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# The Role of Artificial Intelligence Applications in Enhancing the Quality of Online Higher Education

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## Abstract

The aim of this research is to assess and quantify the impacts of leveraging artificial intelligence (AI) applications on enhancing the quality benchmarks in online higher education programs in the kingdom of Saudi Arabia. Specifically, the study will survey a sample of 200 instructors and students involved in the online education process to evaluate their perceptions of how AI-enabled functionalities influence key quality indicators.

This research follows a quantitative methodology to meet the core research objectives of assessing the impacts of AI adoption on online education quality. The target population encompasses all students and instructors engaged in remote higher education programs across universities in Saudi Arabia. Based on sample size power calculations, a sample of 200 participants will be recruited, including both undergraduate and graduate-level students enrolled in fully online degree courses as well as instructors directly responsible for teaching remote classes.

The findings of the research revealed that a Pearson Correlation of 0.784 and a p-value of 0.039 (less than significance level of  $\alpha=.05$ ) suggests a significant positive association between AI Applications and the Quality of Online Higher Education provided by teachers. And a Pearson Correlation of 0.861 and a p-value of 0.022 (less than significance level of  $\alpha=.05$ ) suggests a significant positive

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association between AI Applications and the Quality of Online Higher Education for students.

**Keywords:** Artificial Intelligence, Online Higher Education, Quality Enhancement, AI Adoption, Saudi Arabia, Correlation Testing.

## Introduction

Online higher education has seen rapid growth and adoption over the past decade. As more colleges and universities offer online degree programs, enhancing the quality of these programs has become a major focus. One emerging area that holds great promise in this regard is the development and use of artificial intelligence (AI) applications customized for online education. From automated grading to personalized learning platforms, AI has the potential to significantly enrich the online learning experience for both students and instructors (Shafique et al., 2023).

Broadly speaking, AI allows online education platforms to process large volumes of data in order to uncover patterns and insights for improving course design, teaching methods, and learning outcomes (Rodway and Schepman, 2023). For example, by analyzing information about students' engagement levels, knowledge gaps, interaction patterns, and more, AI applications can enable more personalized and adaptive learning. They can point struggling students to additional resources, recommend relevant study topics or learning activities tailored to the individual learner, and even offer customized feedback (Richter et al., 2019).

For instructors, AI applications are being developed to assist with time-consuming administrative tasks like grading assignments. These applications can provide fast and consistent evaluation of student workloads, allowing professors to focus their time on substantive intellectual interactions with students (Hutson et al., 2022). AI teaching assistants and chatbots are also emerging to help instructor teams scale their support across larger online classes. Such innovations save educators' time while

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allowing students to get their questions answered or issues resolved promptly (Crompton and Burke, 2023).

Beyond automating routine tasks and personalizing content delivery, AI also promises to enhance student collaboration and knowledge sharing. Intelligent discussion forums can facilitate more meaningful conversations and prompt deeper questions or debates on course topics (Janardhanan et al., 2023). Likewise, AI analytics dashboards help professors glean insights across discussion posts to identify learning gaps needing clarification. Such functionalities help drive student engagement and peer-based enrichment of understanding (Dogan et al., 2023).

As AI capabilities continue advancing, even more transformative applications tailored for online higher education are likely to emerge. The quality benchmarks for these programs will keep rising. To fully leverage the promise of AI in enhancing online program effectiveness and student success, institutions will need to invest in emerging innovations, digital capabilities, and faculty training. The initial upfront costs will pay dividends when it comes to enriching remote learning and expanding student access to more affordable, quality higher education (Rahiman and Kodikal, 2023).

The overarching aim of this research study is to assess and quantify the impacts of leveraging artificial intelligence (AI) applications on enhancing the quality benchmarks in online higher education programs in the kingdom of Saudi Arabia. Specifically, the study will survey a sample of 200 instructors and students involved in the online education process to evaluate their perceptions of how AI-enabled functionalities influence key quality indicators including learner engagement, collaboration, course effectiveness, and overall educational experience. Statistical analysis will test for significant relationships between AI application adoption and realized quality gains based on the collected feedback.

