Article

Journal of Interdisciplinary Studies in Education

Volume 15, Issue 7 (2026)
Journal of Interdisciplinary Studies in Education
ISSN: 2166-2681Print 2690-0408 Online | https://ojed.org/jise
https://doi.org/10.32674/jfrs6f53

Examining Adult Learners' Use of Artificial Intelligence for Lifelong Learning in Philippine Higher Education: An Interdisciplinary Empirical Study

Felixberto M. Mercado
Manuel S. Enverga University Foundation, Philippines
ORCID: 0000-0003-3845-7471

Joanne C. Rivera
Don Mariano Marcos Memorial State University, Philippines
ORCID: 0000-0001-8661-4967

Flormando P. Baldovino
Manuel S. Enverga University Foundation, Philippines
ORCID: 0000-0001-8964-5291

ABSTRACT

This interdisciplinary empirical study examined adult learners' use of artificial intelligence (AI) for lifelong learning in Philippine higher education. Using a cross-sectional survey and Structural Equation Modeling (SEM), the study found that Access and Inclusivity was the strongest predictor of AI use. Learning Experience and Engagement also had a significant positive relationship with AI use but contributed less than Access and Inclusivity to predicting adult learners' AI use. The findings highlight the interdisciplinary nature of AI-supported lifelong learning across diverse learner contexts. The study implies that higher education institutions offering lifelong learning programs should prioritize equitable access to AI technologies to promote inclusive, accessible, and sustainable lifelong learning systems for adult learners.

Keywords: adult learners, artificial intelligence, lifelong learning, SEM

INTRODUCTION

Artificial intelligence (AI) is rapidly changing the landscape of higher education by influencing how instruction is designed and delivered and how research is conducted across diverse disciplinary contexts. Its applications in higher education have expanded to include "learning analytics, assessment support, academic integrity monitoring, student services, and institutional decision-making" (Teoh & Tan, 2026, p.1). Drawing from research in various disciplines, studies indicate that AI-driven tools are increasingly integrated into higher education, supporting personalized learning, enhancing learning efficiency, and fostering learner engagement (Alblooshi, 2026; Almasri, 2024; Vieriu & Petrea, 2025; Younas et al., 2025). AI technologies facilitate adaptive and flexible learning pathways that support self-regulated learning (Wang et al., 2025), thereby making such technologies particularly relevant to adult learners engaged in lifelong learning.

As lifelong learning becomes increasingly important in response to rapid technological advancement, digital transformation, and evolving labor market demands, higher education institutions (HEIs) are expected to integrate AI in ways that promote continuous skill development, learner autonomy, and workforce adaptability (Kim et al., 2025). Research suggests that AI can address students' varied needs and enhance personalized and engaging learning experiences (Long et al., 2026; Rawas, 2024), while AI literacy may also contribute to learners' orientation toward lifelong learning (Polat, 2025). AI-supported learning environments show considerable potential in adult and continuing education by enhancing access and learner-centered instruction (Mallary et al., 2025). In this context, AI can expand opportunities for adult learners to engage in flexible and individualized learning experiences throughout their lives.

Despite these benefits, the use of AI presents significant challenges related to how it is generally used in teaching and learning. Concerns regarding ethical use, reliability, the AI tool accuracy, and overreliance on AI (Schmidt et al., 2025) continue to shape discussions surrounding its educational applications. Recent research highlights the need for learners and educators to critically evaluate AI-generated outputs and develop AI literacy to support ethical and effective use of these technologies (Bećirović et al., 2025). These issues raise important questions about the implications of AI for critical thinking and ethical standards (Pratiwi et al., 2025), and academic integrity, particularly as learners and educators increasingly engage with AI-supported learning environments.

Within the Philippine higher education context, AI use remains uneven due to variations in institutional readiness, digital infrastructure, policy support, ethical guidelines, and AI literacy levels among stakeholders (Asio & Soriano, 2025; Caling et al., 2025; Gervacio, 2026). Although international studies have examined the use of AI in higher education, AI literacy, and lifelong learning (Al-Zahrani & Alasmari, 2024; Giray et al., 2024; Lim & Teh, 2026; Polat, 2025; Villarino, 2025), empirical evidence focusing specifically on adult learners remains limited, particularly in developing-country contexts where socio-cultural and economic conditions may influence AI use and learning experiences. This gap is noteworthy in countries such as the Philippines where differences in institutional capacity, digital infrastructure, and learners' AI literacy may shape how AI is used in and for lifelong learning.

Furthermore, empirical studies investigating AI use among adult learners in Philippine higher education institutions (PHEIs) remain scarce, especially those employing advanced analytical approaches such as structural equation modeling. The lack of context-specific evidence constrains the development of effective strategies and policies for integrating AI into lifelong learning initiatives. Therefore, there is a need to examine the factors influencing adult learners' use of AI for lifelong learning and the extent to which these factors contribute to lifelong learning engagement. Addressing this gap, the present study provides empirical insights into AI use among adult learners in Philippine higher education by integrating perspectives from education, technology, and the social sciences.

Research Aim and Questions

This study examined adult learners' use of AI for lifelong learning in Philippine HEIs. Specifically, it sought to investigate the relationships among selected constructs such as access and inclusivity, adoption and integration, and learning experience and engagement using structural equation modeling. Guided by this purpose, the study addresses the following research questions: (1) What is the demographic profile of the respondents in terms of age, employment status, field of work, discipline of study, AI tools used, self-rated digital literacy, and level of engagement in lifelong learning? (2) What are the perceptions of adult learners on the use of AI for lifelong learning? (3) What factors influence adult learners' use of AI for lifelong learning? and (4) Which factors significantly predict adult learners' use of AI for lifelong learning in PHEIs?

Correspondingly, the study tests the following hypotheses:

H_1: Access and Inclusivity positively predicts adult learners' use of AI for lifelong learning.

H_2: Adoption and Integration positively predicts adult learners' use of AI for lifelong learning.

H_3: Learning Experience and Engagement positively predicts adult learners' use of AI for lifelong learning.

LITERATURE REVIEW

Theoretical Framework

This study is grounded in an interdisciplinary theoretical framework that integrates perspectives from educational technology, adult learning, and information systems to explain adult learners' use of AI for lifelong learning. Central to the framework is the Technology Acceptance Model (TAM), which posits that perceived usefulness significantly influences individuals' acceptance and use of technology (Davis, 1989). Complementing this is the Unified Theory of Acceptance and Use of Technology (UTAUT), which emphasizes the role of facilitating conditions and access in shaping technology adoption (Venkatesh et al., 2003). The framework is further informed by Andragogy, which highlights adult learners' need for self-directed, relevant, and experience-based learning (Knowles et al., 2014). Additionally, principles from Self-Directed Learning underscore the importance of autonomy and motivation in lifelong learning contexts (Garrison, 1997).

