

Learning Achievement—Adoption of Artificial Intelligence in Higher Education

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Abstract—The adoption of Artificial Intelligence (AI) influences everyone's life, since it has recently made remarkable achievements. It also has an impact on the educational sector. Through the questionnaire, data related to various factors such as digital, pupil-related, academic and curricular, communal and ecological, and moral and behavioral factors are collected from higher education students. The quantitative and qualitative features are analyzed using statistical tools. A convergent mixed-methods design was employed, combining quantitative surveys of 414 undergraduate and postgraduate students with qualitative interviews of 13 purposively selected participants. Confirmatory factor analysis validated the multidimensional measurement model, while correlation analysis and thematic interpretation highlighted strong interrelationships among AI-related factors and overall learning achievement. Findings indicate that technological readiness, student engagement, pedagogy, social environment, and ethical awareness collectively enhance learning outcomes. The study provides evidence-based insights for educators, administrators, and policymakers seeking to implement AI-supported, student-centred learning strategies in higher education.

Keywords—artificial intelligence, learning achievement, higher education, digital learning, student engagement, mixed-methods research, CFA/SEM analysis, technology-enhanced learning

I. INTRODUCTION

Higher education's teaching and learning methods have evolved drastically as an outcome of the rapid rise of digital technologies. Among these technologies, Artificial Intelligence (AI) has become a potent tool that can transform learning environments through learning analytics, automated assessment, personalized tutoring, adaptive learning platforms, and customized feedback systems. Understanding how AI-driven solutions affect student learning achievement has become a crucial area of educational research as higher education institutions use them more and more.

Learning achievement, which indicates students' capacity to gain knowledge, hone skills, and apply

concepts in a meaningful way, is a vital indicator of the efficacy of education. Conventional instructional methods frequently discover it difficult to meet each student's unique needs and a variety of learning styles and paces. In this respect, personalized learning pathways, real-time feedback, and data-driven instructional support are some of the promising ways that AI-based educational technologies can improve learning achievement. Students can interact more actively with the material thanks to these features, which further assist teachers in making sound pedagogical choices.

The need to enhance academic performance and learning outcomes, as well as the increasing demand for adaptable, student-centered learning environments, have sped up the adoption of AI in higher education. To assist students throughout their academic journey, learning management systems are increasingly incorporating AI applications like chatbots, intelligent tutoring systems, predictive analytics, and adaptive assessments. Even though these innovations have the potential to raise learning outcomes, their actual efficacy depends on a number of variables, including student acceptance, faculty adoption, institutional preparedness, and the caliber of AI implementation.

Empirical data on AI's direct impact on student learning achievement is still scarce, especially in developing educational contexts, despite the growing interest in its use in higher education. Instead of systematically investigating how AI adoption affects measurable learning outcomes, many current studies center on technological capabilities or user perceptions. This gap highlights the need for studies that assess how AI-driven teaching methods relate to students' academic success.

Thus, the purpose of this study is to investigate how student learning achievement is impacted by the use of artificial intelligence in higher education. The study aims to offer insights into how AI adoption can support effective learning and inform institutional strategies for technology-enhanced education by examining students' experiences with AI-enabled learning tools and their academic outcomes. The results are anticipated to add to the growing corpus of research on AI in education and provide useful

guidance for educators, legislators, and higher education entities looking to enhance student learning outcomes through innovative methods.

The research question is: Learning Achievement—Adoption of Artificial Intelligence in Higher Education.

While prior studies highlight the potential benefits of AI in education, empirical evidence on its direct influence on measurable student learning achievement remains limited. Most research focuses on perceptions or technological features, with few studies integrating quantitative outcomes and qualitative insights to explain how AI influences students' learning achievement.

- (1) To what extent is Artificial Intelligence adopted in higher education institutions?
- (2) What is the effect of AI adoption on students' learning achievement?
- (3) How do students perceive AI-enabled learning tools in their academic activities?
- (4) How do students describe the ways in which AI supports or challenges their learning experiences?

