

**The influence of the artificial intelligence capabilities of higher education institutions in Iraq on students' academic performance: The role of AI-based technology application as a mediator**Haady Abdilnibi Altememy¹, Bahira Abdulrazzaq Mohammed², Mizher Khelif Hsony³, Aalaa Yaseen Hassan⁴, Rabaa Mazhair⁵, Imad Ibrahim Dawood⁶, Isra Shakir Hassan Al Jouani⁷, Sajad Ali Zearah⁸, Hedab Rasoul Sharif⁹

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ABSTRACT

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Objective: Artificial intelligence (AI) plays a crucial role in promoting unbiased and effective advancements in the field of education. The benefits of these state-of-the-art technologies in the areas of teaching methods and the acquisition of knowledge have attracted considerable attention in current discussions. The present study aims to investigate the influence of artificial intelligence capabilities (AIC) within Iraqi higher education institutions on students' academic performance. Additionally, the study has also investigated the mediating role of AI-based technology applications (AIBTA).**Methodology:** The research employed a quantitative survey-based approach to gather data, utilizing a questionnaire as the data collection instrument. For the analysis, Smart-PLS 3, a software tool known for its implementation of the PLS-SEM (partial least squares structural equation modeling) analysis method, was utilized (Sarstedt et al., 2022). The study achieved a response rate of 64.3 percent from the participants. **Results:** The findings of the study reveal a significant influence of AIBTA (Artificial Intelligence-Based Teaching and Assessment) on student performance within the context of Iraqi higher education. Moreover, there exists a positive and notable correlation between the AI capabilities integrated into Iraqi higher education and the academic achievements of university students in Iraq. The study's results also suggest that AI capabilities substantially impact the AIBTA framework within¹ College of Islamic Sciences / The Islamic university in Najaf, Iraq. Email: haady.altememy@gmail.com,ORCID: <https://orcid.org/0000-0002-8718-9277>² Department of medical engineering / Al-Hadi University College Baghdad, 10011, Iraq. Email: dr.bahera@huc.edu.iq,ORCID: <https://orcid.org/0009-0003-0192-2074>³ Al-Manara College for Medical Sciences/ (Maysan) / Iraq. Email: mizherkhelifhsony@uomanara.edu.iq,ORCID: <https://orcid.org/0000-0002-6572-7900>⁴ Department of education / Al-Nisour University College / Baghdad / Iraq. Email: alaa.y.english@nuc.edu.iq,ORCID: <https://orcid.org/0000-0002-9970-0458>⁵ English Department, college of education / Al-Farahidi University / Baghdad Iraq. Email: mizherrabaa4@gmail.comORCID: <https://orcid.org/0000-0001-7583-1835>⁶ Department of Media / Mazaya University College / Iraq. Email: prof.dr.imad.i.dawood@mpu.edu.iq,ORCID: <https://orcid.org/0000-0003-3924-323X>⁷ College of Arts, Department of Media / Al-Esraa University, Baghdad / Iraq. Email: isramasar@gmail.com,ORCID: <https://orcid.org/0000-0003-3547-5236>⁸ Scientific Research Center, Al-ayen University, Thi-Qar, Iraq. Email: sajad@alayen.edu.iqORCID: <https://orcid.org/0009-0001-4827-0128>⁹ College of Nursing / National University of Science and Technology, Dhi Qar, Iraq. Email: hadab.r.sh@nust.edu.iq,ORCID: <https://orcid.org/0000-0003-3895-4101>

Iraqi higher education. Furthermore, the mediating role of AIBTA in Iraqi higher education is identified in relation to the relationship between the AI capabilities of the educational system and the academic performance of university students in Iraq. **Implication:** The outcomes of this study hold considerable implications for the landscape of higher education in Iraq. The results underscore that the incorporation of AI-driven technology bears a substantial influence on students' academic achievements. This relationship serves as a pivotal connection, linking the AI capabilities present within higher education institutions to the attainment of academic excellence by students. **Novelty:** This study stands as one of the pioneering efforts in exploring the realm of AIBTA within the context of Iraqi higher education.