AI integration and adoption is conceptualized as the extent to which AI technologies are embedded and utilized within learning environments, influenced by institutional readiness and technological infrastructure. Drawing from UTAUT, access is treated as a facilitating condition that enables or constrains learners' ability to engage with AI tools (Venkatesh et al., 2003). Access encompasses not only physical access to digital technologies but also digital literacy and equitable opportunities for participation in AI-supported learning environments. Perceived use of AI is defined as the degree to which learners utilize AI to enhance their learning efficiency, effectiveness, and outcomes, consistent with TAM (Davis, 1989). Learning experience and engagement is positioned as a key outcome variable, reflecting the depth of learners' cognitive, behavioral, and emotional involvement in AI-supported lifelong learning. This construct is grounded in adult learning theories that emphasize meaningful, self-directed, and contextually relevant learning experiences (Knowles et al., 2014; Garrison, 1997). The framework proposes that AI access and inclusivity, integration and adoption, and learning experience and engagement collectively influence adult learners' use of AI for lifelong learning.

Overall, this theoretical framework provides a structured basis for examining the relationships among key constructs influencing adult learners' use of AI for lifelong learning. It supports the use of Structural Equation Modeling (SEM) to test both direct and indirect effects among variables. By integrating theories

from multiple disciplines, the framework offers a comprehensive lens for understanding how AI can enhance lifelong learning engagement in higher education contexts.

RESEARCH METHOD

Research Design

This study employed a cross-sectional survey research design to examine adult learners' use of artificial intelligence for lifelong learning in higher education. A cross-sectional research design is appropriate for examining adult learners' use of AI for lifelong learning in Philippine higher education institutions (HEIs) because it allows data to be collected from a diverse group of participants at a single point in time. This design enables the researchers to identify relationships in AI use for lifelong learning without requiring prolonged data collection. Consequently, it provides a practical and efficient means of generating insights that can inform policies and strategies to enhance AI use in lifelong learning initiatives within Philippine HEIs.

Respondents

The respondents consisted of 1,349 adult learners enrolled in Expanded Tertiary Education Equivalency and Accreditation Program (ETEEAP), graduate studies, open university, and certification programs offered by twenty-eight (28) higher education institutions (HEIs), consisting of eleven (11) state universities and colleges (SUCs) and seventeen (17) private HEIs distributed across Luzon, Visayas, and Mindanao. The institutions were anonymized in accordance with the study's ethical protocol and the confidentiality provisions communicated to participating institutions; however, their selection ensured geographic diversity and representation of varied adult learning contexts within the Philippine higher education sector. Of the 1,658 eligible lifelong learners invited to participate, 1,349 completed the survey, yielding a response rate of 81.36%.

Sampling Design and Procedure

A two-stage cluster sampling technique was used to select participants from the total population of students enrolled in the identified adult education programs. This approach ensured that each learner had an equal chance of being included in the study. The population was first grouped into clusters, such as higher education institutions (HEIs) across different regions of the Philippines, and randomly selected a subset of these clusters. In the second stage, individuals—such as adult learners—were randomly sampled from within the selected institutions to form the final sample. This procedure reduced logistical constraints and costs while still allowing for a representative and diverse set of respondents across geographic and institutional contexts.

Instrument

Data were collected using a structured survey instrument designed to capture adult learners' perceptions and use of artificial intelligence. The instrument included indicators aligned with established theories in adult learning and technology adoption. Ethical considerations, including informed consent and confidentiality of responses, were strictly observed throughout the data collection process.

The research instrument was developed through a systematic multi-stage process. First, a scoping review of the literature was conducted to identify the key constructs and indicators relevant to AI-supported lifelong learning. To ensure contextual relevance, a scoping survey was subsequently administered to prospective participants to gather insights into their experiences, perceptions, and expectations regarding

the use of artificial intelligence in lifelong learning. Findings from both the literature review and the scoping survey informed the development and refinement of the questionnaire items. The draft instrument was then subjected to expert review to establish content validity, with specialists evaluating the relevance, clarity, and representativeness of the items. Revisions were made based on their recommendations. The final instrument employed a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree) and 1 (Very Low) to 5 (Very High). Prior to the main data collection, the instrument was pilot-tested, yielding a Cronbach's alpha coefficient of .80, which indicates good internal consistency reliability.

Data Analysis

The collected data were screened and prepared for statistical analysis. Structural equation modeling (SEM) was employed to examine relationships among variables and to test the proposed model. Mean, frequency counts, and percentage were also used to analyze data that contextualize the study.

RESULTS

Table 1 presents the demographic profile of the respondents in terms of age, employment status, field of work, and discipline of study. The data indicate that 37% of the respondents were aged 36–45 years, 35% were 46 years old and above, and 28% were between 25 and 35 years old. A substantial majority of the respondents were permanently employed (70%), with most working in the government or public sector (21%), followed by the corporate or business sector (19%), academe (17%), information technology (14%), healthcare (13%), engineering (9%), and other fields (7%). In terms of discipline of study, most respondents were enrolled in Non-STEM programs (64%), while 36% were enrolled in STEM-related programs.

With respect to AI tool use, generative AI tools emerged as the most widely used, accounting for 90.7% of responses. These included ChatGPT, Gemini, and Meta AI. This was followed by transformative AI tools (7.6%), such as QuillBot and Grammarly, and analytical AI tools (1.7%), including Google Search and Perplexity AI. Data are presented in Appendix A.

Table 1

Demographic Profile of Respondents

Variables	f	%
Age		
25-35 years old	378	28.00
36-45 years old	498	37.00
46 years old and above	473	35.00
Employment Status		
Permanent	946	70.00
Non-permanent	314	23.00
Unemployed	89	7.00
Field of Work		
Academe/Education	219	17.00
Corporate/Business	265	19.00
Government/Public Sector	289	21.00
Healthcare	181	13.00
IT	188	14.00
Engineering	118	9.00
*Others	89	7.00
Discipline of Study		
STEM	487	36.00
**Non-STEM	862	64.00

Note. N=1349; *(OFW, VA, Entrepreneur); **(Education, Business & Management; Arts & Design; Hospitality & Tourism, Public Administration; Criminology)

Regarding self-rated digital literacy, respondents reported a high level of competence in using digital devices such as laptops and smartphones (M = 4.47), as well as digital applications such as Google Docs, Zoom, and AI-powered tools like ChatGPT (M = 4.25). In terms of engagement in lifelong learning, respondents demonstrated high levels across all dimensions, with cognitive engagement obtaining the highest mean score (M = 4.42), followed by motivational engagement (M = 4.38) and behavioral engagement (M = 4.28). Detailed results are presented in Appendix B.

