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Higher Education Transformation through AI-Based Learning Innovation: Faculty Members' Perception, Challenges, and Adoption in Teaching and Assessment

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The purpose of this study is to determine the AI-based learning tools used the most by lecturers in higher education and examine the factors affecting the acceptance of AI-based learning innovations in teaching and assessment through the Technology Acceptance Model (TAM). The present study utilized a correlational quantitative cross-sectional design. Data were collected from 300 lecturers using a structured questionnaire through Google Forms. Data was analysed using the Structural Equation Modeling (SEM) technique with a Partial Least Squares (PLS) approach. Key findings of the research indicate that NLP-based technologies such

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as ChatGPT, Grammarly and QuillBot, are the most adopted AI tools. Furthermore, the research indicates that Attitude Toward Using and Behavioral Intention to Use contribute significantly to the adoption of AI technologies. A positive attitude towards AI has a strong positive effect on the lecturers' intention-to-use these technologies, which remains an important direct predictor of actual teaching with such tools. Key factors affecting attitudes and perceived usefulness of AI from lecturers' perspectives include Perceived Ease of Use and availability of adequate support. Such integration of AI into teaching emphasizes the necessity of providing proper support for higher education staff to assist them in using the technology effectively, which in turn can lead to improved teaching practices and learning outcomes. More concretely, the implications of this work include higher education institutions emphasizing solutions to the challenges of AI adoption and spending time developing policies that will allow for efficient AI use in academic contexts.

Introduction

In view of the ever-changing nature of global dynamics, particularly as a result of technological advancements and shifting industrial demands, it is imperative that institutions of higher learning undergo radical reform. The world changes constantly, and schools must change with it. Colleges need to prepare students, giving them solid critical thinking and real-world skills. They must remain agile, responding to what employers want. Technology and new teaching methods can enhance learning, making the hours in class feel swift (Liono et al., 2021). This shift urges teachers to grade justly, to foster a love of learning in their students, and to prepare them to face the world. By transforming the colleges, we can forge a space that embraces openness and creativity, one that is equipped for the future yet attentive to the current needs (Walter, 2024).

The development of new technology, such as AI, has the power to change higher education. However, many educators remain hesitant due to uncertainty about how to effectively integrate these tools into their teaching practices and concerns over the increased workload that might follow (Ertmer et al., 2012; Singun, 2025). Change is hard for them (Alotaibi & Alshehri, 2023). The problems with infrastructure and resources are many. There is not enough money, not enough training, and support from institutions is lacking. These issues stand in the way of putting AI to good use in education. On top of that, there are ethical questions that must be faced. The safety of student data is at stake. There is the danger of bias in the algorithms and the threat that education may lose its human touch (Ajani et al., 2024; Yafie et al., 2024). Not every field of study or course can easily embrace AI without losing what makes teaching true to its purpose. Technology must continue to advance in education, but its success depends on the active participation and commitment of all stakeholders, including teachers, students, and administrators. Clear and well-defined policies are essential to guide this transformation. The challenge lies in achieving a balanced integration of technological tools with the irreplaceable human elements of the learning process (Gkrimpizi et al., 2023).

In this context, innovation in learning becomes a very important aspect to achieve. Digital technology, particularly AI, is a key driver in this change, bringing great potential in transforming the way education is delivered, both in terms of teaching and assessment (Crompton & Burke, 2023; Saidakhror, 2024). Using cutting-edge technologies like AI in higher education can support universities to better respond to the evolving demands of the

digital age, by adapting more flexible and effective learning methods (Algerafi et al., 2023; George & Wooden, 2023). AI has the ability to assist lecturers in managing complex learning materials, personalizing students' learning experience, and simplifying the evaluation process. Therefore, the shift in higher education towards the use of AI is not only relevant but also an urgent need for educational institutions to remain relevant in this digital era (Erbaşı et al., 2023).

AI's new educational tools can make teaching and testing better. They might help solve the problems facing higher education today. But how professors see AI will matter a great deal. Their views will shape how it works in the classroom (Chounta et al., 2022). When educators see AI as a partner, a tool to help them understand their students better and make their work easier, they are more likely to use it. But some teachers hesitate. They worry about whether they can trust it, fear losing their jobs, and simply do not know much about it (Kohnke et al., 2023). It is crucial that educators understand both the pedagogical benefits and potential drawbacks of using AI in the classroom. Only then can they accept it and weave it into their teaching.

Faculty members embrace AI based on how they see it and the difficulties that come with using it. The barriers to fully harnessing AI are many. There is often poor digital infrastructure, teachers who lack the necessary skills, and the absence of strong support from the institution (Dwivedi et al., 2021). Ensuring equitable usage of AI in education is crucial. There are moral questions that need answering. We must find ways to help teachers accept AI. This could mean training them well, setting clear rules, and using technology that keeps the human touch in teaching (Sun & Jung, 2024). When used wisely, AI can make teaching better, create a livelier learning space, and speed up the change in higher education toward something more flexible and prepared for the future.

