item clarity, wording appropriateness, and content relevance. Minor revisions were implemented based on participant feedback and expert recommendations. All items were measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Table 1.
Indicators of Variables

Variables	Indicators	Sources
Education (EDU)		
EDU1	I actively participate in business or entrepreneurship training programs to improve my business performance.	(Aboobaker & Renjini, 2020; Widjaja et al., 2022)
EDU2	My formal education provides useful knowledge and skills that support my business activities.	(Aboobaker & Renjini, 2020; Widjaja et al., 2022)
EDU3	I frequently engage in self-learning for business (e.g., YouTube, podcasts, online resources) to enhance my entrepreneurial skills.	(Aboobaker & Renjini, 2020; Widjaja et al., 2022)
Digital Skill (DS)		
DS1	I use digital applications (e.g., Shopee, Gojek, Tokopedia) to support my business activities.	(Suryawandari et al., 2025)
DS2	I have a good understanding of digital marketing strategies to promote my products/services.	(Shaltoni et al., 2018)
DS3	I use the internet regularly to manage and support my business operations.	(Widhiastuti et al., 2024)
MSE Empowerment (MSEE)		
MSEE1	I can make independent strategic decisions to manage and grow my business effectively.	(Megawati et al., 2021)
MSEE2	The use of digital platforms has helped me expand my customer base and market reach.	(Sulistiyowati et al., 2024)
MSEE3	I continuously innovate my products/services and feel ready to adapt to market changes.	(Sariwulan et al., 2020)

Data analysis was conducted using SmartPLS 4.0, following the two-step approach recommended by Hair et al., (2017). The first stage involved evaluating the measurement model through: Indicator reliability (outer loading > 0.70), internal consistency reliability using Cronbach's Alpha and Composite Reliability (CR > 0.70), convergent validity using Average Variance Extracted (AVE > 0.50) and discriminant validity using Heterotrait-Monotrait Ratio (HTMT < 0.90). The second stage assessed the structural model by examining: Variance Inflation Factor (VIF), Path coefficients, Coefficient of determination (R^2), Effect size (f^2), Predictive Relevance (Q^2) and Model fit indicators. The significance of the hypothesized relationships was assessed using the bootstrapping procedure.

To examine the mediating role of digital skills, an indirect-effect analysis was conducted using the bootstrapping procedure recommended by Hair et al., (2017). The mediation effect was evaluated through the indirect path:

Education $\rightarrow$ Digital Skills $\rightarrow$ MSE Empowerment.

The indirect effect was considered significant when the bootstrapped confidence interval excluded zero, and the p-value was below 0.05. In addition to the direct effect, the indirect and total effects were reported to determine whether Digital Skills served as a partial or full mediator in the relationship between Education and MSE Empowerment. This approach provides a more rigorous assessment of the causal mechanism through which education contributes to the empowerment of micro-entrepreneurs in the digital economy.

Results and Discussion

Results

The characteristics of respondents were reported as follows. They were mostly from Generation Y (68.5%), female (56.5%), and in the growth phase of business (50% operating 1–5 years). In connection with educational backgrounds, it was relatively high, with 42.6% holding a bachelor's degree and 38% high school graduates. Nearly half (46.3%) worked in culinary businesses, followed by retail (34.3%) and fashion (19.4%). Geographically, respondents were concentrated in Subang (17.6%), Sukabumi (13.9%), Bandung (12.0%), Bogor (11.1%), and Tasikmalaya (11.1%). Overall, the sample represents digitally active micro-small entrepreneurs in their productive age, with adequate education and broad distribution across West Java.

Before assessing the structural model, the measurement model was evaluated through indicator reliability, internal consistency reliability, and convergent validity. Table 2 presents the outer loading values of all indicators.

