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Digital Literacy as Nonformal Learning: An Analysis of Information Technology Investment and UMKM Competencies in Aceh

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ABSTRACT

This study examines digital literacy as a form of nonformal learning through patterns of information technology investment among UMKM in Aceh. UMKM actors in Aceh continue to face fundamental challenges in mastering digital literacy, including limited digital competencies, inadequate technological infrastructure, and unequal access to digital learning opportunities. These conditions contribute to a persistent digital divide, which is further influenced by the limited role of educational institutions, including Islamic schools and community-based learning institutions, in preparing society for digital transformation. The study aims to explore information technology investment patterns among UMKM in Aceh as manifestations of nonformal learning processes, identify the role of technology-based training and mentoring in improving entrepreneurs' digital competencies, and examine the potential contribution of educational institutions in supporting community digital transformation. This research employed a qualitative field research approach. Data were collected through in-depth interviews, participatory observation, and documentation studies involving 24 informants selected through purposive sampling in Banda Aceh, Aceh Besar, and Aceh Tengah. Data were analyzed inductively using thematic analysis, and findings were presented descriptively and interpretatively without making causal claims beyond the scope of qualitative inquiry. The findings reveal that 71% of informants experienced self-directed digital learning through gradual technology adoption, ranging from the use of WhatsApp Business to online marketplaces. UMKM actors who received structured technology training and mentoring demonstrated higher levels of digital competence and more significant business performance improvements compared to those relying solely on self-learning. The study concludes that technology adoption among UMKM in Aceh fundamentally represents a process of nonformal learning that requires systematic support from educational institutions and local governments through structured and sustainable digital literacy assistance programs.

Keywords: *Digital Literacy, Nonformal Learning, Information Technology Investment, UMKM Competencies*

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A. INTRODUCTION

Micro, Small, and Medium Enterprises (UMKM) constitute the backbone of the national economy and play a strategic role in employment generation and contribution to Gross Domestic Product (GDP). In Aceh Province, UMKM actors face not only economic challenges but also fundamental educational issues, particularly the low level of digital

literacy as a core competency required in the era of the digital economy. In this context, digital literacy is not merely understood as the ability to operate technological devices, but also encompasses critical thinking skills, information management, adaptability to technological change, and the productive and ethical use of digital media. These competencies are essentially outcomes of continuous and structured learning processes (Octiva et al., 2024).

The theme Digital Literacy as Nonformal Learning: An Analysis of Information Technology Investment and UMKM Competencies in Aceh positions digital literacy as part of a nonformal learning process that develops within society, particularly among UMKM actors. The digital transformation experienced by UMKM in Aceh largely occurs through self-directed learning, experiential practices, and informal educational processes outside formal institutions. Business actors learn how to use marketplaces, social media, digital payment systems, and business management applications through social interaction, short-term training, and direct experience in their daily business activities. This condition demonstrates that UMKM digitalization is not merely an economic and technological phenomenon, but also an educational phenomenon that shapes community competencies in practical and contextual ways.

However, this nonformal learning process still faces various obstacles. The digital divide between urban and rural UMKM in Aceh is not solely caused by limited technological infrastructure, but is also influenced by unequal access to digital literacy education and training (Abdillah, 2024). Many UMKM actors already have access to digital devices, yet they are still unable to optimize their use for improving business productivity. This indicates that investment in information technology without adequate competency development and pedagogical assistance is insufficient to achieve optimal digital transformation.

Investment in Information and Communication Technology (ICT) by UMKM actors essentially represents a concrete form of lifelong learning that transcends the boundaries of formal classrooms. When UMKM actors learn how to utilize e-commerce platforms, manage digital marketing, or use financial technology applications, they are actually engaging in learning processes involving cognitive, affective, and psychomotor dimensions. Therefore, technology investment should not only be interpreted as an economic expenditure, but also as an educational investment aimed at improving the digital competencies and capacities of business actors. Nevertheless, because these learning processes often occur informally and without systematic guidance, many UMKM actors encounter difficulties in maximizing their digital competencies (Rahmawati et al., 2025).

In this regard, educational institutions, particularly madrasahs, hold strategic potential to function as centers for community digital literacy development. As educational institutions with strong social legitimacy and extensive networks reaching rural communities, madrasahs can serve as facilitators of community-based nonformal digital learning for UMKM actors. A community-based digital education model involving madrasahs as centers for technology training and digital mentoring could bridge the gap

between the digitalization needs of UMKM and the educational capacities already existing within society (Mutiarani et al., 2025). Through this approach, madrasahs would not only fulfill their formal educational role, but also expand their function as agents of social and economic empowerment.