This research sheds light on how AI-driven learning is reshaping higher education. It explores the interplay between faculty perspectives, the challenges they encounter, and their patterns of adoption concerning these emerging technologies in both teaching and assessment contexts. While numerous studies have explored AI's impact on student outcomes, relatively few have deeply examined the roles and experiences of faculty members in adopting AI, especially within teaching and assessment contexts. This study seeks to fill that gap by placing faculty members at the center of digital transformation. By integrating both pedagogical and technological insights, this research positions AI as not only a tool for educational delivery but also a transformative force that can foster personalized, efficient, and equitable teaching practices. Understanding how to implement AI-based innovations effectively in instructional and evaluative contexts is essential for achieving long-term institutional relevance in the digital age (Chu & Ashraf, 2025). In this regard, higher education institutions are expected to modernize their systems in order to enhance instructional quality, streamline administrative functions, and ensure fairness in evaluation. These objectives require a robust commitment to technological advancement (Ejjami, 2024). However, several barriers impede this transformation. Many faculty members express skepticism toward AI integration, driven by uncertainties regarding the reliability of AI systems, concerns over the potential devaluation of their professional roles, and limited exposure to AI technologies (Tawfik et al., 2021). In addition, a significant proportion of academic staff lack the necessary digital competencies to leverage AI tools effectively for instructional purposes. These challenges are further compounded by inadequate infrastructure, as well as unresolved ethical and regulatory considerations.

The potential of AI to enhance student learning experiences and improve teaching efficiency is substantial; however, these benefits may be limited if barriers to adoption hinder its widespread implementation in higher education. To support the digital transformation of universities, it is essential to understand how faculty members perceive, respond to, and integrate AI into their teaching and assessment practices. Previous research has shown that faculty adoption of educational technology is shaped by perceived usefulness, ease of use, institutional support, and concerns related to ethics and data privacy (Chugh et al., 2023; Singh & Hiran, 2022). Studies also reveal that common AI tools used in higher education include intelligent tutoring systems, automated grading platforms, plagiarism detection tools, and adaptive learning technologies (Sajja et al., 2024; Slimi et al., 2025). Therefore, the purpose of this study is to determine the AI-based learning tools used the most by lecturers in higher education and examine the factors affecting the acceptance of AI-based learning innovations in teaching and assessment through the TAM. The findings are expected to inform the development of inclusive and sustainable AI implementation strategies tailored to institutional and pedagogical needs.

Method

Research Design

The study employs a cross-sectional design and a quantitative correlational technique, investigating faculty members' adoption of AI-driven learning innovations in the context of higher learning. Employing a correlational approach, the degree of association between the key variables identified through the TAM is measured, particularly, the degree of association between Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Attitude Toward Using AI (ATU), Behavioral Intention to Use AI (BIU) as well as Actual Use of AI and the faculty members' adoption of AI in teaching and assessment. Data can be gathered at one particular moment using a cross-sectional approach, giving an overview of faculty members' attitudes, difficulties, and degrees of acceptance of AI in higher education. This gives a comprehensive picture of the factors that encourage and hinder the use of AI, leading to the generation of strategies to increase its uptake in universities. Based on the TAM framework, the study proposes the following hypotheses:

H1: Perceived Usefulness (PU) positively influences Attitude Toward Using AI (ATU).

H2: Perceived Usefulness (PU) positively influences Behavioral Intention to Use AI (BIU).

H3: Perceived Ease of Use (PEOU) positively influences Perceived Usefulness (PU).

H4: Perceived Ease of Use (PEOU) positively influences Attitude Toward Using AI (ATU).

H5: Attitude Toward Using AI (ATU) positively influences Behavioral Intention to Use AI (BIU).

H6: Behavioral Intention to Use AI (BIU) positively influences Actual Use (AU) of AI.

Population, Sample, and Sampling Techniques

This study population was the members of the *Forum Dosen dan Pendidikan Indonesia* (Indonesian Lecturers and Education Forum), which has 34,000 members coming

together in various faculties of education from all over Indonesia. These are academics involved in the conception, development, implementation of methods of learning in the context of higher learning. To help know the sample of research, a simple random sampling technique was performed by using the Slovin formula, so there were 300 lecturers served as respondents. This technique was adopted to guarantee that each population member had an equal opportunity to take part in the research, making it so that the results obtained could give a representative picture of the perceptions, challenges, and level of acceptance of AI learning innovations in the learning and assessment process of the higher education domain.

Data Collection Techniques

The data for this study were collected using a structured questionnaire distributed online via Google Forms, enabling broad and convenient access for faculty members. The instrument consisted of 57 items measured using a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree), designed to assess faculty members' perceptions, attitudes, and behaviors related to the adoption of AI-based learning innovations. The questionnaire was developed through the adaptation of dimensions and indicators from prior studies, using the TAM as the conceptual framework. It included five main constructs: Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Attitude Toward Using AI (ATU), Behavioral Intention to Use AI (BIU), and Actual Use (AU). Each construct was represented by several indicators and multiple items that were carefully adapted from prior studies to fit the higher education context. Details of the variables, indicators, item numbers, scales, and sources are presented in Table 1. The adaptation process involved contextual modifications and expert validation to ensure the content's relevance and clarity. These constructs were evaluated based on faculty members' actual experiences with AI implementation in their instructional and assessment practices, thereby offering comprehensive insights into the enablers and barriers affecting AI utilization in higher education.