II. LITERATURE REVIEW

The question of AI adoption in higher education is crucial. Chatterjee aims to investigate the adoption potential of the stakeholders and used a variety of adoption theories and models, such as the “Unified Theory of Acceptance and Use of Technology” (UTAUT) model [1]. The literature discovered that behavioral intention moderates the relationship between performance expectations and perceived risks; however, behavioral intentions do not significantly affect the adoption of AI [2]. Adewale's [3] study emphasizes the important elements influencing the use of AI in education as well as its observable advantages for student achievement. It highlights a critical gap in the literature: the lack of a process-based framework intended to more accurately predict AI's educational effects, particularly across gender and geographic boundaries. Faculty engagement levels increased because of the development of strong evaluation and assessment techniques brought about using AI. The study found that through mediating variables, particularly attitude and behavior, perceived risk, performance expectancy, and awareness significantly impact work engagement and the adoption of AI within the higher education system [4]. The literature reveals that AI significantly and favorably affects university students' academic performance. These observations highlight how integrating AI can improve student performance in quantifiable ways and make a significant contribution to the larger conversation on technology-supported education [5]. Adaptive learning technologies have a great deal of promise for supporting individualized, data-driven instruction and providing a scalable way to increase learning efficacy in a variety of academic settings. It indicates that in order to promote more inclusive, effective, and goal-oriented learning environments, higher education institutions should think about implementing AI-based instructional systems more widely [6]. Zheng *et al.* [7] study reveals that AI had a high effect size on learning achievement and a small effect size on learning perception.

When AI is applied in educational settings, it assists teachers in analyzing data from higher education systems, spotting trends in student behavior, and creating solutions for students who are having difficulty.

Online learning has found it challenging to predict students' learning performance due to a lack of use of educational processes, evaluation data, and an accurate computation of statistical relationships between components and results [8–10]. Innovation has significantly altered the global landscape of teaching and learning during the last few decades. Researchers predict that the next big technological shift in how people communicate, work together, do business, and learn will be fueled by AI. Previous research on the intention to use AI technology has shown a positive impact on employment prospects, learning assessment, and educational quality. AI has rapidly emerged as a disruptive force in education, influencing how students learn, develop, and engage with assignments [11]. Critical thinking abilities are more likely to be developed by students who are scaffolded in their use, receive feedback, and acquire AI literacy. However, without instructor mediation, AI's educational potential may be limited. However, a persistent digital divide is highlighted by disparities in access to AI technology, as students from underfunded institutions cannot benefit equally [12]. The objective of the study [13] is to assess concepts like self-efficacy and the use of AI in online learning, as well as to determine the driving forces behind students' adoption of AI tools. Additionally, the study offers empirical proof of how AI improves students' performance in online learning in higher education.

III. FRAMEWORK OF THE STUDY

Using statistical, explainable, and predictive analysis, this study examines how AI affects students' overall learning achievement based on the following factors: Digital, Pupil-related, Academic and Curricular, Communal and Ecological, and Moral and Behavioural. As shown in Fig. 1, the study's conceptual framework positions five major sets of independent variables—digital, pupil-related, academic and curricular, communal and ecological, and moral and behavioural—as determinants of students' overall learning achievement.

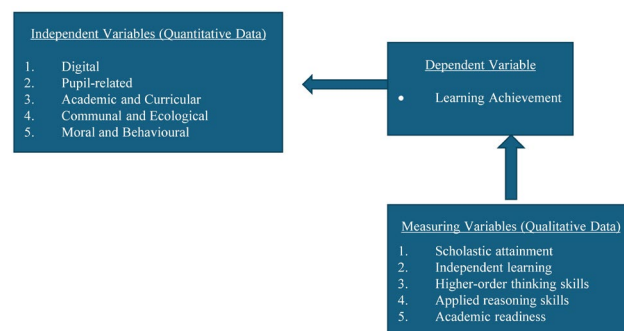


Fig. 1. Adoptive factors of AI in learning achievement.

Following an examination of the corpus of research on AI in education, these components were mapped to the

survey instrument. The framework states that each of these elements has a direct impact on students' scholastic attainment, independent learning, higher-order thinking skills, applied reasoning skills, and academic readiness.

IV. METHODOLOGY

A. Research Design

A convergent mixed-methods design [14] was employed, combining quantitative surveys and qualitative interviews to examine the effect of AI adoption on learning achievement. Quantitative data measured the relationship between AI use and learning outcomes, while qualitative data provided insights into student experiences with AI tools.

The quantitative component comprised 414 undergraduate and postgraduate students, selected using stratified random sampling to ensure adequate representation across academic disciplines and levels of study. The population was first stratified based on faculty/discipline and year of study, after which participants were randomly selected from each stratum in proportion to its size. This sampling approach enhanced the representativeness of the sample and reduced sampling bias, thereby strengthening the generalizability of the findings.