The perception of adult learners under study on the use of AI for lifelong learning is presented in Table 2. With a grand mean of 3.57, they agree that AI tools are useful in lifelong learning as AI applications make lifelong learning more accessible for adult learners (M=3.83); AI supports personalized learning suited to adult learners' needs (M=3.81); AI can enhance the quality of adult education in the Philippines (M=3.75); and educators and trainers are prepared to use AI in adult education (M=3.65). For future outlook on the usefulness of AI tools for lifelong learning, the respondents agree that AI is a valuable long-term partner in their lifelong learning journey (M=3.60); AI plays a crucial role in preparing adult learners for future jobs (M=3.58); AI will positively transform adult education in the next 5 years (M= 3.55); and AI will replace some traditional teaching methods in adult education (M=3.53).

Table 2

Adult Learners' Perception of the Use of AI for Lifelong Learning

Details	Mean	SD
1. AI applications make lifelong learning more accessible for adult learners.	3.83	0.838
2. AI supports personalized learning suited to adult learners' needs.	3.81	0.849
3. AI can enhance the quality of adult education in the Philippines	3.75	0.870
4. Educators and trainers are prepared to use AI in adult education.	3.65	0.917
5. I see AI as a valuable long-term partner in my lifelong learning journey.	3.60	0.974
6. AI plays a crucial role in preparing adult learners for future jobs.	3.58	0.958
7. I am confident that AI will positively transform adult education in the next 5 years.	3.55	0.976
8. I believe AI will replace some traditional teaching methods in adult education.	3.53	1.021
Grand Mean/Standard Deviation (SD)	3.57	0.861

Note. 4.21-5.00 Strongly Agree; 3.41-4.20 Agree; 2.61-3.40 Neutral; 1.81-2.60 Disagree; 1.00-1.80 Strongly Disagree; N=1,349

This study also examined the factors influencing adult learners' use of AI for lifelong learning. The results are presented in Table 3. Among the three factors analyzed, access and inclusivity obtained the highest grand mean (3.81). Among its indicators, *AI-enhanced lifelong learning opportunities for adult learners* (M = 3.89) registered the highest mean. Additionally, indicators such as *reduced barriers to educational access through AI-assisted platforms* (M = 3.81) and *expanded access to learning regardless of time and place* (M = 3.73) suggest that AI is perceived as enhancing access to lifelong learning by minimizing barriers and enabling flexible learning conditions.

Factors associated with *AI adoption and integration* exhibited a high level of influence (grand mean = 3.77). The highest-rated indicators—*effective use of AI tools to support adult learners' educational goals* (M = 3.99), *use of AI-powered learning tools* (M = 3.81), and *implementation of AI in adult education programs* (M = 3.77)—suggest that AI is perceived as valuable in supporting lifelong learning.

Meanwhile, factors related to learning experience and engagement yielded the lowest grand mean (3.74). Among its indicators, *enhanced learner motivation through AI-driven learning platforms* obtained the highest mean (M = 3.89), while *enhanced understanding of course content through AI-provided feedback* recorded a mean of 3.77.

Table 3

Factors Influencing Adult Learners' Use of AI for Lifelong Learning

Factors	Indicators	Mean	SD
Access and Inclusivity	Expanded access to learning regardless of time and place	3.73	0.888
	Reduced barriers to educational access through AI-assisted platforms	3.81	0.841
	AI-enhanced lifelong learning opportunities for adult learners	3.89	0.843
	Grand Mean/Standard Deviation (SD)	3.81	0.772
AI Adoption and Integration	Use of AI-powered learning tools	3.81	0.853
	Implementation of AI in adult education programs	3.77	0.932
	Effective use of AI tools to support adult learners' educational goals	3.99	0.853
	Institutional investment in AI-enabled adult education in the Philippines	3.64	0.921
	AI-enhanced instructional effectiveness in guiding adult learners	3.71	0.926
	AI-enabled workload reduction for teachers, enhancing focus on mentoring	3.67	0.918
	Grand Mean/Standard Deviation (SD)	3.77	0.772
Learning Experience and Engagement	Enhanced learner motivation though AI-driven learning platforms	3.89	0. 880
	Enhanced understanding of course content through AI-provided feedback	3.77	0.890
	Enhanced learning outcomes through AI-driven personalized recommendations	3.62	0.946
	Enhanced learning engagement through AI-based gamification	3.69	0.931
	Grand Mean/Standard Deviation (SD)	3.74	0.817

Note. 4.21-5.00 Very High; 3.41-4.20 High; 2.61-3.40 Moderate; 1.81-2.60 Low; 1.00-1.80 Very Low; N=1,349

The factors influencing adult learners' use of AI for lifelong learning were further examined using Structural Equation Modeling (SEM) to identify the significant predictors of adult learners' AI use for lifelong learning within Philippine higher education institutions (PHEIs). Data are presented in Table 4 which presents the summary of measurement and structural model results.

Results of the measurement model assessment demonstrate the reliability and convergent validity of the latent constructs included in the structural equation model. Reliability was evaluated using Cronbach's alpha (α) and Composite Reliability (CR), while convergent validity was assessed through standardized factor loadings and the Average Variance Extracted (AVE). Following the recommendations of Hair et al. (2021), all constructs satisfied the acceptable thresholds, with factor loadings exceeding 0.70, Cronbach's alpha and Composite Reliability values above 0.70, and AVE values greater than 0.50.

The construct Access and Inclusivity exhibited strong measurement properties, with standardized factor loadings ranging from 0.821 to 0.863, a Cronbach's alpha of 0.86, Composite Reliability of 0.88, and an AVE of 0.716, indicating high internal consistency and adequate convergent validity. Likewise, Adoption and Integration of AI in Adult Education demonstrated excellent reliability, with factor loadings between 0.736 and 0.864, a Cronbach's alpha of 0.91, Composite Reliability of 0.92, and an AVE of 0.676, confirming that its indicators consistently represent the construct. Similarly, Learning Experience and Engagement recorded factor loadings ranging from 0.821 to 0.899, a Cronbach's alpha of 0.90, Composite Reliability of 0.92, and an AVE of 0.740, providing further evidence of strong reliability and convergent validity. Additional details are presented in Appendix C.

The structural model results indicate that all hypothesized relationships are statistically significant, as evidenced by p-values less than 0.05. Access and inclusivity emerged as the strongest predictor of AI use for lifelong learning ($\beta = 0.677$, $p < .001$), highlighting the critical role of system availability and ease of access in promoting AI use among adult learners. Adoption and integration of AI is also a significant predictor ($\beta = 0.160$, $p < .001$), suggesting that learners' ability to adopt and incorporate AI technologies contributes to their usage. Meanwhile, learning experience and engagement is a weaker but still significant predictor ($\beta = 0.102$, $p = 0.026$), indicating that while learner involvement is important, it plays a secondary role compared to access and adoption-related factors.

The Heterotrait-Monotrait (HTMT) ratio was used to assess discriminant validity among the constructs. The results indicate that all HTMT values were below the liberal threshold of 0.90, with most values also below the more stringent threshold of 0.85 (Henseler et al., 2014). This suggests that discriminant validity is established among the constructs. Although the HTMT value between access and engagement slightly exceeds the stricter threshold, it remains within acceptable limits and reflects the theoretical interconnectedness of these constructs. In the context of AI use for lifelong learning, access to technology naturally facilitates learner engagement, explaining the relatively high association. The results confirm that the constructs are empirically distinct yet conceptually related, supporting the adequacy of the measurement model.