Table 1. TAM model variables, indicators and measurement items for AI utilization in higher education

Variable	Indicator	Items (n)	Scale	Source
Perceived Usefulness (PU)	AI's ability to enhance learning outcomes	1, 2, 3	Likert 1-5	Davis (1989); Saadé & Bahli (2005)
	AI in simplifying assessment and student evaluation	4, 5, 6		
	Efficiency in time management and teaching quality	7, 8, 9		
	AI in enhancing student engagement	10, 11, 12		
	AI contribution to personalized learning	13, 14, 15		
Perceived Ease of Use (PEOU)	Ease of access and AI usability	16, 17, 18	Likert 1-5	Mohd Amir et al. (2020); Tubaishat (2018)
	Challenges in understanding and operating AI	19, 20, 21		
	AI integration in existing teaching methods	22, 23, 24		
	AI technical support and training availability	25, 26, 27		
	Institutional readiness for AI implementation	28, 29, 30		
Attitude Toward Using AI (ATU)	Faculty perception toward AI in education	31, 32, 33	Likert 1-5	Schmitt et al. (2024)
	Factors influencing AI adoption	34, 35, 36		
	Trust in AI for education quality improvement	37, 38, 39		
Behavioral Intention to Use AI (BIU)	Likelihood of continued AI adoption	40, 41, 42	Likert 1-5	Dhara et al., (2023); Emon et al., (2024)
	Factors influencing AI adoption intention	43, 44, 45		
	Impact of academic environment and institutional policies	46, 47, 48		
Actual Use of AI	Frequency of AI adoption in teaching practices	49, 50, 51	Likert 1-5	Hosseini (2023)
	Barriers to regular AI utilization	52, 53, 54		
	Factors influencing increased or decreased AI	55, 56, 57		

usage	

Data Analysis Technique

This study employed the Partial Least Squares (PLS) method in conjunction with Structural Equation Modeling (SEM) as its data analysis tool. The measurement model, or outer model, which assesses the relationship between observed variables and related constructs, and the structural model, or inner model, which looks at the relationship between latent variables like lecturers' perceptions, difficulties, and adoption of AI in teaching and assessment, were both analyzed using SEM-PLS. This approach is suitable for testing complex relationships and addressing multiple variables and constructs simultaneously. It also explores the elements influencing higher education lecturers' adoption of AI technologies for their instructional strategies and the incorporation of AI in educational evaluation.

Result

Faculty Characteristics and AI Utilization Trends in Higher Education

Higher education's use of AI is changing administrative duties, teaching strategies, and evaluation procedures. Faculty members utilize AI tools such as Natural Language Processing (NLP), Adaptive Learning, Automated Assessment, and Predictive Learning to enhance teaching efficiency and student engagement. However, the level of AI adoption varies depending on factors such as academic rank, teaching experience, familiarity with AI, and institutional support.

To capture these trends, demographic and contextual data were collected as part of the structured questionnaire used in this study. The questionnaire included a dedicated section comprising multiple-choice and closed-ended items designed to obtain information on faculty characteristics (e.g., age, gender, academic rank, teaching experience) and AI utilization (e.g., type of AI tools used, training received, and perceived barriers to adoption). This section complemented the TAM-based items and was developed to align with current practices in educational technology adoption research. Table 2 summarizes the responses gathered from this section of the questionnaire.

Table 2. Faculty characteristics and AI utilization trends in higher education.

Characteristics	**Response Options**	**(n=300)**	**(%)**
Age	<30 years	32	10.7%
	30–40 years	89	29.7%
	41–50 years	91	30.3%
	51–60 years	60	20.0%
	>60 years	28	9.3%
	Total	**300**	**100%**
Gender	Male	164	54.7%
	Female	136	45.3%
	Total	**300**	**100%**
Academic Rank	Assistant Lecturer	45	15.0%
	Lecturer	103	34.3%
	Senior Lecturer	78	26.0%
	Associate Professor	46	15.3%
	Professor	28	9.3%
	Total	**300**	**100%**
Teaching Experience	<5 years	58	19.3%

Characteristics	Response Options	(n=300)	(%)
	5–10 years	72	24.0%
	11–20 years	91	30.3%
	21–30 years	51	17.0%
	>30 years	28	9.3%
	Total	**300**	**100%**
Level of AI Integration in Teaching	Never used AI	0	0.0%
	Rarely use AI	68	22.7%
	Occasionally use AI	93	31.0%
	Frequently use AI	62	20.7%
	Fully integrated AI	77	25.7%
	Total	**300**	**100%**
Training on AI for Education	Never attended AI training	89	29.7%
	Informal AI training	108	36.0%
	Formal AI courses	72	24.0%
	Certified in AI	31	10.3%
	Total	**300**	**100%**
Type of AI Used in Teaching	NLP (ChatGPT, Grammarly, etc.)	225	75.0%
	Adaptive Learning	120	40.0%
	Automated Assessment	150	50.0%
	Data Analytics	105	35.0%
	Virtual Reality (VR)	60	20.0%
	AI-based Educational Platforms	180	60.0%
	Total	**300**	**100%**
Perceived Barriers to AI Adoption	Lack of AI literacy	102	34.0%
	Lack of institutional support	89	29.7%
	Limited access	67	22.3%
	Ethical concerns	24	8.0%
	Resistance to change	18	6.0%
	Total	**300**	**100%**