The qualitative component comprised 13 students, selected through purposive sampling based on clearly defined criteria: (i) frequent and sustained use of AI-based learning tools (e.g., AI tutoring systems, generative AI platforms, or adaptive learning applications), (ii) representation across different academic disciplines and levels of study, and (iii) willingness to reflect critically on their learning experiences. This approach ensured that participants possessed sufficient exposure to AI-assisted learning environments to offer rich, relevant, and in-depth insights.

B. Data Quality

Quantitative data were analysed using SPSS Version 25. Descriptive statistics summarized respondent characteristics and factor distributions. Confirmatory Factor Analysis (CFA) validated the measurement model, and correlation analysis examined interrelationships among constructs.

Qualitative data were transcribed and analysed using thematic content analysis. Inter-coder reliability was assessed using Cohen's Kappa ($\kappa = 0.956$), indicating strong agreement. Findings from both phases were integrated to provide a comprehensive understanding of AI's multidimensional influence on learning achievement.

V. RESULTS AND DISCUSSION

The descriptive analysis of the demographic and behavioral variables provides key insights into the study sample. As shown in Table I, the majority of respondents (58.2%) are aged 19–22 years, followed by 38.6% aged 15–18 years, with only 3.1% in the 23–26 years category, indicating a predominance of late adolescents and young adults typical of undergraduate and postgraduate

populations. The gender distribution shows a slightly higher proportion of female students (57%) compared to male students (43%), ensuring a reasonably balanced representation of perspectives. In terms of educational qualification, most respondents (85.3%) are undergraduates, while 14.7% are pursuing postgraduate studies, suggesting that the findings largely reflect undergraduate experiences with some comparative insights from postgraduates. Regarding engagement with AI-related activities, 46.9% of students reported daily usage, followed by 19.6% weekly, 14.7% occasionally, and 18.8% rarely, indicating a strong routine engagement with the study's focus area.

TABLE I. DEMOGRAPHIC CHARACTERISTICS OF THE FEMALE STUDENTS

Variable	Category	Frequency (f)	Percent (%)
Age	15–18	160	38.6
	19–22	241	58.2
	23–26	13	3.1
Gender	Female	236	57.0
	Male	178	43.0
Educational Qualification	UG	353	85.3
	PG	61	14.7
Frequency of Activity/Usage	Daily	194	46.9
	Weekly	81	19.6
	Rarely	78	18.8
	Occasionally	61	14.7

As shown in Table II, the construct of overall learning achievement demonstrated consistently strong loadings (0.732–0.802) across all indicators. These results confirm that AI-assisted learning is strongly associated with improved students' Scholastic attainment, Independent learning, Higher-order thinking skills, Applied reasoning skills and Academic readiness. The high and uniform loadings indicate that overall learning achievement is a well-defined and stable outcome construct within the model.

The CFA results validate the proposed measurement model and confirm that AI's impact on learning is multidimensional, shaped by technological readiness, learner characteristics, pedagogical practices, social context, and psychological–ethical considerations. The strong and significant factor loadings across constructs suggest that the instrument is both reliable and theoretically sound, making it suitable for subsequent Structural Equation Modeling (SEM) to examine causal relationships among AI-related factors and students' learning achievement.

Metaphorically, the CFA reveals AI in higher education not as a single engine, but as a well-orchestrated ecosystem—where technology provides the foundation, students supply the momentum, teachers act as navigators, society forms the environment, and psychological–ethical awareness serves as the compass guiding learning toward meaningful and sustainable outcomes.

The factor analysis of students' perceptions toward AI in education shows variations across technological, pedagogical, social, and psychological dimensions. Since the mean values are derived from summated Likert-scale items, higher scores indicate stronger agreement with the

factor, while the standard deviation reflects the spread of responses.