Table 2.
Measurement Model

Variable	Indicators	Loading	Cronbach's Alpha	rho_A	Composite Reliability	AVE
Digital Skills	DS1	0,940	0,947	0,962	0,962	0,894
	DS2	0,949				
	DS3	0,948				
Education	EDU1	0,859	0,885	0,893	0,929	0,813
	EDU2	0,900				
	EDU3	0,943				
Micro-Small E. E	MSEE1	0,946	0,887	0,895	0,930	0,817
	MSEE2	0,862				
	MSEE3	0,901				

Source: Data Processed, 2026

All indicator loadings exceeded the recommended threshold of 0.70, indicating satisfactory indicator reliability. Therefore, all indicators were retained for further analysis. All constructs achieved Cronbach's Alpha and Composite Reliability values above 0.70, indicating satisfactory internal consistency. Furthermore, all AVE values exceeded 0.50, confirming convergent validity. These results demonstrate that the measurement model satisfies the recommended reliability and validity criteria.

To test the discriminant validity, this study employs the Heterotrait-Monotrait Ratio (HTMT), as shown in the table below.

Table 3.
Heterotrait-Monotrait Ratio (HTMT)

	DS	EDU	MSEE
DS			
EDU	0,571		
MSEE	0,726	0,747	

Source: Data Processed, 2026

The above table shows that the HTMT value between DS and EDU is 0.571, while the HTMT value between DS and SMEE is 0.726. Furthermore, the HTMT value between EDU and SMEE is 0.747. All correlation values remain below the threshold value of 0.90, indicating that each construct demonstrates adequate discriminant validity. These findings confirm that Digital Skills, Education, and SME Empowerment are distinct theoretical concepts and empirically distinct from one another. Therefore, there is no evidence of construct overlap, and the measurement model satisfies the discriminant validity requirement.

Before examining the relationship among variables, a multicollinearity test was conducted.

Table 4.

Inner Variance Inflation Factor Values

	DS	SMEE
DS		1,386
EDU	1,000	1,386

Source: Data Processed, 2026

Based on the Inner VIF table, all inner VIF values are relatively low, namely between 1.000 and 1.386. These values are far below the commonly used thresholds of $VIF < 5$ or $VIF < 10$. Even when using a stricter criterion of $VIF < 3.3$, all values still meet the required standard. This means that there is no multicollinearity problem among the variables in the research model. Education, digital skills, and micro-small enterprise empowerment do not have excessively strong linear relationships with one another, so they are considered suitable for further analysis. The model fit indices are reported in Table 5.

Table 5.

Model Fit

	Saturated Model	Estimated Model
SRMR	0,058	0,058
d ULS	0,152	0,152
d_G	0,154	0,154
ChiSquare	103,039	103,039
NFI	0,879	0,879

Source: Data Processed, 2026

The SRMR value of 0.058 is below the recommended threshold of 0.08, indicating an acceptable model fit. Overall, the model demonstrates satisfactory goodness-of-fit and is appropriate for explaining the relationships among Education, Digital Skills, and MSE Empowerment.

The significance of the proposed relationships was assessed using the bootstrapping procedure. The results are presented in Table 6.

Table 6.
Hypothesis Testing

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
DS > MSEE	0,439	0,449	0,104	4,236	0,000
EDU > DS	0,528	0,535	0,080	6,585	0,000
EDU > MSEE	0,433	0,425	0,114	3,785	0,000

Sources: Data Processed, 2026

The results indicate that all hypothesized relationships are positive and statistically significant. Education significantly influences Digital Skills ($\beta = 0.528$, $p < 0.001$). Digital Skills significantly affect MSE Empowerment ($\beta = 0.439$, $p < 0.001$). Education also has a direct positive effect on MSE Empowerment ($\beta = 0.433$, $p < 0.001$). The model explanatory was evaluated using the coefficient of determination (R^2) while the predictive power was measured by the predictive relevance test (Q^2). The results are shown in Table 7.

Table 7.
Model Explanatory and Predictive Power

Endogenous Construct	R^2	Q^2
Digital Skill	0,272	0,239
Micro-Small Ent. Empowerment	0,573	0,464

Sources: Data Processed, 2026

The model explains 27.9% of the variance in Digital Skills and 58.1% of the variance in MSE Empowerment. Based on the predictive relevance test, the Q^2 value for DS is 0.239, while the Q^2 value for MSEE is 0.464. Since both values are greater than 0, the model has predictive relevance for the endogenous constructs. The Q^2 value of DS indicates moderate predictive relevance, while the Q^2 value of MSEE indicates strong predictive relevance.