The model demonstrates generally good overall fit based on multiple fit indices. The CFI (0.973) and TLI (0.968) exceeded the recommended threshold of 0.90, indicating excellent comparative fit. The RMSEA (0.059) and SRMR (0.024) were below the recommended maximum value of 0.08, indicating good and excellent fit, respectively. Although the χ^2/df ratio (4.72) exceeded the commonly recommended value of 3.00, the overall pattern of fit indices indicates that the hypothesized model provides an acceptable representation of the observed data.

The structural model explained 64.7% of the variance in use of AI for lifelong learning ($R^2 = .647$), indicating substantial explanatory power.

Table 4

Summary of Measurement and Structural Model Results

Panel A. Measurement Model (Construct/ Relationship)	α	CR	AVE	β	SE	t	p	Decision
Access and Inclusivity	.86	.88	.716	—	—	—	—	—
Adoption and Integration of AI	.91	.92	.676	—	—	—	—	—
Learning Experience and Engagement	.90	.92	.740	—	—	—	—	—
Access and Inclusivity → Use of AI for Lifelong Learning	—	—	—	.677	.057	12.77	<.001	Supported
Adoption and Integration → Use of AI for Lifelong Learning	—	—	—	.160	.046	4.16	<.001	Supported
Learning Experience and Engagement → Use of AI for Lifelong Learning	—	—	—	.102	.043	2.23	.026	Supported

Panel B. Discriminant Validity (HTMT) (Construct)	Acc & Inc	Ad & Int	LLE
Access and Inclusivity	1.00	.836	.873
Adoption and Integration	.836	1.00	.831
Learning Experience and Engagement	.873	.831	1.00

Panel C. Model Fit			
Index	Value	Threshold	Interpretation
χ^2/df	4.72	<3.00	Less than good
CFI	.973	>0.90	Excellent
TLI	.968	>0.90	Excellent
RMSEA	.059	>0.08	Good
SRMR	.024	≤0.08	Excellent

Panel D. Explained Variance		
Endogenous Construct	R^2	Interpretation
Use of AI for Lifelong Learning	.647	Substantial

With regard to the measurement indicators used to operationalize the endogenous construct 'Use of AI for Lifelong Learning, the results presented in Appendix D reveal that all four indicators loaded strongly on the latent construct, with standardized loadings ranging from 0.779 to 0.862, exceeding the recommended minimum threshold of 0.70 for reflective measurement models.

Among the indicators, "Personalized recommendations from AI tools improve my learning outcomes" recorded the highest standardized loading (β = 0.862). Similarly, the indicators "AI-based learning platforms help me stay more motivated in my studies" (β = 0.854) and "AI technologies provide feedback that helps me better understand course content" (β = 0.853) demonstrated equally strong loadings. The indicator "AI-based gamification increases my engagement in learning" obtained the lowest standardized loading (β = 0.779), although it remained well above the recommended threshold, confirming its significance as a valid measure of the construct.

Overall, the consistently high standardized factor loadings provide strong empirical support for the measurement of Use of AI for Lifelong Learning as a reliable and valid endogenous latent construct. The findings demonstrate that the four indicators collectively capture the essential dimensions of adult learners' AI use for lifelong learning. Consequently, the measurement model establishes a robust foundation for the structural analysis, supporting the examination of how Access, Adoption, and Engagement jointly explain variations in the use of AI for Lifelong Learning. The results therefore reinforce the construct validity of the endogenous variable and enhance confidence in the structural relationships tested in the proposed SEM.

DISCUSSION AND CONCLUSIONS

The demographic profile indicates that a majority of respondents are mid- to late-career adults who are actively engaged in professional sectors, suggesting that AI-supported lifelong learning is particularly relevant among experienced and employed individuals. The high use of AI tools such as ChatGPT and

related platforms further reflects the growing integration of generative AI in workplace and educational contexts, supporting findings that AI tools are increasingly embedded in knowledge work and learning environments (Dwivedi et al., 2023). Moreover, respondents' high self-rated digital literacy suggest that they possess a strong technological foundation for engaging with emerging technologies like AI. This finding is consistent with the notion that digital and AI literacy provide essential competencies for understanding and using AI-driven technologies (Ng et al., 2021). Finally, the high levels of cognitive, motivational, and behavioral engagement suggest that AI tools may play a significant role in enhancing adult learners' participation in lifelong learning, consistent with literature highlighting AI's potential to foster deeper engagement and self-directed learning (Holmes et al., 2019).

The findings indicate that adult learners hold a highly positive perception of AI use for lifelong learning, as reflected in their agreement regarding their use. Respondents particularly recognized the role of AI in enhancing access and supporting personalized learning, which aligns with studies demonstrating the need for AI systems that are flexible, adaptive, transparent, and facilitate learner-centered educational experiences (AlDhaen, 2022; Ng et al., 2021; Saflor, 2025). The perceived importance of AI in preparing adult learners for future employment further supports literature emphasizing AI's role in developing adaptive skills and competencies required in evolving labor markets (Candy, 2002; Dwivedi et al., 2023). Additionally, the view that AI can enhance the quality of adult education in the Philippines suggests growing confidence in technology-driven educational transformation. Looking ahead, respondents expressed optimism that AI will reshape traditional teaching methods, which is consistent with findings that AI is increasingly influencing pedagogical innovation and instructional delivery (Dilinika, 2026; Zawacki-Richter et al., 2019). Their belief that AI will positively transform adult education in PHEIs in the next five years highlights expectations of sustained technological integration in learning systems. Furthermore, the perception of AI as a long-term partner in lifelong learning, alongside confidence in educators' readiness to use AI, suggests that AI is increasingly being viewed as an integral component of teaching and learning, consistent with its increasingly pervasive role in the lives of twenty-first century citizens (Crompton & Burke, 2023).

The analysis reveals that access and inclusivity exert a high level of influence on adult learners' AI use for lifelong learning. This suggests that AI's ability to reduce barriers and provide flexible learning opportunities may contribute to greater engagement among adult learners, consistent with literature emphasizing the potential of AI and digital technologies to expand access, personalization, and flexibility in higher education (AlDhaen, 2022; Zawacki-Richter et al., 2019). The high rating of AI-enhanced lifelong learning opportunities further supports the view that AI facilitates continuous, self-directed, and personalized learning experiences (Ng et al., 2021). Moreover, the emphasis on minimizing temporal and spatial constraints aligns with literature indicating that AI-enabled technologies can expand access to flexible learning opportunities across diverse higher education contexts (Crompton & Burke, 2023). Overall, these findings reinforce the growing recognition of AI as a transformative tool in expanding participation in lifelong learning.