## Problem Definition

The key problem driving this research is the need for quantitative, empirical insight that evidences how emerging AI innovations are actually influencing online education quality in the Kingdom of Saudi Arabia, based on collated perceptions of students and instructors directly engaged in remote learning contexts. The research will contribute much-needed data-backed analysis clarifying if and how AI applications can serve as an advancement lever for continuously improving the quality benchmarks in digitally-enabled higher education platforms.

## Research Objectives

1. Identifying the Role of Artificial Intelligence Applications in Enhancing the Quality of Online Higher Education in the kingdom of Saudi Arabia.
2. Survey a broad sample of higher education students and instructors engaged in online coursework to capture their experiences and perceptions regarding the deployment and impacts of AI applications on learning platforms.
3. Quantitatively assess participant opinions on the extent to which the adoption of key AI solutions influences specific quality metrics for online education.
4. Statistically analyze the questionnaire response data to test for significant correlational relationships between the breadth of AI functionalities utilized and realized quality gains across the defined measures.
5. Provide initial recommendations for AI adoption across institutions delivering online higher education programs, highlighting gaps versus best practices.

## Research Domain and Limitations

This research project aims to quantify the impacts of artificial intelligence (AI) adoption on enhancing quality within online higher education programs. It will survey 200 students and instructors to assess their perceptions of how deploying AI applications influences key quality indicators including engagement, collaboration, feedback, and overall course effectiveness. Questionnaire data will be statistically

analyzed to test for correlations between AI utilization maturity and realized quality gains.

Despite limitations in sampling limitations and causal inferences, the empirical insight will clarify if and how tailored AI innovations can serve as levers for continuously elevating quality standards for rapidly expanding remote and digital learning platforms amid ongoing higher education transformation.

### **Research Methodology**

This study follows a quantitative methodology to meet the core research objectives of assessing the impacts of AI adoption on online education quality. The target population encompasses all students and instructors engaged in remote higher education programs across universities in Saudi Arabia. Based on sample size power calculations, a sample of 200 participants will be recruited, including both undergraduate and graduate-level students enrolled in fully online degree courses as well as instructors directly responsible for teaching remote classes.

Numeric data from completed questionnaires will be compiled into a statistical analysis software package. First cycle analysis will encompass descriptive statistics reporting means, distributions, and variability around perceived quality levels and AI adoption maturity. The core analysis will utilize correlation testing to quantify significant relationships between the utilization of particular AI applications and specific quality enhancement outcomes. Comparison of correlation coefficients will reveal the strongest AI predictors of quality gains for interpreting adoption priorities.

### **Previous Studies**

A study conducted by (Shafique et al., 2023) aims to provide a comprehensive overview of the significance of Artificial Intelligence Applications such as machine learning (ML) approaches in online higher education. It seeks to synthesize information from scientific papers to understand the methodology used to construct

learning analysis tools, the key data resources utilized, and the scope of available data sources. This study adopts a systematic literature review (SLR) approach, covering research from the years 1961 to 2022. It involves analyzing multiple scientific papers that investigate ML and DL techniques in online education. The methodology involves identifying relevant literature, extracting data on methodologies and data sources, and synthesizing findings to understand the applications and solutions offered by ML approaches. The results of the systematic literature review reveal the diverse applications of ML and DL techniques in online education. Various methodologies have been employed to construct learning analysis tools, utilizing different data resources and sources. The study identifies trends, challenges, and opportunities in the field, offering insights for researchers and practitioners.

A study conducted by (Richter et al., 2023) aims to provide an overview of research on Artificial Intelligence in Education (AIEd) applications in online higher education through a systematic review. It seeks to explore the current state of AIEd research, identify trends in disciplinary involvement, research methodologies, and application areas, and reflect on the implications for teaching and learning in higher education. A systematic review approach was adopted to analyze research on AIEd applications in higher education. Initially, 2656 publications from the period between 2007 and 2018 were identified. Through explicit inclusion and exclusion criteria, 146 articles were selected for final synthesis. The review focused on disciplinary involvement, research methodologies employed, and application areas of AIEd in higher education. The descriptive results of the systematic review reveal that most AIEd research in higher education originates from Computer Science and STEM disciplines, and quantitative methods are predominantly used in empirical studies. The synthesis of results highlights four main areas of AIEd applications: profiling and prediction, assessment and evaluation, adaptive systems and personalization, and intelligent tutoring systems. However, the conclusions underscore several gaps and

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challenges in the current state of AIED research, including the lack of critical reflection on challenges and risks, weak connections to theoretical pedagogical perspectives, and the need for further exploration of ethical and educational approaches in AIED application in higher education.