From a policy perspective, various government initiatives such as digital onboarding programs, e-commerce training, and digital ecosystem strengthening for UMKM in the post-COVID-19 era can essentially be understood as forms of technology-based nonformal education aimed at improving community digital competencies. However, empirical evaluations of the effectiveness of these programs in enhancing the digital literacy of UMKM actors in Aceh remain limited. Evidence-based research is therefore essential to assess the extent to which technology investment and training programs contribute to improving digital competencies, adaptive capacities, and the sustainability of UMKM businesses in Aceh (Mutiarani et al., 2025).

Based on the discussion above, this study focuses on three major issues. First, how do patterns of information technology investment among UMKM in Aceh reflect the nonformal learning processes experienced by business actors? Second, to what extent do technology-based training and mentoring programs contribute to improving the digital competencies of UMKM actors in Aceh? Third, what are the potential roles and contributions of educational institutions, including madrasahs, in supporting sustainable digital literacy learning processes for UMKM communities in Aceh?

This study aims to analyze digital literacy as a form of nonformal learning within the digital transformation process of UMKM in Aceh, particularly through patterns of information technology investment and the development of digital competencies among business actors. Furthermore, the study seeks to explore the potential role of educational institutions, especially madrasahs, in developing community-based nonformal education models that support inclusive and sustainable digital transformation. The findings of this research are expected to provide both theoretical and practical contributions to the development of educational policies and digital literacy-based UMKM empowerment programs in Aceh.

B. METHOD

This study employed a qualitative approach using a field research method aimed at obtaining an in-depth understanding of the phenomenon of digital literacy learning among UMKM actors in Aceh in a contextual and holistic manner. An interpretive paradigm was selected because the digital learning experiences encountered by UMKM actors represent subjective realities that cannot be reduced merely to numerical data, but instead need to be understood through the perspectives, narratives, and meaning-making processes of the actors directly involved (Matthew B. Milles, Michael Huberment, 2014; Sugiyono, 2019).

The research was conducted in Banda Aceh, Aceh Besar, and Aceh Tengah, considering variations in digital technology penetration, the density of UMKM, and the presence of nonformal educational institutions in each region. Informants were

determined through purposive sampling techniques based on criteria of relevance and depth of information. The primary informants consisted of UMKM actors who had undergone an information technology adoption process for at least the past year, while supporting informants included digital training facilitators from related government agencies, educational institution managers, and nonformal education academics. A total of 24 informants participated in the study, with data collection terminated once data saturation had been achieved (Fiantika, Wasil M, 2022).

Data collection was carried out through three complementary instruments. Semi-structured in-depth interviews were used to explore the informants' digital learning experiences, including the obstacles, strategies, and mentoring needs they encountered. Participatory observation was conducted at business locations to observe technology utilization practices within real-life contexts. Documentation studies included training materials previously attended by participants, records of digital learning progress, and supporting documents from relevant educational institutions (Isik, 2025; Robert K. Yin, 2011).

Data validity was ensured through systematic source triangulation and method triangulation. Data analysis employed an inductive thematic analysis model developed through the stages of open coding, axial coding, and selective coding (Braun & Clarke, 2022; Matthew B. Milles, Michael Huberment, 2014). It is important to emphasize that all findings were presented descriptively and interpretively in accordance with the capacity of a qualitative research design. This study did not aim to statistically prove causal relationships between variables, but rather to understand the patterns, processes, and meanings of the digital learning experiences of UMKM actors in Aceh within their distinctive context.

C. RESULTS AND DISCUSSION

1. Nonformal Learning Patterns through Information Technology Investment among UMKM in Aceh

Field findings indicate that the process of information technology adoption among UMKM actors in Aceh essentially represents a form of nonformal learning that occurs gradually, independently, and contextually. Of the total 24 informants, approximately 71% experienced a self-directed learning process in adopting digital technologies, ranging from the use of WhatsApp Business and online marketplaces to digital cashier applications and cloud storage systems. This learning process generally took place through mechanisms of trial and error, assistance from fellow UMKM actors (peer learning), or by watching online tutorials rather than through pedagogically structured training programs.