The findings indicate that factors related to AI adoption and integration likewise exert a high level of association on adult learners' use of AI for lifelong learning. The high ratings for the effective use of AI tools and AI-powered platforms suggest a favorable orientation toward AI use, consistent with literature highlighting the expanding educational applications of AI and the importance of AI literacy and self-regulated learning for meaningful engagement with AI-supported learning environments (Wang et al., 2024; Wang et al., 2025). The prominence of AI-supported tools suggests their potential to facilitate personalized and engaging learning experiences that may be particularly relevant to adult learners, consistent with research demonstrating the value of AI in supporting individualized learning and active engagement in higher education (Bora & Sahin Kölemen, 2025). Furthermore, the emphasis on institutional implementation highlights the importance of organizational support in facilitating successful AI integration in educational contexts.

Moreover, the findings indicate that factors related to learning experience and engagement demonstrate comparatively weaker associations with adult learners' use of AI tools, although they continue to receive positive evaluations from the respondents. The high mean score for learner motivation suggests that AI-supported learning environments can foster engagement and sustain interest in learning activities among adult learners, consistent with recent studies demonstrating positive relationships between AI-supported learning interventions, learner motivation, and engagement (Wang et al., 2025; Dai et al., 2025). In contrast, the relatively lower mean for content understanding implies that while AI provides support, its impact on deeper cognitive processing may be more limited. This finding is consistent with evidence that AI-supported personalized feedback can improve both learning outcomes and motivation, with particularly strong effects reported for learner motivation (Wang et al., 2025) . Overall, these findings suggest that AI tools are more effective in enhancing affective dimensions of learning than cognitive outcomes, highlighting the need for pedagogically guided use to optimize comprehension alongside motivation.

The measurement model provides strong evidence of reliability and convergent validity, confirming the robustness of the study's latent constructs. All standardized factor loadings exceed the recommended threshold of 0.70, indicating that the observed indicators are highly representative of their respective constructs, in line with established SEM guidelines such as those outlined by Hair et al. (2021). High values of Cronbach's alpha and Composite Reliability further demonstrate internal consistency, while Average Variance Extracted (AVE) values above 0.50 confirm that each construct explains a substantial proportion of variance in its indicators.

Discriminant validity is likewise established through the Heterotrait-Monotrait (HTMT) ratio, with all values falling below the liberal threshold of 0.90 and most below the stricter 0.85 criterion proposed Henseler et al. (2014). Although the HTMT value between access and engagement slightly exceeds the conservative cutoff, this is theoretically defensible. In AI-supported adult learning contexts, access to digital technologies can create opportunities for interaction and participation, thereby supporting learner engagement, consistent with evidence that educational technologies can facilitate behavioral, affective, and cognitive engagement in higher education (Bond et al., 2020).

The overall model fit further confirms the adequacy of the proposed structural model. The chi-square to degrees of freedom ratio obtained a value which falls below the commonly accepted upper limit of 5.00. The Comparative Fit Index and Tucker-Lewis Index exceed recommended thresholds, while RMSEA and SRMR fall within acceptable limits. Together, these results affirm that the model reliably represents the relationships among access, adoption, engagement, and AI utilization.

The structural model results highlight access as the most influential predictor of AI use for lifelong learning, consistent with the Unified Theory of Acceptance and Use of Technology proposed by Venkatesh et al. (2003). Adoption and integration is also a significant predictor, aligning with the Technology Acceptance Model, although with a smaller effect size. Engagement, while statistically significant, exerts the weakest influence, suggesting that it functions more as a supporting mechanism rather than a primary driver. This is consistent with Andragogy of Knowles et al. (2014) where adult learners prioritize relevance and autonomy, with engagement emerging once access and adoption are established.

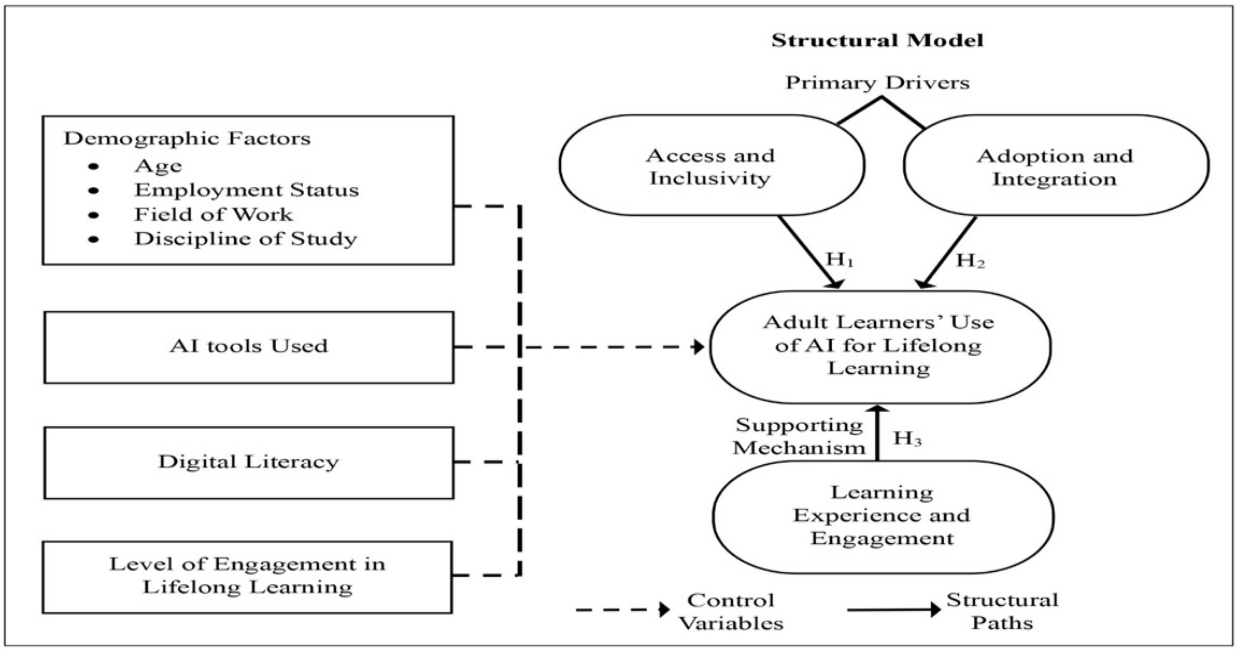
Finally, the model demonstrates substantial explanatory power, with high R^2 values across access, adoption, and engagement. These findings reinforce the central role of access as the foundation of AI-enabled lifelong learning, upon which adoption and engagement are built. From a broader perspective, the results support global perspectives such as those advanced by the European Commission (2020) and UNESCO (2021), emphasizing that equitable access to AI technologies is essential for inclusive and sustainable lifelong learning systems. Consequently, policymakers and educational institutions should prioritize infrastructure, digital literacy, and system usability to fully realize the benefits of AI in adult education.

