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Modeling the Impact of Digital Literacy on AI Based Learning Adoption through Perceived Usefulness and Ease of Use

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ABSTRACT

This research aims to understand the influence of digital literacy on the acceptance of **AI-driven learning** within educational settings. In the era of industrial revolution 4.0, digital literacy is becoming increasingly important, in line with the increasing integration of AI in education. **This study** uses a survey design and quantitative methodology with purposive sampling on a population of educators and students who have interacted with AI learning technology. **The questionnaire** instrument used measures variables such as digital literacy, Perceived Usefulness (PU), Perceived Ease of Use (PEOU), and AI acceptance, whose validity and reliability have been verified. Data analysis was carried out using Partial Least Squares Structural Equation Modeling (PLS-SEM) via SmartPLS software. Results show that digital literacy has a significant positive relationship with AI acceptance, mediated by perceived usefulness and ease of use. **These findings provide** the implication that increasing digital literacy can facilitate the integration of AI technologies in the education sector, underscoring the necessity for skill development programs aimed at improving digital skills among educators and students.

1. INTRODUCTION

Amid the wave of the Fourth Industrial Revolution, Artificial Intelligence (AI) has transformed many aspects of life, including the education sector [1]. AI offers the potential to enhance learning experiences through more personalized, adaptive, and responsive approaches [2]. With its ability to tailor learning materials to individual needs, AI promises to revolutionize how students learn and teachers teach [3]. However, this transformation requires more than just technological advancement, it demands a deep understanding of

digital literacy the ability to use information and communication technologies to locate, evaluate, create, and communicate information effectively [4].

Digital literacy serves as the foundation that enables individuals to interact effectively with advanced technologies [5, 6]. In the context of AI-enhanced learning, digital literacy not only facilitates access to educational resources but also strengthens users ability to navigate complex interfaces, interpret AI outputs, and apply these insights in learning contexts [7]. Therefore, the level of digital literacy can significantly influence the acceptance and integration of AI technologies in education. The adoption of innovative educational technologies, such as AI-based learning platforms, depends heavily on users ability and willingness to embrace change [8, 9]. The main question underpinning this study is, to what extent does digital literacy affect the success of AI learning adoption and acceptance by students and educators?

This research is significant as it provides insights into the patterns and processes involved in adopting AI technologies within educational settings, offering guidance for educational technology developers, policymakers, and practitioners [10]. By analyzing the relationship between digital literacy and AI technology acceptance, this study aims to develop more targeted strategies for implementing effective AI-based learning [11]. The findings are expected to support the growth of a learning system that promotes innovation, fairness, and long term sustainability. Furthermore, this research seeks to fill existing knowledge gaps by providing recommendations grounded in empirical data and robust statistical analysis using the SmartPLS method [12].

2. LITERATURE REVIEW

The literature review discusses the theoretical basis and prior research on how digital literacy influences the acceptance of AI-based learning [13]. It defines AI in education as the use of computational technologies that mimic human cognitive functions to create adaptive and personalized learning environments [14]. Digital literacy is described as the ability to find, evaluate, and create information using digital tools, serving as a key prerequisite for engaging with AI systems [15]. The review also adopts the Technology Acceptance Model (TAM), which identifies PU and PEOU as main factors influencing technology adoption [16]. Studies show that higher digital literacy enhances perceptions of usefulness and ease of use, leading to greater AI adoption [17].

2.1. Artificial Intelligence in Education

The use of intelligent systems that mimic human thinking to aid the learning and teaching process. AI is not merely a tool, but acts as a learning assistant that can analyze student needs and automatically adapt materials.

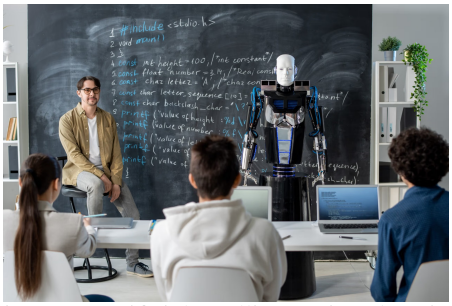

Figure 1. Artificial Intelligence in Education

The Figure 1 Artificial Intelligence (AI) in education is demonstrated through a robotic hand connected to various icons such as a brain, a graph, a gear, an email, and an idea light. These symbols indicate that AI supports the learning process by analyzing data, personalizing learning experiences, automating tasks, providing intelligent guidance, and helping students solve problems more effectively. The robotic hand symbolizes that AI functions as an assistant that helps enhance human capabilities, not replace them.