The results in table 2 indicate that AI adoption among faculty members is increasing; however, disparities exist based on academic position, experience, and institutional support. Faculty members in mid-career stages (30–50 years old) and those with moderate teaching experience (11–20 years) are more likely to include AI into their instruction, as reflected by the higher percentages of AI usage in this group. Younger faculty members (<30 years) are more open to AI adoption but have lower participation rates in AI training programs, indicating a gap in professional development opportunities. Professors and senior lecturers, who often hold administrative roles, report lower AI usage, likely due to traditional teaching preferences and workload constraints. Despite the increasing reliance on AI, faculty members still face challenges in AI integration. The most significant barriers include lack of AI literacy (34%), insufficient institutional support (29.7%), and limited access to AI tools (22.3%). Interestingly, ethical concerns (8%) and resistance to change (6%) are the least cited obstacles, suggesting that most educators recognize AI's potential but require better training and institutional frameworks to facilitate adoption. Overcoming these hurdles through AI training, regulatory reforms, and robust technological infrastructure is critical to unlocking the full potential utilizing AI in higher education and utilizing its potential to enhance teaching and learning.

AI Utilization in Higher Education by Faculty Members

AI is transforming higher education including teaching, assessment and learning. This instruction efficiency and active student engagement is achieved through the usage of

concepts like NLP, Adaptive Learning, Automated Assessment, Predictive Learning, VR, and AI-powered platforms among other AI technologies by various faculty members. That knowledge is important because knowing how AI is being adopted and faculty preferences is critical to understanding how to optimize its impact on education. Transformative technology can benefit students. The table below gives an overview of the use of AI at the faculty level in terms of the percentage of AI used and the specific applications used in teaching and assessment.

Table 3. The use of AI by higher education faculty.

AI Type	Example Technologies	Functions in Teaching	Implementations	N=300)	(%)
NLP	ChatGPT, Grammarly, QuillBot	Helps in natural language processing for academic writing, feedback, and text comprehension.	- Support faculty in preparing syllabi and lesson plans (RPS). - Generating multiple-choice and essay questions. - Checking grammar, spelling, and academic writing quality.	225	75%
Adaptive Learning	Smart Tutoring Systems, Knewton, Squirrel AI	Personalizes learning based on student needs through AI-driven analysis.	- Recommending personalized learning materials. - Assignment difficulty adjustment on the fly. - Providing real-time feedback on student progress.	120	40%
Automated Assessment & Grading	Gradescope, Turnitin AI, AutoTutor	Simplifies grading of assignments, exams, and essays using AI.	- Automatically scoring multiple-choice and essay answers. - Providing automated feedback on assignments. - Detecting plagiarism in student submissions.	150	50%
Data Analytics & Predictive Learning	Learning Analytics, IBM Watson, Tableau AI	Analyzes student learning patterns to provide predictive insights and early interventions.	- Assessing student performance in specific courses. - Identifying students at risk of academic failure. - Recommending adjustments in teaching strategies based on learning data.	105	35%
VR & Simulation-Based Learning	Google Expeditions, ClassVR	Provides interactive simulation-based learning experiences using VR.	- Developing immersive learning media with simulations. - Helping students understand abstract concepts through 3D visualization. - Enhancing laboratory experiences with virtual labs.	60	20%

AI Type	Example Technologies	Functions in Teaching	Implementations	N=300)	(%)
AI Platforms Used by Faculty	Custom AI platforms developed by universities	AI platforms designed to support various aspects of teaching and classroom management.	- Automating classroom management and administrative tasks. - Assisting faculty in content creation (videos, PPT, digital modules). - Optimizing learning strategies through AI-powered recommendations.	180	60%

The results in table 3 indicate that NLP tools are the most widely adopted AI technology, with 75% of faculty members (225 out of 300) actively using tools like ChatGPT, Grammarly, and QuillBot. These tools significantly aid faculty in drafting academic materials, creating assessments, and refining content quality. The second most adopted AI technology is AI-powered educational platforms, used by 60% of faculty members (180 out of 300), highlighting a growing reliance on AI-driven solutions for classroom management, content development, and digital teaching strategies. Conversely, VR and Simulation-Based Learning exhibit the lowest adoption rate (20% or 60 faculty members), likely due to infrastructure limitations, high costs, and the need for advanced technical expertise. Automated assessment and grading systems (50% adoption) and adaptive learning (40% adoption) are moderately utilized, indicating a gradual transition towards AI-driven assessment and personalized learning pathways. However, data analytics and predictive learning remain underutilized (35% adoption), suggesting that while faculty recognize the potential of AI in predictive student performance tracking, institutional barriers, such as data accessibility and analytical proficiency, may hinder full implementation. These insights underscore the need for AI-focused faculty training programs, improved digital infrastructure, and policy frameworks that encourage AI integration into higher education curricula. As AI technologies continue to evolve, addressing faculty concerns, enhancing AI literacy, and promoting interdisciplinary collaboration will be essential in maximizing AI's effect on postsecondary education.