Building on the empirical findings, this study proposes an integrated and interdisciplinary model of adult learners' AI use for lifelong learning that captures the dynamic interplay among access, adoption, and engagement. The model draws on and synthesizes perspectives from UTAUT, TAM, and Andragogy,

reflecting the convergence of information systems, educational technology, and adult learning theory. Within this framework, access and inclusivity are conceptualized as facilitating conditions that enable participation, underscoring the socio-technical dimensions of AI integration in education. Adoption and integration represent the cognitive and technological processes through which learners perceive and actualize the usefulness of AI tools, while engagement captures the pedagogical and experiential aspects of learning grounded in adult learners' autonomy and motivation. Collectively, the model advances a layered and interdisciplinary understanding in which technological, pedagogical, and contextual factors interact, offering a comprehensive framework for examining AI-enabled lifelong learning across diverse educational settings. The model is illustrated in Figure 1.

Figure 1

Integrated and Interdisciplinary Conceptual Model of Adult Learners' AI Use for Lifelong Learning



Conclusions

This study examined the factors influencing adult learners' use of artificial intelligence for lifelong learning in Philippine higher education. The findings demonstrate that Access and Inclusivity, Adoption and Integration of AI, and Learning Experience and Engagement significantly contribute to the use of AI among adult learners. Among these factors, Access and Inclusivity emerged as the most influential predictor, highlighting the critical role of equitable access to AI technologies and inclusive learning environments in promoting meaningful use of AI. The substantial explanatory power of the model further suggests that these factors collectively provide a robust understanding of adult learners' use of AI in educational settings.

The findings contribute to the growing body of literature on technology use and lifelong learning by providing empirical evidence that adult learners' use of AI is shaped not only by technological integration but also by access and learner-centered educational experiences. The study reinforces the relevance of technology adoption theories in adult education while emphasizing the importance of inclusive learning ecosystems that support diverse learner needs and encourage sustained use of AI for learning purposes.

From a practical perspective, higher education institutions, adult learning providers, and policymakers should prioritize initiatives that improve access to AI technologies, strengthen digital inclusion efforts, and

support the effective use of AI in teaching and learning practices. Creating positive and engaging learning experiences with AI may further encourage adult learners to use these technologies as part of their lifelong learning journeys.

Overall, the study provides evidence that the use of AI among adult learners is influenced by a combination of access, integration, and learning experience factors. Future research may employ longitudinal and mixed-method approaches to examine how adult learners' use of AI evolves over time and explore additional factors that may influence AI use across different educational contexts and learner populations.

LIMITATION AND RECOMMENDATION

This study is subject to several limitations that should be considered when interpreting the findings. First, the use of a cross-sectional design limits the ability to establish causal relationships among access, adoption, engagement, and AI utilization. Second, the reliance on self-reported data may introduce response bias and affect the accuracy of the measured constructs. Third, the sample may not fully represent all adult learner populations, thereby limiting the generalizability of the results.

Author Contributions: Conceptualization, Felixberto M. Mercado and Joanne C. Rivera; methodology, Felixberto M. Mercado and Joanne C. Rivera; software, Flormando P. Baldovino; validation, Felixberto M. Mercado and Flormando P. Baldovino; formal analysis, Felixberto M. Mercado and Flormando P. Baldovino; investigation, Felixberto M. Mercado and Joanne C. Rivera; resources, Felixberto M. Mercado and Joanne C. Rivera; data curation, Felixberto M. Mercado and Flormando P. Baldovino; writing—original draft preparation, Felixberto M. Mercado; writing—review and editing, Felixberto M. Mercado; visualization, Flormando P. Baldovino; supervision, Felixberto M. Mercado; project administration, Felixberto M. Mercado and Joanne C. Rivera. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Approved for implementation. MSEUF-FR-018-2024.

Acknowledgments: During the preparation of this manuscript, the authors used ChatGPT to assist with paraphrasing, language editing, and refinement of parenthetical citations and references. The authors have reviewed and edited the output and take full responsibility for the content of this publication.

Conflicts of Interest: The authors declare no conflicts of interest.

REFERENCES

Alblooshi, S. (2026). Artificial intelligence in higher education: Opportunities and challenges: A review. *Frontiers in Education*, *10*, 1683968. https://doi.org/10.3389/feduc.2025.1683968

AlDhaen, F. (2022). The use of artificial intelligence in higher education – Systematic review. In M. Alaali (Ed.), *COVID-19 Challenges to university information technology governance* (pp. 269-285) Springer. https://doi.org/10.1007/978-3-031-13351-0_13

Almasri F. (2024). Exploring the impact of artificial intelligence in teaching and learning of science: A systematic review of empirical research. *Research in Science Education*, *54*(5), 977–997. https://doi.org/10.1007/s11165-024-10176-3

Al-Zahrani, A. M., & Alasmari, T. M. (2024). Exploring the impact of artificial intelligence on higher education: The dynamics of ethical, social, and educational implications. *Humanities and Social Sciences Communications, 11*, 912. https://doi.org/10.1057/s41599-024-03432-4

Asio, J. M., & Soriano, I. D. P. (2025). The state of artificial intelligence (AI) use in higher education institutions (HEIs) in the Philippines. In F. D. Mobo (Ed.), *Impacts of AI on students and teachers in education 5.0* (pp. 523–552). IGI Global Scientific Publishing. https://doi.org/10.4018/979-8-3693-8191-5.ch019

Bećirović, S., Polz, E., & Tinkel, I. (2025). Exploring students' AI literacy and its effects on their AI output quality, self-efficacy, and academic performance. *Smart Learning Environments, 12*, 29. https://doi.org/10.1186/s40561-025-00384-3

Bond, M., Buntins, K., Bedenlier, S., Zawacki-Richter, O., & Kerres, M. (2020). Mapping research in student engagement and educational technology in higher education: A systematic evidence map. *International Journal of Educational Technology in Higher Education, 17*(1), 1–30. https://doi.org/10.1186/s41239-019-0176-8

Bora, B. Y., & Kölemen, C. Ş. (2025). Integrating AI into instructional design: A case study on digital photography education in higher education. *Contemporary Educational Technology, 17*(3), ep583. https://doi.org/10.30935/cedtech/16433

Caling, J. G., Antonio, J. K. T., Dimatactac, M. F. L., Sabellano, M. D., Vicencio, V. D. R., Prias, J. M., & Ramos, J. C. M. (2025). Pre-service teachers' use of ChatGPT and acquired moral dissonance. *Journal of Interdisciplinary Studies in Education, 14*(4), 73–98. https://doi.org/10.32674/zmjq9089

Candy, P. C. (2002). *Lifelong learning and information literacy*," White paper prepared for UNESCO, the U.S. National Commission on Libraries and Information Science, and the National Forum on Information Literacy. 2002. Retrieved from http://www.nclis.gov/libinter/infolitconf&meet/papers/candy-fullpaper.pd

Crompton, H., & Burke, D. (2023). Artificial intelligence in higher education: The state of the field. *International Journal of Educational Technology in Higher Education, 20*, 22. https://doi.org/10.1186/s41239-023-00392-8