A study conducted by (Dogan et al., 2023) aims to examine research on Artificial Intelligence (AI) in the context of online distance higher education. Motivated by the increasing utilization of AI technologies and the current state of the art, the study investigates trends, geographic distribution, thematic tendencies, and research themes in AI research related to online learning and distance education. A systematic review protocol was followed to analyze research on AI in online distance education. A total of 276 publications were examined using data mining and analytics approaches. Time trend analysis was conducted to identify temporal patterns in research output. Geographic distribution analysis was performed to determine leading countries in AI research in online learning. The study reveals a steady increase in research output on AI in online distance education, with a peak in recent years. China, India, and the United States emerge as the leading countries in AI research related to online learning. Computer science and engineering are the primary research areas contributing to AI research in online distance education, followed by social sciences.

A study conducted by (Rahiman and Kodikal, 2023) aims to investigate the level of awareness and adoption of artificial intelligence (AI) among faculty members in higher online education institutions operating in hybrid education modes. Additionally, it seeks to explore how AI enhances faculty members' learning experiences and impacts their degree of work engagement. A cluster and multi-stage sampling method was employed to select 250 faculty members from QS (Quacquarelli Symonds) ranked institutions operating in hybrid education modes. A quantitative research approach was utilized, and a structural equation model (SEM) was employed to explore the factors influencing AI adoption. The study analyzed the

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relationships between perceived risk, performance expectancy, awareness, attitude, behavior, and work engagement regarding AI adoption in higher education. The findings revealed that AI implementation led to the development of robust evaluation and assessment methods, resulting in heightened levels of faculty engagement. Perceived risk, performance expectancy, and awareness were identified as significant factors influencing AI adoption within the higher education system. Additionally, attitude and behavior were found to mediate the relationship between these factors and work engagement.

A study conducted by (Zhang, 2022) aims to propose and evaluate an AI-driven approach for the evaluation and adjustment of online higher education and teaching systems. The aim is to address the current challenges faced by colleges and universities in meeting the demands of society in terms of engineering practice ability, innovation ability, and international competitiveness. The methodology involves designing and implementing a teaching system of talent cultivation driven by AI algorithms. The study utilizes reinforcement learning, specifically the actor-critic algorithm, to build a framework for the instructional system. This framework assists in the design of the university education system, aiming to enable students to understand, master, and apply their knowledge effectively. The results demonstrate that the AI-driven instructional designs are well-received by contemporary students and yield higher evaluation scores compared to traditional methods. Numerical experiment results indicate the stability of the instructional design, overcoming the drawbacks of traditional manual subjectivity. The AI-driven college education and teaching system contributes to cultivating students' solid technical theoretical foundation and enhancing their practical ability.



## Results and Discussion

### First: Descriptive Statistics:

#### A) Demographic and General Information

##### 1- Please select your age range.

Table (1): Age range of the study participants

		Age			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18-24	83	41.5	41.5	41.5
	25-34	69	34.5	34.5	76.0
	35-54	31	15.5	15.5	91.5
	55 and above	17	8.5	8.5	100.0
	Total	200	100.0	100.0	

Table (1) indicates that most of the participants are within the age range of (18-24) years old representing 83 participants (41.5%), and within the age range of (25-34) years old representing 69 participants (34.5%), indicating that most of the study participants are within the youth demographic.