TABLE II. CONFIRMATORY FACTOR ANALYSIS

Factor	Indicator	Estimate	SE	Z	p
Digital Factors	I have sufficient access to AI tools (e.g., ChatGPT, adaptive learning apps, virtual tutors).	0.863	0.0555	15.54	<0.001
	The AI tools I use are reliable and provide accurate information.	0.714	0.0421	16.94	<0.001
	The AI tools I use are updated and relevant to my curriculum.	0.784	0.0438	17.90	<0.001
	AI tools provide personalized learning experiences suited to my level.	0.837	0.0469	17.85	<0.001
Pupil-Related Factors	AI platforms I use are compatible with my devices (mobile, laptop, tablet).	0.945	0.0511	18.50	<0.001
	AI supports my preferred learning style (visual, interactive, self-paced, etc.).	0.749	0.0451	16.60	<0.001
	AI helps me retain and apply knowledge more effectively.	0.751	0.0456	16.49	<0.001
	I can use AI tools independently without much difficulty.	0.835	0.0475	17.58	<0.001
	I feel more confident in asking AI questions than asking teachers.	0.799	0.0528	15.13	<0.001
Academic and Curricular Factors	I use AI to explore topics beyond my syllabus.	0.881	0.0497	17.73	<0.001
	AI combined with teacher instruction improves my learning ability.	0.827	0.0488	16.93	<0.001
	I feel AI cannot completely replace the role of teachers in my learning.	0.760	0.0567	13.41	<0.001
	My teachers recommend reliable AI platforms for learning.	0.520	0.0559	9.30	<0.001
	Teachers explain the limitations of using AI in academics.	0.601	0.0526	11.44	<0.001
Communal and Ecological Factors	AI makes classroom discussions more interactive when guided by teachers.	0.677	0.0495	13.66	<0.001
	My family supports my use of AI for educational purposes.	0.776	0.0491	15.79	<0.001
	My peers influence how I use AI in my studies.	0.812	0.0442	18.35	<0.001
	AI tools help me overcome socio-economic or resource-related learning barriers.	0.790	0.0455	17.39	<0.001
	Peer discussions about AI improve my ability to use it more effectively.	0.800	0.0445	18.00	<0.001
Moral and Behavioural Factors	Lack of resources sometimes prevents me from using AI as much as I need.	0.606	0.0509	11.90	<0.001
	I rely too much on AI instead of thinking independently.	0.651	0.0548	11.89	<0.001
	Using AI increases my confidence in learning difficult subjects.	0.823	0.0471	17.48	<0.001
	I sometimes feel anxious or doubtful about whether AI-generated answers are correct.	0.720	0.0534	13.49	<0.001
	AI has helped me improve creativity and problem-solving skills.	0.756	0.0533	14.19	<0.001
Overall Learning Achievement	I worry that AI might reduce my critical thinking ability.	0.685	0.0573	11.95	<0.001
	AI has positively improved my overall learning ability.	0.802	0.0434	18.46	<0.001
	AI has helped me improve my academic performance (grades, tests, projects).	0.786	0.0456	17.22	<0.001
	I believe AI will be essential for my future education and career.	0.795	0.0458	17.34	<0.001
	I feel more prepared for future challenges because of AI-assisted learning.	0.780	0.0455	17.13	<0.001
	AI has improved my ability to learn independently.	0.732	0.0479	15.30	<0.001

As shown in Table III, the analysis of influencing factors indicates that pupil-related factors recorded the highest mean ($M = 17.67$, $SD = 4.356$), suggesting that students perceive substantial benefits from AI in terms of learning independence, confidence, and engagement. Digital factors ($M = 17.43$, $SD = 4.448$) were also highly ranked, highlighting the critical role of accessibility, compatibility, and reliability of AI tools in shaping students' learning experiences. These findings underscore the combined impact of student-centered attributes and technological readiness on effective AI adoption in higher education.

TABLE III. MEAN AND SD FOR FACTORS

Factors	Mean	Std. Deviation
Digital Factors	17.43	4.448
Pupil-Related Factors	17.67	4.356
Academic and Curricular Factors	16.70	3.935
Communal and Ecological Factors	17.01	4.087
Moral and Behavioral Factors	16.98	4.136
Overall Learning Achievement	17.14	4.194

Overall learning achievement ($M = 17.01$, $SD = 4.087$) was rated as a moderately influencing factor. This suggests that while AI is acknowledged for enhancing students' overall learning performance, its impact is somewhat moderated by external influences such as peers, teachers,

and family support. These effects, though meaningful, appear less pronounced compared to the more direct influences of student-related attributes and technological factors.

Moral and behavioral factors ($M = 16.98$, $SD = 4.136$) and academic and curricular factors ($M = 16.70$, $SD = 3.935$) recorded slightly lower mean values, indicating that while students recognize psychological and ethical concerns—such as anxiety, over-reliance on AI, and ethical dilemmas—these issues do not dominate their overall perceptions. Similarly, teacher and pedagogical factors scored the lowest, suggesting that students perceive teacher involvement in guiding AI use as comparatively limited relative to other influencing factors.

A. Hypothetical Analysis

Hypothesis 1: There is no significance difference among age group with respect to the factors of learning ability.