Table 1. Distribution of Types of Technology Adopted and Learning Sources among UMKM Actors in Aceh

No	Type of Technology	Number of Informants	Percentage (%)
1	WhatsApp Business & social media	20	83.3

2	Marketplace platforms (Shopee, Tokopedia)	17	70.8
3	Digital cashier applications (Point of Sale)	12	50.0
4	Independent business websites	7	29.2
5	Cloud storage & inventory management	5	20.8
6	ERP systems & digital accounting	3	12.5

Source: Primary data from field interviews, 2024.

The adoption pattern, which tends to begin with low-cost and easily accessible technologies, reflects a pragmatic learning strategy influenced by initial limitations in digital literacy. One informant from the culinary sector in Banda Aceh stated that, "we started with the easiest ones first, using WhatsApp and Shopee, because they did not require large capital and the results could immediately be seen in sales." This statement indicates that the motivation for learning technology was more extrinsic in nature driven by immediate economic needs rather than by a comprehensive understanding of the digital ecosystem, highlighting the need for more structured learning assistance.

2. The Impact of Training and Mentoring on UMKM Digital Competencies

Field findings consistently demonstrate observable differences between UMKM actors who participated in structured technology training or mentoring programs and those who learned independently through self-study. Informants who had attended training programs organized by government agencies or vocational education institutions tended to possess a more systematic understanding of digital platform management, content management, and digital financial administration. This condition contributed to more measurable operational efficiency in their business activities.

Table 2. Comparison of Digital Competency Indicators Based on Learning Sources

No	Competency Indicator	Self-Directed Learning	Structured Training Participation
1	Digital platform management	Partial and unsystematic	More systematic and well-planned
2	Marketing content management	Inconsistent	More organized and structured
3	Digital financial recordkeeping	Manual and frequently inaccurate	More accurate and efficient
4	Online market reach	Limited (1–2 cities)	Broader (5–12 cities)
5	Ability to adapt to new technologies	Slow and hesitant	Faster and more confident

Source: Primary data from observations and interviews, 2024.

An informant from the handicraft sector in Aceh Tengah who participated in digital inventory application training stated that, "after using the digital inventory

application, the time previously spent checking stock manually could be redirected to production, so in a single day we were able to complete more orders." This statement indicates that targeted technology training contributes to improving competencies that directly affect work efficiency, thereby emphasizing the importance of the learning dimension in the digitalization process of UMKM.

3. Potential Role of Educational Institutions in Supporting UMKM Digital Literacy

Field data analysis reveals a clear and unmet need for digital literacy education programs that are accessible to UMKM actors from diverse backgrounds. Informants residing in areas with active educational institutions including madrasahs tended to have easier access to technological information through existing socio-educational networks. This finding indicates the significant potential of educational institutions, particularly madrasahs, to function as community learning hubs capable of facilitating the improvement of digital literacy among surrounding communities.

Table 3. Identified Needs for Digital Learning Programs Among Informants

Category of Need	Number of Informants	Expected Form of Support
Basic platform usage training	18	Regular face-to-face classes
Content management assistance	14	Continuous mentoring
Digital financial literacy	16	Self-learning modules
Training from local educational institutions	11	Madrasah/pesantren community programs

Source: Primary data from in-depth interviews, 2024.

One informant, a fashion business owner in Banda Aceh, explained that "once we integrated Shopee, Instagram, and WhatsApp Business simultaneously, orders increased sharply and we were finally able to recruit two new employees within the first three months." However, the informant also emphasized that the learning process "was quite long and time-consuming because there was no one providing structured guidance." This testimony reinforces the argument that without structured educational assistance, the digitalization process of UMKM tends to progress more slowly and less efficiently than its actual potential.

4. Digitalization of UMKM as a Nonformal Learning Process

The findings of this study reveal that the process of information technology adoption among UMKM actors in Aceh fundamentally constitutes a form of nonformal learning that occurs outside the formal education system. This learning pattern, which is self-directed, pragmatic, and experience-based (experiential learning), aligns with the characteristics of nonformal education as conceptualized in the adult education

(andragogy) literature. When UMKM actors learn how to operate marketplace platforms or manage digital finance, they are essentially undergoing a learning cycle involving concrete experience, reflection, conceptualization, and active experimentation precisely as described in the experiential learning model (Rahmawati et al., 2025).