To examine the mediating role of Digital Skills, an indirect-effect analysis was conducted using the bootstrapping procedure. The results indicate, as shown in Table 8, the indirect effect of Education on MSE Empowerment through Digital Skills was positive and significant ($t = 2.844$, $p = 0.005$). This finding indicates that Digital Skills partially mediate the relationship between Education and MSE Empowerment. Therefore, Education contributes to MSE Empowerment both directly and indirectly through the enhancement of Digital Skills.

Table 8.
Mediating Testing

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
EDU > DS > MSEE	0,232	0,244	0,081	2,844	0,005

Sources: Data Processed, 2026

Discussion

This study examined the relationships among education, digital skills, and MSE empowerment among micro-small entrepreneurs in West Java, Indonesia. The findings provide empirical support for all proposed hypotheses and highlight the importance of human capital in fostering entrepreneurial empowerment in the digital economy.

First, the results demonstrate that education has a positive and significant effect on digital skills (coefficient: 0,528, t : 6.585, P : 0.000). This finding answers the first research question by showing that education significantly improves digital skills among micro-small entrepreneurs. This finding supports Human Capital Theory, which argues that education enhances individuals' knowledge, competencies, and learning capacity, enabling them to acquire and utilize new technologies more effectively. The R^2 value of 0.272 indicates that education explains 27.2% of the variance in digital skills. In addition, the f^2 value of 0.386 indicates a large effect size, suggesting that education plays a substantial role in improving digital skills among micro-small entrepreneurs. Entrepreneurs with higher levels of education and greater participation in training activities are more likely to develop digital competencies necessary for business operations, communication, and market engagement. This result is consistent with previous studies by (Aboobaker & Renjini, 2020; Chotisarn & Phuthong, 2026; Kusumojanto et al., 2021; Raharjo et al., 2023; Ruslaini et al., 2026), which indicate that education plays a crucial role in facilitating digital literacy and technology adoption among entrepreneurs.

Second, digital skills were found to influence MSE empowerment positively. This finding answers the second research question by confirming that digital skills are an important determinant of MSE Empowerment. Digital competencies enable entrepreneurs to improve decision-making, expand market access, and enhance innovation capability. In the context of increasing digitalization, entrepreneurs who are able to utilize digital platforms strategically are better positioned to respond to changing customer preferences and competitive market conditions. The f^2 value of 0.332 indicates a moderate to large effect size, showing that digital skills make an important contribution to MSE Empowerment. This result supports previous research by (Ganefri et al., 2025; Quraishi et al., 2024; Ramdan et al., 2025; Umboh & Aryanto, 2023), which emphasizes that digital literacy and technological capability are important drivers of entrepreneurial performance and business sustainability.

Third, education directly and positively influences MSE Empowerment. This finding answers the third research question by showing that education significantly contributes to the empowerment of micro-small entrepreneurs. Education contributes not only to knowledge acquisition but also to the development of critical thinking, problem-solving abilities, and strategic decision-making capabilities that are essential for entrepreneurial success. The f^2 value of 0.322 also indicates a moderate to large effect size, suggesting that education has a meaningful direct contribution to strengthening MSE empowerment. This result reinforces the argument that education remains a fundamental resource for strengthening entrepreneurial capacity and enhancing business resilience in dynamic economic environments.

Finally, an important contribution of this study is the identification of digital skills as a mediating mechanism linking education and MSE empowerment. The indirect-effect analysis demonstrates that education enhances MSE empowerment through the development of digital skills. This finding answers the fourth research question by demonstrating that education

enhances MSE Empowerment through the development of digital skills. However, because both the direct effect of education on MSE empowerment and the indirect effect through digital skills are significant, the results indicate partial mediation rather than full mediation. This finding suggests that while digital skills constitute an important pathway through which education contributes to empowerment, education also exerts an independent influence beyond digital competence alone.

The structural model explains 58.1% of the variance in MSE Empowerment ($R^2 = 0.581$), indicating that education and digital skills jointly constitute important determinants of entrepreneurial empowerment. This level of explanatory power suggests that human capital-related factors play a substantial role in shaping the capacity of micro- and small entrepreneurs to make strategic decisions, expand market opportunities, and strengthen business resilience. Nevertheless, approximately 41.9% of the variance remains unexplained, indicating that additional factors beyond education and digital skills may also influence empowerment outcomes.