The hypothesis that there is no significant difference among age groups is partially rejected. Significant differences were found in technological, student-related, social & environmental factors, and overall learning ability, where older students (particularly those in the 23–26 age group) reported higher positive perceptions. However, no significant differences were observed in teacher and pedagogical factors and psychological and ethical factors.

This implies that age influences how students perceive AI in learning, with older students recognizing its role in enhancing independence, social support, and overall learning ability more strongly than younger students.

Hypothesis 2: Test whether there is no relationship between the factors of learning performance among students.

TABLE IV. ANOVA

Factor	Age Group	N	Mean	Std. Deviation	F	Sig.
Digital Factors	15–18	160	16.77	4.773	4.024	0.019
	19–22	241	17.75	4.178		
	23–26	13	19.62	4.093		
	Total	414	17.43	4.448		
Pupil-Related Factors	15–18	160	17.04	4.763	3.922	0.021
	19–22	241	17.98	3.994		
	23–26	13	19.85	4.598		
	Total	414	17.67	4.356		
Academic and Curricular Factors	15–18	160	16.29	4.202	2.991	0.051
	19–22	241	16.85	3.720		
	23–26	13	18.85	3.826		
	Total	414	16.70	3.935		
Communal and Ecological Factors	15–18	160	16.39	4.351	3.655	0.027
	19–22	241	17.34	3.805		
	23–26	13	18.62	4.942		
	Total	414	17.01	4.087		
Moral and Behavioral Factors	15–18	160	16.43	4.455	2.664	0.071
	19–22	241	17.29	3.840		
	23–26	13	18.15	4.828		
	Total	414	16.98	4.136		
Overall Learning Achievement	15–18	160	16.53	4.335	3.536	0.030
	19–22	241	17.44	4.051		
	23–26	13	18.92	4.232		
	Total	414	17.14	4.194		

TABLE V. CORRELATION COEFFICIENT

Factors	Digital Factors	Pupil-Related Factors	Academic and Curricular Factors	Communal and Ecological Factors	Moral and Behavioral Factors
Digital Factors	1	0.801**	0.658**	0.690**	0.602**
Pupil-Related Factors		1	0.690**	0.725**	0.701**
Academic and Curricular Factors			1	0.705**	0.658**
Communal and Ecological Factors				1	0.702**
Moral and Behavioral Factors					1

B. Correlation Coefficient

The correlation analysis (Table V) shows that all five constructs—digital, pupil-related, academic and curricular, communal and ecological, and moral and behavioral factors—are positively and significantly related ($p < 0.01$), indicating strong interrelationships. Digital factors were highly associated with pupil-related factors ($r = 0.801$) and also correlated strongly with academic and curricular ($r = 0.658$), communal and ecological ($r = 0.690$), and moral and behavioral factors ($r = 0.602$), highlighting technology as a central enabler of learning. Pupil-related factors were strongly linked with communal and ecological factors ($r = 0.725$) and moral and behavioral factors ($r = 0.701$), suggesting that student engagement is influenced by social support and ethical awareness. Academic and curricular factors correlated with communal and ecological factors ($r = 0.705$) and moral and behavioral factors ($r = 0.658$), while communal and ecological factors were associated with moral and behavioral factors ($r = 0.702$), confirming that supportive environments reinforce ethical behavior. These findings

support the hypothesized CFA/SEM model, demonstrating interdependent influences on students' learning outcomes.

C. Qualitative Analysis

Thematic analysis of interview transcripts to identify patterns and provide context for quantitative findings.

With the help of artificial intelligence, students in virtual classrooms may study at their own speed while still collaborating with their peers and instructors. The application of AI in education also allows for the development of individualized lesson plans and the provision of specialized assistance for students with learning differences. In addition, AI may help educators get a deeper understanding of their students' strengths and areas for improvement so they may better personalize their lessons to each individual learner [15].

Its implementation is identified as a pivotal and strategic element of educational advancement. The integration of AI in education marks a transformative phase for the industry. While AI offers substantial benefits in terms of enhanced learning experiences and increased teacher efficiency, potential drawbacks and concerns are also evident [16].

It is determined that digital modernization of the sphere of higher education stimulates the reduction of the universities' need for academic and teaching staff and growth of their unemployment. However, further digital modernization of the economy based on breakthrough technologies of Industry 4.0 will lead to the creation of a new type of educational services that are provided within university entrepreneurship–AI training for business. This will ensure development of university entrepreneurship (and reduction of dependence of universities on state financing), as well as growth of the employment

opportunities for experts (academic and teaching staff) in the sphere of AI [17].