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1.0. Background

The emergence of AI represents a pivotal milestone in the realm of technological progress, ushering in a new era of transformative changes across industries, societies, and global dynamics (Doroudi, 2022). Its far-reaching impact spans education, economic growth, social development, and the intricate interactions of international politics and economics. The arrival of AI has unequivocally triggered a profound transformation in the landscape of educational progress and pedagogy (Salajan, 2019). The incorporation of AI into the education sector yields evident and lasting advantages. Nevertheless, current international research predominantly centers on the analysis of existing trends and inclinations within this domain (Mogavi et al., 2023). Moreover, significant focus has been directed towards exploring prospective scenarios for the practical application of this knowledge. Endeavors have been made to assess the efficacy and impact of this discipline, coupled with efforts to integrate its various components. Many academics have meticulously investigated higher education institutions (HEIs), and personalized learning has also been subjected to thorough scholarly examination.

Bećirović (2023) argues that the integration of AI into educational contexts holds promise for enhancing students' cognitive skills, particularly in critical thinking. Additionally, this integration cultivates a collaborative atmosphere, encouraging collaborative endeavors among students. As a result, the overall capacity for knowledge acquisition is enhanced, leading to a holistic advancement in the learning journey. To delve into the far-reaching implications of AI on the global educational arena, Chen et al. (2020) conducted an exhaustive and thorough investigation. Their comprehensive research findings indicate that this cutting-edge technology has a profound impact on enhancing pedagogical processes in the classroom, leading to significant strides in students' intellectual growth. Additionally, this technological tool can aid educators in closely monitoring their students' academic progress, offering valuable insights and observations. AI stands as a prime example of a burgeoning technological advancement that frequently originates within esteemed academic institutions. Concomitantly, the emergence of new technological breakthroughs has created an environment conducive to fostering innovation and transformation within Higher Education Institutions (HEIs) (Okunlaya, Syed Abdullah, & Alias, 2022).

Xu (2021) posits that academic programs centered around AI technology possess the ability to ignite heightened curiosity and enthusiasm among students, surpassing the efficacy of conventional educational methods. Furthermore, research conducted by Côté, Togay, and Su (2022) has demonstrated that these courses result in enhanced academic achievements. In a comprehensive exploration, Lee and Lee (2021) delved into various facets of artificial intelligence, encompassing machine learning and natural language processing, among others, in their scholarly discourse. The authors also elucidated the practical implications of these concepts through tangible instances of self-directed learning, assessment, and real-world engagement. Dwivedi et al. (2023) carried out meticulous comparative experiments in their study, unveiling the potential of AI integration to significantly elevate college students' levels of enthusiasm and diligence in their academic pursuits. A growing cohort of scholars is directing their attention toward the utilization of AI within the realm of education, acknowledging its pivotal role as a technological tool endowed with substantial potential to bolster learners and educators in the present and forthcoming eras. In order to facilitate seamless information dissemination, the acquisition of digital educational resources, the implementation of precise and efficacious online or offline learning methodologies, the fostering of impactful and meaningful learning experiences, and the ultimate attainment of educational objectives are deemed imperative (Chou et al., 2022). The incorporation of AI into educational pedagogy, particularly through the utilization of AI-driven information technology, emerges as an efficacious avenue to surmount the limitations posed by physical space, temporal constraints, and prevailing socio-economic circumstances. This strategy effectively leverages the distinct attributes of the Internet. Individuals who harness AI within the realm of information technology possess the capability to curtail expenses associated with knowledge acquisition, thereby affording a broader scope for intellectual pursuits. In the context of distance education, the conventional limitations stemming from temporal and spatial considerations become obsolete, granting educators and learners the means to transcend these confines. Consequently, a mounting recognition of the importance of online learning has emerged in response to shifts within the societal landscape. The integration of AI technology into the educational sphere endeavors to provide support in realms such as automated grading and formative assessment for students. The waning prominence of conventional technology-oriented research in instructional design, coupled with the emergence of student profiling models and learning analytics, has catalyzed the progression of personalized tutors, intelligent facilitation of collaborative learning, and intelligent virtual reality applications within the realm of AI in education. Given the pervasive integration of AI technology, educators have compelling rationales for embracing AI-driven tools and approaches within the educational sphere. Notably, Massive Open Online Courses (MOOCs) offered by renowned platforms such as Coursera, Udacity, and EDX have surfaced as significant reservoirs for augmenting online educational offerings and elevating the quality of learning provisions.