The results show that the Q^2 values for the constructs are all positive, indicating that the proposed model has adequate predictive relevance. Specifically, the construct Digital Skills (DS) obtained a Q^2 value of 0.239, while Education (EDU) produced a Q^2 value of 0.000. Meanwhile, SME Empowerment (SMEE) achieved the highest Q^2 value of 0.464.

The Q^2 value of Digital Skills (0.239) indicates that the model has a moderate predictive relevance, suggesting that the proposed model can reasonably predict the indicators related to digital skills. Similarly, the Q^2 value of SME Empowerment (0.464) indicates a strong predictive relevance, meaning that the structural model provides substantial predictive accuracy in explaining SME empowerment outcomes.

However, the construct Education ($Q^2 = 0.000$) does not demonstrate predictive relevance based on the blindfolding criterion. This indicates that although education may have theoretical importance in the research framework, the current model does not provide sufficient predictive capability for this construct. This result may occur because education functions primarily as an explanatory variable rather than an endogenous construct requiring prediction, or because the indicators used for education have limited variation in explaining the construct.

Conclusion

This study examined the relationships among education, digital skills, and MSE Empowerment among micro-small entrepreneurs in West Java, Indonesia. The findings demonstrate that education positively influences digital skills and MSE Empowerment, while digital skills significantly contribute to entrepreneurial empowerment. Furthermore, the results indicate that digital skills partially mediate the relationship between education and MSE empowerment, suggesting that education enhances entrepreneurial empowerment both directly and indirectly through the development of digital competencies.

From a theoretical perspective, this study contributes to the entrepreneurship and MSEE literature by extending Human Capital Theory within the context of digital entrepreneurship. The findings show that educational resources not only strengthen entrepreneurial capabilities directly but also facilitate the acquisition of digital skills that support empowerment outcomes. By integrating education, digital skills, and MSE Empowerment within a single analytical

framework, this study provides a more comprehensive understanding of how human capital contributes to entrepreneurial development in emerging economies.

The findings also offer practical implications for policymakers, educational institutions, and MSEE development agencies. Efforts to strengthen MSE Empowerment should not be limited to providing digital infrastructure and technology access. Greater attention should be given to improving entrepreneurship education, continuous learning opportunities, and digital skills training programs that enable entrepreneurs to utilize digital technologies for business growth and sustainability effectively.

Despite these contributions, several limitations should be acknowledged. First, the study employed a cross-sectional design, which limits the ability to establish causal relationships over time. Second, the sample was restricted to micro-small entrepreneurs in West Java, which may limit the generalizability of the findings to other regions and business contexts. Third, demographic variables such as age, gender, business sector, and entrepreneurial experience were not incorporated as control variables or moderators in the structural model. Finally, the study focused exclusively on education and digital skills. In contrast, other factors such as financial literacy, entrepreneurial orientation, innovation capability, and access to digital infrastructure may also influence MSE Empowerment.

Future research may address these limitations by employing longitudinal designs, expanding the geographical coverage of respondents, and incorporating additional explanatory variables into the analytical framework. Researchers may also conduct multi-group analyses to investigate whether the effects of education and digital skills differ across demographic categories, business sectors, or levels of entrepreneurial experience. Such efforts would provide a deeper understanding of the mechanisms that drive MSE Empowerment in the digital economy.

Acknowledgments

The authors declare that there is no funding or external support for this research.

Author Contributions Statement

AZ conceptualized the study, designed the methodology and drafted the paper. AN contributed to the literature review and instrument development. SAM was responsible for data collection and data analysis, while AH was doing the proofreading, ensuring the format and references.

Conflict of Interest

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

AI Usage Statement

The authors confirm that Artificial Intelligence (AI) tools were only used in the research to edit language, check grammar, and enhance clarity and readability. AI was not employed to come up with fundamental ideas, analyze, examine information, and draw conclusions. The authors assume complete ownership of the originality, accuracy, and academic integrity of the content, and none of the AI tools are listed as an author or contributor.