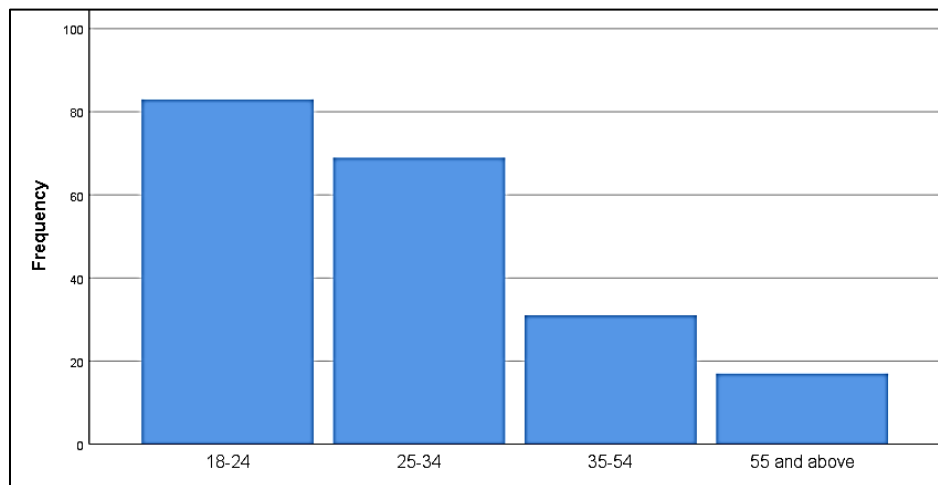


Figure (1): Age range of the study participants

Figure (1) represents the frequencies of the ages of the study participants in four sections.

## 2- What is your gender?

Table (2): Gender of the study participants

		Gender			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	63	31.5	31.5	31.5
	Male	137	68.5	68.5	100.0
	Total	200	100.0	100.0	

Table (2) indicates that most of the participants are within males representing 137 participants (68.5%), and the female participants representing 63 (31.5%), indicating that most of the study participants are males.

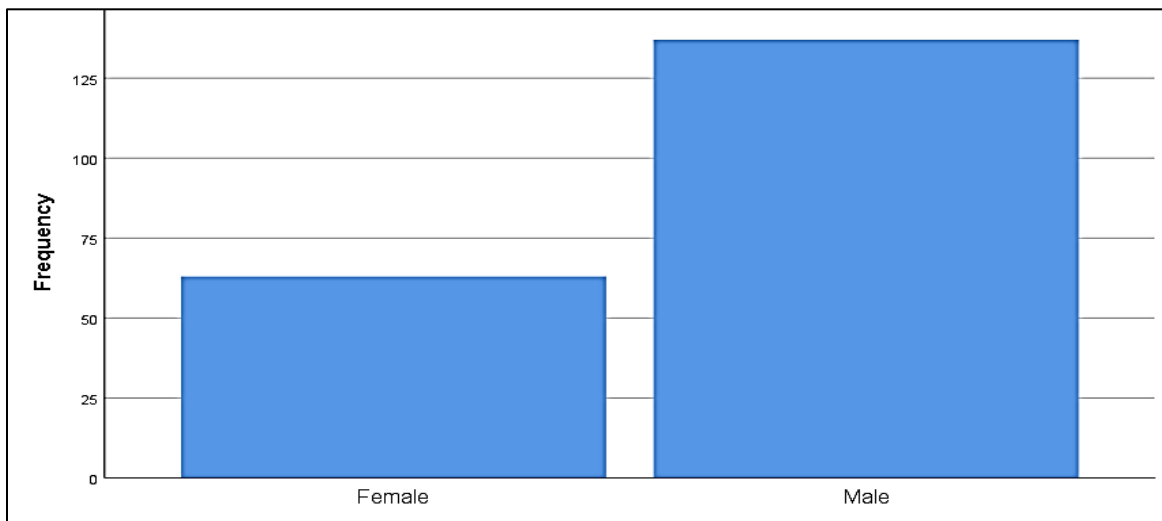


Figure (2): Gender of the study participants

Figure (2) represents the frequencies of the gender of the study participants in four sections.

### 3- Which of the following describes your current role in online higher education?

Table (3): Current role in online higher education

Role in Online Higher Education					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Other	16	8.0	8.0	8.0
	Student	100	50.0	50.0	58.0
	Teacher/Instructor	84	42.0	42.0	100.0
	Total	200	100.0	100.0	

Table (3) indicates that most of the participants are Student representing 100 participants (50%), and the Teacher/Instructor participants representing 84 (42%). Furthermore, there are 16 participants representing (8%), that may be employees or other managerial staff.