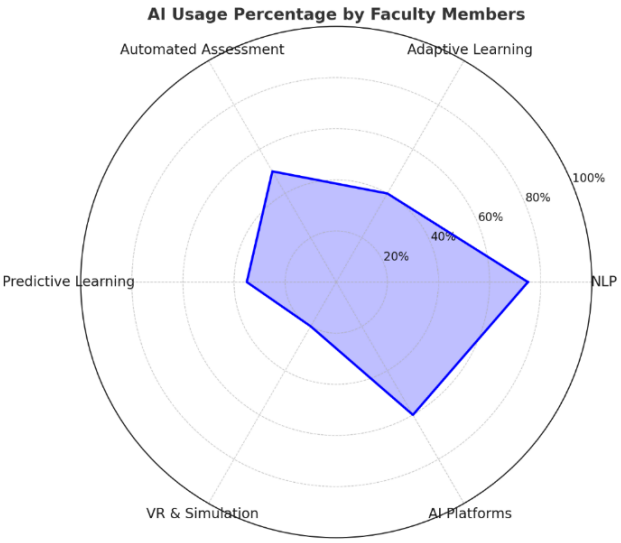

Figure 1. Distribution of AI utilization in higher education teaching and assessment.

Outer Model for TAM in AI Utilization in Higher Education Teaching and Assessment

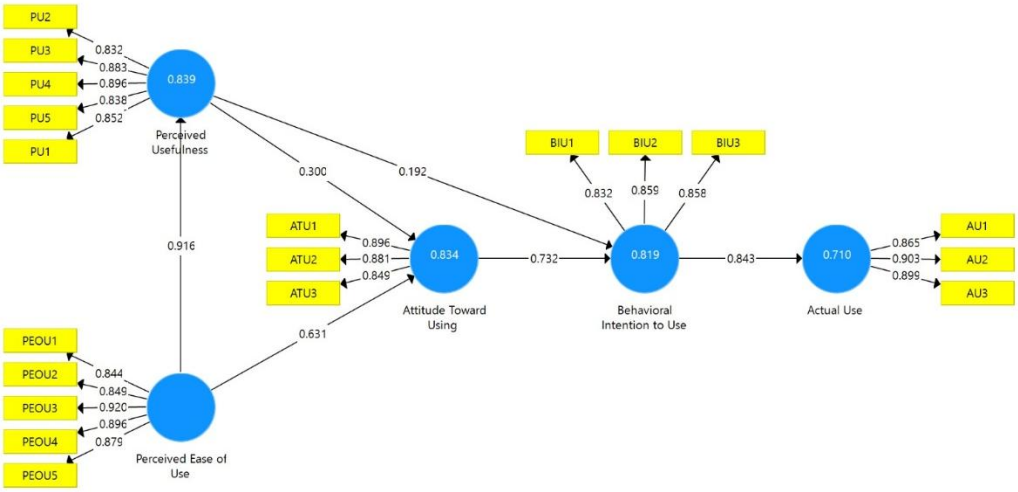

Figure 2. Outer model for TAM in AI utilization in higher education teaching and assessment.

The output for figure 2 in the outer model confirms that the indicators for each construct demonstrate a high degree of reliability and validity because all of the factor loadings are high, between 0.832 and 0.920. All indicators PU, PEOU, ATU, BIU, and AU loadings > 0.7 thus the indicators reliability is strong. The latent variables also demonstrate adequate internal consistency, with factor loading significantly higher than the 0.7 cut-off value, validating the notion of convergent validity. Moreover, the indicators of both BIU and AU present high loadings, which confirm the internal reliability and convergent validities of constructs. These aspects indicate that the outer model possesses good construct validity and would be adequate for testing the relations of the inner model for AI Utilization in Higher Education Instruction and Assessment within the framework of the TAM.

Table 4. Constructs, reliability and validity of all four constructs of TAM in AI adoption in teaching and assessment in higher education.

	N Item	Mean Stdev	Cronbach's Alpha	rho_A	CR	AVE	Correlation Actual Use
Actual Use	15	3.87 (0.87)	0.868	0.868	0.919	0.791	1
Attitude Toward Using	15	4.07 (0.93)	0.847	0.847	0.908	0.767	0.653**
Behavioral Intention to Use	9	4.18 (0.79)	0.808	0.810	0.886	0.722	0.756**
Perceived Ease of Use	9	4.21 (0.82)	0.926	0.927	0.944	0.771	0.532**
Perceived Usefulness	9	4.11 (0.77)	0.912	0.914	0.934	0.741	0.447**