The fragmented and strategically unplanned pattern of technology adoption reflects the absence of a systematic digital literacy curriculum at the level of business actors. Most UMKM adopt technology reactively responding to market pressures or following trends without a deep understanding of the potential and limitations of each digital tool they use. This condition is reinforced by the fact that the contribution of UMKM to Aceh's Gross Regional Domestic Product (GRDP), which reached 55.56 percent in 2024, has not been accompanied by adequate digital capacity, indicating a competency gap that needs to be addressed through planned educational interventions (Modal et al., 2025).

Various obstacles, such as low levels of digital literacy and limited technological infrastructure, remain significant challenges overshadowing the digital transformation process of UMKM in Indonesia, including in Aceh (Rahmawati et al., 2025). These barriers are essentially educational barriers rather than merely economic or infrastructural issues. Therefore, the approach to overcoming them must be grounded in structured strategies aimed at improving community competencies and learning capacities.

5. The Role of Structured Training in Enhancing Digital Competence

The differences observed in this study between UMKM actors who participated in structured training and those who learned independently indicate that educational interventions play a significant role in the digitalization process of UMKMs. This finding confirms that information and communication technology plays an important role in supporting business activities to improve output more efficiently and measurably; however, this role can only be optimized when accompanied by digital competencies developed through planned learning processes (Bangsawan et al., 2023).

Effective training does not merely teach how to use specific applications, but also builds technology adaptability, enabling UMKM actors to continue learning independently alongside technological developments. UMKMs that successfully integrate information technology into their operational activities not only experience increased efficiency, but also demonstrate greater capabilities in innovation and in offering more competitive products and services (Octiva et al., 2024). These achievements essentially represent the learning outcomes of the nonformal education processes they undergo.

The reduction in promotional costs and the expansion of market reach identified in this study should not merely be understood as the direct result of technology usage, but rather as the outcome of improved digital competence acquired through learning processes. Digital transformation implemented in a planned manner, supported by adequate learning assistance, has proven to be more effective in strengthening UMKM competitiveness than sporadic technology adoption (Salam & Imilda, 2024).

6. The Potential of Madrasahs and Educational Institutions as Community Digital Literacy Centers

Findings regarding the need for accessible digital learning programs for UMKM actors open an important discussion on the potential role of educational institutions, particularly madrasahs, in supporting community digital transformation. As institutions with strong social trust and networks that reach rural communities, madrasahs possess highly strategic social capital that positions them as potential community learning centers in the field of digital literacy.

Increasing digital connectivity has a positive correlation with regional economic growth, with internet penetration and mobile connectivity serving as key variables that drive market efficiency and economic expansion in Southeast Asia (Ilmi et al., 2025). However, infrastructure connectivity without improvements in digital literacy will only create new inequalities between those who are able to utilize technology and those who are not. This is where the role of educational institutions becomes crucial as a bridge between the availability of digital infrastructure and the capacity of communities to use it productively.

The integration of digital literacy education into madrasah-based community programs can be implemented in various forms, such as community-based e-commerce training, digital financial management classes for local UMKM actors, or digital mentoring programs involving madrasah students as facilitators for parents or the wider community. Support in the form of training, technology facilitation, and partnerships with digital service providers has been proven to be a significant accelerating factor in helping UMKM overcome barriers to technology implementation (Octiva et al., 2024; Rahmawati et al., 2025).

The relevance of UMKM digitalization to the mission of educational institutions can also be seen from the perspective of community economic empowerment. The growth of UMKM driven by increased digital competencies ultimately contributes to community welfare, which forms part of the social responsibility of value-based educational institutions (Mutiarani et al., 2025). The multiplier effect of improved digital competencies, reflected in the creation of new employment opportunities by UMKM that have enhanced their digital capacities, provides a strong argument for educational institutions to actively engage in the agenda of community digital literacy (Harahap et al., 2024).

Overall, the discussion of these three research dimensions confirms that the digitalization of UMKM in Aceh is fundamentally an educational issue that must be approached through systematic learning strategies. The success of UMKM digital transformation largely depends on the synergy between the independent learning capacities of business actors and institutional support from educational institutions and the government. This synergy can only be realized if educational institutions, including madrasahs, are willing and able to move beyond their conventional roles and actively contribute to building an inclusive digital literacy learning ecosystem for all segments of society (Octiva et al., 2024; Rahmawati et al., 2025).