The integration of AI capabilities in the realm of higher education has showcased a significant influence on students' academic accomplishments. By harnessing the strategic deployment of AI across various educational domains, institutions have adeptly personalized learning experiences to cater to each student's unique needs, thus facilitating a thorough understanding of complex concepts with exceptional efficiency. AI-driven

adaptive learning platforms utilize sophisticated algorithms to assess individual strengths and weaknesses, subsequently crafting personalized study plans that optimize time and cognitive efforts. Additionally, the introduction of AI-powered grading and feedback systems enables the timely delivery of constructive assessments, thereby nurturing a culture of continuous improvement. The widespread adoption of AI-powered tutoring bots and virtual assistants amplifies the delivery of educational support to students, extending beyond the limitations of traditional classroom settings. With instantaneous assistance and 24/7 availability, students can take the initiative to seek guidance on their own terms, fostering increased self-confidence and problem-solving abilities. Additionally, AI technology streamlines administrative responsibilities, relieving instructors from mundane tasks and affording them the opportunity to channel their time and energy toward providing top-notch education, guidance, and support to their students. However, ongoing concerns regarding overreliance on artificial intelligence still persist, challenges related to data privacy protection and the possibility of algorithmic biases persist. Therefore, it is essential to adopt a balanced approach that combines the capabilities of AI with human sensitivities, promoting critical thinking, creativity, and emotional intelligence among students. Ultimately, the seamless integration of AI into higher education offers the potential to elevate students' academic achievements, promoting a personalized, efficient, and comprehensive learning experience.

2.0. Conceptual Framework

The capacity of AI to perform cognitive tasks and exhibit intelligent behavior presents a complex challenge. Given the interdisciplinary and multifaceted nature of artificial intelligence, there is a lack of consensus among scholars regarding its precise definitions and boundaries (de la Fuente Garcia, Ritchie, & Luz, 2020). The integration of innovative technological approaches within higher education institutions (HEIs) necessitates a comprehensive evaluation of numerous factors. Various factors have been identified in the literature as contributing to the successful implementation of technology across different contexts. These factors encompass the configuration of technology systems, the establishment of collaborative relationships, the promotion of reform and innovation (Guo, Guo, & Liu, 2021), the accumulation of digital resources, ensuring the availability of technological resources, fostering an awareness of reform and innovation, enhancing digital competence and information literacy, and cultivating technological proficiency. By considering these factors, higher education institutions (HEIs) can effectively harness the advantages of technological methodologies. Furthermore, it is imperative that the advancement of AI technology within higher education institutions remains focused on enhancing resources and cultivating students' proficiency in information literacy, data literacy, and technical competence (Wang, Sun, & Chen, 2023). A comprehensive classification of the constituent components constituting the AIC (AI Capability) framework in organizations has been undertaken by Mikalef and Gupta (2021), which is regarded as a seminal contribution in the field (Hradecky et al., 2022). The tangible resources encompass essential elements like data, technology, and foundational resources, forming the bedrock for the functioning of the AIC framework. Conversely, intangible resources pertain to the technical and business skills necessary for the successful implementation and operation of the AIC framework. Finally, the human resources

category encompasses the capacity for interdepartmental coordination, adept management of organizational change, and a willingness to embrace calculated risks. These factors hold utmost significance in ensuring the harmonious integration and effective implementation of the AIC (AI Capability) framework within the organizational context. By employing the theoretical framework of enterprise AIC (Wang et al., 2023) and conducting an in-depth analysis of prior research findings, this study endeavors to define the AIC of Higher Education Institutions (HEIs) as the inherent capability to seamlessly and efficiently integrate and utilize AI technologies and products. Building upon the preceding discussion, the conceptual framework is presented in Figure 1 below:

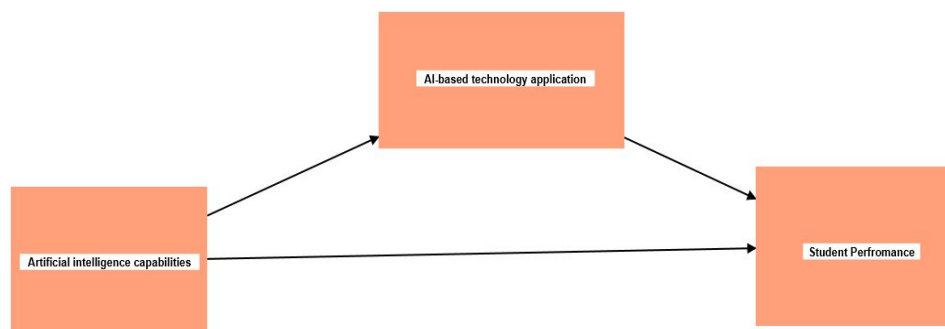


Figure 1. Conceptual Framework

The rise of AI technologies introduces novel avenues for educational approaches and the cultivation of students' self-efficacy (SE). The utilization of computer proficiency within educational settings has yielded positive academic outcomes, as evidenced by the study conducted by Sunday, Adesope, and Maarhuis (2021). Research has consistently highlighted that the incorporation of user-oriented adaptive AI significantly contributes to the enhancement of students' academic accomplishments. AI-supported instructional systems prove invaluable to educators by aiding their comprehension of students' academic progress and facilitating in-depth analysis of the amassed data pertaining to learners' behaviors and preferences (Kamruzzaman et al., 2023). Celik and Yesilyurt (2013) undertook a study exploring the interplay between individuals' attitudes toward emerging technologies, their degree of computer self-efficacy (SE), and their anxiety levels in forecasting the efficacy of computer-based instructional methods. In line with Alam's research (2021), individuals possessing elevated efficacy levels tend to exhibit improved performance in the realm of learning. Notably, the acquisition of competencies in technological applications, particularly artificial intelligence, has been correlated with substantial enhancements in academic accomplishments, as evidenced in previous research (Wang et al., 2023). The transformative influence of AI on the higher education landscape is unquestionable, particularly for university students. The study's findings underscore AI's capacity to facilitate personalized education delivery, elevate classroom pedagogies, and empower data-driven decision-making processes within universities. However, a more thorough examination reveals the existence of certain challenges that demand resolution. Of note is the potential risk of excessive reliance on AI-driven systems, which could potentially curtail students' engagement in their educational endeavors

and hinder their critical thinking capabilities (Wang et al., 2023). The widespread integration of AI technologies might exacerbate the existing disadvantages faced by students who are already lacking in resources or support (Kamruzzaman et al., 2023). Furthermore, a comprehensive examination of ethical considerations like data privacy and algorithmic bias is essential. Despite the undeniable advantages of AI in higher education, scholarly discourse urges caution and thoughtful planning rather than hasty adoption. This approach highlights the importance of balancing the human dimension of education with the utilization of AI's capabilities to improve learning outcomes equitably. Building upon these premises, the study has formulated the following hypothesis:

H1: AI capabilities of Iraqi higher education has significant impact on the of Iraqi university students.

In the context of AITBA, the notion of learning effectiveness revolves around the use of information and communication technology (ICT) digital tools by students to access educational resources through electronic platforms such as the Internet, mobile devices, and multimedia materials like videos and audios (Chou et al., 2022). This empowers students to participate in online or offline learning activities, thereby enriching their acquisition of knowledge, skills, and emotional connections. When confronted with challenges or seeking specific knowledge and competencies, students proactively search for relevant information to effectively address the issue and achieve their desired goals. The evaluation of the effectiveness of AI-based technological interventions in facilitating learning can be classified into three distinct levels (Chou et al., 2022). The notion of "learning autonomy" encompasses the cognitive engagement, enthusiasm, and effort invested by individual learners as they engage in self-directed participation within the educational process (Ding & Ding, 2021). As highlighted by Ardito et al. (2021), there is substantial evidence suggesting that the incorporation of open and student-centered autonomous learning activities is positively associated with the establishment of learning networks (Nikou, Brush, & Wraae, 2023). Within profoundly decentralized and epistemically-oriented domains, a social learning platform has been constructed based on the Elgg software. The active involvement of students in the learning process exerts a significant impact on the overall trajectory of their cognitive growth. The concept of "learning participation" refers to the level of enthusiasm and emotional depth demonstrated by students as they initiate and immerse themselves in educational activities. Often, they actively engage in discussions within the course context, where they deliberate and exchange ideas about relevant topics. Additionally, the concept of "learning performance" pertains to students' ability to effectively boost their intrinsic motivation for learning, drawing from their personal learning experiences. This process is aimed at maximizing learning outcomes and achieving predetermined educational objectives (Liu, 2022).