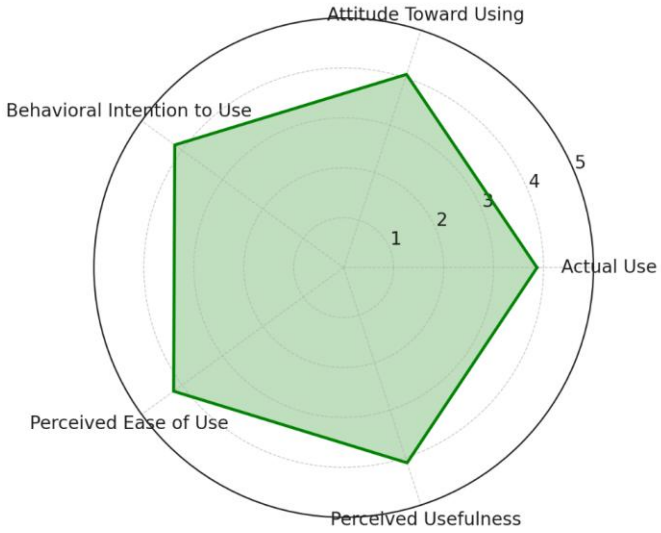

Figure 3. Mean TAM constructs scores on ai employ in higher education instruction and evaluation.

The validity and reliability metrics pertaining to the application of AI in higher education instruction and evaluation, as per the TAM is presented in Table 4. The Cronbach's Alpha value for all variables in this study is above 0.7 which indicates a good level of reliability. The CR values, which hovered between 0.886 and 0.944, likewise indicate strong internal consistency for the measurements. Additionally, all variables' AVE values were determined to be greater than 0.5, indicating adequate convergent validity. The correlations between the variables show a significant positive correlation between Behavioral Intention to Use and Actual Use (r = 0.756) meaning the higher a user's behavioral intention to use the AI, the more likely they will, indeed, use it. In a similar manner, the correlation between Attitude Toward Using and Actual Use (r = 0.653) is relatively significant, indicating that individuals who see AI favorably are more inclined to utilize it for learning purposes. Although PEOU (r = 0.532) and PU (r = 0.447) are also positively correlated to Actual Use bet their lower effect in this regard suggest that other factors, like institutional policies regarding AI or prior experience with this technology, may be in play as well. In sum, these results underline the need to cultivate favourable perceptions and improve user intentions so that AI can be propagated at a greater rate in higher education.

Table 5. Direct effect outcome

		Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Attitude Toward Using Behavioral Intention to Use	->	0.732	0.730	0.051	14.252	0.000
Behavioral Intention to Use Actual Use	->	0.843	0.843	0.014	61.685	0.000
Perceived Ease of Use Attitude Toward Using	->	0.631	0.631	0.051	12.247	0.000
Perceived Ease of Use Perceived Usefulness	->	0.916	0.916	0.011	84.136	0.000
Perceived Usefulness Attitude Toward Using	->	0.300	0.300	0.051	5.903	0.000
Perceived Usefulness Behavioral Intention to Use	->	0.192	0.194	0.053	3.636	0.000

Table 5 shows the indirect effects, T-statistics, and p-values for TAM variables and their influence on Actual Use through Behavioral Intention and Attitude Toward Using. The Total Indirect effect values are shown in the Original Sample (O) column and demonstrate the strength of each indirect effect, whereas T Statistics values show the significance of these effects, with bigger values indicating stronger relationships. The P Values confirm statistical significance, where values below 0.05 indicate a meaningful effect. The results show that Attitude Toward Using → Behavioral Intention to Use (0.732, p = 0.000) has a strong and significant impact, suggesting that a good attitude regarding AI-based learning tools improves the intention to employ them. Similarly, Behavioral Intention to Use → Actual Use (0.843, p = 0.000) highlights the crucial part that intention plays in translating technology acceptance into real adoption. Additionally, Perceived Ease of Use → Attitude Toward Using (0.631, p = 0.000) and Perceived Ease of Use → Perceived Usefulness (0.916, p = 0.000) indicate that when AI technologies are thought to be more beneficial because they are simple to use and foster a positive attitude toward adoption. Perceived Usefulness → Attitude Toward Using (0.300, p = 0.000) and Perceived Usefulness → Behavioral Intention to Use (0.192, p = 0.000) show that while usefulness contributes to adoption, its effect is lower compared to ease of use and attitude. These findings underscore that AI uptake in higher education is primarily driven by attitude and convenience of usage, while perceived usefulness has an auxiliary role in forming behavioral intention.

Discussion

AI-based Learning Tools Most Frequently Used by Lecturers in Higher Education

The results reveal that NLP-based technology tools such as ChatGPT, Grammarly, and QuillBot are the most adopted AI technologies among Lecturers in higher education, recording an adoption rate of 75%. This is a textbook example of how lecturers are increasingly reliant on NLP technologies for a variety of tasks such as designing academic material, developing assessments and enhancing content quality. It helps lecturers polish the accuracy, readability and overall quality of the written content. These examples include Grammarly for grammatical assistance, and QuillBot for rephrasing and restructuring sentences into more readable and compact sentences. The popularity of these tools indicates

that the use of them is spreading rapidly among the teaching staff, and thus it is becoming widely recognized that making lectures is a laborious process, and therefore, the implementation of these tools is beneficial for saving time and improving the quality of academic material (Fitria, 2021).