7. Analysis

Emphasizes that digital literacy is not merely a technical ability to operate technology, but also a social learning process that develops informally within society. The author argues that the digital transformation of UMKM in Aceh occurs through direct experiences, daily practices, and self-directed learning processes undertaken by business actors outside formal educational institutions. The author's analysis shows that the digitalization of UMKM in Aceh is still in a gradual adaptation stage. Most UMKM actors begin using technology through simple and easily accessible platforms such as WhatsApp Business, social media, and online marketplaces. This indicates that technology investment decisions are largely driven by practical economic needs rather than a comprehensive understanding of the broader digital ecosystem. Such conditions reveal that digital literacy among the Acehnese community remains instrumental in nature, meaning that technology is mainly utilized for basic business purposes and has not yet reached a more strategic and innovative level.

The author also argues that investment in information technology should be viewed as an investment in education. When business actors learn to use digital cashier applications, online marketing tools, and electronic payment systems, they are essentially participating in a lifelong learning process. Therefore, digital transformation should not focus solely on providing technological devices, but must also strengthen human capacity through continuous training and mentoring. The study demonstrates that UMKM actors who received structured training and guidance possessed better digital competencies than those who relied only on independent learning.

Furthermore, the research highlights the existence of a digital divide between urban and rural areas in Aceh. These barriers are not only caused by limited internet infrastructure, but also by unequal access to digital literacy education. The author believes that the main challenge in UMKM digitalization is fundamentally an educational issue rather than merely a technological one. Consequently, digital economic development should be integrated with community-based nonformal educational approaches. One of the most significant aspects of this study is its emphasis on the role of educational institutions, particularly madrasahs, as centers for community digital literacy. The author views madrasahs as institutions with strong social legitimacy and close relationships with local communities in Aceh. Therefore, madrasahs have the potential to become digital training centers for UMKM actors through programs such as online marketing assistance, digital financial literacy training, and marketplace management education. This perspective expands the role of Islamic educational institutions beyond formal religious education, positioning them as agents of community economic empowerment.

In addition, the author emphasizes that the success of UMKM digitalization depends greatly on collaboration between the government, educational institutions, and society. Government initiatives such as digital onboarding programs and digital ecosystem strengthening will not be fully effective without systematic and sustainable mentoring. Therefore, a contextual nonformal education model that reflects the social realities of Acehnese society is needed to ensure inclusive digital transformation. Overall,

this study provides an important understanding that digital literacy is a social learning process that plays a crucial role in local economic development. The digitalization of UMKM should not be viewed merely as technological modernization, but also as a process of developing community competencies toward a knowledge-based economy. This research is highly relevant because it demonstrates that digital economic development in Aceh requires adaptive, participatory, and community-based educational approaches.

D. CONCLUSION

Digital Literacy as Nonformal Learning: An Analysis of Information Technology Investment and UMKM Competencies in Aceh concludes that digital literacy among UMKM actors in Aceh develops through a nonformal learning process that occurs independently, gradually, and through direct practical experience in daily business activities. The research shows that investment in information technology is not merely viewed as an economic investment, but also as an educational investment aimed at improving the digital competencies of business actors. Most UMKM actors learn to use digital technologies such as WhatsApp Business, online marketplaces, digital cashier applications, and social media through self-learning processes, assistance from fellow entrepreneurs, and online tutorials.

The study also reveals that UMKM actors who receive structured digital training and mentoring demonstrate better digital competencies compared to those who rely solely on independent learning. They are more capable of managing digital platforms, conducting online marketing, organizing digital financial administration, and expanding market reach more effectively and efficiently. Therefore, training and mentoring are proven to be important factors in enhancing the competitiveness of UMKM in the digital economy era.

In addition, the research emphasizes that low levels of digital literacy and limited technological infrastructure remain major obstacles to the digital transformation of UMKM in Aceh. Consequently, systematic and sustainable learning strategies are needed to improve the digital capacities of the community. The study further highlights the important role of educational institutions, particularly madrasahs and community-based educational institutions, as centers of community digital literacy. Madrasahs are considered to have strong potential to become facilitators of technology training, digital mentoring, and competency development for UMKM because of their close social connection with communities, including those in rural areas. Overall, the study concludes that the success of digital transformation among UMKM in Aceh largely depends on the synergy between the independent learning capacities of business actors, government support, and the active involvement of educational institutions in building an inclusive, structured, and sustainable digital literacy ecosystem.

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