Bibliography

- Aboobaker, N., & Renjini, D. (2020). Human Capital and Entrepreneurial Intentions: Do Entrepreneurship Education and Training Provided by Universities Add Value? *On the Horizon, the International Journal of Learning Futures*, 28(2), 73–83.
<https://doi.org/10.1108/oth-11-2019-0077>
- Amyulianthy, R., Astuti, T., Murni, Y., Mandagie, Y., Siswono, S., Mukri, C., Fredy, H., Prakoso, R., Adapa, S., Rio, M., Irianto, N. Y., & Baihaqi, B. (2025). Empowering Small Business Owners: The Role of Digital Transformation in Fostering Entrepreneurial Motivation. *Journal of Economics Finance and Management Studies*, 08(06).
<https://doi.org/10.47191/jefms/v8-i6-20>
- Chotisarn, N., & Phuthong, T. (2026). Reducing gaps in digital entrepreneurship education: A systematic review of innovative learning strategies and their institutional impact. *International Journal of Management Education*, 24(1), 101283.
<https://doi.org/10.1016/j.ijme.2025.101283>
- Ganefri, Waras, Trisno, B., Nordin, N. M., Hidayat, H., Rahmawati, Y., & Nurhidayatulloh. (2025). Cultivating digital entrepreneurs: Unravelling factors shaping digital entrepreneurship intention among engineering students in higher education. *International Journal of Management Education*, 23(2), 101100.
<https://doi.org/10.1016/j.ijme.2024.101100>
- Gufran, M. I., & Hairi, N. (2019). Pola Integrasi Masyarakat Dan Pesantren Dalam Peningkatan Ekonomi Berbasis Kearifan Lokal. *Amwaluna: Jurnal Ekonomi Dan Keuangan Syariah*, 3(2). <https://doi.org/10.29313/AMWALUNA.V3I2.4401>
- Hair, J. F., Hollingsworth, C. L., Randolph, A. B., & Chong, A. Y. L. (2017). An Updated and Expanded Assessment of PLS-SEM in Information Systems Research. *Industrial Management & Data Systems*, 117(3), 442–458.
- Hairunisya, N., Rindrayani, S. R., & Subiyantoro, H. (2023). Community Development and Social Welfare Through Entrepreneurship Management Training. *Asian Management and Business Review*, 107–120. <https://doi.org/10.20885/ambr.vol3.iss2.art1>
- Isabella, I., Alfritri, A., Saptawan, A., Nengyanti, N., & Baharuddin, T. (2024). Empowering Digital Citizenship in Indonesia: Navigating Urgent Digital Literacy Challenges for Effective Digital Governance. *Journal of Governance and Public Policy*, 11(2), 142–155.
<https://doi.org/10.18196/jgpp.v11i2.19258>
- Kurniawan, I. G. S., & Anwar, N. (2025). Strategic Efforts of Micro Garment Business “Simuh