There is also the use of AI-supported educational platforms in addition to NLPs and this method is slowly used by 60% of lecturers. These technologies are mainly used for managing the classroom, developing its content and applying digital teaching strategies. Consequently, the rise of these AI-supported platforms indicates the emerging trend of implementing technology into higher education instruction to perform administrative tasks more efficiently, facilitate interactive learning environment, and streamline them into an effective teaching process (Almelhes, 2023). Learning platforms like Blackboard and Canvas, which are AI-enabled, offer instructors management tools for assessment, learner performativity, and tailored throughput of learning content (Qazi et al., 2024; Somers et al., 2021) . The growing use of these platforms indicates that lecturers are recognizing the ability of AI-based educational platforms to improve the learning environment and make their teaching workload easier leading to improved and effective teaching practices (Elisante et al., 2024; Rudro et al., 2024).

Nevertheless, despite the growing accessibility of AI technologies, the least amount of people are using VR and simulation-based learning, with only 20% of the lecturers using these technologies. Limited infrastructure, high costs, and requiring higher technical expertise are some of the elements that lead to low usage. The use of such VR and simulation-based learning typically requires a costly investment in hardware and software as well as a steep learning curve for lecturers that wish to implement it (Natale et al., 2020). Even though VR and simulation-based learning's capacity to deliver engaging and useful educational experiences are well acknowledged, practical obstacles to the integration of these tools into the classroom still remain a relevant challenge (Gan et al., 2023; Gao et al., 2023). This emphasizes the significance of the educational system in developing the required infrastructure and training for lecturers to ensure that VR and simulation technologies become more affordable and effectively integrated into higher education.

Similarly, the rate at which automated assessment systems are used, and adaptive teaching systems rose steadily to 50% and 40% respectively. By utilizing automated grading and testing systems, lecturers are recognizing the advantages of automating grading and provide feedback, which can lessen administrative loads and increase the speed with which feedback is provided to students (Combéfis, 2022; Thangaraj, Ward, & O'Riordan, 2022). Adaptive learning systems, which customize content to suit students' individual needs and development, are also taking off, but less so. While the application of data analytics and predictive learning technologies falls a bit behind one, it could represent the potentials of using AI in monitoring student performance and plausibly predicting the outcomes, yet even being aware of it, there are a few institutional bars such as the nature of data, data access, informational analytical skills; all these are hindering the optimal use of it (Radovic et al., 2022). These findings underscore the need for more extensive training programs for lecturers, improved digital infrastructure, and institutional policies that encourage higher education to adopt AI technologies.

Analysis of Factors Affecting the Adoption of AI-Based Learning Innovations by Lecturers

The results reveals factors which Very influential in using lecturers' AI-based learning innovation, out of the factors that have the highest levels of influence namely Attitude Toward Using and Behavioral Intention to Use. Specifically, Attitude Toward Using has a strong direct influence on Behavioral Intention to Use (0.732, p = 0.000), indicating that a positive attitude is a significant driver in a lecturer's intention to use AI technology. Moreover, Behavioural Intention to Use also has a huge effect on Actual Use (0.843, p = 0.000), which implies that the intention to use the technology is very directly associated with its application in teaching. Perceived Ease of Use factor is crucial in developing lecturer Positive Attitude towards AI technology usage (0.631, p = 0.000) and increasing the tendency of lecturers on Perceived Usefulness of AI Technology (0.916, p = 0.000). This suggests that the intuitive use of the technology and sufficient support play a key role in persuading lecturers to adopt such technology. Also, despite Perceived Usefulness having a lower impact on attitude and intention (0.300 and 0.192, p = 0.000) than other variables, the alleged advantages of AI technology in terms of instructional effectiveness are still an important reason for adopting AI.

Innovation in AI-based learning adoption, on a university scale, depends very much on Attitude Toward Using and Behavioral Intention to Use by lecturers, translating into a highly significant impact on teaching and assessment in higher education (Aghaziarati et al., 2023; Karimi & Khawaja, 2023; Sarwari & Adnan, 2024). The results also indicated a positive impact of lecturers' attitude towards using the AI technology on their intention to use the technology. Thus, when lecturers have a positive perception toward the benefits as well as the educational potential of AI, they will be driven to incorporate this technology in the learning process. These attitudes include the idea that AI could improve the effectiveness of instruction, enrich students' gaining knowledge experience, or ease the effort of measuring students (Hussain, 2020). Thus, for educational institutions to promote AI technology application in higher education, they must train their lecturers on the potential and actual advantages to be gained from using these technologies in teaching and evaluation, in order for them to understand the added value.

Moreover, integrating technologies willing of using significantly impacts lecturers' adoption of AI technologies in teaching practices. This should mean that the lecturers knew about the advantages of AI technology, but without a strong intention to use them, AI technology is not adopted (Pellas, 2023; Yafie et al., 2023) Lecturers are more likely to engage them in their everyday activities if they are confident these technologies can make their teaching better, improve student learning outputs, or accelerate evaluation (Yafie et al., 2021). Thus, it is necessary to establish a conducive climate for a faculty to strengthen lecturers' use intentions of this technology, like intensive training, workshops, and sufficient technical assistance. This will make it easier to change the intention into actual usage behavior in teaching.