Marantika (2021) has effectively highlighted the significant impact of artificial intelligence-based applications in enhancing conceptual understanding and advancing educational platforms. The realm of information technology embodies prominent features of openness and interactivity through the integration of artificial intelligence. Digital learning possesses the capability to efficiently disseminate and exchange

knowledge, along with the potential to revitalize and modernize knowledge through advanced discussions and interactions (Sawangchai et al., 2020). Marantika (2021) advocates for the judicious allocation of resources based on specific educational contexts, with a focus on prioritizing student-centered attributes. Furthermore, these studies suggest the integration of AI information technology to enhance the efficacy of the educational process (Qasim & Kharbat, 2020). Furthermore, the notion of "learning satisfaction" encompasses students' attitudes or orientations towards their engagement in educational endeavors, encompassing aspects such as content, methodologies, processes, and outcomes of AI information technology learning initiatives, as well as their subjective experiences within the context (Hong et al., 2021). Chou et al. (2022) undertook an extensive inquiry into the LEAITA learning objective within their scholarly investigation. Their study aimed to probe the potential of this objective in nurturing conscientious individuals with a deep understanding of information and communication technology. When educators impart lessons about AI to their students, the learners underscore the fundamental importance of certain attributes such as creativity, imagination, innovation, and skills, which are regarded as highly challenging for machines to replicate. Concerning the factors influencing LE-AITA, Gong's study (2021) unveiled substantial advancements in learning effectiveness, notably in two distinct domains: electromechanical concepts and image recognition knowledge. This progress was observed through the adoption of active learning approaches and the validation of self-efficacy (SE).

The outcomes of Rekha et al.'s study (2023) reveal that computer self-efficacy (SE) and enjoyment, which function as intrinsic motivators, hold substantial sway over the intention to persist in using computers. Conversely, the study identified that perceived ease of use, perceived usefulness, and user perception did not wield significant influence in this context. This outcome implies that computer SE and enjoyment notably impact students' inclination to continue employing Cloud e-learning applications for educational endeavors. In a comprehensive investigation by Basheer (2023) regarding the adoption of AI-based applications among educators, their findings illuminate a noteworthy correlation between SE and the perception of user-friendliness, along with the overall disposition toward embracing these innovative tools. The findings derived from their study propose that augmenting teachers' computer self-efficacy (SE) might mitigate their concerns related to integrating AI-powered applications into their instructional methodologies (Waer, 2023). The correlation between information and communication technology self-efficacy (ICT-SE) and performance demonstrates a positive influence. Huang et al. (2020) assert that students can employ learning logs or visual representations to monitor their academic advancements. Simultaneously, educators can meticulously evaluate pedagogical missteps, thereby transforming these missteps into valuable learning opportunities that align with the educational objectives of the students. In the realm of AI-driven educational initiatives, the application of Item Response Theory (IRT) is poised to assume a crucial role (Lund et al., 2023). This pivotal task is anticipated to be undertaken by intelligent robots equipped with artificial intelligence capabilities (AIC), according to Lund et al. (2023).

Individuals engage extensively in educational pursuits focused on AI-driven information technology, encompassing activities such as assessing system effectiveness, crafting course content, devising interactive engagement strategies, and appraising network performance, among other tasks. Human-Computer Interaction and Education (HCIE) principles are applied within the domain of education and learning, with a central objective of enriching students' Learning Experience and Academic Achievement through the integration of appropriate learning agent platforms, intelligent agents, and collaborative learning approaches (El Said, 2021). When envisioning the development of an adaptable and intelligent cloud-based learning platform, a range of advanced features necessitate careful consideration. These encompass the incorporation of an adaptable and intelligent learning robot, underpinned by an artificial intelligence software system. Moreover, it is crucial to formulate individualized learning parameters based on Item Response Theory (IRT) for students. The overarching objective is to establish an open-source framework that facilitates the creation of a collaborative human-computer learning system. Introducing physical robots into the future educational landscape holds the potential to effectively enhance students' Learning Enhancement through AI and Technological Advances (LE-AITA). This entails the development of an innovative educational learning model driven by artificial intelligence and the establishment of a smart learning environment that seamlessly integrates both virtual and real-world components. The positive correlation between Higher-Order Cognitive and Intellectual Engagement (HCIE) and academic performance has been highlighted in the preceding discussion. Synthesizing the reviewed literature underscores that students' personal HCIE significantly influences their Levels of Engagement and Achievement in the Academic Domain (LE-AITA). Grounded in the examined literature, the study formulates the following hypothesis.

H2: Learning effectiveness of AIBTA in the Iraqi higher education has significant impact on the student performance of Iraqi university students.

H3: AI capabilities of Iraqi higher education has significant impact on Learning effectiveness of AIBTA in the Iraqi higher education.

H4: Learning effectiveness of AIBTA in the Iraqi higher education mediates between AI capabilities of Iraqi higher education hand the student performance of Iraqi university students.