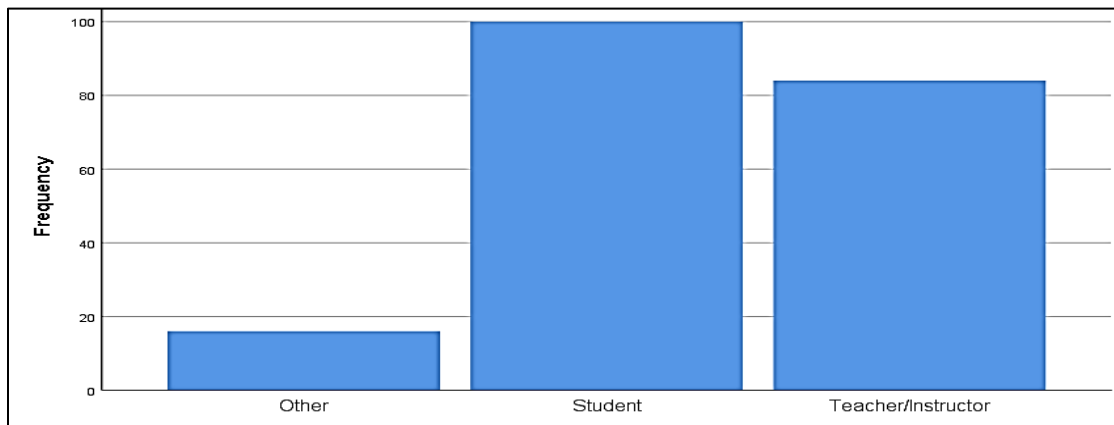


Figure (3): Current role in online higher education

Figure (3) represents the frequencies of the current roles of the study participants in online higher education.

#### 4- How long have you been involved in online higher education?

Table (4): Involvement period in online higher education

Involvement period					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-3 years	22	11.0	11.0	11.0
	3-5 years	123	61.5	61.5	72.5
	Less than 1 year	32	16.0	16.0	88.5
	More than 5 years	23	11.5	11.5	100.0
	Total	200	100.0	100.0	

Table (4) indicates that most of the study participants of (123) representing (61.5%) that have (3-5 years) involvement period in online higher education.