2.2. The Concept of AI in Education

Artificial Intelligence (AI) in education refers to the use of algorithms and computational technologies designed to simulate human intelligence in supporting the teaching and learning process [18]. AI-based systems such as adaptive learning platforms, intelligent tutoring systems, and predictive analytics allow personalized,

interactive, and data driven learning experiences [19]. These applications adapt materials to students pace, provide automated feedback, and help teachers manage instruction efficiently. AI thus promotes inclusive and individualized learning, where students can learn based on their abilities while teachers are supported in optimizing instructional time [20]. Through these functions, AI transforms traditional education into a more dynamic, flexible, and technology integrated environment, enhancing learning engagement and outcomes for both teachers and students [21].

2.3. Digital Literacy

Digital literacy involves the essential abilities required to identify, assess, understand, and produce information using digital technologies [22]. It includes not only technical proficiency in operating digital tools but also critical, cognitive, and ethical abilities to navigate complex online environments effectively. In AI-enhanced education, digital literacy is a fundamental prerequisite that enables users to interact meaningfully with AI systems from interpreting machine generated feedback to applying insights for better learning outcomes [23]. Individuals with high digital literacy levels tend to adapt more easily to technological changes, perceive AI tools as beneficial, and show greater confidence in using them. Consequently, digital literacy is closely linked to the readiness and willingness of both educators and students to adopt AI-based learning technologies [24]. Strengthening digital literacy skills can therefore directly contribute to the effective and safe application of AI tools in educational contexts, guaranteeing that technology promotes rather than impedes learning [25].

2.4. Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) provides the theoretical foundation to understand how users accept and utilize new technologies by identifying two main determinants of acceptance, namely PU, which refers to the belief that using a particular technology enhances performance or productivity, and PEOU, which refers to the belief that using the technology requires minimal effort [26]. In the context of AI learning, TAM explains that users willingness to adopt AI tools is influenced by how useful and easy they perceive the system to be. Research consistently shows that digital literacy strongly affects both PU and PEOU, as individuals with higher digital literacy can better understand AI functionalities, navigate interfaces, and solve technical issues, which leads them to view AI systems as more beneficial and user friendly [27]. Therefore, digital literacy acts as both a direct and indirect factor in AI learning acceptance directly by increasing users ability to use AI effectively, and indirectly by enhancing their perceptions of usefulness and ease of use, which in turn promote acceptance [28]. These relationships align with previous empirical findings suggesting that digital literacy mediates technology adoption behavior by fostering positive attitudes and reducing anxiety toward innovation [29]. Based on this conceptual integration, the study proposes a series of hypotheses that test the relationships among Digital Literacy, Perceived Usefulness, Perceived Ease of Use, and AI Learning Acceptance using the SmartPLS analytical framework, thereby establishing a clear causal pathway in which digital literacy enhances AI acceptance both directly and through the mediating roles of PU and PEOU [30].

3. RESEARCH METHODOLOGY

This study employs a quantitative methodology using a survey design, targeting educators and learners who have interacted with AI-based learning platforms [31]. Data will be collected through purposive sampling, selecting individuals who have specifically used or are familiar with AI technologies in educational contexts [32]. The primary data collection instrument is a questionnaire designed to measure the main variables of the study, including LD, PU, PEOU, and AI Acceptance (PAI) [33]. The questionnaire will use a Likert scale to capture respondents perceptions and experiences, and it will be pilot tested to confirm the consistency and accuracy [34]. The collected information will then be evaluated by applying the PLS-SEM approach with SmartPLS, allowing the testing of hypothesized relationships in the conceptual model [35]. The Research Variables Table below outlines each variable description and role in the study:

Table 1. Research Variables

Variable	Description
Digital Literacy (LD)	The ability to use, understand, and create information in digital formats.
Perceived Usefulness (PU)	The degree to which an individual believes that using AI in learning enhances their performance.
Perceived Ease of Use (PEOU)	The degree to which an individual believes that using AI in learning is easy and effortless.
AI Acceptance (PAI)	The extent to which users are willing to adopt AI in learning activities.