Furthermore, the Perceived Ease of Use factor has a huge impact in establishing a positive attitude among lectures towards the used of the AI technology and also improves their perspectives towards the usefulness of the AI technology. The implications are that if lecturers carry the perception that it is more easier to use with less amount of time and effort putting into it in order to implement these technologies, they are more prone to appear and possess a more favourable attitude towards such technologies (Xiong et al., 2024). This is also a particularly important consideration in the education and evaluation within higher education, that rather complex or less used technology can become a real barrier for the

education lecturers to use them (Delcker et al., 2024; Yafie et al., 2022). User-friendly interfaces and systems should help lecturers become more confident in using AI technologies in the first place. As these technologies become common in academia, for example, access to adequate technical assistance and instruction will allow lecturers to gain a degree of comfort in using them, by moving their focus towards applying these technologies to enhance the standard of their instruction and evaluation.

AI technology perceived usefulness in enhancing teaching effectiveness is still an important variable in adoption but is less of as influencing variable as what we have seen. Any lecturer who thinks these technologies will enhance their efficiency to deliver teaching materials, provide feedback or manage assessment tasks will most probably be more sustainable in embarking to use them (George & Wooden, 2023). In assessment for instance, AI technology can help lecturers to automate the process of evaluation and offer more detailed analysis on student performance (Beans, 2022). This saves lecturers time not just but allows them to give more timely and relevant feedback. Hence, even though the impact of Perceived Usefulness is less in magnitude than the simplicity of use and support variables, the impression practical benefits by lecturers are the most dominant reason in the uptake of this technology. When it comes to AI systems introduced by educational institutions, this is purely to say the technology of AI can also offer some clarity evidential benefits to lecturer's part as in improving the quality about how, when and where they are carrying on the teaching and assessment.

Conclusions

AI-powered educational resources are being adopted by lecturers in higher education, and NLP-based tools like ChatGPT, Grammarly, and QuillBot are the most popular because they have a significant impact on improving the quality of academic materials. AI-based tools such as Blackboard and Canvas are another significant development in education as these platforms are integrated by the lecturers who use it to manage the classroom activities efficiently as well as personalized teaching. There are still challenges, however, especially with the implementation of VR and simulation-based learning, which has infrastructure and pricing obstacles. Adoption of AI technologies are significantly driven by Attitude Toward Using and Behavioral Intention to Use according to the study. Lecturers are likely to use these technologies if they view AI favorably, and this attitude significantly impacts on the actual use of the technologies. The ease of use of AI, as well as the provision of adequate support, are crucial to forming attitudes and perceived usefulness towards the implementation of AI by the lecturers. Perceived Usefulness, although less impactful on adoption, is still relevant in enhancing teaching effectiveness and assessing teaching.

Overall, the results indicate that in order to successfully adopt AI technologies in higher education, it is essential to establish a conducive environment, promote positive perceptions, reinforce the intention of academic staff, and enable ease of use. Providing comprehensive training, technical support, and concrete illustrations of AI's useful benefits in the context of teaching and assessment can assist lecturers in overcoming the challenges that hinder adoption. Positive attitudes regarding AI were fueled by perceived utility and ease of usage, the latter being a driver of their intention to adopt these technologies to their practices, leading to actual utilization. While the perceived usefulness is less important, it is still relevant in attracting lecturers to using AI tools to improve teaching efficiency and student outcomes. So, by focusing on these four pillars attitude, intention, ease of use, and usefulness - the educational institutes could integrate AI technologies in classrooms effectively therefore

raising the standard of instruction and learning opportunities for students.

Insights and Implications

The results of this investigation improve our comprehension of the learning innovations in higher education that are expected to be influenced by AI, at the level of lecturers' perceptions, challenges, and technology adoption in courses and assessments. Conclusion: Although the findings reveal positive lecturer perceptions of AI, its adoption will remain limited due to technical skill inadequacies, data privacy concerns, and insufficient institutional support. Additionally, a significant relationship between attitude towards AI use and the desire to employ it was found in this research; moreover, the importance of policy support and training for lecturers to be ready to use this technology was brought to attention. All these point towards the need of formulating policy that encourages lecturers to continue to train on new technologies while developing technology infrastructure and encouraging the development of learning environment that allows the exploration and use of AI in teaching and assessment processes.

Limitations of the Study

This research has a number of particular limitations that should be acknowledged. While the analysis provides critical insights, the study which was conducted at a single institution may be challenging to generalize to other higher education institutions with different characteristics. Furthermore, the data collection technique, which predominantly relied on a questionnaire, could result in any response bias since respondents may choose to respond in a way they feel is constructive or socially acceptable. Moreover, the paper does not investigate the long-term effects of teaching and assessment with AI, which is only expected to be explored in further studies. Future longitudinal studies and multi-source data collection (such as student feedback, or an analysis of academic performance) are required to provide a thorough overview of the integration and effects of AI in higher education. The limitations of this study, however, suggest that longitudinal studies or in-depth interviews may be more appropriate measures for the real transformation of higher education due to AI.

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