- Konveksi” Through Local Production and Digital Adaptation in the Apparel Industry. *Icsema*, 1, 595–601. <https://doi.org/10.32424/icsema.1.1.417>
- Kusumojanto, D. D., Wibowo, A., Kustiandi, J., & Narmaditya, B. S. (2021). Do Entrepreneurship Education and Environment Promote Students’ Entrepreneurial Intention? The Role of Entrepreneurial Attitude. *Cogent Education*, 8(1). <https://doi.org/10.1080/2331186x.2021.1948660>
- Megawati, Yumna, A., Cheisviyanny, C., & Tasman, A. (2021). *Factors Forming Firm Performance of Micro-Businesses*. 179. <https://doi.org/10.2991/aebmr.k.210616.099>
- Quraishi, T., Ulusi, H., MUHID, A., Hakimi, M., & OLUSI, M. R. (2024). Empowering Students Through Digital Literacy: A Case Study of Successful Integration in a Higher Education Curriculum. *Journal of Digital Learning and Distance Education*, 2(8), 667–681. <https://doi.org/10.56778/jdlde.v2i8.208>
- Rachmatulloh, B., Herdiana, B. N. D., Fitriyah, & Retnasih, N. R. (2025). The Influence of Digital Trust and Artificial Intelligence Literacy on Business Sustainability: The Mediating Role of Innovation Capability. *Asian Journal of Economics, Business and Accounting*, 25(10), 484–501. <https://doi.org/10.9734/ajeba/2025/v25i102030>
- Raharjo, K. M., Sucipto, S., Zulkarnain, Z., Ishom, M., & Haidar, M. (2023). *Contribution of the Nonformal Education Labsite in Empowering Digital Technology-Based Communities*. 277–284. https://doi.org/10.2991/978-2-494069-95-4_33
- Ramdan, A. M., Siwiyanti, L., Komariah, K., Nurmillah, R., & Ramdhany, M. A. (2025). Entrepreneurial Competence, Market Orientation, and Digital Literacy Impact on MSME Culinary Marketing Performance in Indonesia. *Jurnal Ilmiah Manajemen Kesatuan*, 13(5), 3589–3604. <https://doi.org/10.37641/jimkes.v13i5.3548>
- Ruslaini, R., Indupurnahayu, I., Ayuniyyah, Q., Nurhayati, I., & Endri, E. (2026). Islamic Marketing, Customer Service, and Technological Innovation: Advancing Women’s Empowerment in Indonesian MSMEs. *International Review of Management and Marketing*, 16(2), 302–309. <https://doi.org/10.32479/irmm.22342>
- Sariwulan, T., Suparno, S., Disman, D., Ahman, E., & Suwatno, S. (2020). Entrepreneurial Performance: The Role of Literacy and Skills. *Journal of Asian Finance Economics and Business*, 7(11), 269–280. <https://doi.org/10.13106/jafeb.2020.vol7.no11.269>
- Shaltoni, A. M., West, D., Alnawas, I., & Shatnawi, T. (2018). Electronic Marketing Orientation in the Small and Medium-Sized Enterprises Context. *European Business Review*, 30(3), 272–284. <https://doi.org/10.1108/eb-02-2017-0034>
-

- Sudrajad, A. I., Tricahyono, D., Alamin, A., Zuwardi, Yulianti, E., Irnayenti, Ahmad, A., & Rosmawati, W. (2023). The Role of Digitalization Performance on Digital Business Strategy in Indonesian MSEMs. *International Journal of Professional Business Review*, 8(6), e02260. <https://doi.org/10.26668/businessreview/2023.v8i6.2260>
- Sulistyowati, S. N., Pranoto, A. J., & Mas'adah, N. (2024). The Impact of Fintech and Financial Literacy on MSME Development Through Access to Finance. *Die Jurnal Ilmu Ekonomi Dan Manajemen*, 15(1), 79–87. <https://doi.org/10.30996/die.v15i1.10594>
- Suryawandari, D., Wicaksono, A. S., Febryani, M. W., Agustin, R. D., Pamungkas, W., Komariyah, E. F., & Afnan, A. (2025). Digitalisasi UMKM Berbasis E-Commerce: Pelatihan, Pendampingan, dan Implementasi UMKM Go Digital. *Jurnal Pengabdian Masyarakat Dan Riset Pendidikan*, 4(1), 4409–4417. <https://doi.org/10.31004/jerkin.v4i1.2067>
- Umboh, I. A., & Aryanto, V. D. W. (2023). Digital Marketing Development Model Through Digital Literacy Mediation to Improve SME's Performance. *Media Ekonomi Dan Manajemen*, 38(1), 94. <https://doi.org/10.56444/mem.v38i1.3315>
- Widhiastuti, R. N., Irmasari, S., & Syihab, F. (2024). Penyuluhan Pemasaran Digital Untuk Meningkatkan Kesejahteraan Pelaku Umkm Di Desa Ciampea Kecamatan Ciampea Bogor. *Swadimas Jurnal Pengabdian Kepada Masyarakat*, 2(2), 1–5. <https://doi.org/10.56486/swadimas.vol2no2.504>
- Widjaja, S. U. M., Wibowo, A., Narmaditya, B. S., Wardoyo, C., & Saptono, A. (2022). Identifying Factors Affecting Entrepreneurship Education and Entrepreneurial Intention Among Indonesian University Students. *Entrepreneurial Business and Economics Review*, 10(3), 89–104. <https://doi.org/10.15678/eber.2022.100306>