Dai, X., Wang, Y., Yu, J., Qiu, B., Wang, R., & Na, M. (2025). Motivation and engagement as pathways: How AI-augmented online assessment shapes English speaking competency in vocational EFL classrooms. *Frontiers in Psychology, 16*. https://doi.org/10.3389/fpsyg.2025.1730953

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319–340. https://doi.org/10.2307/249008

Dilinika, J. M. S. (2026). Factors influencing faculty decision-making on student use of generative AI in higher education. *Journal of Interdisciplinary Studies in Education, 15*(4), 107-134. https://doi.org/10.32674/ksb6gv95

Dwivedi, Y. K., Kshetri, N., Hughes, L., Slade, E. L., Jeyaraj, A., Kar, A. K., Baabdullah, A. M., Koohang, A., Raghavan, V., Ahuja, M., Albanna, H., Albashrawi, M. A., Al-Busaidi, K. A., Balakrishnan, J., Barlette, Y., Basu, S., Bose, I., Brooks, L., Buhalis, D., & Wright, R. (2023). So what if ChatGPT wrote it? Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research, practice and policy. *International Journal of Information Management, 71*, 102642. https://doi.org/10.1016/j.ijinfomgt.2023.102642

European Commission. (2020). *Digital education action plan (2021–2027): Resetting education and training for the digital age,"* Publications Office of the European Union, 2020. https://education.ec.europa.eu/focus-topics/digital-education/actions

Garrison, D. R. (1997). Self-directed learning: Toward a comprehensive model. *Adult Education Quarterly, 48*(1), 18–33. https://doi.org/10.1177/074171369704800103

Gervacio, J.L.M. (2026). *Rewriting the rules: The Philippine AI roadmap and its transformative implications for higher education* (Discussion Paper Series, No. 2026-10). UP Center for Integrative and Development Studies, Diliman, Quezon City.

Giray, L., De Silos, P.Y., Adornado, A., Buelo, R. J. V., Galas, E., Reyes-Chua, E., Santiago, C., & Ulanday, M.L. (2024). Use and impact of artificial intelligence in Philippine higher education: Reflections from instructors and administrators. *Internet Reference Services Quarterly, 28*(3), 315–338. https://doi.org/10.1080/10875301.2024.2352746

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2021). *A primer on partial least squares structural equation modeling (PLS-SEM)* (3rd ed.). Sage.

Henseler, J., Ringle, C. M., & Sarstedt, M. (2014). A new criterion for assessing discriminant validity in variance-based structural equation modelling. *Journal of the Academy of Marketing Science, 43*(1), 115–135. https://doi.org/10.1007/s11747-014-0403-8

Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial intelligence in education: Promises and implications for teaching and learning*. Center for Curriculum Redesign.

Kim, J., Yu, S., Detrick, R., Lin, X., & Li, N. (2025). Designing AI-powered learning: Adult learners' expectations for curriculum and human-AI interaction. *Educational Technology Research and Development, 73*, 3397–3421. https://doi.org/10.1007/s11423-025-10549-z

Knowles, M. S., Holton, E. F., & Swanson, R. A. (2014). *The adult learner* (8th ed.). Routledge. https://doi.org/10.4324/9781315816951

Lim, T. P., & Teh, W. C. (2026). IT mindfulness and AI literacy shape lifelong learning orientation through student engagement and learning agency in AI-enhanced online learning. *Discover Education, 5*, 192. https://doi.org/10.1007/s44217-026-01219-0

Long, D.Y., Wang, S., Md Rashid, S., & Lu, X. T. (2026). Artificial intelligence in higher education: A systematic review of its impact on student engagement and the mediating role of teaching methods. *Frontiers in Education, 10*, 1648661. https://doi.org/10.3389/feduc.2025.1648661

Mallary, K. J., Moore, E. J., & McClain, A. L. (2025). Artificial intelligence and universal design for learning: Transforming teaching and learning in adult and continuing higher education. *New Directions for Adult and Continuing Education, 2025*(188), 39–47. https://doi.org/10.1002/ace.70016

Ng, D. T. K., Leung, J. K. L., Chu, S. K. W., & Qiao, S. M. (2021). Conceptualizing AI literacy: An exploratory review. Computers and Education: *Artificial Intelligence, 2*, 100041. https://doi.org/10.1016/j.caeai.2021.100041

Polat, E. (2025). Artificial intelligence literacy, lifelong learning, and fear of innovation: Identification of profiles and relationships. *Education and Information Technologies, 30*, 20183–20214. https://doi.org/10.1007/s10639-025-13548-y

Pratiwi, H., Suherman, Hasruddin, & Ridha, M. (2025), Between shortcut and ethics: Navigating the use of artificial intelligence in academic writing among Indonesian doctoral students. *European Journal of Education Research, Development, and Policy, 60,* e70083. https://doi.org/10.1111/ejed.70083

Rawas, S. (2024). ChatGPT: Empowering lifelong learning in the digital age of higher education. *Education and Information Technologies, 29*(6), 6895–6908. https://doi.org/10.1007/s10639-023-12114-8

Saflor, C. S. R. (2025). Modeling student acceptance of AI technologies in higher education: A hybrid SEM–ANN approach. *Future Internet, 17*(12), 581. https://doi.org/10.3390/fi17120581

Schmidt, D. A., Alboloushi, B., Thomas, A., & Magalhães, R. (2025). Integrating artificial intelligence in higher education: Perceptions, challenges, and strategies for academic innovation. *Computers and Education Open, 9,* 100274. https://doi.org/10.1016/j.caeo.2025.100274

Teoh, K. B. & Tan, W. L. (2026). Policy alignment and trustworthy AI governance in higher education: A conceptual analysis of Malaysia's reform agenda and ASEAN governance imperatives. *Journal of Interdisciplinary Studies in Education, 15*(4), 1-22. https://doi.org/10.32674/eqphhh11

UNESCO. (2021). *AI and education: Guidance for policy-makers*. UNESCO Publishing. https://doi.org/10.54675/PCSP7350

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly, 27*(3), 425–478. https://doi.org/10.2307/30036540

Vieriu, A. M., & Petrea, G. (2025). The impact of artificial intelligence (AI) on students' academic development. *Education Sciences, 15*(3), 343. https://doi.org/10.3390/educsci15030343

Villarino, R. T. (2025). Artificial intelligence (AI) integration in rural Philippine higher education: Perspectives, challenges, and ethical considerations. *International Journal of Educational Research and Innovation, 23*. https://doi.org/10.46661/ijeri.10909

Wang, K., Cui, W., & Yuan, X. (2025). Artificial intelligence in higher education: The impact of need satisfaction on artificial intelligence literacy mediated by self-regulated learning strategies. *Behavioral Sciences, 15*(2), 165. https://doi.org/10.3390/bs15020165