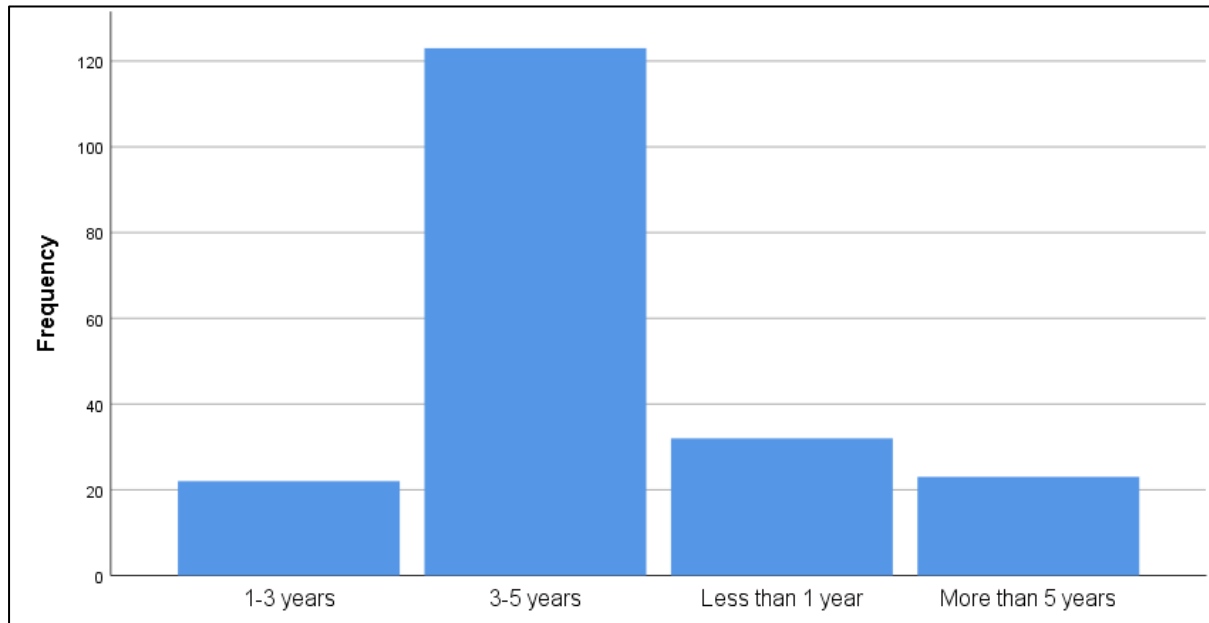


Figure (4): Involvement period in online higher education

Figure (4) represents the frequencies of the involvement period of the study participants in online higher education.

## B) Questions Directed to Teachers:

Knowing that this questionnaire uses 5 points Likert scale, where (5= Highest degree), and (1= Lowest degree), the following Descriptive Statistics can be provided:

Table (5): Questions Directed to Teachers

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
1- To what extent do you believe that AI applications, such as automated grading systems and intelligent tutoring systems, have enhanced the quality of online higher education?	200	1	5	3.35	1.307
2- How familiar are you with the current AI applications used in online higher education, such as plagiarism detection software and adaptive learning platforms?	200	1	5	3.30	1.549
3- To what extent do you utilize AI applications, such as virtual teaching assistants or learning analytics tools, in your online teaching practices?	200	1	5	3.93	.916
4- To what extent do you believe AI applications, such as machine learning algorithms, can contribute to the personalization and well-designing of learning materials?	200	1	5	3.87	.992
5- In your opinion, how effective are AI-driven tools like chatbots in supporting student inquiries, engagement, and feedback collection?	200	1	5	3.60	1.219
6- How confident are you in your ability to adapt and integrate new AI tools into your teaching methodologies?	200	1	5	3.61	1.190
7- To what degree do you believe AI-based tools, such as plagiarism detection software, contribute to maintaining academic integrity in online courses?	200	1	5	3.84	1.037
Valid N (listwise)	200				

Table (5) indicates that, the highest mean score of (3.93) and std. deviation of (0.916) indicate that teachers in study sample utilize AI applications, such as virtual teaching assistants or learning analytics tools, which had led to enhance their online teaching practices.

Furthermore, there is a mean score of (3.87) and std. deviation of (0.992) indicate that teachers believe AI applications, such as machine learning algorithms, can contribute to the personalization and well-designing of learning materials which enhancing the online education process.

### C) Questions Directed to Students:

Table (6): Questions Directed to students

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
1-How effective do you find AI-based tools and resources, such as personalized learning platforms, in supporting your online learning experience?	200	1	5	3.76	.905
2-How would you rate the impact of AI applications, such as virtual teaching assistants or adaptive assessments, on the quality of your academic performance?	200	1	5	3.60	1.191
3-How comfortable are you interacting with AI-based virtual assistants or chatbots, like ChatGPT, Google Bard or Bing AI, for academic support?	200	1	5	3.01	1.382
4-To what extent do AI-driven collaborative tools enhance your ability to work on group projects in an online learning environment?	200	1	5	2.95	1.424
5-How confident are you in interpreting and utilizing feedback generated by AI-based grading systems to improve your grades in your online courses.	200	1	5	3.98	.921
6-Have you experienced an ease in receiving information through personalized learning pathways in your courses?	200	1	5	3.85	.912
Valid N (listwise)	200				

Table (6) indicates that, the highest mean score of (3.98) and std. deviation of (0.921) indicate that students are confident in interpreting and utilizing feedback generated by AI-based grading systems to improve their grades in their online courses.

Furthermore, there is a mean score of (2.95) and std. deviation of (1.424) indicates that students use AI-driven collaborative tools to enhance their abilities to work on group projects in an online learning environment.

## Second: Reliability Test for the Questionnaire:

Table (7): Cronbach's Alpha Reliability test

Reliability Statistics	
Cronbach's Alpha	N of Items
.728	15

Using Cronbach's alpha to measure the extent to which the items in a scale or survey instrument are correlated with each other, indicating the reliability or consistency of the scale.