The Table 1 summarizes the main research variables and their definitions forming the study conceptual framework. LD refers to one ability to use, understand, and create information in digital formats [36]. PU reflects the belief that using AI in learning enhances performance, while PEOU represents the belief that AI-based learning is easy and effortless to use [37]. AI Acceptance (PAI) measures users willingness to adopt and utilize AI in education. Together, these variables explain how digital literacy shapes perceptions of usefulness and ease of use, ultimately influencing AI learning acceptance [38].

4. RESULTS AND DISCUSSION

As a first step in data analysis, this study emphasizes the importance of the validity and reliability of the research instrument [39]. Through a structured testing procedure, the survey instrument used in this study demonstrated an adequate level of reliability with a Cronbach Alpha value exceeding the generally accepted threshold of 0.7. This indicates consistency in responses to survey items [40]. Construct validity is also strengthened by the Average Variance Extracted (AVE) value, which indicates the proportion of variance explained by the construct in relation to measurement error, with each AVE value also exceeding the recognized minimum threshold of 0.5. These data confirm that the scale used in the survey is a reliable and valid measurement tool for assessing the hypothesized constructs [41].

Table 2. Validity Testing

Variable	Cronbach Alpha	AVE
Digital Literacy (LD)	0.860	0.705
Perceived Usefulness (PU)	0.849	0.690
Perceived Ease of Use (PEOU)	0.837	0.671
AI Acceptance (PAI)	0.848	0.686

The Table 2 above presents the reliability and validity test results for each research variable using Cron- bach Alpha and Average Variance Extracted (AVE) values [42]. Cronbach Alpha measures internal consistency, indicating how well the items within each construct are correlated and represent the same underlying concept [43]. All variables Digital Literacy (LD = 0.860), Perceived Utility (PU = 0.849), Perceived Simplicity (PEOU = 0.837), and artificial intelligence Acceptance (PAI = 0.848) have values above the acceptable threshold of 0.70, demonstrating high reliability. The AVE values for all variables also exceed 0.50 (LD = 0.705; PU = 0.690; PEOU = 0.671; PAI = 0.686), which confirms good convergent validity, meaning that the indicators effectively explain the construct they are intended to measure. Overall, these results indicate that the measurement model used in the study is both reliable and valid for further analysis using the SmartPLS method [44].

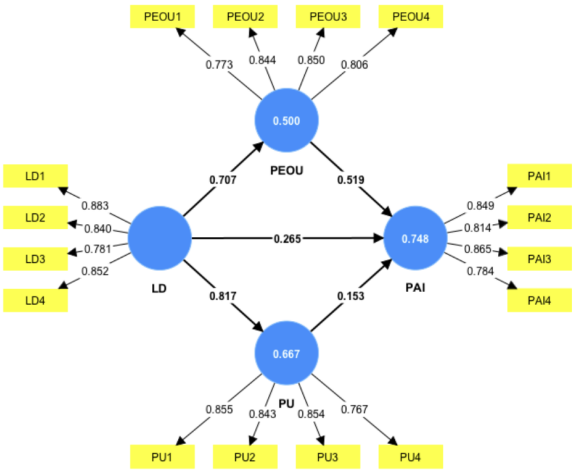

Figure 2. Result of SmartPLS

The Figure 2 Perceived Simplicity (PEOU), PU, and artificial intelligence Acceptance (PAI). All indicators show high factor loadings above 0.70, indicating strong reliability. The model reveals that Digital Literacy strongly influences Perceived Usefulness (0.817) and moderately affects Perceived Ease of Use (0.707), while its direct impact on AI Acceptance (0.265) is smaller [45]. Perceived Ease of Use significantly affects AI Acceptance (0.519), and Perceived Usefulness has a smaller yet positive influence (0.153). The R^2 values for PEOU (0.500), PU (0.667), and PAI (0.748) indicate that the model explains a large portion of the variance in AI acceptance.