Wang, S., Wang, F., Zhu, Z., Wang, J., Tran, T., & Du, Z. (2024). Artificial intelligence in education: A systematic literature review. *Expert Systems with Applications, 252*, 124167. https://doi.org/10.1016/j.eswa.2024.124167

Wang, W., Wang, Y., Chen, J., Wang, X., Zhang, H., Guo, C., & Peng, Y. (2025). The effectiveness of AI-supported personalized feedback on students' learning outcomes and motivation: A meta-analysis. *Journal of Educational Computing Research*, *64*(3), 724-755. https://doi.org/10.1177/07356331251410020

Younas, M., El-Dakhs, D. A., & Noor, U. (2025). The impact of artificial intelligence-based learning tools in academic innovation: A review of Deepseek, GPT, and Gemini (2020-25) . *Frontiers in Education, 10*, 1689205. https://doi.org/10.3389/feduc.2025.1689205

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education: Where are the educators? *International Journal of Educational Technology in Higher Education, 16*, 39. https://doi.org/10.1186/s41239-019-0171-0

FELIXBERTO M. MERCADO, PhD is the Dean of the Dr. Cesar A. Villariba Research and Knowledge Management Institute at the Manuel S. Enverga University Foundation in Lucena City, Philippines. As principal investigator, he has led and successfully completed several multi-million-peso research projects funded by the Commission on Higher Education (CHED) of the Philippines. He is a regular member of Division I of the National Research Council of the Philippines (NRCP). Dr. Mercado's research interests include lifelong learning, adult education, micro-credentials, and artificial intelligence (AI) governance in education. In 2018, he undertook advanced training in Adult Education at the University of Toronto. He holds a Doctor of Philosophy (PhD) in Linguistics. He may be contacted at felixmercado@mseuf.edu.ph.

JOANNE C. RIVERA, PhD is Professor VI at Don Mariano Marcos Memorial State University–South La Union Campus (DMMMSU-SLUC), Philippines. She holds a Ph.D. in Development Administration, completed the Leadership and Management Certificate Program at the Wharton School, University of Pennsylvania, and is a member of the Senior Executives Class (Batch 15) of the Development Academy of the Philippines. Her expertise spans adult education, lifelong learning, governance, public management,

and institutional development, informed by her service as Executive Director of the DMMMSU Open University System (2019–2021) and Chancellor of DMMMSU-SLUC (2021–2026). Through her leadership and research, she has advanced evidence-based governance, digital transformation, and innovative management systems that strengthen accountability, quality assurance, and institutional excellence in Philippine higher education. Her email address is jrivera@dmmmsu.edu.ph.

FLORMANDO P. BALDOVINO, **PhD** is the Dean of the College of Business and Accountancy at Manuel S. Enverga University Foundation, where he also serves as Program Chairperson of the MBA program under the Institute of Graduate Studies and Research, and as Research Coordinator for Business Education. He holds degrees in Bachelor of Science in Statistics and Bachelor of Science in Business Administration major in Financial Management, a Master in Business Administration (MBA), and two doctoral degrees: Doctor of Business Administration (DBA) and Doctor of Philosophy in Business Management (PhD BM). His expertise spans business management, business analytics, quantitative research, sequential equation modelling, and health informatics – reflecting his commitment to advancing academic excellence and global research collaboration. Email: baldovinoflormando@mseuf.edu.ph

APPENDIX A

Table 1.1

Type of AI Tools Used

Generative (creates new contents) (90.7%); N=1,600 • ChatGPT (89.6%) • Gemini (14.5%) • Microsoft Copilot (0.8%) • Meta AI (5.6%) • DeepSeek (0.9%) • Cici (6.8%) • Turbo AI (0.1%) • Blackbox AI (0.4%) They *generate* essays, answers, code, summaries, etc.	Transformative (modifies or improves existing contents) (7.6%); N=135 • QuillBot (9.3%) • Grammarly (0.7%) They *transform* input text rather than create from scratch.
Analytical AI (retrieves, evaluates, synthesizes information) (1.7%); N= 30 • Perplexity AI (0.5%) • Google Search (1.7%) They *analyze and retrieve* information rather than primarily generate.	Adaptive AI None

Multiple responses

APPENDIX B

Table 1.2

Self-rated Digital Literacy of the Respondents

Statements	Mean
I can effectively use digital devices (e.g., laptop, smartphone).	4.47
I can use digital tools (e.g., Google Docs, Zoom, AI tools like ChatGPT).	4.25
I can navigate online platforms (e.g., LMS, websites, apps).	4.21
I can search, evaluate, and use online information efficiently.	4.07
I can troubleshoot basic technical problems.	4.01

Note: 1.00–1.80 → Very Low; 1.81–2.60 → Low; 2.61–3.40 → Moderate; 3.41–4.20 → High; 4.21–5.00 → Very High

Table 1.3

Respondents' Level of Engagement in Lifelong Learning

Categories	Details	Mean
Behavioral Engagement (What they do)	Regular participation in learning activities (e.g., courses, trainings, webinars).	4.37
	Time allocation for continuous learning despite other responsibilities	4.27
	Actively seeking opportunities to learn new skills	4.19
	Grand Mean	4.28
Cognitive Engagement (How they think)	Making an effort to understand new concepts deeply	4.54
	Reflection on learning application to life/work	4.38
	Connecting new knowledge with prior knowledge	4.35
	Grand Mean	4.42
Motivational Engagement (Why they learn)	Motivation to continue learning throughout life	4.54
	Importance of lifelong learning for personal/ professional growth	4.35
	Enjoyment from learning new things even outside formal education	4.26
	Grand Mean	4.38

Note: 1.00–1.80 → Very Low; 1.81–2.60 → Low; 2.61–3.40 → Moderate; 3.41–4.20 → High; 4.21–5.00 → Very High

APPENDIX C

Table 4.1

Measurement Model: Reliability and Convergent Validity

Construct	Item	Loading	α	CR	AVE
Access and Inclusivity	Acc&Inc1	0.821	0.86	0.88	0.716
	Acc&Inc2	0.854			
	Acc&Inc3	0.863			
Adoption and Integration of AI in Adult Education	Ad&Int1	0.736	0.91	0.92	0.676
	Ad&Int2	0.826			
	Ad&Int3	0.864			
	Ad&Int4	0.813			
	Ad&Int5	0.850			
	Ad&Int6	0.836			
Learning Experience and Engagement	LLE1	0.838	0.90	0.92	0.740
	LLE2	0.899			
	LLE3	0.821			
	LLE4	0.881			

APPENDIX D

Table 4.2

Measurement Indicators of the Endogenous Construct: Use of AI for Lifelong Learning

Construct	Measurement Indicator	Standardized Loading (β)
Use of AI for Lifelong Learning	AI-based learning platforms help me stay more motivated in my studies.	0.854
	Personalized recommendations from AI tools improve my learning outcomes.	0.862
	AI technologies provide feedback that helps me better understand course content.	0.853
	AI-based gamification increases my engagement in learning.	0.779