3.0. Methodology

The study adopts a quantitative research approach and utilizes a questionnaire as the data collection instrument. The scale used in the study draws from prior research conducted by Chou et al. (2022) as well as Wang et al. (2023). To form the research sample from the university student population, a combination of stratified clustering and random sampling techniques were employed to select participants for the study.

The employment of stratified random sampling takes into account crucial variables such as gender, grade level, professional domains, prior exposure to AI information technology education, and possession of personal information technology resources. Following this, a computer-based random sampling approach was utilized to create a

diverse sample across various departments. The study introduces a sophisticated conceptual model encompassing a predictive component. For analysis, the study utilizes Smart-PLS 3, a software tool known for implementing the PLS-SEM analysis technique (Sarstedt et al., 2022). The study achieved a notable response rate of 64.3 percent.

4.0. Results

It's important to acknowledge the possibility of introducing bias into the results through common method bias (CMB), as highlighted by Kock, Berbekova, and Assaf (2021). To address this concern, this study made substantial efforts to implement robust procedural and statistical measures aimed at mitigating the potential influence of confounding variables, particularly common mode bias (CMB). Specific procedural protocols were adopted to enhance the reliability of participants' responses on the self-report scale. To address this concern, several strategies were employed. Firstly, the survey questions were designed to be non-confidential in nature, facilitating a more candid response from participants. Additionally, preliminary testing was carried out to validate the survey's clarity and ensure participants' understanding of its underlying objectives.

Statistical controls were incorporated into the study methodology, drawing inspiration from Lindell and Whitney's methodology outlined in their influential publication from 2001. The researchers leveraged the principal component analysis function within the SPSS software, employing Harman's one-factor test as a diagnostic tool. This meticulous analysis revealed that the data collected did not exhibit a variance exceeding the critical threshold of 40%. Importantly, no single factor emerged that could adequately explain the majority of the observed variability.

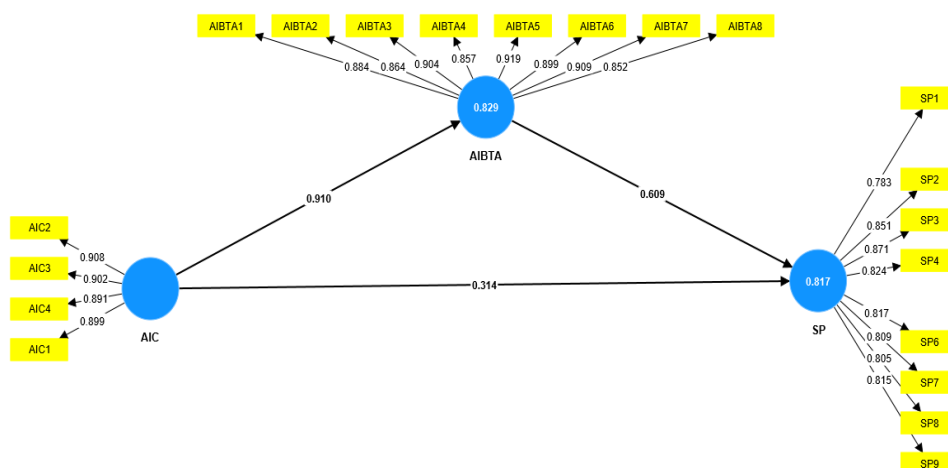


Figure 2. Measurement Model

Table 1 presents the outer loading values derived from the analysis. Items with loading values below 0.70 have been excluded from the analysis.

Table 1

Measurement Model

	AIBTA	AIC	SP
AIBTA1	0.884		
AIBTA2	0.864		
AIBTA3	0.904		
AIBTA4	0.857		
AIBTA5	0.919		
AIBTA6	0.899		
AIBTA7	0.909		
AIBTA8	0.852		
AIC1		0.899	
AIC2		0.908	
AIC3		0.902	
AIC4		0.891	
SP1			0.783
SP2			0.851
SP3			0.871
SP4			0.824
SP6			0.817
SP7			0.809
SP8			0.805
SP9			0.815

Sarstedt et al. (2022) affirmed that the content validity of the measurement scale was acceptable within the context of this study. Table 2 provides a comprehensive display of the statistical metrics, including Cronbach's alpha (CA), Composite Reliability (CR), and Average Variance Extracted (AVE) for each latent variable. It's notable that all AVE values surpass 0.5, indicating a strong level of convergent validity across all latent variables, consistent with the work of Purwanto (2021). Reliability of the measurement models was assessed by comparing CR and CA values against the established benchmark of 0.7. The results revealed that CR and CA values for each latent variable substantially exceeded the threshold of 0.70, as outlined by Kock et al. (2021) and Purwanto (2021). This finding confirms the high reliability of the measurement model. Furthermore, the evaluation of discriminant validity involved meticulous scrutiny of correlation coefficients. In summary, the model underwent rigorous examination, establishing its commendable reliability and validity.