Table 3. SmartPLS Results

Hypothesis	Relationship	Path Coefficient	Result
H1	LD → PU	0.817	Supported
H2	LD → PEOU	0.707	Supported
H3	PU → PAI	0.153	Supported
H4	PEOU → PAI	0.519	Supported
H5	LD → PAI	0.265	Supported

The Table 3 above presents the hypothesis testing results for the relationships between research variables based on the path coefficients obtained from the SmartPLS analysis. All five hypotheses (H1–H5) are supported, indicating that each proposed relationship is consistent with the theoretical model [46]. The results show that LD has a very strong positive influence on PU (path coefficient = 0.817) and a strong effect on PEOU (0.707). Additionally, PU has a positive but smaller effect on AI Acceptance (PAI) (0.153), while PEOU demonstrates a substantial influence on AI Acceptance (PAI) (0.519). Finally, Digital Literacy (LD) also directly affects AI Acceptance (PAI) (0.265), although the effect is moderate compared to its indirect effects through PU and PEOU [47].

5. MANAGERIAL IMPLICATIONS

The managerial implications of this study emphasize that enhancing digital literacy is essential for ensuring the successful adoption of AI-based learning within educational environments [48]. Educational institutions should prioritize the integration of digital literacy training for both educators and students to strengthen their ability to effectively utilize AI tools and optimize technology driven learning experiences. Policymakers are encouraged to develop supportive frameworks and equitable access initiatives that promote digital inclusion and provide resources for capacity building, while also creating policies that encourage AI integration in education [49]. For AI developers and technology practitioners, the findings highlight the importance of designing user friendly, accessible, and pedagogically relevant AI systems that cater to varying levels of digital literacy. Collaboration among educators, policymakers, and technology developers is therefore critical to fostering an inclusive and sustainable educational ecosystem where improved digital literacy enhances both the acceptance

and long-term effectiveness of AI-based learning.

6. CONCLUSION

This study concludes that digital literacy plays an important role in significant role in the acceptance of AI-based learning among educators and students. The high path coefficients derived from the SmartPLS model confirm that stronger digital literacy skills are positively correlated with higher perceptions of the perceived usefulness and ease of use, both of which are key factors in technology acceptance. These results suggest that initiatives aimed at improving digital literacy can serve as a systematic approach to facilitating the adoption of AI-based learning, implying that investment in developing digital competencies can accelerate the integration of innovative educational technologies and enhance learning outcomes.

Furthermore, the findings of this study provide valuable insights for policymakers and educational practitioners regarding the importance of designing educational and training programs that focus on strengthening digital literacy. In an era of rapid digitalization and increasing reliance on adaptive and responsive learning tools, the ability to effectively engage with digital platforms is becoming a fundamental requirement. Enhancing digital literacy not only empowers educators and learners to utilize AI technologies more effectively but also fosters confidence and readiness to embrace technological innovation in education.

Overall, this study emphasizes that digital literacy is not merely a supporting skill but a crucial foundation for the successful integration of AI in educational environments. By acknowledging the strong link between digital literacy and AI acceptance, institutions can develop more targeted and sustainable strategies for implementing AI-driven learning systems. Consequently, improving digital literacy can lead to a more inclusive, efficient, and future ready education ecosystem one that equips both teachers and students to thrive in the evolving landscape of technology enhanced learning.

7. DECLARATIONS

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7.2. Author Contributions

Conceptualization: PH; Methodology: SW; Software: UR; Validation: BN and AA; Formal Analysis: PH and BN; Investigation: UR; Resources: AA; Data Curation: SW; Writing Original Draft Preparation: PH and UR; Writing Review and Editing: UR and AA; Visualization: AA; All authors, PH, SW, UR, BN, and AA, have read and agreed to the published version of the manuscript.

7.3. Data Availability Statement

The data presented in this study are available on request from the corresponding author.

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The authors received no financial support for the research, authorship, and/or publication of this article.

7.5. Declaration of Conflicting Interest

The authors declare that they have no conflicts of interest, known competing financial interests, or personal relationships that could have influenced the work reported in this paper.

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