Table (7) indicates a Cronbach's alpha coefficient of 0.728 for a set survey question suggests a good level of internal consistency reliability among the items in the survey.

## Third: Association between Variables:

### 1-Association between AI Applications and the Quality of Online Higher Education provided by teachers.

Table (8): Pearson Correlation for the association between AI Applications and the Quality of Online Higher Education provided by teachers

Correlations			
		Using AI Applications	Quality of Online Higher Education provided by teachers
Using AI Applications	Pearson Correlation	1	.784
	Sig. (2-tailed)		.039
	N	200	200
Quality of Online Higher Education provided by teachers	Pearson Correlation	.784	1
	Sig. (2-tailed)	.039	
	N	200	200

Table (8) indicates a Pearson Correlation of 0.784 and a p-value of 0.039 (less than the significance level of  $\alpha=.05$ ) which suggests a significant positive association

between AI Applications and the Quality of Online Higher Education provided by teachers.

## 2- Association between AI Applications and the Quality of Online Higher Education for Students.

Table (9): Pearson Correlation for the association between AI Applications and the Quality of Online Higher Education for students

Correlations			
		Using AI Applications	Quality of Online Higher Education for students
Using AI Applications	Pearson Correlation	1	.861
	Sig. (2-tailed)		.022
	N	200	200
Quality of Online Higher Education for students	Pearson Correlation	.861	1
	Sig. (2-tailed)	.022	
	N	200	200

Table (9) indicates a Pearson Correlation of 0.861 and a p-value of 0.022 (less than the significance level of  $\alpha=.05$ ) which suggests a significant positive association between AI Applications and the Quality of Online Higher Education for students.

## Conclusion

This research project aimed to empirically assess the impacts of artificial intelligence (AI) adoption on advancing quality metrics for rapidly expanding online higher education programs. Through a quantitative, correlational methodology, the study analyzed questionnaire data from 200 students and instructors to determine significant relationships between the utilization of AI applications and enhancement across key quality indicators including learner engagement, peer collaboration, evaluation consistency, feedback sufficiency, and overall course effectiveness.

The sample size of 200 participants, including undergraduate and graduate-level students as well as instructors, was determined through sample size power



calculations. We collected numeric data through questionnaires and compiled it into a statistical analysis software package for analysis. In the first cycle of analysis, descriptive statistics were used to report means, distributions, and variability around perceived quality levels and AI adoption maturity. This provided a comprehensive overview of the current state of AI adoption and quality perceptions in online higher education. The core analysis focused on correlation testing to quantify significant relationships between the utilization of particular AI applications and specific quality enhancement outcomes. Through examining correlation coefficients, we were able to identify the strongest AI predictors of quality gains, which can guide decision-makers in setting adoption priorities.

Findings suggest that specific AI applications such as (automated grading systems, intelligent tutoring systems, plagiarism detection software, adaptive learning platforms, virtual teaching assistants, learning analytics tools, machine learning algorithms, and chatbots) have a significant impact on enhancing the quality of online higher education for both teachers and students.

Furthermore, findings indicate a Pearson Correlation of 0.784 and a p-value of 0.039 (less than the significance level of  $\alpha=.05$ ) which suggests a significant positive association between AI Applications and the Quality of Online Higher Education provided by teachers. And a Pearson Correlation of 0.861 and a p-value of 0.022 (less than the significance level of  $\alpha=.05$ ) which suggests a significant positive association between AI Applications and the Quality of Online Higher Education for students.

Through identifying the most influential AI predictors, institutions can prioritize the adoption and integration of these applications to improve the overall learning experience and outcomes for students.

## Future Work

Future work in this area should explore the long-term effects of AI adoption in online higher education. Additionally, qualitative research methods such as interviews or focus groups can provide deeper insights into the experiences and perspectives of students and instructors regarding AI adoption and its impact on quality. This could help uncover potential challenges, barriers, and opportunities associated with AI integration and inform the development of more effective strategies for implementing AI in online education.

Furthermore, it would be beneficial to investigate the specific mechanisms through which AI applications contribute to quality enhancement. Understanding how AI technologies facilitate personalized learning, adaptive feedback, or intelligent content delivery can provide valuable insights for designing effective pedagogical approaches and support systems.

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