AI in education initially took the form of computers and computer-related systems, and later, the form of web-based and online education platform. Embedded systems have made it possible to use robots, in the form of cobots or humanoid robots as teacher colleagues or independent instructors, as well as chatbots to perform teacher or instructor-like functions. The use of these platforms and tools has enabled or improved teacher effectiveness and efficiency, resulting in richer or improved instructional quality [18].

TABLE VI. THEMATIC SUMMARY OF QUALITATIVE FINDINGS ON AI ADOPTION AND LEARNING ACHIEVEMENT

Theme	Sub-Themes	Description	Link to Quantitative Findings
1. Personalized and Self-Paced Learning	Individualized instruction; adaptive learning pathways; support for learning differences	Students reported that AI enables learning at their own pace while offering customized content based on individual strengths and weaknesses. AI tools were perceived as enhancing independent learning and conceptual clarity.	Supports strong loadings under <i>Pupil-Related Factors</i> and <i>Overall Learning Achievement</i> (independent learning, academic readiness).
2. Enhanced Engagement and Collaborative Learning	Peer collaboration; AI-supported discussions; virtual classroom interaction	Participants noted that AI tools facilitate collaboration with peers and instructors while maintaining flexibility in learning environments. AI-enhanced platforms improved participation and engagement.	Aligns with high mean scores in <i>Digital</i> and <i>Communal & Ecological Factors</i> .
3. Pedagogical Support and Teacher Efficiency	Instructional personalization; feedback mechanisms; instructional quality improvement	Students perceived AI as assisting teachers in identifying learning gaps and tailoring instruction. AI tools enhanced feedback quality and instructional effectiveness.	Corresponds with <i>Academic and Curricular Factors</i> and CFA validation of multidimensional influence.
4. Transformational Impact on Higher Education	Strategic educational advancement; digital modernization; innovation in teaching models	AI integration was viewed as a transformative force reshaping higher education systems and delivery models, including entrepreneurship-oriented and AI-based educational services.	Reinforces strong inter-correlations among all AI-related constructs.
5. Concerns and Ethical Considerations	Over-reliance; employment displacement; uncertainty about AI accuracy	Students expressed concerns about dependency on AI, potential reduction in academic roles, and long-term implications of digital modernization.	Aligns with <i>Moral and Behavioral Factors</i> and moderate mean values indicating awareness but not dominance of concerns.
6. Technological Evolution of AI in Education	From computer-based systems to AI chatbots and humanoid assistants; automation in instruction	Participants recognized the progression of AI from basic digital systems to advanced intelligent platforms, including chatbots and robotic assistants, enhancing instructional delivery.	Supports high loadings under <i>Digital Factors</i> and confirms technological readiness as a foundational driver.

VI. CONCLUSION

Using a mixed-methods approach that combined quantitative surveys and qualitative interviews, this study investigated the effects of AI adoption on student learning achievement in higher education. The results show that the use of AI improves students' engagement, independence, higher-order thinking, applied reasoning, and general academic preparedness, all of which have a positive impact on learning outcomes. While student-related, academic and curricular, communal and ecological, and moral and behavioral factors collectively shaped students' experiences and outcomes, digital factors emerged as a key enabler. The proposed CFA/SEM model was validated by confirmatory factor analysis and correlation results, which showed the interdependence of digital, academic and curricular, communal and ecological, and moral and behavioral issues in promoting successful AI-supported learning. Qualitative insights further highlighted the importance of personalized learning pathways, real-time feedback, and institutional support in maximizing AI's

educational benefits. Overall, the study offers empirical proof that, when carefully combined with pedagogy and social support networks, AI can greatly improve learning achievement. In addition to highlighting the necessity of ethical awareness, balanced AI use, and ongoing faculty engagement, these findings provide useful advice for educators, administrators, and legislators looking to implement technology-enhanced, student-centered learning strategies.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Dr. Sornakumari N. conceptualized the study, developed the research framework and methodology, designed the research instrument, coordinated data collection, conducted the statistical analysis, interpreted the findings, and prepared the manuscript. Dr. J. Samuel Jesudoss contributed to the conceptualisation of the study,

literature review, data collection, interpretation of results, and critical revision of the manuscript. Both authors contributed to the discussion of the findings, reviewed and revised the manuscript critically, and approved the final version for publication.

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