Table 2

Reliability Analysis

	CA	(rho_a)	(rho_c)	(AVE)
AIBTA	0.961	0.962	0.967	0.786
AIC	0.922	0.922	0.945	0.810
SP	0.932	0.938	0.943	0.676

Table 3

Discriminant Validity (Fornell-Larcker criterion)

	AIBTA	AIC	SP
AIBTA	0.886		
AIC	0.810	0.900	
SP	0.794	0.868	0.822

This study employed structural equation models, particularly partial least squares-structural equation modeling (PLS-SEM), to analyze the collected questionnaire data. The assessment of hypotheses was carried out with the widely recognized software Smart-PLS 3, as detailed by Purwanto (2021). The process of evaluating hypotheses involved the implementation of the Bootstrapping technique, which employs a systematic method of random sampling for robust statistical analysis. To ensure a dependable representation of the investigated population, the sample size was intentionally set at 5000. The structural model utilized in this study is visually depicted in Figure 3, illustrating the relationships between the various constructs and variables under investigation.

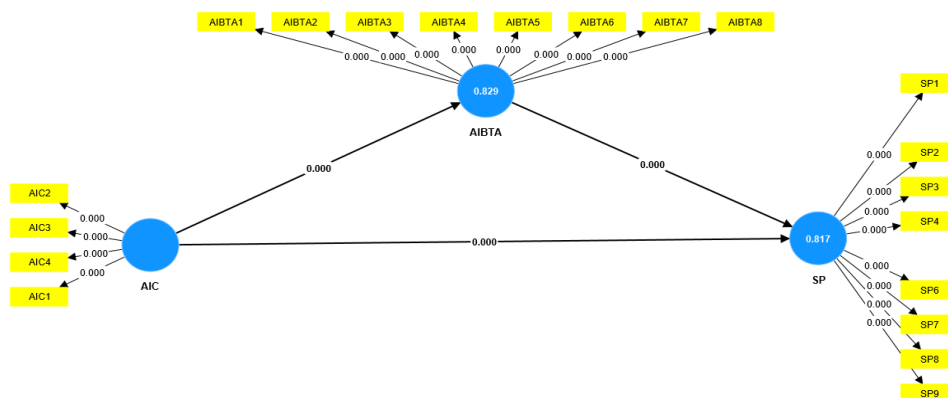


Figure 3. Structural Model

The outcomes of the direct hypotheses are outlined in Table 4. The findings underscore that the Artificial Intelligence-Based Technological Advancement (AIBTA) within Iraqi higher education significantly influences students' performance. Furthermore, the positive and substantial relationship between the AI capabilities of Iraqi higher education and the academic performance of Iraqi university students is evident. Lastly, the study's results affirm the notable impact of AI capabilities on the AIBTA within the context of Iraqi higher education.

Table 4

Direct effects

	(O)	(M)	(STDEV)	(O/STDEV)	P values
AIBTA -> SP	0.609	0.611	0.076	8.056	0.000
AIC -> AIBTA	0.910	0.910	0.015	6.396	0.000
AIC -> SP	0.868	0.870	0.020	4.709	0.000

The mediation analysis results are presented in [Table 5](#). These outcomes elucidate that the Artificial Intelligence-Based Technological Advancement (AIBTA) in Iraqi higher education operates as a mediator between the AI capabilities of Iraqi higher education and the academic performance of Iraqi university students. This mediation process highlights the role of AIBTA in facilitating the relationship between AI capabilities and student performance.

Table 5

Specific Indirect Effects

	(O)	(M)	(STDEV)	(O/STDEV)	P values
AIC -> AIBTA -> SP	0.554	0.556	0.070	7.932	0.000

5.0. Discussion

The information presented in [Table 4](#) provides valuable insights into the implications of implementing AI technology within the context of higher education in Iraq, particularly its influence on students' academic performance. The outcomes highlight a statistically significant and positive relationship between AI technology implementation and student academic performance, underscoring the potential advantages of integrating AI capabilities into the educational domain. This analysis aims to delve into the significance and broader implications of these findings. Notably, the results align with previous research studies conducted by [Alam \(2021\)](#), [Malinka et al. \(2023\)](#), and [Mikalef and Gupta \(2021\)](#).

Essentially, these findings mark a pivotal turning point, revealing that the introduction of AI-driven technology holds the promise of positively impacting the academic achievements of students within Iraqi higher education. The integration of AI has the potential to reshape traditional educational approaches, leading to the creation of personalized learning experiences that cater to the unique requirements and preferences of individual students. Educational platforms that harness the capabilities of AI possess a remarkable capacity to tailor their methods to cater to diverse learning styles, varying paces, and individual preferences. As a consequence, these platforms play a pivotal role in amplifying students' understanding and bolstering their capacity to retain knowledge. This revelation underscores the notion that the integration of AI technology holds the potential to yield better academic outcomes and enhance students' readiness to tackle future obstacles. Furthermore, the study highlights a notable connection between the proficiency of AI within Iraqi higher education institutions and the academic excellence demonstrated by their students. Higher education institutions that invest resources into the development of AI-driven infrastructure and expertise are poised to witness a favorable influence on the academic accomplishments of their students. This assertion suggests that these esteemed institutions can effectively utilize AI to simplify administrative processes, design inventive educational curricula, and offer personalized support to students. This synergy creates an educational setting characterized by exceptional efficiency and profound impact.

The findings suggest the presence of a self-reinforcing cycle, denoting the mutually beneficial relationship between AI capabilities and the implementation of AI-based technology. This pattern aligns with the conclusions drawn by [Dwivedi et al. \(2023\)](#), [Côté et al. \(2022\)](#), and [Lee and Lee \(2021\)](#). As educational institutions strengthen their AI

capacities, they gain proficiency in deploying and enhancing AI-driven technologies within their teaching methodologies. Consequently, students' academic performance improves, validating the ongoing commitment to advancing AI capabilities. Creating and sustaining this positive feedback loop is essential for ensuring the enduring integration of AI into Iraq's higher education system. However, it is crucial to acknowledge the necessity for meticulous implementation and ongoing monitoring. Notwithstanding the potential advantages that AI holds for the domain of education, it is imperative to acknowledge the potential hazards and challenges that arise in conjunction with its integration. The most important aspect lies in the concerns surrounding privacy, the existence of bias in algorithms, and the potential displacement of conventional teaching positions. To ensure the ethical and efficient use of artificial intelligence (AI) within the domain of education, it is imperative to build a framework of responsible governance and rules for AI.

The results of the mediation study, as displayed in [Table 5](#), offer robust evidence in favor of the theoretical framework and are consistent with previous research on the effects of AITBA in the context of Iraqi higher education. The findings suggest that the association between the AI capabilities of Iraqi higher education and student performance can be partially accounted for by the availability and utilization of AI-based technology in the educational process. In accordance with established theoretical frameworks, the findings underscore the capacity of artificial intelligence to bring about significant changes in the field of education. The incorporation of artificial intelligence (AI) technology has the potential to enhance multiple facets of the educational process, including personalized learning trajectories, intelligent tutoring systems, and immediate feedback. These enhancements, in turn, have a positive impact on pupils' academic achievement. The results are consistent with previous studies that have highlighted the significance of AI-based technologies in improving educational achievements. Prior research conducted in other settings has consistently demonstrated comparable patterns, indicating that interventions powered by artificial intelligence (AI) can result in enhanced student engagement, information retention, and overall academic performance.

6.0. Policy Implication

The results and implications of the present study hold significant importance for the realm of higher education within the context of Iraq. The results indicate that the integration of AI-driven technology has a notable influence on students' academic performance, serving as a connection between the AI capabilities of higher education institutions and the attainment of scholarly accomplishments. The integration of artificial intelligence with strategic planning and foresight holds the promise of transforming the educational domain. This entails using the capabilities of artificial intelligence to provide tailored instruction, thereby enhancing the overall educational results. It is imperative for policymakers and educators to place a high level of importance on the cultivation of AI competencies within organizations. Simultaneously, they must ensure the careful and efficient incorporation of AI-driven technology. The aforementioned consequences indicate that the utilization of artificial intelligence (AI) holds promise for improving educational standards, thereby preparing students with the requisite skills and knowledge to effectively confront forthcoming difficulties.

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